State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

General

LANL-PUBLIC

June 3, 1997

H.L. Daneman
1304 Calle Ramon
Santa Fe, New Mexico 87501

Dear Mr. Daneman:

On May 8, 1997, Michael Dale committed to deliver to you additional information detailing sampling results and correspondence between the DOE Oversight Bureau and DOE. Enclosed are the following documents:

May 2, 1995	Notification of DOE OB sampling results at two springs in TA-16.
June ~~May~~ 19, 1995	Request to sample deep aquifer wells for tritium.
June 26, 1995	DOE OB review of the DARHT Environmental Impact Statement.
August 25, 1995	DOE OB review comments of the SWMU 9-013 Expedited clean-up plan. Included are DOE OB surface water quality data collected from springs in the local area.
September 25, 1995	Detection of Strontium-90 in Test Well 3 and DOE OB observations and recommendations.
October 6, 1995	Request for delineation of Environmental Restoration sites in or near watercourses
October 11, 1995	DOE OB radionuclide results for Test Well 4 and Test Well DT-9.
December 5, 1995	DOE reply to October 11, 1995 letter.
November 17, 1995	LANL internal reply to DOE in regards to October 11, 1995 letter.
December 6, 1995	DOE OB groundwater and surface-water flow measurements and recommendations.
December 12, 1995	DOE OB data and recommendations concerning Mortandad Canyon sediment trap.
January 12, 1996	Submittal of DOE OB (1995) stormwater data prior to publication.
March 27, 1996	DOE OB groundwater data submittal for Test Wells TW-3, TW-4, and TW-8.
March 27, 1996	DOE OB recommendations concerning geophysical activities.
March 29, 1996	DOE OB submittal of groundwater data obtained from special purge test of TW-2, TW-2A, TW-3, TW-4, and TW-8.
May 6, 1996	DOE OB review comments on Field Unit 4 (Canyons) RFI work plan.

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May 21, 1996	Recommendations concerning prioritization of Solid Waste Management Units.
June 20, 1996	DOE OB data submittal concerning sediment sampling results from Los Alamos Canyon below confluence with DP Canyon.
June 25, 1996	DOE OB review comments concerning Draft EIS for the Medical Isotope Production Project.
October 2, 1996	DOE OB review comments concerning the Corrective Action Report for TA-18 septic tank leach field.
October 25, 1996	DOE OB review comments concerning the LANL 1994 Environmental Surveillance publication (published in July, 1996)
March 26, 1997	DOE OB submittal of 1996 split-sampling and independent sampling (wells, springs, surfacewater) data.
April 8, 1997	Access request to Water Canyon.
April 9, 1997	DOE OB submittal of 1996 split-sampling and independent sampling (sediments) data.
October, 1996	Published paper on Upper Pajarito water quality and aquatic insect populations.
October, 1996	Published paper on hydrologic issues at LANL.
October 1996	Published paper on (off-site)stormwater transport of radionuclides from Los Alamos Canyon

In addition, the 1996 surfacewater data has been submitted to DOE and will be available for release by June 1, 1997. If you have any questions please feel free to call me at 672-0448.

Sincerely,

Stephen Yanicak

Steve Yanicak

DOE OB, LANL POC

SY:rfs

cc: John Parker, NMED, Chief, DOE OB

Ed Kelley, NMED, Director, WWMD

LANL-/Comments/Hi Damon, w.d

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EDGAR T. THORNTON, III
DEPUTY SECRETARY

2 May 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

RE: Notification of the presence of chlorinated hydrocarbons at two ground-water discharge points (Burning Ground and SWSC Line Springs) at Field Unit (FU) 3, Operable Unit (OU) 1082, TA-16, Los Alamos National Laboratory (LANL)

Dear Mr. Trujillo:

NMED AIP/LANL staff sampled two ground-water discharge points (Burning Ground and SWSC Line Springs) on March 17, 1995, and analytical results (Table 1.) indicate that trichloroethene and tetrachloroethene are present in the ground water. AIP request access to the area in order to re-sample the springs as soon as possible. As per AIP protocol, NMED DOE Oversight Bureau will not submit these results to any regulatory agencies until the receipt of the verification results and/or the required thirty day (30) data review by the Department of Energy.

Please feel free to contact me at 672-0449 if you have any questions concerning this matter.

Sincerely,

Michael R. Dale

Michael R. Dale, DOE Oversight Bureau
New Mexico Environment Department

cc: Brad Martin, LANL, CST-6, MS E525
Don Hickmott, LANL, EES-1, MS D462
Steve Rae, ESH-18, MS K490
Neil Weber, DOE Oversight Bureau Chief
Steve Yanicak, DOE Oversight Bureau, POC/LANL

Please Keep all Attached letters With # 13033

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DRAFT

TABLE 1 - AROMATIC AND HALOGENATED PURGEABLE HYDROCARBON RESULTS FOR BURNING GROUND AND SWSC LINE SPRINGS

SAMPLE ID	SAMPLING DATE	PARAMETER	REPORTED VALUE (ppb)	MDL (ppb)	METHOD
Burning Ground Spring	3/17/95	Trichloroethene	2.60	1.00	EPA 601/602
		Tetrachloroethene	2.80	1.00	EPA 601/602
		Aromatic Volatiles	0.00	1.00	EPA 601/602
SWSC Line Spring	3/17/95	Trichloroethene	2.20	1.00	EPA 601/602
		Tetrachloroethene	2.30	1.00	EPA 601/602
		Aromatic Volatiles	0.00	1.00	EPA 601/602
Trip Blank	3/17/95	EPA 601/602 Volatiles	0.00	1.00	EPA 601/602

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SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

19 June 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

RE: Low-level tritium split sampling (Environmental Surveillance) request at TW-3 and TW-8, Los Alamos National Laboratory (LANL)

Dear Mr. Trujillo:

The DOE Oversight Bureau (DOE OB) is requesting that LANL's ES group sample for low-level tritium at the beginning and end of purging at deep aquifer test wells TW-3 and TW-8, and other deep aquifer wells if possible. Results may improve the evaluation of borehole leakage and/or natural recharge at the referenced wells. DOE OB would also like to split sample on TW-3 and TW-8.

Please feel free to contact me at 672-0449 if you have any questions concerning this matter.

Sincerely,

Michael R. Dale

Michael R. Dale, DOE Oversight Bureau
New Mexico Environment Department

cc: Neil Weber, DOE Oversight Bureau Chief
Steve Yanicak, DOE Oversight Bureau, POC/LANL
Bruce Gallaher, ESH-18, MS K497
Steve Rae, ESH-18, MS K497

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State of New Mexico
ENVIRONMENT DEPARTMENT
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GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

June 26, 1995

M. Diana Webb
DOE/LAAO
DARHT EIS Project Manager
528 35th Street
Los Alamos, NM 87544

FU 2 OU 1056

RE: Review of Los Alamos National Laboratory's (LANL) Draft Environmental Impact Statement (EIS) for the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT), Technical Area 15

Dear M. Webb:

The DOE Oversight Bureau (DOE OB) has reviewed the subject document. The following comments are provided for the purpose of communicating the results of the DOE OB review. These comments are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department.

DOE OB General Statement on the proposed completion of the DARHT facility

DOE OB recommends and supports the "Enhanced Containment Alternative" (Section 3.7) for the proposed completion of the DARHT facility at TA-15. In addition to the obvious benefits of limiting releases to the environment and therefore being more protective of the public health and the environment, there are a number of specific issues elaborated on and listed in the comments below (i.e., perennial stream and spring flows, aquatic communities in the adjacent canyons and the presence of threatened and endangered species (TES)) which support our backing of this alternative. In addition, DOE OB does not feel that DOE has adequately demonstrated that this alternative would compromise the diagnostic capabilities of the proposed facility. One major question that should be addressed by DOE is: Why will it be necessary to conduct 25 percent of the tests in an uncontained mode? LANL is purportedly working on reusable containment vessels which can be used with higher explosive loadings and accommodate a full diagnostic suite. DOE OB feels that the 25 percent figure was not adequately justified. In summary, DOE OB recommends that the "Enhanced Containment Alternative" should be re-written as to fully mitigate environmental impacts by the DARHT facility.

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GROUND-WATER AND SURFACE-WATER

1. Page 4-26, Section 4.4.1

   General Statement: It should be noted that surface-waters discharged off-site (San Ildefonso Pueblo, Bandelier National Monument, Rio Grand River, etc.) via Pajarito and Los Alamos Canyons from 1992 to 1995. Pueblo and Acid Canyon surface waters may have flowed off-site; however, we have no direct evidence. Ancho Canyon surface waters may have connected with Ancho Spring and subsequently discharged off-site (Rio Grande River); however, we have no direct evidence.

2. Page 4-26, Section 4.4.1, Second paragraph, First sentence

   Comment: Recent investigations conducted in 1994 and 1995 indicate that there is a perennial reach in Cañon de Valle. A total of three springs: Burning Ground (long 106 20 15; lat 35 50 56), SWSC (long 106 20 25; lat 35 51 02), and Peter (long 106 20 25; lat 35 51 02), contribute to perennial flow in Cañon de Valle whose total combined flow has been measured at the culvert below MDA P, ranging from 18 gpm (1-20-95) to 80 gpm (5-5-95). Visual observations have determined that Burning Ground and SWSC emanate at a relatively constant rate. On December 9, 1994, flow was encountered in Cañon de Valle approximately 0.8 miles up from the confluence of Water Canyon and Cañon de Valle. Flow continued some unknown distance down Water Canyon. More surveillance is needed to determine if flow in this reach is perennial.

3. Page 4-26, Section 4.4.1, Second paragraph, Second sentence

   Comment: NPDES Outfall #05A056 discharges approximately 700 ft upgradient (southwest) from SWSC Line Spring. Should be noted that Material Disposal Areas (MDA) M is located near springs that contribute to perennial flow in Pajarito, and MDAs P and R are located near springs that contribute to perennial flow in Cañon de Valle. Solid Waste Management Unit (SWMU) 22-015(c), a former outfall and plating etching facility, is also located at the upper area of perennial flow in Pajarito Canyon.

4. Page 4-26, Section 4.4.1, Third paragraph, Third sentence

   Comment: Recent investigations in Pajarito Canyon have shown that there are several (9) additional springs (4 perennial, 5 ephemeral) which feed a perennial reach in Starmers Gulch (tributary to Pajarito Canyon). This perennial flow joins with the flow from Homestead Spring (long 106 20 21; lat 35 51 31) for a combined discharge that ranges from 46 gpm (8-9-94) to 120 gpm (2-24-95) and extending for up to 3 miles downstream, near the confluence of Two Mile Canyon (depending on climatic conditions). The flow in this reach is supplemented by a smaller canyon, consisting of several perennial springs and seeps whose total combined flow has been measured to be 12 gpm to 15 gpm (2-10-95). This canyon joins Pajarito about 1/3 mile below the junction of Starmers Gulch and Pajarito Canyon.

5. Page 4-26, Section 4.4.1, Fourth paragraph, First sentence

Comment: Springs that supply perennial flow in Pajarito Canyon emanate from elevations that range from approximately 7,456 ft to 7,400 ft are: Charlies Spring (long 106 20 21; lat 35 51 31) located in southern tributary to Pajarito Canyon, Bulldog Spring (long 106 20 17; lat 35 51 24) located in a southern tributary to Pajarito Canyon. Springs that supply perennial flow in Cañon de Valle emanate from elevations that range from approximately 7,370 ft to 7,400 ft are: Burning Ground Spring, located in Cañon de Valle; SWSC and Peter Spring, also located in Canon de Valle.

6. Page 4-26, Section 4.4.2

General Statement: It should be noted that perched ground water in canyon alluvium and volcanics exist at the subject area. Little or no investigation has occurred.

7. Page 4-27, Section 4.4.2, Second paragraph, First sentence

Comment: Recent field surveillance indicates that a saturated perched zone within the canyon alluvium and an associated wetlands exists in the lower section of Threemile Canyon. The existence off a perched zone within the bandelier tuff and/or basalts beneath Threemile canyon has not been investigated.

8. Page 4-27, Section 4.4.2, Second paragraph, Second sentence

Comment: It should be noted that hydrologic characteristics of the "Discharge Sink" in Potrillo Canyon have not been determined.

9. Page 4-27, Section 4.4.2, Third paragraph

Comment: A total of three springs: Burning Ground, SWSC and Peter, contribute to perennial flow in Cañon de Valle, east of West Jemez Road, and the possibility of a perched zone within the canyon alluvium is probable.

10. Page 4-27, Section 4.4.2, Fourth paragraph, Fifth sentence

Comment: The thickness of the alluvium at Beta Hole and WCO-1 is 8 and 24 ft respectively. Hence, Beta Hole may have been drilled at an inappropriate location (i.e., side of canyon) for ground-water detection. Beta Hole was drilled for geologic information, not ground-water exploration (Purtymun, 1995). "Near saturation" conditions existed at a depth interval of 24 to 32 ft at observation well WCO-1 in October of 1989 (Purtymun, 1995). It appears that perched ground water does indeed exist in Water Canyon because two shallow wells, WCM-1 and WCM-2, were drilled due south of TA-15 and ground water was encountered (Purtymun, 1995).

11. Page 4-27, Section 4.4.2, Sixth paragraph, Sixth sentence

Comment: No direct evidence exists to support this statement. The usage of the word "may" or "could" may be more appropriate.

12. Page 4-30, Section 4.4.3, First paragraph: "Important contaminant transport mechanisms associated with surface water include:
*Erosion and sedimentation (sediment and contaminant accumulation) of contaminated surface and near-surface materials
*Infiltration of surface water that may be contaminated, or movement of water through a contaminated deposit that in turn carries contamination deeper into the soil/rock profile
*Movement of contaminants in surface water as solutes, suspended sediments and bedload phases."

Comment: Though storm water monitoring stations at the PHERMEX site exist (station #'s SWO-15-184A, B, & C), no data is presented that characterizes the water quality resulting from storm water runoff resulting in the movement of contaminants as solutes, or suspended sediments from a facility with known contamination levels (approximately the same levels projected for the DARHT facility). PHERMEX storm water quality data, displaying the dissolved and suspended components, must be obtained and presented to verify that the model described in appendix E3 correctly simulates the transport of depleted uranium, beryllium and other heavy metals.

13. Page 4-30, Section 4.4.3, Fifth paragraph: "Surface water sampling station locations near TA-15 are presented in figure 4-14. The radiochemical, trace metals, and chemical quality analysis of samples taken at Pajarito Canyon, Water Canyon, and Ancho Canyon at the Rio Grande are listed in tables 4-6 and 4-7 (LANL 1994a)."

Comment: The surface water monitoring station for Water Canyon is located just below the junction of Water Canyon and Cañyon de Valle. The data presented in Table 4-6 and 4-7 is representative of springs, NPDES outfalls and snowmelt runoff from watersheds upstream from the potential effects of PHERMEX and the proposed DARHT facilities. The data presented in table 4-6 is for dissolved constituents (filtered prior to analysis) and therefore does not include the suspended sediment component. This data does not adequately characterize the water quality of Water Canyon and does not assess contaminant contribution from the PHERMEX facility.

14. Page 4-30, Section 4.4.3, Fifth paragraph, Second sentence

Comment: It should be noted that Ancho Canyon surface-water data may actually be from Ancho Spring. Ancho Spring water is ground water, not surface water.

15. Page 4-33, Section 4.4.3, Tenth paragraph

Comment: It should be noted that isotopic data from LANL test wells are questionable due to the fact that the wells are not adequately grouted which could cause wellbore leakage. Hence, results may yield erroneous results. We question all analytical and aquifer data from these test wells.

16. Page 5-18, Section 5.1.11.1, First sentence: "Environmental monitoring currently performed at LANL would continue under the No Action Alternative. Existing stations for monitoring external penetrating radiation and radioactive and hazardous substances in air, water, soil, and sediment would be used to monitor the environmental impacts of the facility." This section is repeated for all alternatives.

*Comment: Existing surface water monitoring stations are inadequate to assess the impacts of the existing PHERMEX facility (see comment 13). The Water Canyon surface water monitoring station needs to be located further down stream in Water Canyon to adequately assess all runoff Water and Cañon de Valle from the existing PHERMEX and the proposed DARHT facilities. Storm water monitoring stations at the PHERMEX site need to be monitored to verify that the surface water model adequately predicts contaminant transport from the existing facility. The construction of a new facility on LANL property (DARHT) may require a modification of LANL's general storm water permit. Mitigation measures (i.e., the installation of catchment basins) should be addressed in the EIS in order to prevent the transport of contaminants to Water Canyon, Cañon de Valle, and Potrillo Canyon and to monitor storm water runoff from these facilities.

THREATENED AND ENDANGERED SPECIES

17. Page 4-43, Section 4.5.4, First paragraph, First sentence: "Surveys conducted at TA-15 in 1992 (Risberg 1995) did not locate any currently listed threatened or endangered species (Table 4-12), although suitable habitat may exist for many of these."

Comment: The statement that suitable habitat may exist for TES species does not adequately address the location of suitable habitats, what surveys were conducted and according to what protocol. Recent investigations have determined the presence of suitable Mexican Spotted Owl habitat within approximately 1/4 mile of the proposed DARHT site.

18. *Page 4, Section 3.1.2, Fourth paragraph in: Draft Biological and Floodplain/Wetland Assessment for the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT), Debra Risberg, February 1995, LAUR 95-649: "Results from initial modeling indicate three areas within Laboratory boundaries that could have potential owl habitat, one of them being an area near the junction of Water Canyon and Cañon de Valle. Because the model is based on topographic features, the nature of the forest stand is unaccounted for;

thus, this area would not be suitable for nesting spotted owls due to the extensive burn caused by the 1977 La Mesa Fire."

Comment: The model used to determine potential Mexican Spotted Owl habitat underestimates suitable owl habitat. Extensive field checking is required when this model is used. Recent field investigations have determined that suitable owl habitat exists in Cañon de Valle, Threemile Canyon and Pajarito Canyon. Ongoing Spotted Owl surveys (ESH-20) in these canyons indicate that at least one pair of Spotted Owls is present in the project area. Until the nest and/or roost area is located, all suitable habitat must be considered occupied.
*Note: This comment is related to the Draft EIS for DARHT but refers to a different document referenced above.

19. Page 5-59, Section 5.8.1, Last sentence on page: "Disturbing wildlife as a result of blast noise from detonation of high explosives"

Comment: This addresses impacts due to uncontained tests. This would require seasonal restrictions (from March 1 - August 31), on uncontained tests, to prevent the disturbance of Mexican Spotted Owls during the mating/nesting season. These seasonal restrictions apply to noise due to construction as well as the blast noise from detonation of high explosives. This disturbance may result in the disruption of mating, or disrupted feeding of nestlings, resulting in reproductive failure of a pair of owls. Intensive studies should be initiated to determine the effects of current blast noise on nesting/roosting spotted owls and mitigation measures need to be addressed to prevent a takings issue.

20. Page 5-18, Section 5.1.11.1, First sentence: "Environmental monitoring currently performed at LANL would continue under the No Action Alternative. Existing stations for monitoring external penetrating radiation and radioactive and hazardous substances in air, water, soil, and sediment would be used to monitor the environmental impacts of the facility."

Comment: Additional studies, especially biological studies must be initiated to monitor the impacts of the proposed facility. Small mammal studies need to be initiated that will determine the current contamination levels present in prey that may be utilized by Mexican Spotted Owls. The impacts of feeding contaminated mice to nestling Spotted Owls must be evaluated to prevent a takings issue. Studies also should be initiated to determine the concentration of contaminants found in pellets found near Spotted Owl roost/nest sites.

21. Page 5-11, Section 5.1.5.4, First sentence: "It is unlikely that activities at PHERMEX would change the attractiveness of the area for potential use by threatened or endangered species. The concentration of depleted uranium and metals in foodstuffs of threatened and endangered species is expected to remain negligible. Ingestion of these substances is not expected to have any consequences to these populations."

Comment: See above comments. What studies of foodstuffs have been completed which allow these expectations to be stated?

22. Page 5-26, Section 5.2.5.1.2, Second paragraph: "Impacts upon wildlife would be caused by repetitive, short-term disturbances from site activities. However, these impacts would be insignificant to overall population levels."

Comment: Populations of TES species is not the issue, individual animals and the impacts upon each individual or their habitats need to be addressed.

23. Page 5-27, Section 5.2.5.4: "It is unlikely that completion of DARHT construction would change the attractiveness of the area for potential use by threatened or endangered species."

Comment: This statement needs qualification. Seasonal restrictions would need to be placed on construction for the protection of TES species.

AIR QUALITY AND HUMAN HEALTH

24. Page 3-21, Section 3.5.2, Sixth paragraph, First sentence

Comment: It is presumed that the limits established under the NESHAPS permit would not limit testing under the Enhanced Containment alternative. These limits apply to the release, not the use of depleted uranium.

25. Page 3-24, Section 3-7, First paragraph

Comment: The need for conducting 25 percent of the tests in an uncontained mode is not adequately justified. The only satisfactory explanation given is the need to conduct optical diagnosis. However, it is not clear whether the prototype containment vessel, stated to be able to accommodate a full suite of diagnostics, would accommodate laser/optical diagnosis.

26. Page 4-14, Section 4.2.5, Last paragraph: "Later in 1993, three air monitoring stations ... were added downward of the firing site for PHERMEX and DARHT. The monitoring stations are about 320 to 3,200 ft (100 to 1,000 m) northeast of the firing site. The samples collected at these stations are analyzed for isotopic uranium, isotopic plutonium, gross alpha, beta gamma, and beryllium (Jacobson 1995)."

Comment: The significance of these stations is unclear. No data is presented from these three stations, nor is there any reference to the possible future use of these stations for monitoring any of the operational alternatives presented. Since the soil around PHERMEX is contaminated as a result of previous experiments, it may be worth while to examine the possibility that these stations can detect the effects of soil resuspension

due to wind or construction activities in the vicinity.

Comment: Does the term "downward" mean down wind or down gradient? The samplers would be most effective if they are place down wind of the prevailing daytime winds.

27. Page 4-69, Section 4.8.1.1, Third paragraph, Second sentence: "In 1992, the estimated maximum EDE resulting from LANL operations was 6.1 mrem, taking into account shielding by buildings (30 percent reduction) and occupancy (100 percent of residences, 25 percent for businesses)."

Comment: It should be noted that EPA Region 6 issued DOE a Notice of Noncompliance (NON) with the National Emissions Standards for Hazardous Air Pollutants (NESHAPS), 40 C.F.R. part 61, Subpart H, on November 23, 1992 for taking into account the shielding by building (30 percent reduction) in assessing the dose for 1990 LAMPF emissions. It is recommended that the shielding criteria not be used in dose calculations.

28. Page 4-70, Section 4.8.1.1, First paragraph

Comment: Comparison with the DOE 100 mrem/yr PDL is misleading when as is stated 95 percent of the dose is attributable to the airborne emissions from LAMPF. A more appropriate comparison would therefore be made to the EPA's 10 mrem standard for radionuclide air emissions.

29. Page 5-4, Table 5-1 "Impacts on Air Quality from Hydrodynamic Testing in the No Action Alternative"; Page 5-37, Table 5-12 "Impacts on Air Quality from Hydrodynamic Testing in the Enhanced Containment Alternative"

Comment: Intuitively, it is unclear why the values for beryllium, heavy metals, and lead are greater for the Enhanced Containment Alternative (Table 5-12) compared to the No Action Alternative (Table 5-1).

30. Page 5-50, Section 5.4.12

Comment: The range provided for the lessening of the required soil cleanup under the Enhanced Containment Alternative (25-90 percent) is too broad. This is an important component of the cost savings associated with the Enhanced Containment Alternative and should therefore be more accurately estimated.

31. Page 5-36, Section 5.4.2.1.2 "Operations"; Page C-4, Section C1.3 "Source Term"; and Page H-4, Section H2.2 "Atmospheric Release" :

General Statement: There are inconsistencies through out the document regarding the elevation of pollutant release for the uncontained alternatives. On page 5-36, Section

5.4.2.1.2, first paragraph, the statement is made that the emissions for beryllium, heavy metals, and lead are higher for the Enhanced Containment Alternative compared to the other alternatives because the calculations are preformed as a ground level release rather than as an elevated release. Page C-4, Section C1.3, states that pollutants were assumed to be released from a ground level point source with the exception of fugitive dust emissions during construction. Page H-4, Section H2.2, third paragraph, deals with determining the effective release height to be used in the GENII and MEPAS models. It is very unclear under which circumstances an elevated height release was assumed, and exactly how these assumptions affected the final outcome of the model calculations.

32. Page D-3, Section D.2, Second paragraph

Comment: The term "area-weighted integration" should be defined as it applies to this context.

DOE correspondence to NMED DOE OB comments on this document should be directed to John Parker at (505) 827- 4355.

SY:sy:mp:mrd:bs:rfs:jwp

Sincerely,

Stephen Yanicak

Steve Yanicak, DOE Oversight Bureau, POC/LANL
New Mexico Environment Department

cc:: Ivan Trujillo, DOE POC/ LAAO
Barbara Driscoll, EPA Region 6
Gilbert Sanchez, Environmental Director San Idlefonzo Pueblo
Neil Weber, Bureau Chief, NMED DOE Oversight Bureau
John Parker, Program Manager, NMED DOE Oversight Bureau
Ralph Ford-Schmid, NMED DOE Oversight Bureau
Bill Stone, NMED DOE Oversight Bureau
Michael Dale, NMED DOE Oversight Bureau
Mary Perkins, NMED DOE Oversight Bureau
Dave Englert , NMED DOE Oversight Bureau
Benito Garcia, Bureau Chief, NMED HRMB
Teri Davis, NMED HRMB
Glen Saums, Program Manager, NMED SWQB
Cecilia Williams, Bureau Chief, NMED AQB
Dennis McQuillan, Program Manager, NMED GWPRB
Gedi Cibas, NMED Administrative Services Division

GARY E. JOHNSON
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Los Alamos, New Mexico 87545

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

MEMORANDUM

TO: Benito J. Garcia, Chief, HRMB

FROM: Steve Yanicak, NMED DOE Oversight Bureau, POC/LANL

DATE: 25 August 95

SUBJECT: Review of Los Alamos National Laboratory's (LANL) Environmental Restoration (ER) Project Expedited Cleanup (EC) Plan for Solid Waste Management Unit (SWMU) 9-013, Field Unit 5, Operable Unit 1157, Technical Area (TA) 9

The DOE Oversight Bureau (DOE OB) has reviewed the subject document. The following comments are provided for the purpose of communicating the results of the DOE OB review. These comments are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department. All NMED DOE OB derived data (Table 1) will be submitted to the appropriate agency thirty (30) days from DOE's receipt of this letter.

SPECIFIC

1. Page 4, 2.1, Detailed Description of SWMU 9-013

   General Comment: Is there an earthen berm around the satellite site? If there is no berm or if a berm has been breached, downgradient soil samples are needed to define nature and extent of COCs that have moved laterally from the site.

2. Page 4, Section 2.1.2, Physical Setting, Third Paragraph, First Sentence

   Question: Why was the term "unsaturated" used knowing that ground-water discharges from volcanics (Bandelier Tuff) approximately 230 ft south of MDA M and several other

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locations across the laboratory, such as Burning Ground Spring (Latitude 35° 50' 56" N; Longitude 106° 20' 15" W), which is located at TA-16?

3. Page 4, Section 2.1.2, Physical Setting, Third Paragraph, Fifth Sentence

Once again, the existence of springs emanating from volcanics north and south of MDA M supports the fact that saturated conditions within the volcanics do exist, not "may exist" as stated in the EC plan.

4. Page 6, Section 2.2.2, RCRA Facility Investigation

General Statements: A single ground-water and surface-water sampling event may have not adequately addressed possible contaminant transport via surface water and/or ground water at MDA M. Recent investigations by the NMED's DOE OB have shown that ground water discharges from fractured volcanics which lie beneath MDA M. Flow may be perennial or seasonal. A high degree of horizontal and vertical fracturing of the tuff exists at MDA M. Field observations and ground-water sampling were conducted by NMED DOE OB from July 22, 1994, to June 22, 1995. Results (Table 1) and observations indicate that a complex hydrogeologic system is present at MDA M. The referenced springs in LANL's EC for MDA M, Charlie's and Homestead Spring, showed consistent flow throughout the sampling period; however, on April 28, 1995, four additional springs were observed discharging from the tuff at estimated flow rates ranging from 5 gallons per minute (gpm) to 0.5 gpm. This may be in response to snow-melt runoff or "spring recharge". That is, excess recharge may have exceeded the discharge potential, and subsequently caused an additional discharge flux through the unsaturated zone. On April 28, 1995, and May 19, 1995, ground-water sampling events at Homestead Spring and Charlie's Spring, and two of the four ephemeral springs, Upper Starmer's Spring and Perkins Spring occurred. Upper Starmer's Spring is located approximately 150 ft upgradient of Charlie's Spring. Perkins Spring is located approximately 30 ft upgradient of Starmer's Spring. Both springs emanate from the south-facing canyon wall of Starmer's Gulch, south of MDA M. Nitrite-nitrate as total nitrogen and total Kjeldahl nitrogen values (Table 1) from Upper Starmer's Spring were consistent with historical values from Homestead, Charlie's and Starmer's Springs; however, during the same sampling event, Perkins Spring showed elevated values of nitrogen. The ephemeral springs showed a decrease in total dissolved solids, specific conductance and flow through time.

Increased concentrations of dissolved barium at Charlie's and Homestead Springs (Table 1) have also been observed. The above indicates that the unsaturated (vadoze) zone is undergoing saturation, and possible flushing. We recommend ground-water characterization and periodic monitoring of all known ground water at MDA M. Vadoze and/or ground-water contamination via fracture flow may be occurring; hence, specific sampling of the fractures along the soil-tuff interface below MDA M is also recommended.

It should be noted that perennial flow occurs from each referenced spring to an unknown distance down Pajarito Canyon. Hence, the presence of perched ground water in the Pajarito Canyon alluvium is probable, and characterization should be performed.

5. Page 8, Section 2.2.2, Judgmental Sampling of Downgradient Sediments

Comment: Three samples are not enough to determine if there has been a release from the site. Additional samples of downgradient sediments along the south, east, and northeast sides of MDA M need to be taken to define nature and extent of contamination.

6. Page 8, Section 2.2.2, Spring and Creek Samples, First Paragraph, First sentence

Comment: It should be noted that Starmer's Spring (sample ID:09-7550) emanates from the north-facing canyon wall of Starmer's Gulch. Hence, it is doubtful that Starmer's Spring discharges ground water that interacts with the subsurface beneath MDA M.

7. Page 8, Section 2.2.2, Spring and Creek Samples, First Paragraph, Fourth sentence

Comment: Why would one assume a source of a spring or ground-water discharge point without making additional observations (i.e., tracer test data, flow-path data, etc.)?

8. Page 8, Section 2.2.2, Spring and Creek Samples, Second Paragraph

General Questions: Were surface waters from Pajarito Canyon, where sample ID 09-7561 was collected, flowing at Homestead Spring? Sample 09-7561 needs to be shown on a location map. On which side of the lab boundary shown on Figure 2-1 was the sample located? Have there been any

recorded lab activities on the west side of State Road 501? These are relevant questions in light of the high-explosive detects found in this surface water sample. Please define "comparative purposes"?

9. Page 9, Section 2.2.2.1, Summary of RFI Analytical Results

General Comment: It would be helpful to graphically illustrate in your data tables (Annex 6.9) each analyte (both detect or non-detect), detection limit, SAL, UTL and sampling date.

General Question: Were the analytical detection limits for each analyte less than its associated screening action level and/or upper tolerance limits?

General Question: Would it not be more appropriate to relate site-specific geochemistry to background geochemical data (soil, water, etc.) when defining or assessing environmental impacts?

10. Page 10, Section 2.2.2.1, Summary of RFI Analytical Results, Spring and Creek Samples

Comment: Sampling volatile organic compounds (VOCs) may not adequately characterize the presence of VOCs within the perched zone because of the increased rate of the natural degradation (i.e., biological) and volatilization at ground-water discharge points.

11. Page 10, 2.2.3 Evaluation of the RFI Results, Fifth Bullet

Comment: High-explosive (2,4-DNT) results for sample 09-7561 are suspect because the sample was taken up gradient from not only the MDA but also possibly from the lab boundary itself. Surface water west of State Road 501 in Pajarito Creek should be resampled to determine if this is truly a background location. The comment in bullet 5 should be supported with further spring and creek data.

Comment: It is probable that the high-explosive detects in the ground water are related to MDA M. Additional ground-water monitoring and characterization is recommended.

Comment: Using upgradient and downgradient in terms of the ground-water movement should not apply at this site because sufficient data do not exist to support it. Only broad-based assumptions should be used when comparing and/or relating ground-water to surface-water data.

12. Page 11, Section 2.4.1.1, SWMU - In Place, First Paragraph

    Comment: Contaminant transport via ground water needs to be added to the list because of the lack of sufficient ground-water data.

13. Page 14, Section 3.0, Expedited Cleanup

    General Comment: The twenty-two judgmental samples that were taken at the disposal area during the original RFI activities may not be representative of what is actually present at the site considering the volume of material at the site, and we recommend additional biased sampling during the Phase I remediation activities.

    General Comment: During the last forty-seven years the disposal area may have absorbed, collected, and transmitted water and contaminants, and contaminants may have leached to the soil-tuff interface and/or subsurface. If interflow (flow along the soil-tuff interface) is occurring, then contaminants may be transported along the soil-tuff interface and ultimately along vertical fractures. Hence, we recommend full characterization of the media (i.e., soils, tuff and fractures) beneath the debris, not field screening. This step should be performed immediately after the surface debris cell is removed so that horizontal and vertical mixing of contaminants between cells does not occur.

14. Page 14, Section 3.3.1, Cleanup Activities, Fifth and Sixth Bullets

    Question: Do field screening detection limits exceed UTLs or SALs? Will field screening instruments detect analytes down to their SALs, such as vinyl chloride (SAL at 0.013 mg/kg), beryllium (SAL at 0.16 mg/kg) or 2,6-dinotrotoluene (SAL at 1.0 mg/kg)?

15. Page 16, 3.5 Verification Plan, <u>Phase 1</u>, Paragraph 4

    Question and Comments: Will the off-site laboratory analyze for the same constituents as the on-site laboratory? Please specify what the QA level will be for each sample set; field screening, on-site laboratory, and off-site laboratory. The number of off-site laboratory confirmatory samples (5) may not be adequate for a SWMU of this size (3.2 acres).

16. Page 17, Phase II, First Paragraph

Comments: According to this paragraph, verification soil samples will be analyzed for total metals. SVOCs and PCBs will be analyzed for only if Phase I sampling indicates their presence. A representative number of samples should be analyzed for total metals, SVOC, PCB, and HE, regardless of Phase I sampling results.

17. Page 17, Phase II, First Paragraph

Question and Comments: Compositing is not a recommended sampling method. Is there a SOP for composite sampling? The Phase II confirmatory sampling plan should provide more detail. Please include a map of MDA M showing a grid with an example of how many samples from each grid cell will be composited. Will the random samples obtained from the soil surrounding the excavations be composited with the internal grid samples?

18. Page 17, Phase II, First Paragraph

Sampling below MDA M after excavation should be judgmental. For example, if soils contain levels above SALs, the tuff should be cored and sampled for COCs along well developed vertical fractures. Selective sampling will help determine if COCs have infiltrated along fractures and have potentially reached ground-water.

Please feel free to contact Michael Dale at 672-0449 or Martyne Kieling at 827-1536 if you have any questions concerning this matter.

Reviewed by: M. Kieling
M. Dale
W. Stone

attachment
cc: Ivan Trujillo, US DOE LAAO, AIP POC, MS A316
Mike Gilgosch,, US DOE FU5, FPC, MS A316
Cheryl Rofer, LANL, EES-1, MS D462
Tracy Glatzmaier, LANL ER Project, MS M992
Steve Rae, LANL, ESH-18, MS K490
Barbara Driscoll, US EPA Region 6
Gilbert Sanchez, San Ildefonso Pueblo, Environmental Director
Neil Weber, NMED, Chief, DOE Oversight Bureau
Steve Yanicak, NMED, DOE Oversight Bureau
John Parker, NMED, DOE Oversight Bureau
Teri Davis, NMED, HRMB
Jim Piatt, NMED, Chief, SWQB
Marcy Leavitt, NMED, Chief, GWPRB
File LOOK

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Table 1- NMED DOE Oversight Bureau Ground-Water Quality Results, Field Unit 5, Tech Area 9:General Chemistry (Preliminary)

STATION ID	Date	Si (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOT PHOS (mg/L)	SO4 (mg/L)	NO3-N (mg/L)	KJEL.-N (mg/L)	AMMON (mg/L)	TDS (mg/L)	TSS (mg/L)	ALK (mg/L)	FIELD pH (S.U.)	FIELD SC (umhos)	TEMP. (C)	ESTM. FLOW (gpm)
UPPER STARMER'S SPRING	4/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08	NA	0.1	<0.5	<0.05	145	NA	NA	6.69	167.3	8.1	7
	5/19/95	18	7	2	2	7	<5	<0.5	<5	37	NA	17	NA	NA	NA	80	16	37	6.69	96.5	8.5	5
(ephemeral; active channel of	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.77	91.7	8.9	5
Starmer's Gulch)	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.98	100.6	9.1	4
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.86	96.6	10.6	2
CHARLIE'S SPRING	7/22/94	17	10	3.5	4	10	8	0.1	<1	52	<0.09	8	0.3	0.3	0.2	132	20	42	7.10	132.0	9.0	4
(perennial; south-facing slope of	2/24/95	21	11	3.8	3	14	31	<0.2	<1	29	NA	27	NA	NA	NA	230	6	NA	7.43	110.0	8.9	4
Starmer's Gulch)	4/28/95	15	10	3	2	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	143	NA	NA	7.03	166.3	8.4	4
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.78	91.7	8.5	4
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.85	100.7	8.6	4
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.83	95.6	8.4	4
PERKINS SPRING	4/28/95	15	10	4	3	11	NA	NA	NA	NA	0.13	NA	29	2.0	<0.05	148	NA	NA	6.76	168.7	8.5	1
(ephemeral; south-facing slope	5/19/95	NA	NA	NA	NA	NA	<5	<0.5	<5	40	NA	19	NA	NA	NA	80	84	40	6.81	92.9	9.1	0.75
Starmer's Gulch)	5/24/95	18	7	2	2	6	8	<0.5	<10	40	0.09	20	0.1	<0.5	<0.05	90	106	40	6.24	91.4	9.4	0.25
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.62	90.6	9.1	0.25
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.57	102.8	9.0	0.1
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.48	96.4	9.3	0.1
STARMER'S SPRING	7/22/94	NA	10	3.2	4	9	8	0.1	<1	50	<0.09	7	0.2	0.3	0.1	142	18	41	7.27	120.0	9.1	20
(perennial; north-facing slope of	2/24/95	36	13	4.6	4	13	31	<0.2	<1	32	NA	26	NA	NA	NA	250	9	NA	7.79	130.0	8.9	20
Starmer's Gulch)	4/28/95	15	11	4	3	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	144	NA	NA	6.85	171.4	8.8	20
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	96.4	8.8	20
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.42	96.2	8.9	20
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.80	101.0	8.6	20
HOMESTEAD SPRING	8/9/94	13	10	3.7	5	11	17	<0.1	<1	46	<0.09	6	0.3	0.3	0.2	158	15	37	7.06	145.0	9.5	25
(perennial; north-facing slope of	2/24/95	45	12	4.6	4	8.4	19	<0.2	<1	31	NA	14	NA	NA	NA	200	<5	NA	6.75	90.0	7.6	25
Pajarito Canyon)	4/28/95	15	10	4	2	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	133	NA	NA	6.81	158.1	7.7	25
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.45	82.1	8.2	25
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.52	79.8	8.6	25
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.45	69.9	8.6	25

SC - SPECFIC CONDUCTANCE

NA - NOT ANALYZED

SHADED CATION RESULTS ARE FROM A NON-FILTERED SAMPLE & REPRESENTS TOTAL METALS

Table 2- NMED DOE Oversight Bureau Ground-Water Quality Results, Field Unit 5, Tech Area 9:Dissolved and Total Metals (Preliminary)

STATION ID	Date	Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Sn (mg/L)	Sr (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
UPPER STARMER'S SPRING	4/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5/19/95	<0.01	1.3	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	<0.01	0.5	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	0.01	0.05	<0.01	<0.01	<0.02
(ephemeral; active channel of	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Starmer's Gulch)	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHARLIE'S SPRING	7/22/94	<0.01	0.4	<0.06	0.01	<0.1	<0.001	<0.005	<0.01	<0.01	<0.01	0.2	<0.0002	NA	<0.01	<0.01	<0.02	<0.05	<0.06	<0.005	<0.2	0.07	<0.2	<0.01	<0.02
(perennial; south-facing slope of	2/24/95	<0.01	2.5	<0.005	0.04	0.2	<0.001	<0.005	<0.01	<0.01	<0.01	1.7	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.06	<0.005	<0.01	0.06	<0.005	<0.01	0.05
Starmer's Gulch)	4/28/95	<0.01	0.8	<0.01	0.06	0.5	<0.005	<0.005	<0.01	<0.01	<0.01	0.3	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.08	<0.01	<0.01	0.11
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PERKINS SPRING	4/28/95	<0.01	1.0	<0.01	0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.01	0.4	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.08	<0.01	<0.01	0.03
(ephemeral; south-facing slope	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Starmer's Gulch)	5/24/95	<0.01	0.8	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.02	0.3	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	0.02	0.05	<0.01	<0.01	<0.02
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
STARMER'S SPRING	7/22/94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(perennial; north-facing slope of	2/24/95	<0.01	8.3	<0.005	0.03	0.1	<0.001	<0.005	<0.01	<0.01	<0.01	4.5	<0.0002	<0.01	0.02	<0.01	<0.02	<0.003	<0.06	<0.005	0.02	0.10	<0.005	<0.01	0.03
Starmer's Gulch)	4/28/95	<0.01	1.2	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.01	0.6	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.09	<0.01	<0.01	0.03
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HOMESTEAD SPRING	8/9/94	<0.1	2.30	0.001	<0.1	<0.1	<0.1	<0.001	0.003	<0.05	<0.1	1.50	<0.0005	NA	<0.05	<0.1	<0.1	<0.1	NA	<0.005	<0.1	<0.1	NA	<0.1	<0.1
(perennial; north-facing slope of	2/24/95	<0.01	8.7	<0.005	0.01	<0.1	<0.001	<0.005	<0.01	<0.01	<0.01	4.9	<0.0002	<0.01	0.02	<0.01	<0.02	<0.003	<0.06	<0.005	0.09	0.10	<0.005	<0.01	<0.02
Pajarito Canyon)	4/28/95	<0.01	0.8	<0.01	0.05	0.4	<0.005	<0.005	<0.01	<0.01	<0.01	0.4	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.09	<0.01	<0.01	0.06
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - NOT ANALYZED

SHADED METAL RESULTS ARE FROM A NON-FILTERED SAMPLE & REPRESENTS TOTAL METALS

Table 3- NMED DOE Oversight Bureau Ground-Water Quality Results, Field Unit 5, Tech Area 9:Radionuclides (Preliminary)

STATION ID	Date	H3 (pCi/L)	UNC	90Sr (pCi/L)	UNC	137Cs (pCi/L)	UNC	U (ug/L)	UNC	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	UNC	239/240 Pu (pCi/L)	UNC	241Am (pCi/L)	UNC	Gross Alpha (pCi/L)	UNC	Gross Beta (pCi/L)	UNC
UPPER STARMER'S SPRING	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(ephemeral; active channel of	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
Starmer's Gulch)	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
CHARLIE'S SPRING	7/22/94	<167.3	BDL	<0.85	BDL	<2.981	BDL	0.241	0.033	NA	NA	NA	<0.035	BDL	<0.011	BDL	<2.693	BDL	<2.92	BDL	<4.38	BDL
(perennial; south-facing slope of	2/24/95	NA	-	<0.66	BDL	NA	-	NA	-	0.23	<0.03	0.14	<0.08	BDL	0.03	0.02	<0.07	BDL	<3.4	BDL	4.87	0.90
Starmer's Gulch)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
PERKINS SPRING	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(ephemeral; south-facing slope o	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
Starmer's Gulch)	5/24/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
STARMER'S SPRING	7/22/94	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(perennial; north-facing slope of	2/24/95	NA	-	<0.69	BDL	NA	-	NA	-	0.24	<0.02	0.16	<0.06	BDL	0.04	0.02	<0.07	BDL	<2.6	BDL	3.49	0.75
Starmer's Gulch)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
HOMESTEAD SPRING	8/9/94	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	*1.1/**1.2	0.4/0.4	*3.4/**3.4	0.7/0.7
(perennial; north-facing slope of	2/24/95	NA	-	<0.97	BDL	NA	-	NA	-	0.06	<0.02	0.09	<0.08	BDL	<0.05	BDL	<0.05	BDL	<2.4	BDL	3.62	0.67
Pajarito Canyon)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-

*-ALPHA RESULT USING AMERICIUM-241 SOURCE

*-BETA RESULT USING CESIUM-137 SOURCE

**-ALPHA RESULT USING NATURAL URANIUM SOURCE

**-BETA RESULT USING STRONTIUM-90 SOURCE

NA - NOT ANALYZED

Table 4 - NMED DOE Oversight Bureau Ground-Water Quality Results; Field Unit 5
Tech Area 9: Volatile Organic Compounds (Preliminary)

SAMPLE ID: Homestead Spring
SAMPLING DATE: 5/19/95

PARAMETER	RESULT (ug/l)
BENZENE	<0.5
BROMOBENZENE	<0.5
BROMOCHLOROMETHANE	<0.5
BROMODICHLOROMETHANE	<0.5
BROMOFORM	<0.5
BROMOMETHANE	<0.5
2-BUTANONE (MEK)	<5
n-BUTYLBENZENE	<0.5
sec-BUTYLBENZENE	<0.5
tert-BUTYLBENZENE	<0.5
tert-BUTYL METHYL ETHER (MTBE)	<5
CARBON TETRACHLORIDE	<0.5
CHLOROBENZENE	<0.5
CHLOROETHANE	<0.5
CHLOROFORM	<0.5
CHLOROMETHANE	<0.5
2-CHLOROTOLUENE	<0.5
4-CHLOROTOLUENE	<0.5
1,2-DIBROMO-3-CHLOROPROPANE	<0.5
DIBROMOCHLOROMETHANE	<0.5
1,2-DIBROMOETHANE (EDB)	<0.5
DIBROMOMETHANE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
DICHLORODIFLUOROMETHANE	<0.5
1,1-DICHLOROETHANE	<0.5
1,2-DICHLOROETHANE (EDC)	<0.5
1,1-DICHLOROETHENE	<0.5
1,2-DICHLOROETHENE	<0.5
S-1,2-DICHLOROETHENE	<0.5
1,2-DICHLOROPROPANE	<0.5
CIS-1,3-DICHLOROPROPENE	<0.5
2,2-DICHLOROPROPANE	<0.5
2,2-DICHLOROPROPENE	<0.5
TRANS-1,3-DICHLOROPROPENE	<0.5
ETHYLBENZENE	<0.5
HEXACHLOROBUTADIENE	<0.5
ISOPROPYLBENZENE	<0.5
4-ISOPROPYLTOLUENE	<0.5
METHYLENE CHLORIDE	<0.5
NAPHTHALENE	<0.5
PROPYLBENZENE	<0.5
STYRENE	<0.5
1,1,1,2-TETRACHLOROETHANE	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.5
TETRACHLOROETHENE	<0.5
TETRAHYDROFURAN (THF)	<5
TOLUENE	<0.5
1,2,3-TRICHLOROBENZENE	<0.5
1,2,4-TRICHLOROBENZENE	<0.5
1,1,1-TRICHLOROETHANE	<0.5
1,1,2-TRICHLOROETHANE	<0.5
TRICHLOROETHENE	<0.5
TRICHLOROFLUOROMETHANE	<0.5
1,2,3-TRICHLOROPROPANE	<0.5
1,2,4-TRIMETHYLBENZENE	<0.5
1,3,5-TRIMETHYLBENZENE	<0.5
VINYL CHLORIDE	<0.5
o-XYLENE	<0.5
p- & m-XYLENE	<0.5
TOTAL XYLENES	<1

SAMPLE ID: Charlie's Spring
SAMPLING DATE: 5/19/95

PARAMETER	RESULT (ug/l)
BENZENE	<0.5
BROMOBENZENE	<0.5
BROMOCHLOROMETHANE	<0.5
BROMODICHLOROMETHANE	<0.5
BROMOFORM	<0.5
BROMOMETHANE	<0.5
2-BUTANONE (MEK)	<5
n-BUTYLBENZENE	<0.5
sec-BUTYLBENZENE	<0.5
tert-BUTYLBENZENE	<0.5
tert-BUTYL METHYL ETHER (MTBE)	<5
CARBON TETRACHLORIDE	<0.5
CHLOROBENZENE	<0.5
CHLOROETHANE	<0.5
CHLOROFORM	<0.5
CHLOROMETHANE	<0.5
2-CHLOROTOLUENE	<0.5
4-CHLOROTOLUENE	<0.5
1,2-DIBROMO-3-CHLOROPROPANE	<0.5
DIBROMOCHLOROMETHANE	<0.5
1,2-DIBROMOETHANE (EDB)	<0.5
DIBROMOMETHANE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
DICHLORODIFLUOROMETHANE	<0.5
1,1-DICHLOROETHANE	<0.5
1,2-DICHLOROETHANE (EDC)	<0.5
1,1-DICHLOROETHENE	<0.5
CIS-1,2-DICHLOROETHENE	<0.5
TRANS-1,2-DICHLOROETHENE	<0.5
1,2-DICHLOROPROPANE	<0.5
CIS-1,3-DICHLOROPROPENE	<0.5
2,2-DICHLOROPROPANE	<0.5
2,2-DICHLOROPROPENE	<0.5
TRANS-1,3-DICHLOROPROPENE	<0.5
ETHYLBENZENE	<0.5
HEXACHLOROBUTADIENE	<0.5
ISOPROPYLBENZENE	<0.5
4-ISOPROPYLTOLUENE	<0.5
METHYLENE CHLORIDE	<0.5
NAPHTHALENE	<0.5
PROPYLBENZENE	<0.5
STYRENE	<0.5
1,1,1,2-TETRACHLOROETHANE	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.5
TETRACHLOROETHENE	<0.5
TETRAHYDROFURAN (THF)	<5
TOLUENE	<0.5
1,2,3-TRICHLOROBENZENE	<0.5
1,2,4-TRICHLOROBENZENE	<0.5
1,1,1-TRICHLOROETHANE	<0.5
1,1,2-TRICHLOROETHANE	<0.5
TRICHLOROETHENE	<0.5
TRICHLOROFLUOROMETHANE	<0.5
1,2,3-TRICHLOROPROPANE	<0.5
1,2,4-TRIMETHYLBENZENE	<0.5
1,3,5-TRIMETHYLBENZENE	<0.5
VINYL CHLORIDE	<0.5
o-XYLENE	<0.5
p- & m-XYLENE	<0.5
TOTAL XYLENES	<1

THAN (<) SYMBOL INDICATES THAT THE REPORTED VALUE IS LESS THAN THE MEAN DETECTION LIMITS
ODS USED:SDWA VOC-I(EPA-502.2)

Table 5 - NMED DOE Oversight Bureau Ground-Water Quality Results; Field Unit 5, Tech Area 9:High Explosive Compounds (Preliminary)

IPLE ID: Perkins Spring
SAMPLING DATE: 5/24/95

PARAMETER	*RESULT (ug/l)
2-AMINO-4,6-DNT & AMINO-2,6-DNT	<2
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	<2
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	<2
1,3,5-TRINITROBENZENE (1,3,5-TNB)	<2
1,3-DINITROBENZENE (1,3-DNB)	<2
TETRYL	<2
NITROBENZENE (NB)	<2
2,4,6-TRINITROTOLUENE (2,4,6-TNT)	<2
2,4-DINITROTOLUENE(2,4-DNT) & 2,6-DINITROTOLUENE(2,6-DNT)	<2
o-NITROTOLUENE (2-NT)	<2
p-NITROTOLUENE (4-NT)	<2
m-NITROTOLUENE (3-NT)	<2

* - Modified Method 8330

STATION ID	Date	Si (mg/L)	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOT PHOS (mg/L)	SO4 (mg/L)	NO3-N (mg/L)	KJEL.-N (mg/L)	AMMON (mg/L)	TDS (mg/L)	TSS (mg/L)	ALK (mg/L)	FIELD pH (S.U.)	FIELD SC (umhos/c	TEMP. (C)	ESTM. FLOW (gpm)
PPER STARMER'S	4/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08	NA	0.1	<0.5	<0.05	145	NA	NA	6.69	167.3	8.1	7
SPRING	5/19/95	18	7	2	2	7	<5	<0.5	<5	37	NA	17	NA	NA	NA	80	16	37	6.69	96.5	8.5	5
hemeral; active channel of	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.77	91.7	8.9	5
Starmer's Gulch)	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.98	100.6	9.1	4
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.86	96.6	10.6	2
CHARLIE'S SPRING	7/22/94	17	10	3.9	4	10	8	0.1	<1	52	<0.09	6	0.3	0.3	0.2	132	20	42	7.10	132.0	9.0	4
ennial; south-facing slope of	2/24/95	21	11	3.8	3	14	31	<0.2	<1	29	NA	27	NA	NA	NA	230	6	NA	7.43	110.0	8.9	4
Starmer's Gulch)	4/28/95	15	10	3	2	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	143	NA	NA	7.03	166.3	8.4	4
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.78	91.7	8.5	4
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.85	100.7	8.6	4
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.63	95.6	8.4	4
PERKINS SPRING	4/28/95	15	10	4	3	11	NA	NA	NA	NA	0.13	NA	29	2.0	<0.05	148	NA	NA	6.78	168.7	8.5	1
hemeral; south-facing slope	5/19/95	NA	NA	NA	NA	NA	<5	<0.5	<5	40	NA	19	NA	NA	NA	80	84	40	6.61	92.9	9.1	0.75
Starmer's Gulch)	5/24/95	18	7	2	2	6	6	<0.5	<10	40	0.09	20	0.1	<0.5	<0.05	90	106	40	6.24	91.4	9.4	0.25
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.62	90.8	9.1	0.25
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.57	102.8	9.0	0.1
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.48	96.4	9.3	0.1
STARMER'S SPRING	7/22/94	NA	10	3.2	4	9	8	0.1	<1	50	<0.09	7	0.2	0.3	0.1	142	16	41	7.27	120.0	9.1	20
rennial; north-facing slope of	2/24/95	33	13	4.6	4	13	31	<0.2	<1	32	NA	26	NA	NA	NA	250	9	NA	7.79	130.0	8.9	20
Starmer's Gulch)	4/28/95	15	11	4	3	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	144	NA	NA	6.85	171.4	8.8	20
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	96.4	8.8	20
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.42	96.2	8.9	20
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.80	101.0	8.6	20
HOMESTEAD SPRING	8/9/94	13	10	3.7	5	11	17	<0.1	<1	46	<0.09	6	0.3	0.3	0.2	158	15	37	7.06	145.0	9.5	25
rennial; north-facing slope of	2/24/95	45	12	4.6	4	8.4	19	<0.2	<1	31	NA	14	NA	NA	NA	200	<5	NA	6.75	90.0	7.6	25
Pajarito Canyon)	4/28/95	15	10	4	2	9	NA	NA	NA	NA	NA	NA	NA	NA	NA	133	NA	NA	6.81	158.1	7.7	25
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.45	82.1	8.2	25
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.52	79.8	8.6	25
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.45	89.9	8.8	25

C - SPECFIC CONDUCTANCE

A - NOT ANALYZED

HADED CATION RESULTS ARE FROM A NON-FILTERED SAMPLE & REPRESENTS TOTAL METALS

Total metals (Preliminary)

STATION ID	Date	Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Sn (mg/L)	Sr (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
PPER STARMER'S	4/28/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPRING	5/19/95	<0.01	1.3	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	<0.01	0.5	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	0.01	0.05	<0.01	<0.01	<0.02
hemeral; active channel of	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Starmer's Gulch)	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHARLIE'S SPRING	7/22/94	<0.01	0.4	<0.06	0.01	<0.1	<0.001	<0.005	<0.01	<0.01	<0.01	0.2	<0.0002	NA	<0.01	<0.01	<0.02	<0.05	<0.06	<0.005	<0.2	0.07	<0.2	<0.01	<0.02
ennial; south-facing slope of	2/24/95	<0.01	2.5	<0.005	0.04	0.2	<0.001	<0.005	<0.01	<0.01	<0.01	1.7	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.06	<0.005	<0.01	0.09	<0.005	<0.01	0.05
Starmer's Gulch)	4/28/95	<0.01	0.8	<0.01	0.06	0.5	<0.005	<0.005	<0.01	<0.01	<0.01	0.3	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.06	<0.01	<0.01	0.11
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PERKINS SPRING	4/28/95	<0.01	1.0	<0.01	0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.01	0.4	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.08	<0.01	<0.01	0.03
emeral; south-facing slope	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Starmer's Gulch)	5/24/95	<0.01	0.8	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.02	0.3	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	0.02	0.05	<0.01	<0.01	<0.02
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TARMER'S SPRING	7/22/94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ennial; north-facing slope of	2/24/95	<0.01	8.3	<0.005	0.03	0.1	<0.001	<0.005	<0.01	<0.01	<0.01	4.5	<0.0002	<0.01	0.02	<0.01	<0.02	<0.003	<0.06	<0.005	0.02	0.10	<0.005	<0.01	0.03
Starmer's Gulch)	4/28/95	<0.01	1.2	<0.01	<0.01	<0.1	<0.005	<0.005	<0.01	<0.01	0.01	0.8	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.09	<0.01	<0.01	0.03
	6/14/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OMESTEAD SPRING	8/9/94	<0.1	2.30	0.001	<0.1	<0.1	<0.1	<0.001	0.003	<0.05	<0.1	1.50	<0.0005	NA	<0.05	<0.1	<0.1	<0.1	NA	<0.005	<0.1	<0.1	NA	<0.1	<0.1
ennial; north-facing slope of	2/24/95	<0.01	8.7	<0.005	0.01	<0.1	<0.001	<0.005	<0.01	<0.01	<0.01	4.9	<0.0002	<0.01	0.02	<0.01	<0.02	<0.003	<0.06	<0.005	0.05	0.10	<0.005	<0.01	<0.02
Pajarito Canyon)	4/28/95	<0.01	0.8	<0.01	0.05	0.4	<0.005	<0.005	<0.01	<0.01	<0.01	0.4	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	<0.02	0.09	<0.01	<0.01	0.06
	5/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6/22/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7/7/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

- NOT ANALYZED

ADED METAL RESULTS ARE FROM A NON-FILTERED SAMPLE & REPRESENTS TOTAL METALS

STATION ID	Date	H3 (pCi/L)	UNC	90Sr (pCi/L)	UNC	137Cs (pCi/L)	UNC	U (ug/L)	UNC	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	UNC	239/240 Pu (pCi/L)	UNC	241Am (pCi/L)	UNC	Gross Alpha (pCi/L)	UNC	Gross Beta (pCi/L)	UNC
UPPER STARMER'S SPRING	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(ephemeral; active channel of	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
Starmer's Gulch)	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
CHARLIE'S SPRING	7/22/94	<167.3	BDL	<0.85	BDL	<2.981	BDL	0.241	0.033	NA	NA	NA	<0.035	BDL	<0.011	BDL	<2.693	BDL	<2.92	BDL	<4.38	BDL
(perennial; south-facing slope of	2/24/95	NA	-	<0.66	BDL	NA	-	NA	-	0.23	<0.03	0.14	<0.08	BDL	0.03	0.02	<0.07	BDL	<3.4	BDL	4.87	0.90
Starmer's Gulch)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
PERKINS SPRING	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(ephemeral; south-facing slope o	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
Starmer's Gulch)	5/24/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
STARMER'S SPRING	7/22/94	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(perennial; north-facing slope of	2/24/95	NA	-	<0.69	BDL	NA	-	NA	-	0.24	<0.02	0.16	<0.06	BDL	0.04	0.02	<0.07	BDL	<2.6	BDL	3.49	0.75
Starmer's Gulch)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/14/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
HOMESTEAD SPRING	8/9/94	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	*1.1/**1.2	0.4/0.4	*3.4/**3.4	0.7/0.7
(perennial; north-facing slope of	2/24/95	NA	-	<0.97	BDL	NA	-	NA	-	0.06	<0.02	0.09	<0.08	BDL	<0.05	BDL	<0.05	BDL	<2.4	BDL	3.62	0.87
Pajarito Canyon)	4/28/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	5/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	6/22/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
	7/7/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-

*ALPHA RESULT USING AMERICIUM-241 SOURCE

**BETA RESULT USING CESIUM-137 SOURCE

*ALPHA RESULT USING NATURAL URANIUM SOURCE

**BETA RESULT USING STRONTIUM-90 SOURCE

NA - NOT ANALYZED

Table 4 - NMED DOE Oversight Bureau Ground-Water Quality Results, Field Unit 6,
Tech Area 9: Volatile Organic Compounds (Preliminary)

SAMPLE ID: Homestead Spring SAMPLING DATE: 5/19/95 PARAMETER	RESULT (ug/l)
BENZENE	<0.5
BROMOBENZENE	<0.5
BROMOCHLOROMETHANE	<0.5
BROMODICHLOROMETHANE	<0.5
BROMOFORM	<0.5
BROMOMETHANE	<0.5
2-BUTANONE (MEK)	<5
n-BUTYLBENZENE	<0.5
sec-BUTYLBENZENE	<0.5
tert-BUTYLBENZENE	<0.5
tert-BUTYL METHYL ETHER (MTBE)	<5
CARBON TETRACHLORIDE	<0.5
CHLOROBENZENE	<0.5
CHLOROETHANE	<0.5
CHLOROFORM	<0.5
CHLOROMETHANE	<0.5
2-CHLOROTOLUENE	<0.5
4-CHLOROTOLUENE	<0.5
1,2-DIBROMO-3-CHLOROPROPANE	<0.5
DIBROMOCHLOROMETHANE	<0.5
1,2-DIBROMOETHANE (EDB)	<0.5
DIBROMOMETHANE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
DICHLORODIFLUOROMETHANE	<0.5
1,1-DICHLOROETHANE	<0.5
1,2-DICHLOROETHANE (EDC)	<0.5
1,1-DICHLOROETHENE	<0.5
CIS--1,2-DICHLOROETHENE	<0.5
TRANS--1,2-DICHLOROETHENE	<0.5
1,2-DICHLOROPROPANE	<0.5
CIS--1,3-DICHLOROPROPENE	<0.5
2,2-DICHLOROPROPANE	<0.5
2,2-DICHLOROPROPENE	<0.5
TRANS--1,3-DICHLOROPROPENE	<0.5
ETHYLBENZENE	<0.5
HEXACHLOROBUTADIENE	<0.5
ISOPROPYLBENZENE	<0.5
4-ISOPROPYLTOLUENE	<0.5
METHYLENE CHLORIDE	<0.5
NAPHTHALENE	<0.5
PROPYLBENZENE	<0.5
STYRENE	<0.5
1,1,1,2-TETRACHLOROETHANE	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.5
TETRACHLOROETHENE	<0.5
TETRAHYDROFURAN (THF)	<5
TOLUENE	<0.5
1,2,3-TRICHLOROBENZENE	<0.5
1,2,4-TRICHLOROBENZENE	<0.5
1,1,1-TRICHLOROETHANE	<0.5
1;1,2-TRICHLOROETHANE	<0.5
TRICHLOROETHENE	<0.5
TRICHLOROFLUOROMETHANE	<0.5
1,2,3-TRICHLOROPROPANE	<0.5
1,2,4-TRIMETHYLBENZENE	<0.5
1,3,5-TRIMETHYLBENZENE	<0.5
VINYL CHLORIDE	<0.5
o-XYLENE	<0.5
p- & m-XYLENE	<0.5
TOTAL XYLENES	<1

SAMPLE ID: Charlie's Spring SAMPLING DATE: 5/19/95 PARAMETER	RESULT (ug/l)
BENZENE	<0.5
BROMOBENZENE	<0.5
BROMOCHLOROMETHANE	<0.5
BROMODICHLOROMETHANE	<0.5
BROMOFORM	<0.5
BROMOMETHANE	<0.5
2-BUTANONE (MEK)	<5
n-BUTYLBENZENE	<0.5
sec-BUTYLBENZENE	<0.5
tert-BUTYLBENZENE	<0.5
tert-BUTYL METHYL ETHER (MTBE)	<5
CARBON TETRACHLORIDE	<0.5
CHLOROBENZENE	<0.5
CHLOROETHANE	<0.5
CHLOROFORM	<0.5
CHLOROMETHANE	<0.5
2-CHLOROTOLUENE	<0.5
4-CHLOROTOLUENE	<0.5
1,2-DIBROMO-3-CHLOROPROPANE	<0.5
DIBROMOCHLOROMETHANE	<0.5
1,2-DIBROMOETHANE (EDB)	<0.5
DIBROMOMETHANE	<0.5
1,2-DICHLOROBENZENE	<0.5
1,3-DICHLOROBENZENE	<0.5
1,4-DICHLOROBENZENE	<0.5
DICHLORODIFLUOROMETHANE	<0.5
1,1-DICHLOROETHANE	<0.5
1,2-DICHLOROETHANE (EDC)	<0.5
1,1-DICHLOROETHENE	<0.5
CIS--1,2-DICHLOROETHENE	<0.5
TRANS--1,2-DICHLOROETHENE	<0.5
1,2-DICHLOROPROPANE	<0.5
CIS--1,3-DICHLOROPROPENE	<0.5
2,2-DICHLOROPROPANE	<0.5
2,2-DICHLOROPROPENE	<0.5
TRANS--1,3-DICHLOROPROPENE	<0.5
ETHYLBENZENE	<0.5
HEXACHLOROBUTADIENE	<0.5
ISOPROPYLBENZENE	<0.5
4-ISOPROPYLTOLUENE	<0.5
METHYLENE CHLORIDE	<0.5
NAPHTHALENE	<0.5
PROPYLBENZENE	<0.5
STYRENE	<0.5
1,1,1,2-TETRACHLOROETHANE	<0.5
1,1,2,2-TETRACHLOROETHANE	<0.5
TETRACHLOROETHENE	<0.5
TETRAHYDROFURAN (THF)	<5
TOLUENE	<0.5
1,2,3-TRICHLOROBENZENE	<0.5
1,2,4-TRICHLOROBENZENE	<0.5
1,1,1-TRICHLOROETHANE	<0.5
1,1,2-TRICHLOROETHANE	<0.5
TRICHLOROETHENE	<0.5
TRICHLOROFLUOROMETHANE	<0.5
1,2,3-TRICHLOROPROPANE	<0.5
1,2,4-TRIMETHYLBENZENE	<0.5
1,3,5-TRIMETHYLBENZENE	<0.5
VINYL CHLORIDE	<0.5
o-XYLENE	<0.5
p- & m-XYLENE	<0.5
TOTAL XYLENES	<1

LESS THAN (<) SYMBOL INDICATES THAT THE REPORTED VALUE IS LESS THAN THE MEAN DETECTION LIMITS
METHODS USED:SDWA VOC-I(EPA-502.2)

Table 5 - NMED DOE Oversight Bureau Ground ...

Explosive Compounds (Preliminary)

SAMPLE ID: Perkins Spring
SAMPLING DATE: 5/24/95

PARAMETER	*RESULT (ug/l)
2-AMINO-4,6-DNT & AMINO-2,6-DNT	<2
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	<2
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	<2
1,3,5-TRINITROBENZENE (1,3,5-TNB)	<2
1,3-DINITROBENZENE (1,3-DNB)	<2
TETRYL	<2
NITROBENZENE (NB)	<2
2,4,6-TRINITROTOLUENE (2,4,6-TNT)	<2
2,4-DINITROTOLUENE(2,4-DNT) & 2,6-DINITROTOLUENE(2,6-DNT)	<2
o-NITROTOLUENE (2-NT)	<2
p-NITROTOLUENE (4-NT)	<2
m-NITROTOLUENE (3-NT)	<2

* - Modified Method 8330

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

25 September 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

RE: Strontium-90 (^{90}Sr) in Test Well 3 (TW-3), Los Alamos Canyon, Los Alamos National Laboratory (LANL)

Dear Mr. Trujillo:

The observations and recommendations of NMED DOE OB concerning ^{90}Sr in TW-3 are as follows:

- TW-3 was not sampled for ^{90}Sr from 1981 to 1992. Since 1980, the referenced test well has only been sampled once (1993) for ^{90}Sr.

- Data from two shallow-aquifer (alluvium) monitoring wells indicate that a viable ^{90}Sr source exists near TW-3. LAO-2, a shallow-aquifer well located approximately 50 ft northwest of TW-3, was sampled in 1991 and 1992, and showed ^{90}Sr concentrations of 42.0 and 23.0 pCi/L (LANL ES Reports, 1991 and 1992) respectively. LAO-3, a shallow-aquifer well located approximately 400 ft east of TW-3, was sampled in 1991 and 1992, and showed ^{90}Sr concentrations of 55.0 and 49.9 pCi/L (LANL ES Reports, 1991 and 1992) respectively. It should be noted that TW-3 intersects this zone and an intermediate perched ground-water zone which was encountered during the drilling of O-4; hence, borehole leakage may be occurring. The intermediate zone near TW-3 has not been characterized due to the lack of monitoring wells.

- Ground-water radionuclide concentrations at LANL vary considerably through time. For example, Plutonium-239/240 ($^{239/240}Pu$) concentrations in water from TW-2A were less than the limit of detection (0.02 pCi/L) in 1991, but 1.28 pCi/L, or 64 times the limit of detection in 1992. Re-sampling a year later to confirm or verify a previous non-detectible or detectible amount of a radionuclide may not be valid.

XXS-18+

13112

- Production well O-4 may have a significant hydraulic influence on TW-3. More specifically, pumping O-4 may cause head loss at TW-3. Because of that, a larger than normal (static) volume of ground water may be transmitted through the interval that TW-3 monitors. Such stress could possibly increase the variability of contaminant levels through time.

- NMED DOE OB submitted an archive sample (duplicate sample) from TW-3 for ^{90}Sr analysis on July 7, 1995. ^{90}Sr was not detected above 1.5 pCi/L. It should be noted that the sample was collected one year prior to analysis and was neither preserved nor stored at 4° C.

- NMED DOE OB initiated and performed purge/concentration test at TW-3 on July 7, 1995. Ground-water samples were obtained from the initial (beginning of pumping) and the third-casing volume purge. Results from the initial and third casing volume were less than 1.2 pCi/L and 1.3 pCi/L respectively.

- The NMED DOE OB recommends quarterly sampling of TW-3 in order to monitor any possible contamination.

The above DOE OB data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies within thirty (30) days of receipt of this letter. Please contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, POC LANL, DOE OB
New Mexico Environment Department

SY:mrd

cc: Matt Johansen, DOE LAAO, MS A316
Steve Rae, LANL, ESH-18, MS K490
Allyn Pratt, LANL, EES-13, MS J521
Neil Weber, NMED, Chief, DOE OB

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

October 6, 1995

Ted Taylor
Department of Energy
Los Alamos Area Office
MS-A316
Los Alamos, NM 87545

Subject: Request for delineation of Environmental Restoration sites in or near watercourses

Dear Mr. Taylor:

The New Mexico Environment Department, Department of Energy Oversight Bureau (NMED DOE OB) needs more information to assess Potential Release Sites (PRS), Solid Waste Management Units (SWMUs), Voluntary Corrective Action (VCA) and Expedited Cleanup (EC) sites for potential impacts to surface water quality. To fulfill this need the NMED DOE OB is requesting a map which indicates all of the above sites that are located in natural watercourses or where there is a reasonable probability that Constituents of Concern (COCs) will be moved into a natural watercourse by leaching or otherwise. In addition we are requesting a listing of COCs and their concentration found at each site delineated on the map.

It is the understanding of NMED DOE OB that a comprehensive, technically defensible, Lab-wide site prioritization scheme relating to surface water quality impacts of Environmental Restoration (ER) sites is not in place at this time. A prioritization scheme which incorporates the proximity of a site to a watercourse, the extent of contamination, and the likelihood of contaminant mobilization and transport from stormwater should be developed. Best Management Practices (BMPs) should then be put in place and maintained on a priority basis to mitigate the spread of these contaminants until final remediation of the site is accomplished.

13113

It is our understanding that funding for BMP incorporation into the ER, VCR and EC investigation process has not been provided for. Adequate funding for interim measures should be obtained and applied to BMPs. Funds expended now preventing the spread of contamination will save money in the future when actual remediation commences, and mitigate transport of contaminants from laboratory property.

DOE OB requests that two copies of these maps and supporting information be provided to the DOE OB. One copy of these maps and supporting information will be delivered to the Surface Water Quality Bureau (SWQB). These maps will be used to prioritize sites for the implementation of storm water Best Management Practices (BMPs) and to track mitigation progress.

Watercourse protection is addressed in New Mexico Water Quality Control Commission Regulations in Section 2-200; 2-201.

> "DISPOSAL OF REFUSE-No person shall dispose of any refuse in a natural watercourse or in a manner where there is a reasonable probability that the refuse will be moved into a natural watercourse by leaching or otherwise. Solids diverted from the stream and returned thereto are not subject to abatement under this section".

Historical release sites should be addressed in the same manner as spills. They should be reported to the SWQB and mitigation measures need to be addressed to prevent the spread of contamination until final clean-up.

If you have any further questions please do not hesitate to call me at 672-0459 to discuss this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak
NMED/DOE/OB, POC

SY:rfs:hd

cc: Neil Weber, Chief, NMED/AIP Bureau
Jim Piatt, NMED, Chief, SWQB
Steve Rae, Group Leader, ES&H-18, MS/K497
Benito Garcia, NMED, Chief, HRMB
Joseph Vozella, AAMEP, LAAO, MS-A316
Ivan Trujillo, DOE\AIP\POC, MS-A316
Jorg Jansen, EM/ER/D&D, MS-M992

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GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

11 October 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

RE: Radionuclide results for Test Well 4 (TW-4) and Test Well DT-9, Los Alamos National Laboratory (LANL)

Dear Mr. Trujillo:

The New Mexico Environment Department(NMED) Department of Energy Oversight Bureau(DOE OB) conducted split sampling of LANL's Environmental Surveillance (ES) test well TW-4 on June 6, 1994, and results indicate elevated concentrations (6.59 pCi/L ±1.00) of strontium-90. The DOE OB data were confirmed by LANL's ESH-18 hydrology group. LANL's ES test well DT-9 showed elevated levels of plutonium-238 (0.135 pCi/L ±0.065) and plutonium-239/240 (0.045 pCi/L ±0.036), americium-241 (0.117 ±0.073), alpha (9.55 pCi/L ±1.87) and beta (14.19 pCi/L ±1.92). The above DOE OB data warrants our recommendation for quarterly sampling of the referenced test wells.

The above DOE OB data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies within thirty (30) days of receipt of this letter. Please contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, POC LANL, DOE OB
New Mexico Environment Department

SY:ard

cc: Matt Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Steve Rae, LANL, ESH-18, MS K490
Allyn Pratt, LANL, EES-13, MS J521
Neil Weber, NMED, Chief, DOE OB

13114

United States Government

Department of Energy

memorandum

Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

DATE: DEC 0 5 1995

REPLY TO ATTN OF: LAAMEP:2KZ-012

SUBJECT: Your Letter of October 11, 1995 Regarding Radionuclide Results for Test Well 4 (TW-4) and Test Well DT-9, LANL

TO: Steve Yanicak, LANL Point of Contact, DOE Oversight Bureau, NMED, LANL, MS-J993

DOE LAAO and LANL have reviewed the NMED OB environmental surveillance data for TW-4 and Test Well DT-9. Subsequent sampling and analysis of TW-4 does not support the 1994 finding for Strontium-90; however, it also does not necessarily invalidate the result. The data for DT-9 are inconclusive as evaluation of the results indicate the levels near the analytical detection limit. Regardless of the interpretation of these data, we agree with DOE OB recommendation that quarterly sampling of the test wells is warranted.

LANL will implement quarterly sampling of the referenced test wells in January 1996 when NMED OB funding will allow for split sampling. Further elaboration on the above comments is attached.

These comments are submitted under the Agreement-in Principle Umbrella Protocol. If you have any questions, please contact Ken Zamora of my staff at 665-5047.

Joseph C. Vozella
Assistant Area Manager
Office of Environment
and Projects

Attachment

RECEIVED
DEC 0 7 1995

cc w/attachment:
N. Weber, Bureau Chief
AIP, DOE Oversight Program
New Mexico Environment Dept.
2044 Galisteo St., Bldg. A
P. O. Box 26110
Santa Fe, NM 87505
I. Trujillo, AAMEP, LAAO
K. Zamora, AAMEP, LAAO
S. Rae, ESH-18, LANL, MS-K497
B. Gallaher, ESH-18, LANL, MS-K497
D. Rogers, ESH-18, LANL, MS-K497
K. McAda, EPD, AL

13115

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

DATE: November 17, 1995
IN REPLY REFER TO: ESH-18/WQ&H-95-0550
MAIL STOP: K497
TELEPHONE: (505) 667-0313

Mr. Joseph C. Vozella
Assistant Area Manager
Office of Environment and Projects
U.S. Department of Energy
Los Alamos Area Office
Los Alamos, NM 87544

SUBJECT: **RESPONSE TO 10/11/95 NMED DOE OB MEMO REGARDING RADIONUCLIDE RESULTS FOR TEST WELLS TW-4 AND DT-9**

Dear Mr. Vozella:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) has called to our attention their 1994 finding of a Strontium-90 value in Test Well 4 of 6.6±1.0 pCi/L. This is close to our value of 6.2±3.4 pCi/L for a split sample.

In July of 1995 during constant pumping of Test Well 4, we collected a time series of eight samples and two duplicates. Preliminary trace-level tritium analyses by the University of Miami show that all samples have a tritium level below 1 tritium unit (about 3.24 pCi/L). Waters with such low tritium levels have probably been isolated from surface recharge for at least 50 years.

Strontium-90 results for these eight time series Test Well 4 samples (see Table 1) were all below about 1.0±0.8 pCi/L, with one possible exception. One sample had a higher value of 2.9±0.8 pCi/L initially, but showed 0.5±1.2 pCi/L on reanalysis. These tritium and Strontium-90 data contradict the 1994 findings, and suggest that there is no surface contamination in this well.

There are two possible explanations for the 1994 ^{90}Sr finding: (1) both the Laboratory and NMED samples were contaminated by the sampling process, which occurred near the site of the former TA-45 radioactive liquid waste treatment plant; or, (2) contamination in this test well, if present, is not pervasive in light of the negative 1995 and prior years' results.

The NMED DOE OB also cited what they believe to be elevated levels of ^{238}Pu, $^{239,240}Pu$, ^{241}Am, Gross Alpha, and Gross Beta for Test Well DT-9 (see Table 2). The Laboratory's 1994 Environmental

Surveillance Report values for the split sample are also presented in Table 2, and these values are generally lower than the NMED DOE OB results. The numbers presented in parentheses are the standard deviation of the analytical uncertainty for the analytical result given.

The counting statistics for radiometric analyses are described by a Poisson distribution. If the measured value exceeds 1.65 times the standard deviation, a detection may have occurred. This procedure only accounts for uncertainty in counting statistics, however, and may be less than the overall method error for an analysis. The 1.65 σ values are shown in Table 2.

The values for ^{238}Pu, $^{239,240}Pu$, ^{241}Am, which the NMED DOE OB cited as elevated, are either near or less than 1.65 times the standard deviations of the analytical result. It is questionable whether these analytical results are significantly different from zero. Therefore these values are not elevated, but are near the analytical detection limit.

Table 1. Strontium-90 Results from Test Well 4 for 1995

Well Bore No.	^{90}Sr (pCi/L)	$\pm^{90}Sr$ (pCi/L)
0	0.10	0.70
1	1.10	0.80
2	0.30	0.90
2 Duplicate	0.20	1.20
3	2.90	0.80
3 Reanalysis	0.50	1.20
4	0.50	0.90
4 Reanalysis	0.10	1.20
5	0.10	0.80
7	0.30	0.90
10	0.50	1.20
10 Duplicate	1.00	1.20

In the case of the gross alpha and beta results, the Laboratory's 1994 Environmental Surveillance Report values for the split sample are again lower than those of the NMED DOE OB. According to the Laboratory radiochemists, the methods used to determine gross alpha and beta are only approximate. The NMED DOE OB value for gross alpha is below the EPA primary drinking water maximum contaminant level of 15 pCi/L, and the gross beta value is below the EPA screening level of 50 pCi/L.

Table 2. Radiochemical Analysis of Test Well DT-9 for 1994

	^{3}H (nCi/l)	^{90}Sr (pCi/l)	^{137}Cs (pCi/l)	Total Uranium (mg/l)	^{238}Pu (pCi/l)	$^{239,240}Pu$ (pCi/l)	^{241}Am (pCi/l)	Gross Alpha (pCi/l)	Gross Beta (pCi/l)	Gross Gamma (pCi/l)
NMED/AIP	<0.2	<1.4	<2.9	<0.3 (0.04)	0.135 (0.065)	0.045 (0.036)	0.117 (0.073)	9 (2)	14 (2)	
1.65 × σ					0.11	0.06	0.12			
LANL	0.1 (0.3)	0.7 (0.7)	<1.2	0.2 (0.0)	-0.004 (0.030)	0.026 (0.020)	0.062 (0.030)	1 (1)	4 (1)	90 (50)
1.65 × σ					0.05	0.03	.05			

Regardless of the interpretation of these data, we agree with the NMED DOE OB that quarterly sampling of the Test Wells is desirable. We have laid out our proposal to institute such sampling in two previous letters to you (WQ&H:95-0469 dated October 6, 1995 from Steve Rae; and WQ&H:95-0499 dated October 25, 1995 from Bruce Gallaher).

Please call me at 667-0313 if I can be of further help in this matter.

Sincerely,

David B. Rogers, Hydrologist,
Water Quality & Hydrology Group

DBR/em

Attach.: 10/11/95 Memo "Radionuclide results for Test Well 4 (TW-4) and Test Well DT-9, Los Alamos National Laboratory (LANL)"

Cy: Dennis Erickson, ESH-DO, w/att., MS K491
John Gustafson, PA-1, w/att., MS C177
Steve Rae, ESH-18, w/att., MS K497
Bruce Gallaher, ESH-18, w/att., MS K497
Ken Mullen, ESH-18, w/att., MS K497
WQ&H File, w/att., MS K497

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

11 October 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

RE: Radionuclide results for Test Well 4 (TW-4) and Test Well DT-9, Los Alamos National Laboratory (LANL)

Dear Mr. Trujillo:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) conducted split sampling of LANL's Environmental Surveillance (ES) test well TW-4 on June 6, 1994, and results indicate elevated concentrations (6.59 pCi/L ±1.00) of strontium-90. The DOE OB data were confirmed by LANL's ESH-18 hydrology group. LANL's ES test well DT-9 showed elevated levels of plutonium-238 (0.135 pCi/L ±0.065) and plutonium-239/240 (0.045 pCi/L ±0.036), americium-241 (0.117 ±0.073), alpha (9.35 pCi/L ±1.37) and beta (14.19 pCi/L ±1.92). The above DOE OB data warrants our recommendation for quarterly sampling of the referenced test wells.

The above DOE OB data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies within thirty (30) days of receipt of this letter. Please contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, POC LANL, DOE OB
New Mexico Environment Department

SY:mrd

cc: Matt Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Steve Rae, LANL, ESH-18, MS K490
Allyn Pratt, LANL, EES-13, MS J521
Neil Weber, NMED, Chief, DOE OB

Facsimile Copy

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

6 December 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

RE: Ground-water and surface-water flow measurements and recommendations, Los Alamos National Laboratory, New Mexico

Dear Mr. Trujillo:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) staff conducted quantitative and visual estimate flow measurements (Tables 1 and 2) in Pajarito Canyon, Canon de Valle, Threemile Canyon, Water Canyon and two (2) unnamed tributaries (Drop Tower and Fish Ladder Canyons) during 1994 and 1995 (Figure 1). Flow data were obtained by measuring the volume of water collected via natural or man-made water fall (e.g., culvert) or temporary water-diversion structure during a given time interval and by visual estimations. Water was collected in either a 1 or 5 gallon plastic container and timed using a stopwatch. Mean flow measurements at each location were calculated using multiple measurements. The number of flow measurements taken at each station varied from three to nine. Our measurements indicate that several perennial reaches and springs or seeps exist within the laboratory boundary. Surface-water flow from a number of the perennial springs is lost within several hundred feet; however, some of the perennial springs support surface-water flow at distances greater than one mile.

It should be noted that these perennial reaches and springs are viable recharge zones for perched ground water within the canyon alluvium and possibly deeper ground-water zones. Hence, these possible perched zones should be characterized.

NMED DOE OB is recommending monitoring (e.g., flow measurements, water quality) of the springs and surface waters within the referenced canyons. The attached data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies within thirty (30) days of receipt of this letter.

Contact Michael Dale at 672-0449 or Ralph Ford-Schmid at 827-1536 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

attachments
SY:mrd
cc: Matt Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Bonnie Koch, DOE LAAO, MS A316
Everett Trollinger, DOE LAAO, MS A316
Mike Gilgosch, DOE LAAO, MS A316
Gary Allen, LANL, CST-18, MS E525
Gene Gould, LANL, ESA-DE, MS G787
Brad Martin, LANL, CST-18, MS E525
Cheryl Rofer, LANL, EES-1, MS D462
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490
Neil Weber, NMED, Chief, DOE Oversight Bureau

Table 1. Flow observations and measurements obtained from several on-site surface-water reaches, Los Alamos National Laboratory, New Mexico

Location	Number on Map	Date	Mean Measured Flow (cfs)	Number of Measurements	Estimated Flow (cfs)
SURFACE WATER					
Pajarito Canyon					
PA 7.0	1	7/22/94	-	-	0.033
		10/27/95	-	-	0.078
PA 8.9	2	2/10/95	0.134	3	-
		2/25/95	0.267	3	-
		4/28/95		-	0.401
		5/19/95		-	0.357
		6/20/95	0.446	3	-
		8/9/95	0.212	4	-
		10/27/95	0.094	4	-
		11/16/95	0.086	5	-
PA 9.05	3	8/9/94		-	0.007
		2/24/95		-	0.022
		4/28/95		-	0.022
		5/19/95		-	0.022
		7/7/95		-	0.011
		11/9/95	0.011	7	-
Starmer's Gulch					
ST 0.05	4	8/9/94		-	0.045
		2/24/95		-	0.045
		4/28/95		-	0.067
		5/19/95		-	0.067
		7/7/95		-	0.045
		10/27/95		-	0.045
		11/9/95	0.050	7	-
Bulldog Tributary					
BU 0.1	5	8/9/94		-	0.022
		2/10/95		-	0.022
		2/24/95		-	0.022
		4/28/95		-	0.033
		5/19/95		-	0.033
		6/20/95		-	0.033
		7/7/95		-	0.022
		8/9/95		-	0.022
		10/20/95		-	0.022
		11/9/95	0.035	9	-
Canon de Valle					
VA 1.85	6	6/16/95		-	0.022
		8/31/95		-	0.007
		11/16/95	0.021	5	-
VA 2.1	7	11/16/95	0.018	6	-
VA 2.6	8	11/16/95		-	0.038

Table 1 (cont.). Flow observations and measurements obtained from several on-site surface-water reaches, Los Alamos National Lat tory, New Mexico

Location	Number on Map	Date	Mean Measured Flow (cfs)	Number of Measurements	Estimated Flow (cfs)
SURFACE WATER (cont.)					
Canon de Valle (cont.)					
VA 2.7	9	6/20/95	0.040	3	-
		3/17/95	0.154	3	-
		3/22/95	0.159	3	-
		3/30/95	0.166	3	-
		5/5/95	0.178	3	-
		6/16/95	0.103	3	-
		8/8/95	0.040	3	-
		8/31/95	0.088	3	-
		11/16/95	0.035	5	-

Note: See Figure 1 for location and data correlation.

Table 2. Flow observations and measurements obtained from several on-site springs, Los Alamos National Laboratory, New Mexico

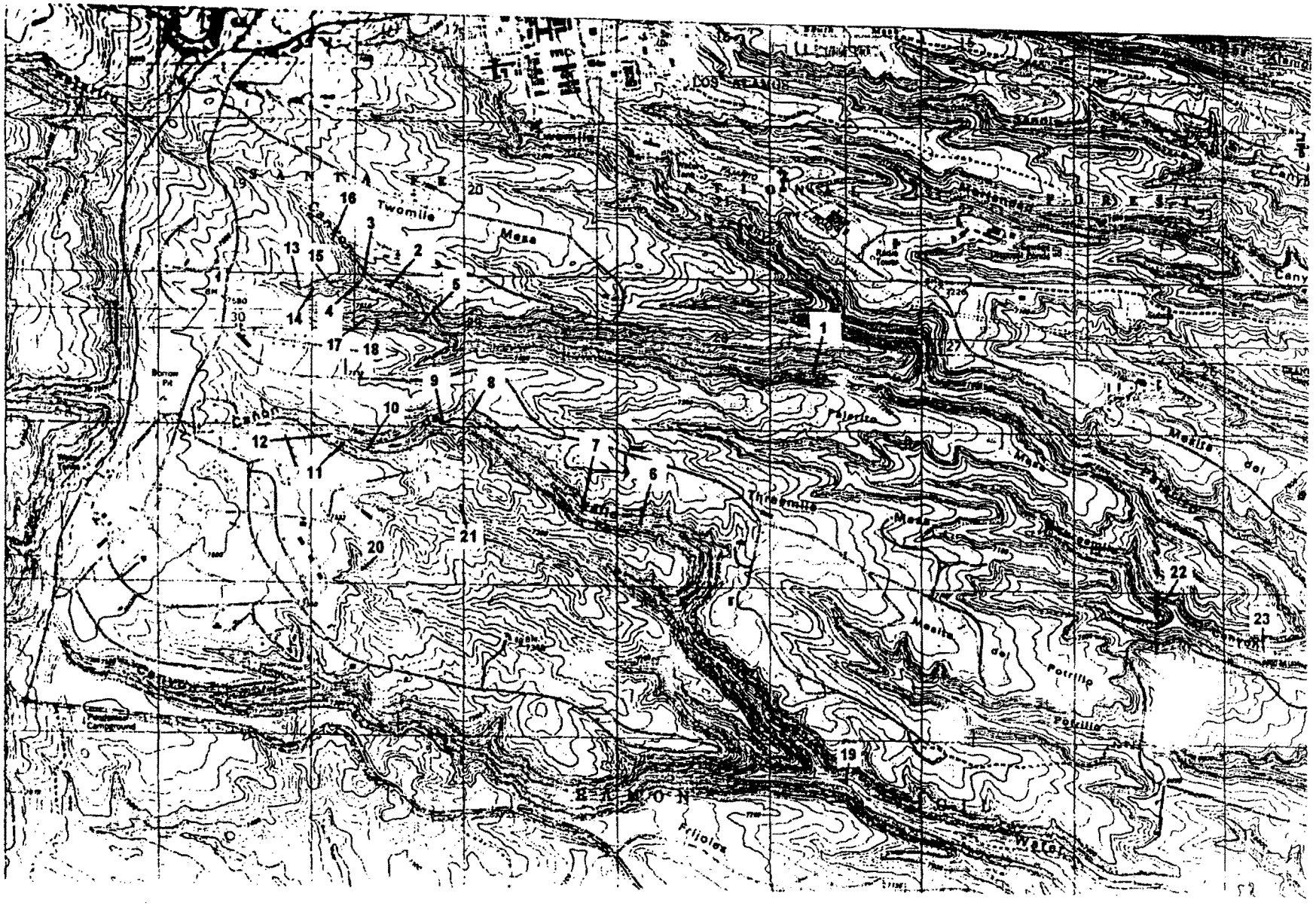
Location	Number on Map	Date	Mean Measured Flow (gpm)	Number of Measurements	Estimated Flow (gpm)
SPRINGS/SEEPS					
Canon de Valle					
Burning Ground Spring	10	8/12/94	-	-	10-15
		3/17/95	-	-	10-15
		3/22/95	-	-	10-15
		5/12/95	-	-	10-15
		8/31/95	13.4	4	-
SWSC Spring	11	8/12/94	-	-	3-5
		3/17/95	-	-	3-5
		3/22/95	-	-	3-5
		5/12/95	-	-	3-5
		8/31/95	-	-	3-5
Peter Spring	12	8/12/94	-	-	3-5
		3/17/95	-	-	5-7
		3/22/95	-	-	5-7
		5/12/95	-	-	7-10
		8/31/95	-	-	3-5
Starmer's Gulch					
Charlie's Spring	13	7/22/94	-	-	2-4
		2/24/95	-	-	2-4
		4/28/95	-	-	2-4
		5/19/95	-	-	2-4
		6/14/95	-	-	2-4
		6/22/95	-	-	2-4
		7/7/95	-	-	2-4
		10/20/95	-	-	2-4
		11/9/95	-	-	2-4
Starmer's Spring	14	7/22/94	-	-	15-20
		2/24/95	-	-	15-20
		4/28/95	-	-	15-20
		6/14/95	-	-	15-20
		6/22/95	-	-	15-20
		7/7/95	-	-	15-20
		10/20/95	-	-	15-20
		11/9/95	-	-	15-20
Bryan Spring	15	5/19/95	-	-	3-5
		6/22/95	-	-	3-5
		7/7/95	-	-	3-5
		10/20/95	-	-	3-5
		11/9/95	-	-	3-5
Pajarito Canyon					
Homestead Spring	16	8/9/94	-	-	3-5
		2/24/95	-	-	3-5
		4/28/95	-	-	3-5
		5/19/95	-	-	3-5
		6/22/95	-	-	3-5
		7/7/95	-	-	3-5
		10/20/95	-	-	3-5
		11/9/95	-	-	3-5

Table 2 (cont.). Flow observations and measurements obtained from several on-site springs, Los Alamos National Laboratory, New Mexico

Location	Number on Map	Date	Mean Measured Flow (gpm)	Number of Measurements	Estimated Flow (gpm)
SPRINGS/SEEPS (cont.)					
Bulldog Tributary					
Kieling Spring	17	5/19/95	-	-	3-5
		7/7/95	-	-	3-5
		10/20/95	-	-	3-5
Bulldog Spring	18	8/9/94	-	-	10-15
		2/24/95	-	-	10-15
		4/28/95	-	-	15-20
		5/19/95	-	-	15-20
		7/7/95	-	-	10-15
		10/20/95	-	-	10-15
		11/9/95	-	-	10-15
Water Canyon					
WC 6.25 Seep	19	8/4/95	-	-	1-3
Drop Tower Canyon					
Martin Spring	20	5/12/95	-	-	2-3
		7/21/95	-	-	2-3
Fish Ladder Canyon					
FL Seep	21	5/12/95	-	-	2-4
		6/2/95	-	-	1-3
Threemile Canyon					
Threemile Spring	22	3/13/95	-	-	10-15
		6/23/95	-	-	5-10
		8/18/95	-	-	5-10
		11/9/95	7.3	8	-
TA-18 Spring	23	3/21/95	-	-	2-4
		3/13/95	-	-	2-4
		11/9/95	1.6	8	-

Note: See Figure 1 for location and data correlation.

Figure 1. [illegible]ED DOE OB's ground-water and surface-water flow measr[illegible]ent locations, Los Alamos National Laboratory, New Mexico (n[illegible]ified from USGS, Frijoles 7.5 Quadrangle)



Note: locations approximate

SCALE 1:24 000

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Michael's copy

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ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

12 December 1995

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

RE: Data submittal and recommendations concerning Mortandad Canyon sediment trap (ST) No. 1, Field Unit 4, Operable Unit 1129, Tech Area 5, SWMU NO. 0-001, Los Alamos National Laboratory

Dear Mr. Trujillo:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) staff performed sediment sampling at the referenced SWMU on October 28, 1994. Sampling occurred at two locations within ST No. 1. A total of four samples were taken. Two samples (Fines-1 and Sand-1) were taken at the head of ST No.1 and two samples (Fines-2 and Sand-2) were taken at approximately the center of ST No.1. Sample Fines-1 apparently represents fine-grained deposits (0.3-1.0 cm thick) or suspended fraction and overlies sample Sand-1 which may represent coarse-grained deposits (unknown thickness) or bedload fraction. The sediments may correspond to some type of prograding fluvial facies. Fines-2 apparently represents fine-grained pond deposits (2-3 cm thick) that overlies sample Sand-2 (unknown thickness) which may represent the base of the most recent excavation or a coarse-grained fluvial deposit. Our observations at ST No. 1 indicate that a fining-upward sequence results from storm events. Since the fine-grained fraction absorbs the bulk of the contaminants we recommend that the fine-grained fraction be selectively removed on a routine basis. We feel this would be very cost effective and would decrease the amount of contaminant dispersion. It should be noted that the ST No. 1 material that was removed by past excavations probably contain a mixture of these deposits; hence, investigations that assume homogeneity may need to be reevaluated.

13117

The preliminary data (see attachment) are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, they will be released to applicable agencies. Contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Michael R. Dale for SY

Steve Yanicak, NMED, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

attachments
SY:mrd
cc: Mat Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490
Neil Weber, NMED, Chief, DOE Oversight Bureau

Table 1. Prelimin[illegible] analytical results (metals) for NMED DOE Oversight Bureau sampl[illegible]n Sediment Trap ST No. 1, Mortandad Canyon, Field Unit 4, Lo[illegible]amos National Laboratory, New Mexico

SAMPLE ID	Date	Ag (mg/kg)	Al (mg/kg)	As (mg/kg)	B (mg/kg)	Ba (mg/kg)	Be (mg/kg)	Ca (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Co (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	K (mg/kg)	Mg (mg/kg)	Mn (mg/kg)	Mo (mg/kg)	Na (mg/k	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Se (mg/kg)	Si (mg/kg	Sn (mg/kg)	Sr (mg/kg)	Tl (mg/kg)	V (mg/kg)	Zn (mg/kg)
FINES-1	10/28/94	<1	5100	2.5	<1	80	0.8	2000	<0.5	6	3	9	9400	<0.2	900	940	380	1	70	4	13	<6	0.6	580	6	12	<0.5	10	39
SAND-1	10/28/94	<1	650	<0.5	<1	<10	0.1	220	<0.5	<1	<1	<1	1600	<0.2	100	100	62	<1	20	<2	1.9	<6	<0.5	200	3	<1	<0.5	1	9
FINES-2	10/28/94	<2	4330	2.1	NA	92.9	1	2810	<0.2	12	3.2	12	7190	<0.025	RP	1090	439	<2	127	5	18	<10	<0.05	NA	<10	NA	NA	10.1	37.4
SAND-2	10/28/94	<2	278	<0.5	NA	10.3	<0.2	184	<0.2	0.41	<2	0.87	791	<0.025	NA	54.5	93	<2	<50	<5	1.5	<10	<0.5	NA	<10	NA	<0.5	<2	<5
*SAL	-	400	n/a	0.4	n/a	5500	0.16	n/a	80	400	n/a	3000	n/a	24	n/a	n/a	11000	n/a	n/a	1600	500	32	400	n/a	n/a	n/a	6.4	560	24000
*Background (mean)	-	n/a	n/a	5	n/a	510	2.3	n/a	0.17	38.3	6	10	n/a	n/a	n/a	n/a	n/a	0.59	n/a	9.9	27	n/a	0.26	n/a	n/a	120	n/a	52	34

NA - Not Analyzed

BDL - Below Detection Limits

Fines-1 - Grab sample of fine-grained deposits at head of pond

Sand-1 - Grab sample of coarse-grained deposits beneath Fines-1

Fines-2 - Grab sample of fine-grained deposits within pond

Sand-2 - Grab sample of coarse-grained deposits beneath Fines-2

SAL - Screening Action Level

n/a - not available

* - SAL and background data from TA-21 OU RFI phase report 1B, Table 2.3 and Final Draft of RFI Work Plan for OU 1136, Appendix D

TBD - To be determined

Table 2. Prelim' ·y analytical results (radionuclides) for NMED DOE Oversight P ·au samples in Sediment Trap ST No. 1, Mortan. . Canyon, Field Unit 4, Los Alamos National Laboratory, New M .co

SAMPLE ID	Date	Gross Alpha (pCi/g)	UNC	Gross Beta (pCi/g)	UNC	90Sr (pCi/g)	UNC	89Sr (pCi/g)	UNC	238Pu (pCi/g)	UNC	239/240 Pu (pCi/g)	UNC	241Am (pCi/g)	UNC	137Cs (pCi/g)	UNC	60Co (pCi/g)	UNC
FINES-1	10/28/94	32.80	4.0	29.50	3.4	3.01	0.87	<2.6	BDL	2.95	0.40	8.3	1.0	10.50	0.989	27	4.1	0.309	0.062
SAND-1	10/28/94	4.44	0.56	4.16	0.51	<0.72	BDL	<0.83	BDL	0.37	0.07	1.29	0.19	1.19	0.241	3.15	0.225	<0.043	BDL
FINES-2	10/28/94	86	12	67.6	7.8	4.51	0.95	NA	-	10.0	1.2	26.4	3.1	33.87	4.50	57	7.1	<1.2	BDL
SAND-2	10/28/94	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	3.0	0.46	<0.03	BDL
*SAL	-	n/a		n/a		8.9		n/a		27		24		22		4		0.90	
*B ·ground (mean)	-	n/a		n/a		0.34		n/a		0.001		0.007		n/a		0.01-0.82		TBD	

NA - Not Analyzed

BDL - Below Detection Limits

Fines-1 - Grab sample of fine-grained deposits at head of pond

Sand-1 - Grab sample of coarse-grained deposits beneath Fines-1

Fines-2 - Grab sample of fine-grained deposits within pond

Sand-2 - Grab sample of coarse-grained deposits beneath Fines-2

SAL - LANL's Environmental Restoration screening action level

n/a - not available

* - SAL and background data from TA-21 OU RFI phase report 1B, Table 2.3 and Final Draft of RFI Work Plan for OU 1136, Appendix D

TBL - To be determined

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

12 January 1996

Mr. Ivan Trujillo, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

RE: Data submittal concerning storm-water sampling that occurred on September 7, 1995, in Los Alamos Canyon at State Route 4 (SR 4), Los Alamos, New Mexico

Dear Mr. Trujillo:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) staff performed surface-water sampling in Los Alamos Canyon at SR 4 on September 7, 1995. A total of four samples were taken. The samples were analyzed for radiologicals and suspended sediment. NMED DOE OB obtained surface-water discharge data from two USGS gaging stations (#08313030 and #08313042) and precipitation data from three rainfall gaging stations (TA-6, TA-53 and North Community) for September 7, 1995. The data was obtained from Los Alamos National Laboratory's Environment, Safety and Health Divisions (ESH), and are requesting the use of data in an upcoming publication by NMED DOE OB. The NMED DOE OB data (see attachment) are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment, the data will be released to applicable agencies. In addition, we would like to thank Dave Shaull (ESH-18) and Jeff Baars (ESH-17) for their assistance. Contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, Program Manager, DOE OB/LANL
New Mexico Environment Department

attachments
SY:mrd
cc: Mat Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490
Neil Weber, NMED, Chief, DOE Oversight Bureau

13118

STATION ID	DATE	TIME	DISCHARGE *GS-2 (L/sec)	GROSS BETA (pCi/L)	unc	det	Sr-90 (pCi/L)	unc	det	Pu-239/240 (pCi/L)	unc	det	Pu-238 (pCi/L)	unc	det	Am-241 (pCi/L)	unc	det	Cs-137 (pCi/L)	unc	det
LA-I	9/7/95	20:34	651.17	24.6	4.0	0.60	7.2	1.4	0.59	0.05	0.02	0.01	ND	-	0.04	ND	-	0.15	ND	-	3.91
LA-II	9/7/95	21:04	424.68	17.3	2.5	0.42	4.8	1.0	0.63	NA	-	-	NA	-	-	NA	-	-	NA	-	-
LA-III	9/7/95	21:34	263.30	14.8	2.1	0.40	4.1	0.91	0.60	0.04	0.02	0.01	ND	-	0.04	ND	-	0.06	ND	-	3.37
LA-IV	9/7/95	22:04	158.55	14.9	2.2	0.42	4.1	0.91	0.61	NA	-	-	NA	-	-	NA	-	-	NA	-	-
		mean values		17.9	NA	NA	5.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		standard deviation		4.00	NA	NA	1.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* - USGS gaging station # 08313042

NA - not analyzed or determined

ND - not detected

unc - Estimated total propagated uncertainties (2 sigma)

STATION ID	DATE	TIME	DISCHARGE *GS-2 (L/sec)	SUSPENDED SEDIMENT (g/L)	GROSS BETA (pCi/g)	unc	det	Sr-90 (pCi/g)	unc	det	Pu-239/240 (pCi/g)	unc	det	Pu-238 (pCi/g)	unc	det	Am-241 (pCi/g)	unc	det	Cs-137 (pCi/g)	unc	det
LA-I	9/7/95	20:34	651.17	40.3	13.3	1.8	0.74	1.46	0.43	0.47	1.833	0.24	0.01	0.086	0.023	0.02	0.98	0.55	0.03	4.60	0.411	0.21
LA-II	9/7/95	21:04	424.68	5.2	15.9	2.1	0.75	2.81	0.61	0.39	1.42	0.19	0.01	0.14	0.03	0.02	1.58	0.03	0.05	7.33	0.621	0.46
LA-III	9/7/95	21:34	263.30	5.7	16.5	2.2	0.75	2.78	0.62	0.45	1.50	0.19	0.01	0.14	0.03	0.02	1.44	0.03	0.04	6.85	0.543	0.45
LA-IV	9/7/95	22:04	158.55	4.4	15.9	2.1	0.75	2.69	0.60	0.42	1.39	0.19	0.03	0.22	0.05	0.03	1.44	0.05	0.03	7.74	0.928	0.32
		mean		5.1**	15.4	NA	NA	2.44	NA	NA	1.54	NA	NA	0.15	NA	NA	1.36	NA	NA	6.63	NA	NA
		standard deviation		NA	1.24	NA	NA	0.56	NA	NA	0.18	NA	NA	0.05	NA	NA	0.23	NA	NA	1.21	NA	NA

* - USGS gaging station # 08313042

NA - not analyzed or determined

** - mean calculated from LA-II, III and IV

unc - estimated total propagated uncertainties (2 sigma)

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

27 March 1996

Mr. Court Fesmire, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Data submittal concerning ground-water sampling at LANL test wells TW-3, TW-4 and TW-8, Los Alamos National Laboratory

Dear Mr. Fesmire:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) staff performed ground-water split sampling with ESH-18 at test wells TW-3, TW-4 and TW-8. Results (Tables 1-3) are being submitted for your review as stated in the Agreement-in-Principle Umbrella Protocol. Under the Site-Specific Protocol currently being negotiated, DOE will be afforded a 20-working-day review and comment period after which, the data will be available for release to applicable agencies. Contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

attachments
SY:mrd
cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Mat Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490

XXS-149

Table 1 - NMED DOE Oversight Bureau Ground-Water Quality Results, Environmental Surveillance: General Chemistry (Preliminary)

STATION ID	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOT. PHOS* (mg/L)	SO4 (mg/L)	NO3-N (mg/L)	KJELD-N (mg/L)	AMMON. (mg/L)	TDS (mg/L)	TSS (mg/L)	ALK (mg/L)	FIELD pH (S.U.)	FIELD SC (umho/cm)	TEMP. (C)
TEST WELLS																				
TW-3	1/29/96	NA	NA	NA	NA	5	NA	NA	NA	<0.05	<10	<0.1	NA	NA	81	<5	NA	6.63	137	18.4
TW-4	1/23/96	NA	NA	NA	NA	<5	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	NA	7.78	137	11.9
TW-8	2/13/96	NA	NA	NA	NA	3	NA	NA	NA	<0.05	<10	0.3	NA	NA	160	<5	NA	8.02	259	17.3
Methods (EPA)**		-	-	-	-	325.3	-	-	-	365.1	375.4	353.2	-	-	160.1	160.2	-	-	-	-

* samples (metals) were filtered through a 0.45 micron filter prior to acidification and analysis
al phosphate as phosphorus
** - Water/Waste Method (EPA-600)

Table 2 - NMED DOE Oversight Bureau Ground-Water Quality Results, Environmental Surveillance:Dissolved Metals (Preliminary)

STATION ID		Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Si (mg/L)	Sn (mg/L)	Sr (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
TEST WELLS																										
TW-3	1/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-4	1/23/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-8	2/13/96	NA	NA	<0.01	<0.1	<0.1	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methods (EPA)**		-	-	200.7	200.7	200.7	-	-	-	-	-	200.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: samples were filtered through a 0.45 micron filter prior to acidification and analysis
**Water/Waste Method (EPA-600)

Table 3 - NMED DOE Oversight Bureau Ground-Water Quality Results, Environmental Surveillance: Radionuclides (Preliminary)

STATION ID	Date	H3 (pCi/L)	unc	90Sr (pCi/L)	unc	137Cs (pCi/L)	unc	U (ug/L)	unc	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	unc	239/240Pu (pCi/L)	unc	241Am (pCi/L)	unc	Gross Alpha (pCi/L)	unc	Gross Beta (pCi/L)	unc
TEST WELLS																						
TW-3	1/29/96	NA	-	<0.58	BDL	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	2.09	0.90
TW-4	1/23/96	NA	-	<0.61	BDL	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	2.02	0.51
TW-8	2/13/96	NA	-	<0.42	BDL	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	<0.79	BDL	<2.0	BDL
Methods (SW-846)*		-		905.0 (modified)		-		-		-	-	-	-		-		-		900.0 (modified)		900.0 (modified)	

Note: samples were filtered through a 0.45 micron filter prior to acidification and analysis
*Hazardous Waste Method

- 1/1/ IEP - Info/Action from AIP Court

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

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DEPUTY SECRETARY

27 March 1996

Mr. Court Fesmire, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Recommendations concerning Environmental Restoration (ER) geophysical activities, Los Alamos National Laboratory, New Mexico

Dear Mr. Fesmire:

As part of DOE OB's oversight of ground-water activities (issues) concerning LANL's ER Project, it has been brought to our attention that there is little or no information to date concerning the occurrence of shallow ground water in Pueblo Canyon. Exploratory geophysical activities were conducted by LANL in Pueblo Canyon during December 1995 and January 1996. The objective was to locate and/or define areas where ground water exists in Pueblo Canyon. It has come to our attention that exploratory geophysical activities were conducted prior to any type of preparatory investigation. Preparatory investigations would include such elements as collecting data or signatures (e.g., temperature anomalies) in areas such as Mortandad Canyon and/or Los Alamos Canyon, where ground-water characteristics (e.g., saturated thickness, lateral boundaries) are known. That is, it might me more scientifically valid to first determine how geophysical data correlate to known ground-water system(s) before entering unexplored areas. As part of DOE OB's general technical comments regarding ER Work Plans, it is recommended that a preparatory investigation (i.e., calibration of a method) be performed prior to entering unexplored areas. We have verbally conveyed our concerns to Field Unit 4 personnel. If there are any questions concerning this matter please contact me at 672-0448.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE OB, LANL POC
New Mexico Environment Department

SY:mrd

13119

Michael Copy

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

29 March 1996

Mr. Court Fesmire, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Ground-water data concerning special purge test at LANL test wells TW-2, TW-2A, TW-3, TW-4 and TW-8, Los Alamos National Laboratory

Dear Mr. Fesmire:

A letter dated June 19, 1995, was submitted to DOE by the New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) requesting that LANL perform low-level tritium sampling at the referenced wells during well-purging. It was DOE OB's theory that data might provide insight on possible borehole leakage and/or natural recharge. It was DOE OB's intention to perform low-level tritium splits with LANL, however, DOE OB was unable to contract a laboratory with such analytical capabilities. Therefore, DOE OB took split samples and analyzed them for a variety of chemical constituents and field measurements. The results (Tables 1-3) are being submitted for your review as stated in the Agreement-in-Principle Umbrella Protocol. DOE OB data show no trends or obvious anomalies, except for a slight detection of ^{241}Am and total phosphate as phosphorus at the initial purge. Under the Site-Specific Protocol currently being negotiated, DOE will be afforded a 20-working-day review and comment period after which, the data will be available for release to applicable agencies. Contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Steve Yanicak

Steve Yanicak, NMED, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

attachments
SY:mrd
cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Mat Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490

13120

Table 1 - NMED DOE Oversight Bureau Ground-Water Data Concerning Special Purge Test, Environmental Surveillance: General Chemistry

STATION ID TEST WELLS	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO (mg/L)	TOT. PHOS. (mg/L)	SO4 (mg/L)	NITRATE+ NITRITE (mg/L)	KJELD-N (mg/L)	AMMON (mg/L)	TDS (mg/L)	TSS (mg/L)	ALK (mg/L)	FIELD pH (S.U.)	FIELD SC (umho/c)	TEMP (C)
TW-2																				
(TEST @ 09:48)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.52	131	16.6
(TEST @ 13:16)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.48	131	15.0
(TEST @ 15:05)	8/1/95	NA	NA	NA	NA	2.3	NA	NA	NA	0.05	NA	<0.10	<0.2	<0.05	100	10	NA	8.58	151	15.8
TW-2A																				
(TEST @ 09:48)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5	333	11
(TEST @ 13:10)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.5	335	11.5
(TEST @ 15:00)	8/1/95	NA	NA	NA	NA	40.9	NA	NA	NA	0.13	NA	1.6	0.2	<0.05	243	14	NA	7.1	387	15.8
TW-3																				
(TEST @ 08:10)	7/18/95	16	5	2	NA	NA	NA	<1	83	<0.05	NA	<0.1	<0.5	<0.05	90	4	NA	8.23	170	11.1
(TEST @ 10:08)	7/18/95	12	4	2	NA	NA	NA	<1	64	<0.05	NA	<0.1	<0.5	<0.05	60	7	NA	7.51	133	18.5
(TEST @ 10:45)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.49	164	20.1
(TEST @ 12:09)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.15	179	21.0
(TEST @ 14:00)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.56	170	21.3
(TEST @ 15:50)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.74	179	21.2
(TEST @ 17:00)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.4	179	21.2
TW-4																				
(TEST @ 09:00)	10/19/95	NA	NA	NA	NA	2	NA	NA	NA	NA	<10	NA	NA	NA	NA	NA	NA	8.00	139	10.2
(TEST @ 13:30)	10/19/95	NA	NA	NA	NA	2	NA	NA	NA	NA	<10	NA	NA	NA	NA	NA	NA	7.78	142	14.9
TW-8																				
(TEST @ 09:10)	7/17/95	NA	NA	NA	9	NA	NA	NA	57	0.39	NA	<0.1	<0.5	<0.05	53	<5	NA	8.57	116	12.1
(TEST @ 11:00)	7/17/95	NA	NA	NA	10	NA	NA	NA	NA	<0.05	NA	0.2	<0.5	<0.05	NA	NA	NA	8.12	142	17.6
(TEST @ 12:30)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.99	138	18.8
(TEST @ 13:56)	7/17/95	NA	NA	NA	10	NA	NA	NA	NA	<0.05	NA	0.2	<0.5	<0.05	NA	NA	NA	7.83	133	18.8
(TEST @ 15:30)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.89	139	18.8
(TEST @ 17:10)	7/17/95	NA	NA	NA	10	NA	NA	NA	NA	<0.05	NA	0.2	<0.5	<0.05	NA	NA	NA	8.03	139	18.9
(TEST @ 00:30)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.90	139	18.7
(TEST @ 01:11)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.96	139	18.6
Methods (EPA)*		200.7	200.7	200.7	200.7	200.7	325.3	-	2320B	2320B	365.1	375.4	353.2	351.2	350.1	160.1	160.2	-	-	-	-

Note: metal samples were acidified in the field and represents total metals
* - Total phosphate as phosphorus
** - Water/Waste Method (EPA-600)
NA - not analyzed
SC - Specific conductance

Table 2 - NMED DOE Oversight Bureau Ground-Water Data Concerning Special Purge Test, Environmental Surveillance: Total Metals

STATION ID	Date	Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Si (mg/L)	Sn (mg/L)	Sr (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
TEST WELLS																										
TW-2																										
(TEST @ 09:50)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 13:16)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 15:05)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	26	NA	NA	0.55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-2A																										
(TEST @ 09:48)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 13:10)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 15:00)	8/1/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	47	NA	NA	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-3																										
(TEST @ 08:10)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 10:08)	7/18/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-4																										
(TEST @ 09:00)	10/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 13:30)	10/19/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-8																										
(TEST @ 09:10)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 11:00)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 13:56)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(TEST @ 17:10)	7/17/95	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methods (EPA)**		-	-	-	-	-	-	-	-	-	-	200.7	-	-	200.7	-	-	-	-	-	-	-	-	-	-	-

Note: metal samples were acidified in the field and represents total metals
** - Water/Waste Method (EPA-600)
NA - not analyzed

Table 3 - NMED DOE Oversight Bureau Ground-Water Data Concerning Special Purge Test, Environmental Surveillance: Radionuclides

STATION ID	Date	H3 (pCi/L)	unc	90Sr (pCi/L)	unc	137Cs (pCi/L)	unc	U (ug/L)	unc	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	unc	239/240Pu (pCi/L)	unc	241Am (pCi/L)	unc	Gross Alpha (pCi/L)	unc	Gross Beta (pCi/L)	unc
WELL																						
TW-2																						
(TEST @ 09:50)	8/1/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	<0.42	BDL	<0.27	BDL	NA	-	NA	-	NA	-
(TEST @ 13:16)	8/1/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	<0.35	BDL	<0.22	BDL	NA	-	NA	-	NA	-
(TEST @ 15:05)	8/1/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	<0.59	BDL	<0.34	BDL	NA	-	<1.6	BDL	3.3	2.00
TW-2A																						
(TEST @ 09:48)	8/1/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	<0.50	BDL	<0.44	BDL	NA	-	NA	-	NA	-
(TEST @ 13:10)	8/1/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	<0.44	BDL	<0.36	BDL	NA	-	NA	-	NA	-
(TEST @ 15:00)	8/1/95	<470	BDL	NA	-	NA	-	NA	-	NA	NA	NA	<0.48	BDL	<0.33	BDL	NA	-	<2.7	BDL	<3.2	BDL
TW-3																						
(TEST @ 08:10)	7/18/95	NA	-	<1.2	BDL	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(TEST @ 10:08)	7/18/95	NA	-	<1.3	BDL	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
TW-4																						
(TEST @ 09:00)	10/19/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-
(TEST @ 13:30)	10/19/95	NA	-	<0.88	BDL	NA	-	NA	-	NA	NA	NA	<0.02	BDL	<0.03		NA	-	<0.6	BDL	3.08	0.84
TW-8																						
(TEST @ 09:10)	7/17/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	0.12	0.07	NA	-	NA	-
(TEST @ 11:00)	7/17/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	<0.06	BDL	NA	-	NA	-
(TEST @ 13:56)	7/17/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	<0.06	BDL	NA	-	NA	-
(TEST @ 17:10)	7/17/95	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	<0.06	BDL	NA	-	NA	-
Methods		-		905 0 (modified)		-		-		-	-	-	Alpha Spectrometry		Alpha Spectrometry		Alpha Spectrometry		900 0 (modified)		900.0 (modified)	

Note: metal samples were acidified in the field and represents total metals
UNC-uncertainties (2 SIGMA)
NA - not analyzed
BDL-below detection limit
Method 900 0 - Gas proportional counting
Method 905.0 - Gas proportional counting

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

6 May 1996

Mr. Court Fesmire, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Review of Los Alamos National Laboratory's (LANL) Environmental Restoration (ER) Project Resource Conservation Recovery Act Facility Investigation (RFI) Work Plan for Los Alamos and Pueblo Canyons, Field Unit (FU) 4, Operable Unit 1049

Dear Mr. Fesmire:

This conveys New Mexico Environment Department (NMED), Department of Energy Oversight Bureau's (DOE OB) review of the referenced Work Plan. Our focus was on Chapter 7, Sections 7.3 through 7.3.3.1.4. The following comments are provided for the purpose of communicating the results of the DOE OB review. These comments are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department. Under the Site-Specific Protocol currently being negotiated, DOE will be afforded a 20-working-day review and comment period after which, this review will be available for release to applicable agencies.

GENERAL COMMENTS

1). It should be noted that anthropogenic and/or elevated constituents have been detected in the deep aquifer. Historical data collected by LANL's Environmental, Safety and Health, Water Quality & Hydrology Group (ESH-18) and DOE OB show evidence of possible contaminant migration to the deep aquifer:

- In 1991, TW-2 showed elevated tritium (^3H) at 1800 pCi/L (LANL, 1991 ES Report). In 1993, ESH-18 detected chloride at 39 mg/L and sulfate at 25 mg/L at TW-4 (LANL, 1993 ES

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Report). In 1994, DOE OB sampled TW-4, and strontium-90 (^{90}Sr) was detected at 6.59 (±1.00) pCi/L. In 1993, TW-1 showed elevated uranium, tritium, total lead and nitrate/nitrite.

DOE OB recommends an investigation of the deep aquifer in the Acid/Pueblo Canyon area and the installation of deep-aquifer monitoring well upgradient of test well TW-1.

2). Based on historical data and general observations, DOE OB suggests that the source of ground water within canyon alluvium from the DP/Los Alamos Canyon confluence to approximately LAO-5 may be from DP Spring and intermittent surface-water flow in DP Canyon. Ground water issuing from DP Spring appears to infiltrate rapidly and may enter Los Alamos Canyon through a saturated zone or underflow within the alluvium of DP Canyon. This possible ground-water zone or conduit may be entirely or intermittently connected to saturated alluvium in Los Alamos Canyon at LAO-2. Hence, ground water within the Los Alamos Canyon alluvium may be subdivided into two distinct ground-water occurrences; one located at some unknown distance upgradient of the DP and Los Alamos Canyon confluence, and one located between the mouth of DP Canyon and the vicinity of LAO-4.5. If this interpretation is correct, then LANL's conceptual model for Los Alamos Canyon shallow ground-water system will need to be re-evaluated. DOE OB also recommends monitoring of DP Spring and DP Canyon surface water, and investigating (e.g., bromide tracer test) the possible connection between DP Spring and ground water within the alluvium at LAO-2.

DOE OB collected surface-water samples at the mouth of DP Canyon on June 21, 1995 and July 16, 1995, and ^{90}Sr results were 46.1 (±5.2) pCi/L, and 15.0 (±3.0) pCi/L, respectively. Hence, ^{90}Sr contamination in ground water may vary from year to year due to surface-water infiltration. Characterization may be difficult since the source of ^{90}Sr and other possible contaminants has not been contained or removed.

DOE OB has two recommendations concerning the intermediate aquifer at LANL:

- The installation of an additional intermediate well near LAO-4.5 to monitor possible migration or seepage of contaminants beneath ground water within canyon alluvium between LAO-2 and LAO-4.5.

- Continuous water-level recording at LAOI-1.5, LAOI(B)-1.1 and LAOI(A)-1.1 during purging events. In addition, water levels at POI-4 should be obtained for correlation with any drawdown observed at TW-1A. Such data may yield additional hydrologic information (e.g., fracture intersection).

3). DOE OB has concerns over the re-mobilization of contaminants within the canyon alluvium vadose zone at Technical Areas (TAs) - 2 and TA-41. Water levels within the alluvium could rise to a point at which ground water may come into contact with contaminates (e.g., ^{90}Sr) in the vadose zone, and therefore, introduce or re-mobilize into ground water via dissolution. Characterization of ground water near the referenced TAs may be difficult since the contaminant source may still exist. DOE OB recommends monitoring ground water during both low- and high-head conditions, evaluating any variations, and possibly remediating contaminated areas which may come into contact with ground water.

4). Several lines of evidence suggest that some recharge to Basalt Spring may be from near-by surface-water infiltration, and that Basalt Spring may not entirely represent intermediate ground water:

- At approximately 7:30 a.m. on April 17, 1996, DOE OB staff observed surface-water (effluent water from Los Alamos County Sewage Treatment Facility) flow in Pueblo and Los Alamos Canyon below the Pueblo confluence at <1 gpm, and at 8:25 a.m., observed little or no flow in the active channel above Basalt Spring, suggesting that the outfall at the treatment facility had been temporarily turned off. Basalt Spring was flowing; however, DOE OB noted that flow had decreased due to the presence of high water-marks (still wet) on structures (boulders, sticks, etc.) within the surface-water flow path downstream from the spring discharge point. The sewage treatment facility was contacted that day, and confirmed that the outfall had been turned off at approximately 9:00 p.m. on April 16, 1996 and turned back on at approximately 9:00 a.m. on April 17, 1996.

- Temperature of Basalt Spring water was 7.2 ° C on April 17, 1996, and does not correlate with that of intermediate ground-water temperatures at TW-1A, which has a temperature of approximately 16.3 ° C (measured by DOE OB on June 6, 1995). This abnormally low temperature of Basalt Spring water suggests nearby recharge.

- On May 25, 1995, LANL's ESH-18 and DOE OB sampled Basalt Spring at a location considered to the be the spring source; however, on November 15, 1995, DOE OB observed that flow had completely ceased at this particular location. Basalt Spring may have discharged greater volumes of water in May due to an increase in surface-water flow due to the mixing of snow-melt runoff in Los Alamos Canyon with sewage treatment-plant outfall water.

Therefore, DOE OB cautions against the use of Basalt Spring as an intermediate ground-water monitoring location. LANL may want to utilize Los Alamos Spring, which is located approximately 0.2 mi east of Basalt Spring. This spring issues from the north-facing side of Los Alamos Canyon at an elevation approximately 40 ft directly above the active channel. Hydrochemical data obtained by DOE OB during 1994 and 1995 and general observations suggest that this spring may represent some type of intermediate ground water. Data concerning Basalt and Los Alamos Springs were submitted to DOE and LANL in a letter dated July 28, 1995.

5). DOE OB recommends that LANL continue drilling to the deep aquifer at the proposed intermediate wells if intermediate ground water is not encountered. This would be cost effective, yield much needed hydrogeologic and hydrochemical information (e.g., flow gradients, water quality, etc.), and other data which might address contaminant migration.

6). DOE OB has concerns over the movement of contaminants (e.g., storm-water run-off) from sites near the edge of canyon walls and the possibility that contaminants are entering active channels within Los Alamos and Pueblo Canyons and their tributaries. During storm-water run-off events, contaminants may become re-mobilized in solution (if soluble) into surface water and ground water. Insoluble constituents may be transported in suspended sediment during run-off events, and ultimately deposited downstream (San Ildefonso Pueblo, Rio Grande, Cochiti Lake, etc.). DOE OB collected storm-water samples at Los Alamos Canyon and State Road 4 on September 7, 1995, and data show that the radionuclides ^{90}Sr, ^{238}Pu, $^{239/240}Pu$, ^{241}Am and ^{137}Cs are being transported in suspended sediment. The radionuclide ^{90}Sr was detected in solution. Data concerning this sampling event were submitted to DOE and LANL in a letter dated January 12, 1996. DOE OB recommends that measures be implemented in a timely manner to contain suspected and known contamination sources (e.g., SWMUs).

Please feel free to contact Michael Dale at 672-0449 if any question arise.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

SY:mrd
cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Mat Johansen, DOE LAAO, MS A316
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

21 May 1996

Mr. Court Fesmire, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Recommendations concerning the prioritization of Solid Waste Management Units at Los Alamos National Laboratory, New Mexico

Dear Mr. Fesmire:

As part of DOE OB's oversight of the Environmental Restoration Project, we recommended that LANL focus its efforts (i.e., cleanup, stabilization, etc.) to SWMUs that contain high concentrations of surficial contaminants, both radionuclides and non-radionuclides, that are subject to transport during surface-water run-off events. For example, Rad- and Chem-Van data obtained at E-F firing site (TA-15) show gross beta at 1,469 pCi/g, lead at 335 ppm and uranium at 2291 ppm in soil/sediment within a drainage located south of the site (LANL, RFI Report for PRSs at TA-15, 1995). The drainage extends to Potrillo Canyon; therefore, primary or fixed contaminants may have been transported into Potrillo Canyon. Other sites include: 1) SWMU 3-056(c), which contained PCBs as high as 33,000 ppm that may have re-mobilized by erosional processes and deposited downstream (LANL, NOD for SWMU 3-056(c), Expedited Cleanup Status Report, 1996), 2) SWMU 1-001(d), located on the south facing hillside of Los Alamos Canyon, which contains concentrations of plutonium-239/240 (7,282 pCi/g), mercury (1,770 ppm), chromium (398 ppm) and lead (548 ppm) of which may be entering Los Alamos Canyon and ultimately the Rio Grande (see LANL, Remedial Action Plan for SWMU 1-001(d) Hillside, 1996), and 3) SWMU 21-001(k), located on the north-facing side of DP Canyon, contains plutonium-239/240 at 46,000 pCi/g, and field observations at this SWMU show that erosional processes are occurring (see LANL, Phase Report 1C, TA-21 Operable Unit, 1994).

If there are any questions concerning this matter please contact me at 672-0448 or Michael Dale at 672-0449.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE OB, LANL POC
New Mexico Environment Department

SY:mrd

13122

cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Benito Garcia, NMED, Chief, HRMB
Jim Piatt, NMED, Chief, SWQB
Marcy Leavitt, NMED, Chief, GWQB
Mat Johansen, DOE LAAO, MS A316Bob Simeone, DOE LAAO, MS A316
Bonnie Koch, DOE LAAO, MS A316
Everett Trollinger, DOE LAAO, MS A316
Mike Gilgosch, DOE LAAO, MS A316
Joseph Mose, DOE LAAO, MS A316

Michaels copy

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

20 June , 1996

Mr. Mat Johansen, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Data submittal concerning sediment sampling, Field Unit 4, OU 1049, Los Alamos Canyon Reach LA2, Los Alamos National Laboratory

Dear Mr. Johansen:

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) staff performed split-sampling with Field Unit 4 at the referenced canyon reach. Results (Tables 1 and 2) are being submitted for your review as stated in the Agreement-in-Principle Umbrella Protocol. Under the Site-Specific Protocol currently being negotiated, DOE will be afforded a 20-working-day review and comment period after which, the data will be available for release to applicable agencies. Contact Chris Hanlon-Meyer at 827-1536 or Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE Oversight Bureau, LANL POC
New Mexico Environment Department

attachments
SY:mrd
cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Bob Simeone, DOE LAAO, MS A316
Allyn Pratt, LANL, EES-13, MS J521
Steve Rae, LANL, ESH-18, MS K490

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Table 1 - NMED DOE Oversight Bureau sediment results, Field Unit 4, OU 1049, Los Alamos Canyon Reach LA2: Metals (Preliminary).

SAMPLE ID	Date	As^ (mg/kg)	Ba^ (mg/kg)	Be^ (mg/kg)	Cd^ (mg/kg)	Cr^ (mg/kg)	Hg^^ (mg/kg)
#31	5/15/96	3	110*	0.9	<0.5	29*	0.2
#48	5/15/96	2	40	<0.5	<0.5	6	<0.1
REPORTING LIMIT	-	1.0	10	0.5	0.5	1	0.1

^ - USEPA METHOD 6010

^^ - USEPA METHOD 7471

* DUPLICATE PRECISION NOT WITHIN CONTROL LIMITS

Table 2 - NMED DOE Oversight Bureau sediment results, Field Unit 4, OU 1049, Los Alamos Canyon Reach LA2: Radionuclides (Preliminary).

SAMPLE ID	Date	Gross Alpha (pCi/g)	unc	Gross Beta (pCi/g)	unc	Total Uranium (ug/g)	unc	234U (pCi/g)	unc	235U (pCi/g)	unc	238U (pCi/g)	unc	Sr-90 (pCi/g)	unc	Pu-239/240 (pCi/g)	unc	Pu-238 (pCi/g)	unc	Am-241 (pCi/g)	unc	Cs-137 (pCi/g)	unc
#31	5/15/96	11.2	1.40	211	23	5.26	0.71	1.82	0.24	0.12	0.03	1.79	0.24	31.3	5.70	5.40	0.66	0.08	0.02	1.55	0.20	186	11.8
#48	5/15/96	4.19	0.50	7.71	0.66	3.53	0.48	1.36	0.19	0.06	0.02	1.27	0.18	1.06	0.47	0.44	0.08	0.10	0.03	0.69	0.10	4.23	0.302

INSTRUMENT/METHOD USED:

Strontium-90 -Gas proportional counter

Cesium-137 - Gamma spectroscopy

Americium-241 - Alpha spectroscopy

Plutonium-239/240&238 - Alpha spectroscopy

Uranium-234/235/238 - Alpha spectroscopy

Total uranium- Laser-induced kinetic phosphorimetry

Gross alpha/beta - Gas proportional counter

Steve's Copy

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

25 June 1996

Mr. Mat Johansen, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Review comments concerning Los Alamos National Laboratory's (LANL) Draft Environmental Impact Statement (EIS) for the Medical Isotope Production Project: Molybdenum-99 and Related Isotopes

Dear Mr. Johansen:

The following DOE OB review comments were initially submitted to the DOE NEPA Section via NMED letter correspondence dated February 15, 1995. It should be noted that due to the short turn-around time required for review submittal and because the DOE OB responded during a public comment period, the referenced comments were never officially provided to the DOE LAAO POC. In order to keep all DOE OB correspondence consistent with the Site Specific Protocol currently being negotiated, these comments are now being provided to you for completeness of interagency record keeping. The following comments convey the New Mexico Environment Department (NMED), Department of Energy Oversight Bureau's (DOE OB) review of the referenced EIS. The following comments are provided for the purpose of communicating the results of the DOE OB review. These comments are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department.

GROUND WATER AND SURFACE WATER, LANL

1. Page 3.38, Section 3.3.2.9 Required Modifications

   General Statement: While it is true that the cooling-water leak at the Omega West Reactor (OWR) reactor has been stopped, it is unclear what remediation activities have taken place since the leak was discovered. A comprehensive report of the extent of surface and subsurface contamination and the remediation activities completed to date should be included in the Draft EIS in order to make a reasonable determination as to whether the reactor should be re-started. Additionally, for the Omega West Reactor/Chemistry and Metallurgy Research Facility Alternative the NMED DOE OB staff recommends that OWR safeguards be installed to prevent future releases from underground piping, such as water-flow rate instrumentation with alarms that would detect water loss and notify process control technicians. Other reactor-hardware upgrades described in the Draft EIS need to be clarified for further review.

2. Page 4.29, Section 4.2.6.3 Site Stability

   Comment: The text mentions that the Pajarito Plateau is dominated by three prominent fault zones, but fails to acknowledge that the trace of the Guaje Mountain Fault passes near the cooling towers of the OWR at TA-2. In the event OWR is re-started, has the Guaje Mountain Fault been

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Los Alamos Canyon be funded and implemented if the DOE is seriously considering the Omega West Reactor/Chemistry and Metallurgy Research Facility Alternative. The recommended ground-water monitoring system could be addressed in a timely manner by implementing the LANL Ground Water Protection Management Program Plan (GWPMPP).

5. Page 4.46, Section 4.2.14.2 Low-Level Wastes

General Statement: Has there been a performance assessment of TA-50's current and future low-level radionuclide waste-treatment capabilities (with all proposed up-grades) to address the Omega West Reactor/Chemistry and Metallurgy Research Facility Alternative? TA-50 is currently experiencing problems with the present site-wide radionuclide waste stream it processes. Will TA-50, a facility that still utilizes "sixties technology" be able to adequately address the increased waste stream from Moly-99 target preparation and target dissolution?

If there are any questions concerning this matter please contact me at 672-0448.

Sincerely,

Stephen Yanicak

Steve Yanicak, NMED, DOE OB, LANL POC
New Mexico Environment Department

SY:mrd
cc: Neil Weber, NMED, Chief, DOE Oversight Bureau
Elizabeth Withers, DOE LAAO, MS A316
Steve Rae, LANL, ESH-18, MS K490

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

September 9, 1996

Mat Johansen, DOE LAAO AIP POC
U.S. Department of Energy
P.O. Box 1663, MS A316
Los Alamos, NM 87545

RE: Review of Los Alamos National Laboratory's "Task/Site Workplan for Operable Unit 1049" dated November 1995

Dear Mr. Johansen:

DOE Oversight Bureau (DOB) has reviewed the subject document. The following comments are provided for the purpose of communicating the results of the review. They are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department. This review is offered as a supplement to an earlier review transmitted in a letter to Court Fesmire dated May 6, 1996 which focused on Chapter 7 Sections 7.3 through 7.3.3.1.4. The comments included here are consistent with recent discussions between the DOE OB and LANL FU-4 staff.

General Comments:

1. DOE OB staff appreciate the effort that has gone into the preparation of this document. It describes investigations which appear to be appropriately designed to answer important questions regarding the characterization of sediment, surface water and ground water in Los Alamos and Pueblo Canyons.

2. We suggest that LANL take interim measures to stabilize any known areas of significant contamination in sediment units from further migration until appropriate final measures can be implemented.

Specific comment:

1. § 5.1.5, Impacts Through Contaminant Transport

We suggest that LANL perform investigations to confirm the conceptual model related to the depth of sedimentary units and any buried sedimentary units that may have been affected by laboratory activities. Sampling at the bottom of the sedimentary units may be required to define the vertical extent of contamination.

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2. § 7.2.2.1.2, Reach LA-2

It is unclear to us why the entire DP Canyon reach is not included in the investigation of reach LA-2. DOE OB's observations show that a large amount of storm water enters Los Alamos Canyon from DP Canyon, and LANL historical data and more recent DOE OB data show that contaminants are being transported in the dissolved and suspended-sediment fractions of storm water. We believe that a large portion of the contamination in reach LA-2 is a result of contaminant migration from DP Canyon; therefore, we suggest the inclusion of DP Canyon in the LA-2 investigation.

3. § 7.3.3.1.1, Page 7-39, Surface Water Sampling

"The number and location of surface water samples will be determined in the field based on the availability of water at the time of sample collection."

Surface-water samples should be collected in conjunction with runoff from precipitation and spring snow melt. Information is needed on the physical transport of contaminants in suspended and bed-load sediments and dissolved phase. This information should then be compared to Purtymun et al. 1990, 6992, and other applicable historical data.

If there are any questions, please contact me at 505-672-0448 or Chris Hanlon-Meyer of the DOE Oversight Bureau Technical Support staff at 505-827-1536.

Sincerely,

Stephen Yanicak

Steve Yanicak
NMED LANL POC

SY:CHM:chm

cc: Neil Weber, NMED, Chief DOE OB
John Parker, NMED, DOE OB
Benito Garcia, NMED, Chief HRMB
Jim Piatt, NMED, Chief SWQB
B. Simeone, DOE FU-4 FPC, MS A316
A. Pratt, LANL, FU-4 FPL, MS J521
D. Broxton, LANL FU-4
P. Longmire, LANL FU-4

REFERENCE CONDITIONS FOR LOS ALAMOS NATIONAL LABORATORY STREAMS USING BENTHIC MACROINVERTEBRATE ASSESSMENT IN UPPER PAJARITO CANYON

RALPH E. FORD-SCHMID
New Mexico Environment Department, Department of Energy Oversight Bureau, 2044 A Galisteo St., Santa Fe, N M 87502

Abstract—Benthic macroinvertebrates and water samples were collected at three stations in upper Pajarito Creek and at one station in each of two first-order tributaries to Pajarito Creek at Los Alamos National Laboratory (LANL). A total of 63 taxa were identified from the five stations. Number of taxa per study location ranged from 25 to 35 and standing crop ranged from 2351 (no/m^2) to 11,212 (no/m^2). EPT/EPT + Chironomid ratios, a measure of community balance, ranged from 0.17 to 0.84, while another measure of community balance, the Shannon-Weaver's index of diversity, ranged from 2.48 to 3.53. The Winget and Mangum CTQd index, a measure of non-organic perturbations, ranged from 72.5 to 89.1, and the Hilsenhoff Biotic Index (HBI), a measure of the presence of organic perturbation, ranged from 4.20 to 6.92. Habitat assessments indicate that four of the five stations were comparable, whereas the station farthest downstream in Pajarito Canyon displayed effects of embeddedness, channel alteration, scouring and reduced flow. The HBI = 6.92, calculated for Starmer Spring station (ST 0.5), indicates fairly poor water quality with substantial organic pollution likely. The complete absence of the scraper functional feeding group, the dominance of the community by one tolerant midge, and the presence of mats of filamentous algae at Starmer Spring indicate a community structure that is tolerant of nutrient enrichment. The State of New Mexico water-quality standards for livestock watering and wildlife habitat were met at all stations, while the fisheries acute standard for aluminum (750 µg/L) was exceeded at the station farthest downstream in Pajarito Canyon. The 11 metrics used to compare sites indicate that the farthest upstream station in Pajarito Canyon (PA 9.0) is appropriate for use as the reference condition for future comparisons of streams at LANL.

INTRODUCTION

As part of a program to monitor water and habitat quality at Los Alamos National Laboratory (LANL), New Mexico Environment Department (NMED), Department of Energy Oversight Bureau (DOE OB) personnel collected benthic macroinvertebrate and water samples in upper Pajarito Canyon and two of its perennial tributaries, between July 1 and August 9, 1994. The five locations studied (Fig. 1) are: Station PA 9.0 - Pajarito Creek, 5 m below its confluence with Starmer Gulch; Station PA 8.7 - Pajarito Creek, 5 m below its confluence with Bulldog Gulch; Station PA 6.7 - Pajarito Creek, 10 m above its confluence with Two Mile Canyon; Station BU 0.01 - Bulldog Gulch, approximately 23 m upstream from its confluence with Pajarito creek; Station ST 0.5 - Starmer Gulch, approximately 800 m upstream from its confluence with Pajarito Canyon, 2 m upstream from Starmer Spring.

One purpose of this monitoring was to determine baseline conditions that could be used as a reference for future surface-water quality monitoring studies at LANL. Surveys conducted in most of the canyon systems at LANL have located springs and short perennial reaches that support macroinvertebrate communities. The quantity and quality of aquatic habitat is limited in the majority of these canyons, with the exception of upper Pajarito Canyon. Surveys indicate that upper Pajarito Canyon has optimum habitat consisting of gravel/rubble riffles, plunge pools, stable-vegetated undercut banks, healthy riparian vegetation, and perennial flows supplied by numerous springs.

General setting

LANL is located west of the Rio Grande in Los Alamos County, approximately 40 km northwest of Santa Fe, New Mexico. Geologically, LANL is located on the Pajarito Plateau, an area of deeply dissected Quaternary volcanic deposits and Tertiary fill of the Española Basin (Stone et al., 1993). The volcanics belong to the Bandelier Tuff, largely rhyolitic ash flows and pumice falls that were derived from the Valles caldera in the Jemez Mountains (Purtymun, 1980). The basin fill is represented by the Puye and Tesuque Formations. Perennial, interrupted, and ephemeral streams flowing easterly to the Rio Grande dissect the plateau into many narrow, finger-like mesas separated by narrow deep canyons. The average elevation of the mesas is approximately 2134 m. From an elevation of approximately 1890 m at White Rock, the plateau ends in sheer cliffs, dropping to 1646 m at the Rio Grande (Cross, 1994). The major canyons that cut across the plateau are Guaje, Rendija, Barrancas, Bayo, Pueblo, Los Alamos, Sandia, Mortandad, Pajarito, Water, Ancho, and Frijoles.

Springs at elevations between 2408 m and 2713 m on the eastern slopes of the Sierra de Los Valles supply perennial base flow to the headwaters of Guaje, Los Alamos, Pajarito and Water canyons (Abeele et al., 1981). These springs are located west of LANL property. Other springs and perennial reaches located in the western one third of LANL property have received little attention and are the subject of this report.

Study area

The vegetation of this study's canyon systems are generally of a mixed-conifer type, consisting of Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), and Gambels oak (*Quercus gambelii*). The mixed-conifer community prevails on north-facing slopes, while the south-facing slopes are drier and support a ponderosa pine/Gambel's oak community. The average annual precipitation in the vicinity is 475 mm. Summer rain showers during July and August account for 36% of the area's annual precipitation. (Anonymous, 1992a).

Springs, at elevations between 2225 m and 2286 m, supply base flow to Cañon de Valle, Starmer Gulch and Pajarito Canyon. Riparian vegetation and algal growth noted in 1992 (Anonymous, 1993) indicate that the springs in Starmer Gulch and Pajarito Canyon are perennial. Springs, at elevations between 2252 and 2255 m, supply base flow to another southern tributary to Pajarito Canyon. These springs are referred to as Keiling and Bulldog Springs, and the tributary is referred to as Bulldog Gulch. Bulldog Gulch joins with Pajarito Canyon at 35°51'23" N lat.; 106°19'53" W long. (approximately 500 m downstream from the Starmer Gulch junction). These springs discharge from units D or E of the Tshirege Member of the Bandelier Tuff (Rogers, 1995). This study documents water-quality parameters and the benthic macroinvertebrate communities present below these springs and in the perennial reaches of Starmer Gulch and upper Pajarito Canyon.

Station designations

All sample stations in major canyons are designated by incorporating the first two letters of the canyon name and the distance in miles from them to the Rio Grande, as determined from USGS topographic maps (scale 1:24000). For tributaries to major canyons, the station designation is the first two letters of that canyon name and the distance from its junction with the main canyon. For example, station PA 9.0 is located in Pajarito Canyon, 9.0 mi upstream from the Rio Grande, at the confluence of Starmer Gulch and Pajarito Creek. A sample collected in Starmer gulch, 16 m above the confluence with Pajarito Creek, would be designated ST 0.01. A sample collected in Pajarito Creek, below the confluence of Starmer Gulch would be designated PA 9.0.

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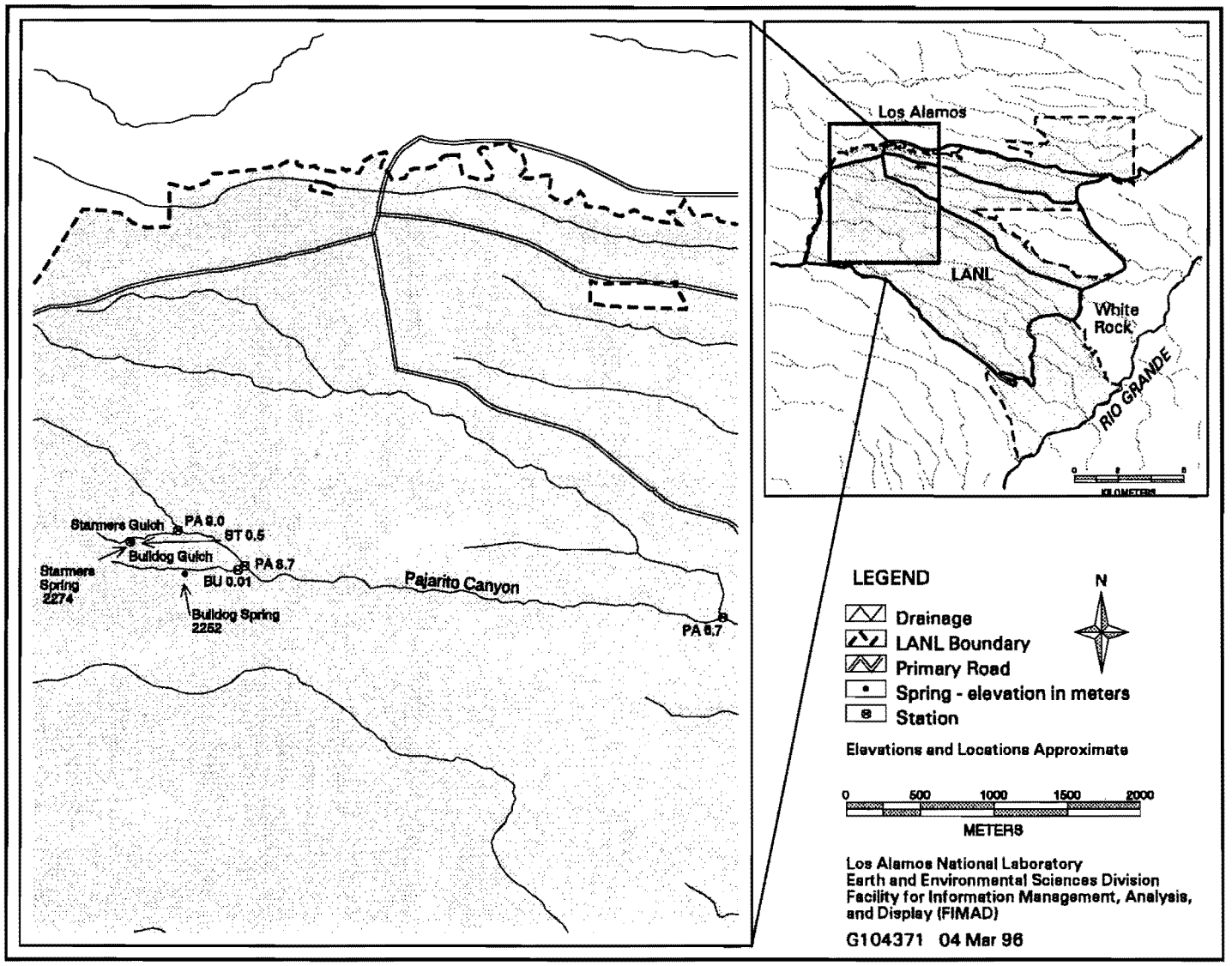

FIGURE 1. Location of upper Pajarito Creek, Bulldog Gulch and Starmer Gulch stations.

METHODS

Benthic macroinvertebrates

Three replicate, modified-Hess circular (Jacobi, 1978) samples (0.059 m^2) were collected from rubble substrate that represented the best habitat quality at each location. Samples were stored individually in 70% ethyl alcohol for analysis by Dr. Gerald Z. Jacobi of New Mexico Highlands University. Samples were sorted in their entirety and macroinvertebrates, with the exception of Chironomidae, were enumerated and identified to the lowest taxonomic level possible using available keys (Merritt and Cummins, 1984; Pennak, 1989; Usinger, 1956; Wiggins, 1978 and Baumann et al., 1977). Chironomidae were enumerated and identified to the genus level by Daniel L. McGuire of McGuire Consulting, Española, NM, using available keys (Coffman and Ferrington, 1984; Hilsenhoff, 1981; Oliver et al., 1978 and Wiederholm, 1983).

Habitat assessment

Benthic invertebrate habitat quality was rated using the U. S. EPA's Rapid Bioassessment Protocol III (RBP III) (Plafkin et al., 1989). This method rates nine habitat parameters (Table 1) and weights the scores according to their degree of importance to benthic macroinvertebrate communities. Habitat parameters are assigned to one of three categories: primary (substrate and instream cover), secondary (channel morphology), and tertiary (riparian and bank structure). The range of scores for parameters is 0–20 for primary, 0–15 for secondary, and 0–10 for tertiary. All nine parameter scores are totaled and the maximum score a site can receive is 135.

In the EPA-RBP III, flow is considered a primary habitat parameter and is scored from 0 to 20 for flows ranging from <0.5 cfs (14.2 L/sec) to >2 cfs (56.6 L/sec). The flow scoring range was modified to account for flows normally encountered at LANL because base flows in LANL streams are normally <15 L/sec and resulted in a score of 0 for all streams. Flows of 0.31–1.6 L/sec were scored 0–5; flows of 1.61–3.2 L/sec - 5–10, flows of 3.21–9.5 L/sec - 10–15; and flows of 9.51–15.7 L/sec - 15–20. Flow was measured monthly from February through November, 1995 with a bucket and stopwatch at natural waterfalls. Three to five such measurements were averaged for each station and the lowest monthly value was considered base flow for the purpose of habitat assessment. Where there were no natural falls, flow was visually estimated. Flow data used in this report will be presented in a forthcoming NMED report detailing water quality and flow characteristics of LANL springs and streams.

Water quality sampling

To aid in assessing the suitability of each location for colonization by macroinvertebrates, field parameters (pH, dissolved oxygen, specific conductance, and temperature) were measured at each station. Water samples were collected for analysis by the Scientific Laboratory Divi-

TABLE 1. Habitat quality assessment for upper Pajarito Creek, Bulldog Gulch and Starmer Gulch stations.

HABITAT PARAMETER	LANL REFERENCE FOR STREAMS PA 9.0	PA 8.7	PA 6.7	BU 0.01	ST 0.5
Date	22-Jul-94	22-Jul-94	22-Jul-94	9-Aug-94	22-Jul-94
Latitude	35 51 31	35 51 23	35 51 14	35 51 23	35 51 31
Longitude	106 21 20	106 19 53	106 17 46	106 19 53	106 20 21
Elevation	2243 m	2225 m	2164 m	2231 m	2271 m
Bottom substrate instream cover	15	15	10	14	11
Embeddedness	16	19	6	11	16
Flow	8	9	6	3	4
Channel alteration	12	15	7	12	11
Bottom scouring and deposition	9	15	7	12	9
Pool/riffle, run/bend ratio	12	11	10	15	15
Upper bank stability	10	10	10	10	10
Bank vegetative protection	10	10	10	10	9
Streamside cover	9	9	9	8	10
Total Score	*101*	*113*	*75*	*95*	*95*

sion (SLD) of the New Mexico Department of Health for total and dissolved metals, nutrients, and general water chemistry. Samples analyzed for dissolved metals were passed through a 0.45 micron filter prior to shipment to SLD. Samples analyzed for total and dissolved metals were preserved with nitric acid. Samples analyzed for nutrients were preserved with sulfuric acid. All samples were stored on ice at 4°C until analyzed at SLD. Water quality sampling methods were in accordance with the U. S. EPA-approved Quality Assurance Project Plan for Water Pollution Control Programs (Anonymous, 1992b).

Data analysis

This assessment modified metrics (calculations used for comparisons in biological assessments) found in the EPA-RBP III for use in streams and rivers. Taxonomic data were entered into a computer program (BASICA, developed by M. D. and G. Z. Jacobi), which incorporates a data base of over 550 macroinvertebrate taxa found in New Mexico streams. This program calculated the metrics used in this report. A complete description of these common metrics can be found in (Klemm et al., 1990; Plafkin et al., 1989, or Garn and Jacobi, in press). The following metrics were used in this report (G. Z. Jacobi, unpubl. report for Camp, Dresser McKee, 1994).

"Eleven metrics were selected as indices of comparison because individual taxa as well as total communities respond to stress (flow regime, sediment loading, organic and toxic pollutants, thermal variation, etc.) in different ways. The selected metrics, which encompass a wide range of benthic macroinvertebrate sensitivity to environmental perturbation, included (1) Standing crop (macroinvertebrate density, No/m^2); (2) Taxa richness (number of taxa per study location); (3) CTQ_d - community tolerance dominance quotient, from Winget and Mangum (1979) BCI - biotic condition index methodology; (4) HBI - Hilsenhoff's biotic condition index (Hilsenhoff, 1988); (5) EPT Index (the number of Ephemeroptera, Plecoptera and Trichoptera taxa present); (6) EPT/EPT + Chironomidae (total number of organisms in Ephemeroptera, Plecoptera, and Trichoptera/ EPT +Chironomidae); (7) Community loss (the number of taxa at a reference location minus the number of common taxa/the number of taxa at the comparison location) which is related to similarity between sample locations; (8) Percent dominant taxon (the taxon which contained the greatest number of organisms at each study location); (9) Diversity index (d) which reflects the number of specimens in the various taxa and the richness of the taxa; (10) Scrapers/ scrapers + filtering collectors feeding groups; and (11) Shredders/ total number of organisms in the sample."

These criteria (Table 2) were used to assign scores for characterizing macroinvertebrate communities at a particular location (Garn and Jacobi, in press). The individual scores for each station were totaled to obtain the Biological Condition score and compared to the reference location total Biological Condition score. The reference location was selected to best represent the least perturbed stream or spring brook reach within LANL.

The categories defined by the Hilsenhoff Biotic Index (Table 3) were originally intended to evaluate samples collected in spring and fall. Samples collected from organically enriched streams during the summer tend to have much higher HBI values (Hilsenhoff, 1987). All data used in this study were collected in July and August and therefore may overestimate the degree of organic pollution. Adequate seasonal correctional factors have yet to be developed; therefore, I have used the next lower (better) assessment category of the HBI for determining the degree of organic pollution present. Macroinvertebrate samples, collected in April 1995 will be used to verify the results of this study.

RESULTS AND DISCUSSION

Biological assessment of upper Pajarito Creek, Bulldog Gulch and Starmer Gulch stations

Results of the benthic macroinvertebrate survey and the analysis of these data from upper Pajarito Creek, Bulldog Gulch, and Starmer Gulch are listed in Tables 4 and 5. The habitat analysis results are listed in Table 1. It should be noted that three genera of Chironomidae, identified from Starmer Gulch and upper Pajarito Creek, are uncommon in New Mexico,

TABLE 2. Metric scoring criteria (based on those of Garn and Jacobi, in press).

	Scoring Criteria			
score:	6	4	2	0
Standing Crop(No/m2)[a]	50-149%	35-49% or 150-199%	20-345% or 200-249%	<20% or >250%
No. of Taxa [a]	>80%	60-79%	40-59%	<40%
CTQ_d [b]	>85%	70-84%	50-69%	<50%
HBI[b]	>85%	70-84%	50-69%	<50%
EPT Index [a]	>90%	80-89%	70-79%	<70%
EPT/EPT+Chironomidae[a]	>75%	50-74%	25-49%	<250%
Community Loss[c]	<0.5	0.5-1.4	1.5-3.9	>4.0
Dominant Taxon[d]	<20%	20-29%	30-39%	>40%
Diversity[d]	>3.0	2.00-2.99	1.00-1.99	<1.00
Sc./Sc. + Fl. Cl.[a]	>50%	35-49%	20-34%	<20%
Shredders/Total[a]	>50%	35-49%	20-34%	<20%

[a] score is a ratio of study site to reference site x 100.
[b] score is a ratio of reference site to study site x 100.
[c] range of values obtained-comparison to reference station.
[d] actual % composition for study and reference station.

TABLE 3. Evaluation of water quality using the family-level biotic index (Hilsenhoff, 1988, table 2).

Biotic Index	Water Quality	Degree of Organic Pollution
0.00 - 3.75	Excellent	Organic pollution unlikely
3.76 - 4.25	Very Good	Possible slight organic pollution
4.26 - 5.00	Good	Some organic pollution probable
5.01 - 5.75	Fair	Fairly substantial pollution likely
5.76 - 6.50	Fairly Poor	Substantial pollution likely
6.51 - 7.25	Poor	Very substantial pollution likely
7.26 - 10.00	Very Poor	Severe organic pollution likely

TABLE 4. Metric calculations for upper Pajarito Creek, Bulldog Gulch and Starmer Gulch stations.

Metric	Stations				
	PA 9.0 reference	PA 8.7	PA 6.7	BU 0.01	ST 0.5
Calculated Value					
Standing Crop (No./m2)	2589	6562	2913	2351	11212
No. of Taxa	25	25	32	25	35
BCI(CTQd)	80.0	77.9	89.1	72.5	85.5
HBI	4.38	4.95	4.20	4.66	6.92
EPT Index	10	11	8	8	8
EPT/EPT + Chiron.	0.84	0.79	0.78	0.60	0.17
Community Loss	0	0.24	0.38	0.52	0.23
% Dominant Taxon	21	39	55	24	59
Diversity	3.53	2.67	2.63	3.52	2.48
Scra./Scra.+Filt. Coll.	0.948	0.961	0.975	0.637	0.000
Shredders/Total	0.051	0.023	0.139	0.012	0.171
Percent of Reference					
Standing Crop (No./m2)	100	253	112	90	433
No. of Taxa	100	100	100	100	100
BCI(CTQd)	100	100	89	100	93
HBI	100	88	100	93	63
EPT Index	100	100	80	80	80
EPT/EPT + Chiron.	100	94	93	71	20
Scra./Scra.+Filt. Coll.	100	100	100	67	0
Shredders/Total	100	44	100	24	100
Score					
Standing Crop (No./m2)	6	0	6	6	0
No. of Taxa	6	6	6	6	6
BCI(CTQd)	6	6	6	6	6
HBI	6	6	6	6	2
EPT Index	6	6	4	4	4
EPT/EPT + Chiron.	6	6	6	4	0
Community Loss	6	6	6	4	6
% Dominant Taxon	4	2	0	4	0
Diversity	6	4	4	6	4
Scra./Scra.+Filt. Coll.	6	6	6	6	0
Shredders/Total	6	4	6	2	6
Biological Condition					
Total	64	52	56	54	34
% of Reference	100	81	87	84	53
Condition		NI	NI	NI	MI
Habitat Condition					
Total	101	113	75	95	95
% of Reference	100	100	74	94	94
Condition		C	PS	C	C

and restricted to springs and first-order streams. They are listed as Chironomidae A, B, and C in Table 5.

Station PA 9.0

Station PA 9.0 was selected as the reference site for this analysis. The habitat at this site rated "good", though it was moderately impacted by bottom scouring and deposition. This station had the highest benthic diversity (3.53), the lowest percent dominant taxon (21% *Baetis tricaudatus*), a moderately tolerant mayfly, and the highest EPT/EPT + Chironomid ratio (0.84). These metrics indicate a well-balanced, diverse community. The Winget & Mangum CTQd index of 80.0 indicates a community that is moderately tolerant to inorganic perturbations (sedimentation, low flows, habitat degradation). Sampling conducted by the LANL Ecological Studies Team obtained similar values at their upper Pajarito and Starmer Gulch stations (Cross, 1995). Wilhm's biodiversity index values ranged from 2.20–3.03 and CTQ values ranged from 70.4–87.5 (Cross, 1995). The standing crop values reported by Cross (1995) are generally lower than those reported here and may be attributable to the use of a Surber sampler instead of a circular sampler (Jacobi, 1978). The HBI index (4.38) indicates "very good" water quality with "possible slight organic pollution" (Table 3).

Station PA 8.7

The habitat at this site was comparable, though it rated slightly higher than the reference site. The substrate was less embedded, and displayed fewer effects from scouring and deposition. The standing crop of 6562 was 2.5 times the standing crop of the reference station. Diversity (2.67) was lower due to the dominance of three taxon, *Simulium* sp.(39%), *Optioservus* sp. (24%), and *Baetis tricaudatus* (18%). The Winget & Mangum CTQd (77.9) was lower, primarily due to the presence of seven intolerant EPT taxa. The HBI index (4.95) indicates "very good" water quality with "possible slight organic pollution" (Table 3). Overall, the biological condition at this site scored 81% of the reference condition and was considered non-impaired (Table 4).

TABLE 5. Taxa represented at upper Pajarito Creek, Bulldog Gulch and Starmer Gulch stations.

	Stations				
	PA 9.0 reference	PA 8.7	PA 6.7	BU 0.01	ST 0.5
PLECOPTERA - stoneflies					
Amphinemura banksi Baumann and Gaufin	6	51	352	0	1361
Isoperla sp.	0	0	17	0	0
Sweltsa sp.	193	40	0	0	0
Alloperla severa (Hagen)	0	85	0	45	62
Hesperoperla pacifica (Banks)	266	62	0	51	40
EPHEMEROPTERA - mayflies					
Ameletus sp.	79	6	0	0	6
Baetis tricaudatus Dodds	539	1162	34	232	295
Centroptilum sp.	0	0	6	0	0
Paraleptophlebia sp.	0	0	0	0	6
TRICHOPTERA - caddisflies					
Rhyacophila sp.	0	0	0	0	11
Rhyacophila brunnea complex	0	108	0	11	0
Glossosoma sp.	6	102	0	0	0
Ceratopsyche oslari sp. (Banks)	23	68	40	312	0
Hydroptila sp.	6	6	198	11	0
Hesperophylax sp.	57	51	6	0	85
Psychoglypha sp.	0	0	0	6	0
Ecclisomyia sp.	11	0	0	0	0
Lepidostoma sp.	0	0	17	23	0
DIPTERA - true flies					
Tipulidae	0	6	0	0	0
Pedicia sp.	0	0	0	51	0
Antocha monticola Alexander	0	6	0	323	11
Dicranota sp.	57	0	23	125	34
Tipula sp.	0	0	0	6	6
Maruina sp.	0	0	0	11	0
Pericoma sp.	6	0	0	11	57
Simulium sp.	227	2529	6	79	119
Chironomidae A Paramorina sp.	0	0	0	0	17
Chironomidae B Boreochlus sp.	0	0	0	0	23
Chironomidae C Chaetocladius sp.	0	6	23	0	0
Diamesa sp.	51	159	0	0	0
Pagastia sp.	119	221	17	289	6645
Thienemannimyia sp.	0	0	11	0	0
Pseudodiamesa sp.	0	0	0	0	340
Orthocladius sp.	6	0	6	11	45
Brillia sp.	11	6	23	0	136
Eukiefferiella sp.	0	28	28	40	68
Parametriocnemus sp.	6	0	11	0	57
Tvetenia sp.	6	45	28	17	306
Cricotopus sp.	0	0	6	0	318
Corynoneura sp.	34	0	0	11	40
Rheocricotopus sp.	0	0	6	0	40
Rheotanytarsus sp.	0	0	6	0	0
Micropsectra sp.	0	0	23	57	442
Paraphaenocladius sp.	0	0	0	45	420
Ceratopogonidae	0	0	6	17	0
Ephydra sp.	0	0	0	0	6
HEMIPTERA - true bugs					
Gerris sp.	0	0	11	0	0
Rhagovelia sp.	0	0	6	0	0
Circadellidae	0	0	6	0	0
COLEOPTERA - beetles					
Dytiscidae	0	0	6	0	0
Helichus sp.	6	6	0	0	0
Heterelmis sp.	0	0	255	0	62
Narpus sp.	57	34	0	0	6
Optioservus sp.	414	1559	1588	556	0
Curculionidae	0	0	0	0	6
COLLEMBOLA - springtails					
Poduridae	0	0	0	0	6
ASCHELMINTHES					
Nematoda	0	0	0	0	6
MOLLUSCA - snails/clams					
Sphaeriidae	0	0	0	11	0
ANNELIDA - segmented worms					
Tubificidae	0	0	6	0	0
Naididae	0	0	68	0	0
Lumbricidae	352	210	0	0	11
Lumbiculidae	0	0	74	0	0
PLATYHELMINTHES - flatworms					
Turbellaria	51	6	0	0	119
Total (numbers/m2)	2589	6562	2913	2351	11212

Station PA 6.7

The habitat at this site scored 74% of the reference site and was rated as partially supporting. Effects from scouring and deposition resulted in reduced instream cover, increased channel alteration, and increased embeddedness. This site had the highest number of taxa (32) of the three sites studied in upper Pajarito Creek, primarily due to an increased number of tolerant Diptera. The community was dominated by the moderately tolerant riffle beetle *Optioservus* sp. (55%). The EPT index (80% of the reference site) and the CTQd of 89.1 indicate a shift towards a community more tolerant of the reduced habitat quality. However, the HBI index (4.20) indicates "excellent water quality" with "organic pollution unlikely" (Table 3). Overall the biological condition score was 87% of the reference site and was rated non-impaired (Table 4).

Station BU 0.01

The habitat score of 95 at station BU 0.01 was comparable to the reference site. The high number of taxa (25), diversity (3.52) and EPT/EPT + Chironomid index (0.60) indicate a reasonably well balanced macroinvertebrate community, though 24% of the sample consisted of the moderately tolerant riffle beetle, *Optioservus* sp. The low CTQd (72.5) indicates a high percentage of intolerant taxa, (11 of 25), six of which were intolerant Diptera. The HBI (4.66) indicates "very good water quality" with "possible slight organic pollution" (Table 3). Overall the biological condition score was 84% of the reference site and was rated non-impaired (Table 4).

Station ST 0.5

The habitat score of 95 at station ST 0.5 was comparable to the reference site, indicating that differences in the macroinvertebrate communities are probably attributable to water quality. Heavy growths of filamentous algae were present at this station, indicating possible nutrient enrichment. The standing crop at this station was 4.3 times higher than the reference site. Despite the high number of taxa (35), the diversity of 2.48 is the lowest of all five stations sampled. This is primarily due to the dominance of the macroinvertebrate community by the tolerant, collector-gatherer midge *Pagastia* sp. (59%), which is indicative of a community under stress (D. L. McGuire, personal commun., 1996). A shift in community structure to a high standing crop (11,212 no/m^2) dominated by one or few genera is common with eutrophication, or nutrient enrichment. The moderately elevated CTQd (85.5) is influenced by the sixteen tolerant Dipteran taxa which compose 80% of the total population. The EPT/EPT + Chironomid index (0.17) indicates a disproportionate number of tolerant midges. The HBI (6.92) generated from this station indicates "fairly poor water quality" with "substantial organic pollution likely" (Table 3). The Scraper/Scraper + Filtering Collectors feeding group metric reflects the riffle community food-base. Scrapers increase with increased diatom abundance and decrease as filamentous algae and aquatic mosses, (which scrapers cannot efficiently harvest) increases (Plafkin et al., 1989). Filamentous algae provide good attachment sites for filtering collectors, and the organic enrichment often responsible for overabundance of filamentous algae provide Fine Particulate Organic Matter (FPOM) utilized by the filterers (Klemm et al., 1990). The complete absence of the scraper functional feeding group and presence of mats of filamentous algae indicate a community structure tolerant of nutrient enrichment. Overall the biological condition score (34) is 53% of the reference station and ST 0.5 is considered moderately impaired (Table 4).

Water-quality data collected in 1994 for nutrient analysis did not indicate high nutrient levels (samples did not meet holding time). Surveys conducted in spring 1995 located an ephemeral spring, discharging approximately 3.8 L/min, approximately 10 m upstream from ST 0.5 (see Dale and Yanicak, this volume). Water samples collected on April 28, 1995, yielded 29 mg/L NO_3–N, 2.0 mg/L Kjeldahl–N, and 0.13 mg/L Total Phosphorus (see Dale and Yanicak, this volume). When the spring was resampled on May 24, 1995, the flow had dropped to less than 1 L/min, and the nutrient levels had dropped significantly to 0.1 mg/L NO_3–N, <0.5 mg/L Kjeldahl–N, and 0.09 mg/L Total Phosphorus (see Dale and Yanicak, this volume). This indicates that there may be a seasonal input, during the spring snowmelt, of nutrient-rich waters. The presence of algal growth at Starmer Spring, noted in 1992 (Anonymous, 1993), indicates this may be an annual or semi-annual occurrence.

Water-quality assessment

In accordance with Section 1105 of the State of New Mexico Standards for Interstate and Intrastate Streams, the current designated use for surface waters occurring at LANL is "livestock watering" and "wildlife habitat" (Anonymous, 1995). The water-quality data collected during this study indicate that the livestock watering and wildlife habitat standards are being attained. A comparison of the water-quality data and the fishery standards is provided in Tables 6 and 7 for discussion purposes only. While not applicable, the fishery "acute standard" for aluminum (750 µg/L) was exceeded at the most downstream station (PA 6.7), and the "chronic standard" for aluminum (87 µg/L) was exceeded at all stations. Chronic criteria are applicable only to the arithmetic mean of four samples collected on each of four consecutive days. The water quality of upper Pajarito Canyon, Starmer Gulch and Bulldog Gulch meets all applicable water-quality standards.

CONCLUSIONS

Conditions at station PA 9.0 in upper Pajarito Creek are the appropriate reference conditions with which to compare other LANL streams and spring brooks. Upper Pajarito Creek supports a diverse, well-balanced, moderately tolerant macroinvertebrate community. Habitat quantity and quality is high at the junction of Starmer Gulch and Pajarito Creek, displaying some degradation 2.6 km downstream due to scouring, deposition and reduced flows, which result in reduced instream cover and increased embeddedness. Water quality is good, though there may be periodic inputs of elevated nutrient levels 800 m upstream (near ST 0.5). Aluminum concentrations are elevated and are probably attribut-

TABLE 6. General water chemistry results and coldwater fishery standards (Anonymous, 1995).

UPPER PAJARITO SAMPLING STATIONS	DATE	ST 0.5	ST 0.0	PA 9.0	BU 0.01	PA 6.7	COLD WATER FISHERIES STANDARDS
	TIME	22-Jul-94	1-Jul-94	22-Jul-94	22-Jul-94	22-Jul-94	
		1420	1320	1445	1300	1117	
WATER CHEMISTRY	UNITS						
AIR TEMP	(C)						
WATER TEMPERATURE (FIELD)	(C)	11.7	12.5	14.3	14.6	16.5	< 20 C
CONDUCTIVITY (FIELD)	(uhmo)	120	122	138	200	120	
O2 DISSOLVED (FIELD)	(mg/L)	8.8	7.4	8.8	8.4	7.8	> 6.0mg/L
pH (FIELD)	(S.U.)	7.45	8.00	8.45	7.98	7.81	8.6 > pH < 8.8
NITRATE+ITE	(mg/L)	0.20Q	0.20	0.20Q	0.40Q	0.10KQ	
AMMONIA	(mg/L)	0.10Q	0.10Q	0.10Q	0.30Q	0.10KQ	
KJELDAHL N	(mg/L)	0.30Q	0.30Q	0.10Q	0.20Q	0.40Q	
TOTAL PHOSPHORUS	(mg/L)	0.09KQ	0.09KQ	0.09KQ	0.09KQ	0.09KQ	
Ca	(mg/L)	10.00Q	8.60Q	10.00Q	16.00Q	12.00Q	
Mg	(mg/L)	3.20Q	6.40Q	3.10Q	4.20Q	3.40Q	
K	(mg/L)	4.00Q	5.00Q	4.00Q	4.00Q	4.00Q	
Na	(mg/L)	9.00Q	9.00Q	10.00Q	18.00Q	13.00Q	
HARDNESS	(mg/L)	38.00Q	35.00Q	38.00Q	58.00Q	44.00Q	
ALKALINITY	(mg/L)	41.00Q	38.00Q	42.00Q	65.00Q	52.00Q	
BICARBONATE	(mg/L)	50.00Q	46.00Q	52.00Q	79.00Q	64.00Q	
CARBONATE	(mg/L)	0.00Q	0.00Q	0.00Q	0.00	0.00Q	
CHLORIDE	(mg/L)	8.00	8.00	8.00	12.00	9.00	
FLOURIDE	(mg/L)	0.10	0.10K	0.10	0.30	0.20	
SULFATE	(mg/L)	7.00	6.00	7.00	9.00	6.00	
COLOR TEST	(units)	15	25.00	20.00	15.00	50.00L	
CONDUCTIVITY (LAB)	(uS/cm)	120	113.00Q	120.00	197.00	153	
pH (LAB)	(S.U.)	7.28Q	7.90Q	6.95Q	7.34Q	6.81Q	
TDS	(mg/L)	142	154	122	174	162	
TSS	(mg/L)	18	5	4	3K	3K	

K = Less Than Q = Did Not Meet Holding Time NA = Not Analyzed For

TABLE 7. Total and dissolved metals results and water quality standards (Anonymous, 1995).

UPPER PAJARITO SAMPLING STATIONS DISSOLVED METALS	DATE TIME UNITS	Starmer Spring 22-Jul-94 1420	ST 0.0 1-Jul-94 1320	PA9.0 22-Jul-94 1445	BU 0.01 22-Jul-94 1300	PA 6.7 22-Jul-94 1117	Fisheries Acute Hardness-Dependent Criteria Hardness (35)	Fisheries Chronic Hardness-Dependent Criteria Hardness (35)	Livestock Watering Standards	Wildlife Habitat Standards
Al	(ug/l)	700	500	700	400	800	750	87	5000	
Ba	(ug/l)	100K	100K	100K	100K	100K				
Be	(ug/l)	100K	100K	100K	100K	100K	130	5.3		
B	(ug/l)	100K	100K	100K	100K	100K			5000	
Ca	(ug/l)	9600	9600	10,000	16,000	12,000				
Co	(ug/l)	50K	50K	50K	50K	50K			1000	
Cu	(ug/l)	10KQ	10KQ	10K	10KQ	10KQ	7	5	500	
Fe	(ug/l)	300	300	1,000	200	500				
Mg	(ug/l)	3200	2900	3400	4300	3600				
Mn	(ug/l)	50K	50K	50K	50K	50K				
Mo	(ug/l)	100K	1KQ	100K	100K	100K				
Ni	(ug/l)	100K	100K	100L	100K	100K	600	60		
Si	(ug/l)	20,000	19,000	NA	21,000	18,000				
Ag	(ug/l)	100K	100K	100K	100K	100K	0.7			
Sr	(ug/l)	100K	100K	100K	100K	100K				
Sn	(ug/l)	100K	100K	100K	100K	100K				
V	(ug/l)	100K	100K	100K	100K	100K			100	
Zn	(ug/l)	20Q	10KQ	10	20Q	1KQ	50	40	2500	
U	(ug/l)	NA	1KQ	NA	NA	NA				
As	(ug/l)	1KQ	1KQ	1K	2Q	2Q			200	
Cd	(ug/l)	1KQ	1KQ	1K	1KQ	1KQ	1.2	0.5	50	
Cr	(ug/l)	1KQ	1KQ	1K	1KQ	1KQ	700	90	1000	
Pb	(ug/l)	1KQ	1KQ	1K	1KQ	1KQ	21	0.8	100	
Hg	(ug/l)	0.5K	0.5K	0.5K	0.5K	0.5K				
Se	(ug/l)	5K	5K	5K	5K	5K			50	

UPPER PAJARITO SAMPLING STATIONS TOTAL METALS	DATE TIME UNITS	Starmer Spring 22-Jul-94 1420	ST 0.0 1-Jul-94 1320	PA9.0 22-Jul-94 1445	BU 0.0 22-Jul-94 1300	PA 6.7 22-Jul-94 1117	Fisheries Acute Hardness-Dependent Criteria Hardness (35)	Fisheries Chronic Hardness-Dependent Criteria Hardness (35)	Livestock Watering Standards	Wildlife Habitat Standards
Al	(ug/l)	600	1000	700	900	2400				
Ba	(ug/l)	100K	100K	100K	100K	100K				
Be	(ug/l)	100K	100K	NA	NA	100K				
B	(ug/l)	100K	100K	NA	NA	100K				
Ca	(ug/l)	9800	16,000	NA	NA	12,000				
Co	(ug/l)	50K	50K	50K	50K	50K				
Cu	(ug/l)	10KQ	10KQ	10K	10KQ	10K				
Fe	(ug/l)	300	500	500	600	1,400				
Mg	(ug/l)	3300	3100	3100	4300	3700				
Mn	(ug/l)	50K	50K	50K	50K	50K				
Mo	(ug/l)	100K	1KQ	100K	100K	100K				
Ni	(ug/l)	100K	100K	100K	100K	100K				
Si	(ug/l)	20,000	19,000	20,000	19,000	1200				
Ag	(ug/l)	100K	100K	100K	100K	100K				
Sr	(ug/l)	100K	100K	100K	100K	100K				
Sn	(ug/l)	100K	100K	100K	100K	100K				
V	(ug/l)	100K	100K	100K	100K	100K				
Zn	(ug/l)	10KQ	10KQ	10K	10Q	1				
U	(ug/l)	NA	1KQ	NA	NA	NA				
As	(ug/l)	1KQ	1KQ	1K	4Q	2				
Cd	(ug/l)	1KQ	1KQ	1K	1KQ	1K				
Cr	(ug/l)	1Q	1Q	1K	3Q	3				
Pb	(ug/l)	1KQ	1K	1K	2Q	2				
Hg	(ug/l)	0.5K	0.5K	0.5K	0.5K	0.5K	2.4	0.012	10	0.012
Se	(ug/l)	5K	5K	5K	5K	5K	20	2	50	2

K = Less than Q = Did not meet holding time NA = Not analyzed for

able to the abundance of aluminum oxides in the rhyolitic ash-flow tuffs and pumice which make up much of the Pajarito Plateau.

Bulldog Gulch supports a diverse, well-balanced, moderately-intolerant macroinvertebrate community. Habitat quality is high, though limited in quantity. Low flow in Bulldog Gulch (45-57 L/min) is a major limiting factor affecting habit availability.

Starmer Gulch, near Starmer Spring (ST 0.5), supports an unbalanced, tolerant, macroinvertebrate community, indicative of nutrient enrichment. The distance downstream from ST 0.5 that is affected by the nutrient enrichment has not been determined, but the effects do not extend to Pajarito Creek, 800 m downstream. The ephemeral nature of springs discharging into Starmer Gulch emphasizes one of the advantages of biological assessment. An important value of using macroinvertebrates as an index to water quality lies in the long-term

effects that invertebrates will reflect. Water samples offer a snapshot of the water quality at the time of collection, but give little insight to the streams' water-quality history. Water samples collected after a pulse of nutrient-rich spring discharge may not reveal nutrient enrichment, whereas the growth of filamentous algae and the macroinvertebrate community response to the organic enrichment will persist for some time after nutrient input has ceased.

Studies will be undertaken in 1996 to determine the flow characteristics and water-quality trends at ephemeral springs in Starmer Gulch, and the extent downstream that these flows influence the resident macroinvertebrate community. It is not yet understood whether the elevated nutrient levels are a natural phenomenon or due to anthropogenic causes. In view of the proximity of these ephemeral springs to a Solid Waste Management Unit (Material Disposal Area M), additional studies to determine the source of these nutrients are warranted.

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Travertine mound spring, in the reeds between the bathhouse in Jemez Springs and the Jemez River, issues at 72°C, and is the hottest spring outside the caldera depression. It is reported to contain an extremely rare species of alga.

SOME FUNDAMENTAL HYDROLOGIC ISSUES PERTINENT TO ENVIRONMENTAL ACTIVITIES AT LOS ALAMOS NATIONAL LABORATORY, NEW MEXICO

WILLIAM J. STONE
New Mexico Environment Department, DOE Oversight Bureau, 4131 Montgomery NE, Albuquerque, NM 87109

Abstract—Monitoring/restoring the 2000+ contaminated sites at Los Alamos National Laboratory (LANL) and protecting ground water in future waste-disposal activities, requires an understanding of the hydrologic system(s) on the Pajarito Plateau. Despite previous work, the conceptual hydrogeologic model for LANL is incomplete. Some fairly basic questions about ground-water occurrence, movement and quality remain. For example, what is the number of perched-water zones, the depth of ground water, the extent of perched-water zones, the possibility of recharge through the tuff, the ground-water flow direction near well fields, the origin of springs in White Rock Canyon, the fate of perched ground water, the water budget for the Pajarito Plateau, the background hydrochemistry for the saturated zones and the inventory of radionuclides in canyons receiving effluent? Answering these involves synthesis of existing information, collection of new data and rethinking of current concepts.

INTRODUCTION

Radioactive and hazardous waste has been generated and disposed of at Los Alamos National Laboratory (LANL) since its inception in 1943 (Kelly, 1975). More than 2000 potentially contaminated sites or solid waste management units were recognized at LANL in 1995 (Anonymous, 1995a). The monitoring and restoration of these sites, as well as protection of ground water in future waste-disposal activities, requires a thorough understanding of the hydrologic system(s) at LANL.

The New Mexico Environment Department (NMED) entered into an agreement with the Department of Energy (DOE) in October 1990 (renewed in September 1995) to provide guidance regarding applicable state laws and regulations as well as technical comments on environmental activities. These include air quality, surface-water quality, ground-water quality and hazardous-and-radioactive-materials issues. In January 1995, a separate NMED bureau was created to handle these functions. Oversight at LANL is provided by a staff of seven based in White Rock, supplemented, as necessary, by technical support staff based in Santa Fe and Albuquerque.

LANL is situated on the Pajarito Plateau, the expanse of deeply dissected Bandelier Tuff between the Jemez Mountains and the Rio Grande. Much has been learned about the hydrogeology of the Pajarito Plateau since Purtymun and Johansen (1974) described it in the New Mexico Geological Society's last guidebook on the area. For example, the U.S. Geological Survey developed a four-layer numerical model of the regional hydrology (McAda and Wasiolek, 1988). This was recently modified into an eight-layer model to incorporate new hydrogeologic findings (Frenzel, 1995). Despite this previous work, the conceptual hydrogeologic model for LANL (Fig. 1) is still incomplete and some questions remain.

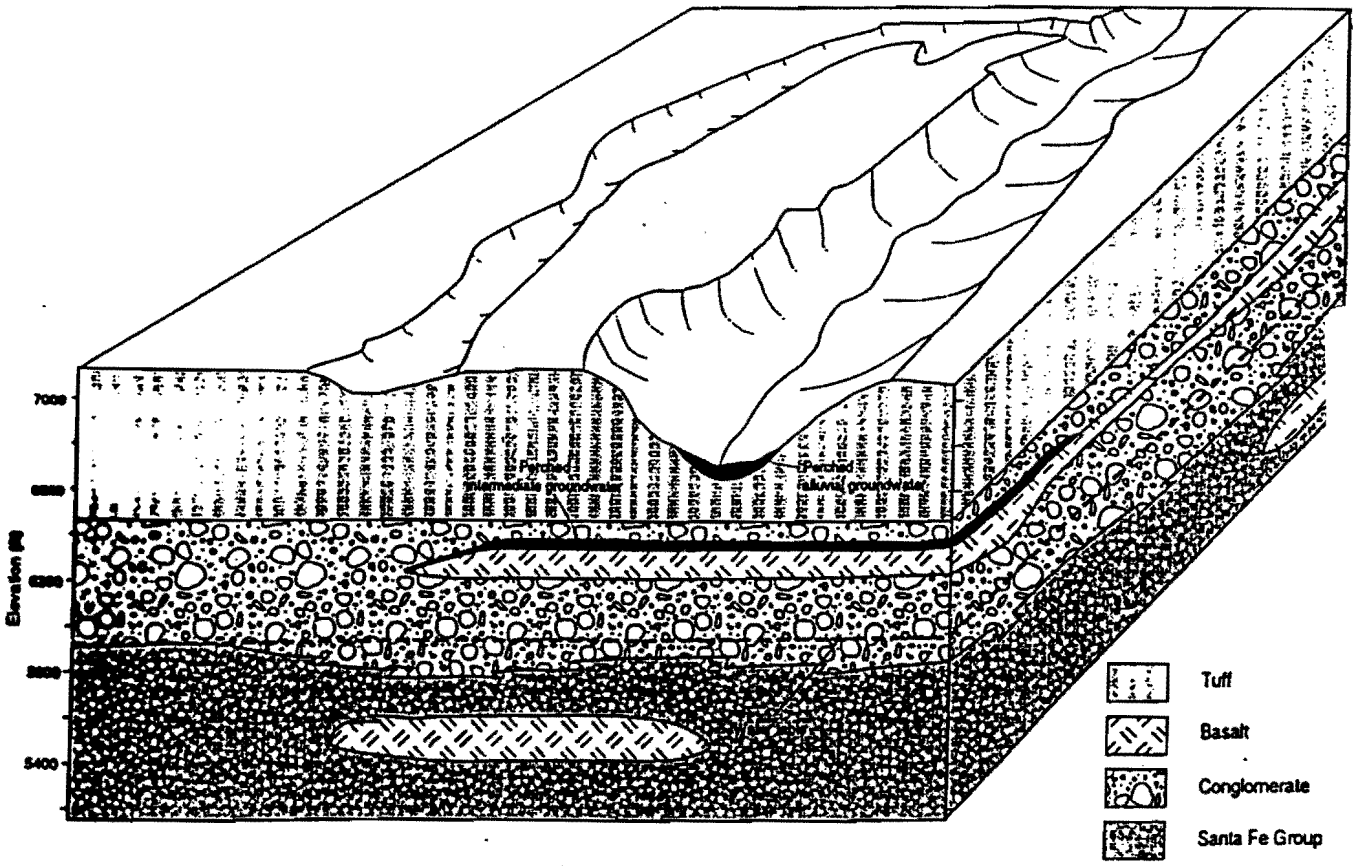

FIGURE 1. Conceptual hydrogeologic model for LANL (Anonymous, 1995b, fig. 3-2).

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This paper identifies and discusses some hydrologic issues of concern in environmental efforts at LANL. Many issues could be included and omission of a specific issue here does not mean NMED considers it unimportant. In view of space limitations, 10 of the more fundamental issues have been selected. They span all areas of the conceptual hydrogeologic model: ground-water occurrence, movement and quality. In other words, where is the water, where does it come from, where does it go and what is its chemistry? Below, issues are presented in the form of questions, followed by a summary of what is known, what is not known and possible solutions. The observations made herein are offered in the spirit of technical comment and do not represent the regulatory position of NMED.

GROUND-WATER OCCURRENCE ISSUES

The occurrence of saturated zones at LANL must be known in order to protect, monitor or remediate them. More specifically, this includes determining the stratigraphic as well as geographic position of ground-water bodies. Of special interest are perched saturated zones—their occurrence, depth and lateral extent.

How many perched-water zones are there?

Significant water-yielding media are often called "aquifers". More specifically, an aquifer is a geologic material whose saturated portion has sufficient porosity, permeability, thickness and extent to yield useful quantities of water to wells. Since what constitutes "useful quantities" is subjective, so too is the designation of materials as aquifers.

The recognition of aquifers at LANL has had an interesting history. The initial and long-standing view has been that there is only one saturated material capable of providing a water supply at Los Alamos, the so-called "main aquifer". It consists mainly of the Santa Fe Group and overlying Puye Formation (the conglomerate in Fig. 1) and contains the regional water table. However, as more holes were drilled, various perched saturated zones were encountered. Initially, this included the perched water bodies associated with alluvium in canyons (shallow perched water; Devaurs and Purtymun, 1985; Purtymun and Stoker, 1990) and with basalt or sedimentary units of the Puye Formation (intermediate perched water; Purtymun, 1975, 1995). However, in some places the intermediate perched water was found to be in the tuff. Griggs (1964) reported that a 2000-ft test hole to the Tschicoma Formation in upper Los Alamos Canyon (sec. 17, T19N, R6W) encountered perched water in both the alluvium and the Guaje Pumice Bed of the Otowi Member of the Bandelier Tuff. Higher perched saturated zones also have been discovered in the Bandelier Tuff (Gardner et al., 1993; Broxton et al., 1995; Dale and Yanicak, this volume).

Although none of these perched zones appears to be a potential source of water supply, they have sometimes been referred to as aquifers because they generally yield more water than the surrounding materials. The term "perched aquifer" is not strictly correct as it is the water that is perched, not the geologic material containing it. In fact, the perched water may occur in the same geologic unit as the regional water table. Several standard hydrology texts apparently share this concern as they refer to "perched ground water" but not "perched aquifers".

The piecemeal evolution of nomenclature associated with the various saturated zones has led to communication problems. A simple scheme of designating them as "shallow", "intermediate" and "deep" will not work. That is, the practice of calling the ground water in the canyon alluvium the "shallow perched water" and that in the saturated Puye sediments or basalt above the regional water table the "intermediate perched water" is not strictly valid in view of the discovery of still shallower perched water in the tuff, not to mention other perched-water zones occurring in different geologic units than these. Of course the regional or "main aquifer" remains the "deep aquifer".

We need to know more about all of the materials containing perched water; their lithology, thickness and hydraulic properties across the Pajarito Plateau are not documented. This would require further drilling and aquifer testing. Additionally, we need to know where ground water is unconfined and where it is confined. It was recognized very early that water in the main aquifer is confined in some places (Cushman, 1965). Although recent studies of water-level fluctuations in the main aquifer confirm this (McLin, 1993), the specific areas where this applies should be delineated and mapped.

How deep is ground water?

Knowledge of the depth to various saturated zones at LANL is critical not only for understanding the hydrogeologic system in general, but also for ground-water protection, monitoring and remediation activities. Water-depth data come from measurements in wells and observations at springs. Thus, the understanding of ground-water depth is only as good as the well network and water-level data base. According to LANL's latest annual surveillance report (Kohen et al., 1995, table VII-1), this includes one spring for the water perched in the tuff, 19 wells for water perched in the canyon alluvium, two wells and one spring for the water perched in the basalt and sediments of the Puye Formation and 17 wells and 28 springs for the deep or main aquifer.

As noted in NMED's evaluation of the monitoring at LANL (Stone et al., 1993), this network is not adequate. There are too few wells for monitoring perched water in the tuff or the Puye, and large gaps in the coverage of the deep or main aquifer. Too many of the monitoring points are production wells with long screen intervals and too many are clustered at the same location. The need for additional drilling and better spacing of wells is now recognized by LANL and remedies are proposed in their Draft Ground Water Protection Management Program Plan (Anonymous, 1995b).

What is the extent of the perched-water zones?

In addition to depth, the lateral extent of the perched-water zones is pertinent to conducting/evaluating environmental activities. Perched ground water probably occurs in the alluvium of most of the canyons, especially in the western part of the Pajarito Plateau (Purtymun, 1995). However, its extent is best documented in Los Alamos, Mortandad and Pajarito Canyons (Devaurs and Purtymun, 1985; Purtymun, 1995).

The extent of other perched-water zones is poorly known. For example, although water is known to be perched in the Bandelier Tuff in some mesas, based initially on springs and now on drilling, its lateral extent there or under other mesas has not been determined. Similarly, although water is known to be perched in the basalt and sediments of the Puye Formation beneath Pueblo, Los Alamos and Sandia Canyons, its lateral extent has not been determined.

GROUND-WATER MOVEMENT ISSUES

Understanding ground-water movement is also essential to environmental activities at LANL. This includes movement of water between streams and saturated zones, between the various saturated zones and within saturated zones. More specifically, this involves a knowledge of the recharge, flow and discharge of ground water.

Is there recharge through the tuff?

As the Bandelier Tuff caps the Pajarito Plateau, it is the medium encountered by infiltrating precipitation, runoff and effluent. It was long thought that this material is sufficiently tight to prevent downward fluid movement. However, various lines of evidence suggest that while the tuff may retard percolation, it does not prevent it. The perching of ground water in the canyon alluvium on the tuff attests to its low permeability, but modeling of such perched water in Mortandad Canyon has suggested that there is considerable leakage into the tuff (Koenig and McLin, 1992; Geddis, 1992; Stone, 1995). Further, where the deep aquifer is unconfined, it presumably is in contact with the atmosphere through the tuff. Although the tuff lacks primary porosity and permeability, especially where welded, cooling and tectonic fractures are common. Such fractures often exhibit clay skins, suggesting water has moved along them. The importance of these features as potential pathways for contaminant transport has been recognized by LANL and an excellent study of the fractures in the north wall of Los Alamos Canyon has been made by Wohletz (1995). However, it is not clear whether fractures run all the way through the tuff or are interconnected enough to permit water to migrate to the underlying units. As noted by Rogers (1995), tectonic fractures may be more important as migration pathways than cooling joints. Another line of evidence that the tuff is not a barrier to flow is the occurrence of water within the tuff itself. Water that was not introduced

during drilling has been encountered in two holes in mesa settings (Gardner et al., 1993). Also, springs have been observed discharging from the tuff in the Pajarito Canyon and Canyon De Valle areas (Dale and Yanicak, this volume).

What is the ground-water flow direction around the well fields?

Water-level maps for LANL show that the regional ground-water flow direction is easterly (Fig. 2). Thus, monitoring is focused on detecting movement of contaminants toward the Rio Grande. However, near water-supply well fields, cones of depression associated with pumping can reverse flow direction, causing contaminants to move toward production wells rather than the river. The capture zone for each production well should be determined and cones of depression reflected on water-level maps. Both of these should be considered in placing future monitoring wells.

Why are all the springs in White Rock Canyon attributed to the main aquifer?

Water levels for the main aquifer decrease toward the Rio Grande and it is the logical discharge area for the regional saturated zone (Fig. 2). Presumably such discharge would be at river level, as shown in various LANL reports (e.g., Purtymun, 1984, fig. 2). However, of the 27 springs monitored by LANL, 15 are reported to be above the river or on the canyon wall and, based on the elevations given by Purtymun (1980, table 1), five more are also above the river. Thus, 20 of the 27 springs in White Rock Canyon discharge above the river and thus above the regional water table.

Various alternative interpretations are possible. The simplest is that the elevated springs represent discharge of some perched saturated zone(s) rather than that of the main aquifer. Other scenarios involve some splitting of the regional ground-water flow around basalt bodies, resulting in discharge at both perched and river-level positions. This could be tested by means of an east-west water-level profile across the plateau. However, construction of such a profile is hindered by uncertainty as to the elevation of the springs. Different reports give different values; for example, the elevation for Spring 6 (of Purtymun et al., 1980) is given as 5412 ft, as 5380 ft by Purtymun (1995) and as 5480 ft in a LANL memo to DOE (Rogers, personal commun., 1995).

Where does perched ground water beneath the Pajarito Plateau go?

Understanding the movement of perched water at LANL is important not only for conceptualizing the hydrogeologic system, but also for predicting the fate of water-borne contaminants. Such contaminants may reach the perched waters by recharge from contaminated surface waters, especially in the canyons. Leakage from perched-water zones may permit contamination of the regional aquifer. For example, tritium has been detected at depths of at least 195 ft beneath Mortandad Canyon (Stoker et al., 1991). The perched saturated zones in the tuff come to the surface via springs along canyons, where the water issues from fractures. The

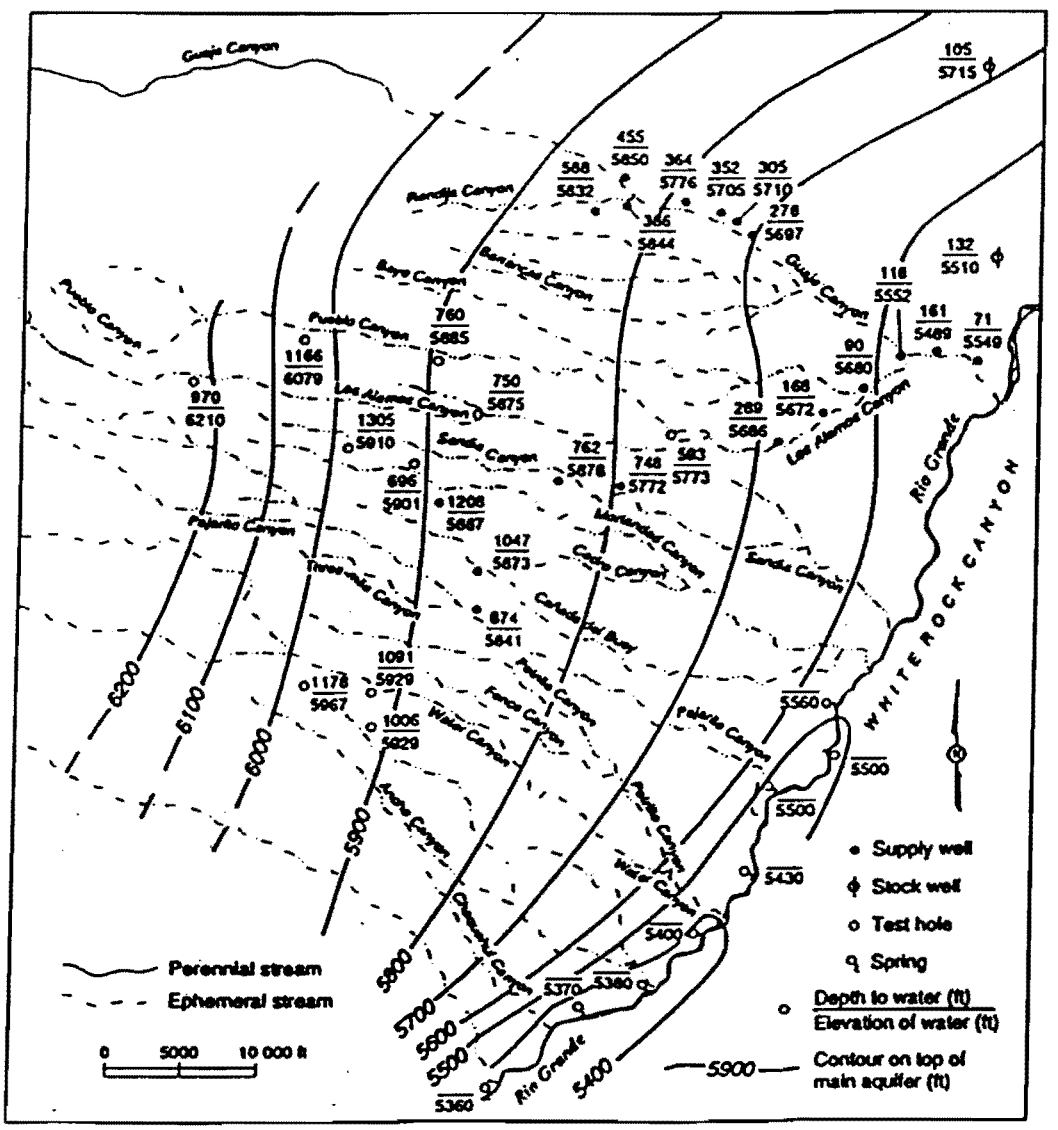

FIGURE 2. General water-level map for LANL (Purtymun, 1995, fig. I-AE).

vertical position of the springs may be controlled by the degree of welding in the tuff.

The fate of water perched in the canyon alluvium is less obvious. Based on findings for Mortandad Canyon, it appears to be lost by leakage into the underlying tuff (Stone, 1995). Where there is a perched zone in the Puye beneath the canyon, it is recharged by downward percolating water from the tuff. In some canyons, however, there is no second perched zone. For example, Mortandad and Pajarito Canyons lack perched zones in the Puye, in the latter case despite the presence of basalt (Devaurs and Purtymun, 1985).

Water percolating downward from all of the perched saturated zones eventually reaches the regional aquifer. The fewer perched zones there are, the more direct the communication with the surface.

What is the water budget for the Pajarito Plateau?

The water budget for an area is essential in understanding its hydrologic system. Such budgets relate the various parameters of the hydrologic cycle. A common form deals with the redistribution or partitioning of precipitation: precipitation (P) = runoff (RO) + evapotranspiration (ET) + recharge (R). However, the quantification of these parameters at LANL is incomplete. Recent instrumentation has expanded the capability for assessing rates of P, RO and ET, but R remains essentially undefined. Separate water budgets for selected canyons of concern will be essential for contaminant-transport modeling.

GROUND-WATER QUALITY ISSUES

Another important attribute of the hydrologic system at LANL relating to environmental activities is water chemistry. An understanding of both natural and impacted ground-water chemistry is essential to interpreting monitoring results and determining clean-up levels.

What is the background hydrochemistry for each of the saturated zones ?

Although the various ground waters at LANL have been sampled and analyzed for many years, a definitive synthesis of background water quality has not been made. In other words, what are normal constituents in waters of the Pajarito Plateau and what is their normal concentration (range, mean, etc.)?

What is the inventory of radionuclides in the canyons?

Effluent containing radionuclides has been discharged into Acid, DP, Los Alamos and Mortandad Canyons. Most of the radionuclides become bound to alluvial sediments, so their concentration in the canyons increases. Because these sediments are then carried out of the canyons by storm runoff (Purtymun, 1974), the quantity of radionuclides in the canyons should be determined and monitored. The amount of radionuclides present in Mortandad Canyon as of 1978 was determined by Purtymun et al. (1983). They also projected that by 1990 this inventory would increase by 80%. A follow-up study would permit an evaluation of their projection as well as compliance with DOE concentration (activity) guides.

SUMMARY AND SUGGESTIONS

This paper has addressed some fundamental hydrologic issues for environmental activities at LANL. Their resolution will require the synthesis of information already available, the collection of some new data and, in some cases, the rethinking of current concepts.

1. The conceptual hydrogeologic model for LANL should be modified to include all the perched-water zones known and a nomenclature developed for them that eliminates confusion.
2. The lithology, thickness and hydraulic characteristics of the material making up such zones should be determined where necessary and compiled in a sitewide data base.
3. Additional wells should be drilled to permit adequate characterization of all saturated zones, especially near contaminated sites.
4. The Bandelier Tuff should no longer be assumed to be a hydrologic barrier.
5. The vertical extent of fractures in the Bandelier Tuff should be determined as far as possible.
6. Capture zones should be determined for each water-supply well.
7. Cones of depression for the producing wells should be reflected by contours on water-level maps.
8. The source of water issuing from the springs in White Rock Canyon should be reconsidered.
9. The fate of the various perched waters should be investigated, especially where they are near contaminated sites and could convey contamination back to the environment outside the lab or to deeper saturated zones.
10. The geologic control of the vertical position of springs in the tuff deserves more study.
11. A water budget should be constructed for the Pajarito Plateau and perhaps selected canyons of concern.
12. Background water chemistry for all waters should be determined, as far as possible.
13. An inventory of radionuclides in canyons should be carried out.

The current climate of budget cuts and staff reductions has led some to conclude that, "the time for study is over and the time for clean-up is here". Although that is a catchy phrase, where fundamental information is lacking or incomplete, studies are still needed.

ACKNOWLEDGMENTS

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PRELIMINARY ASSESSMENT OF RADIONUCLIDE TRANSPORT VIA STORM-WATER RUNOFF IN LOS ALAMOS CANYON, NEW MEXICO

MICHAEL R. DALE
New Mexico Environment Department, DOE Oversight Bureau, 35 Rover Blvd., White Rock, NM 87544

Abstract—Observations on streamflow, suspended-sediment concentration and radionuclide activity during a 7-8 September 1995 flow event provide insight into contaminant transport in Los Alamos Canyon. Measurable discharge data from two gaging stations, one above and one below the mouth of DP Canyon, show that flow persisted for 8.8 hrs and at the downstream gage ranged from 651 to 0.28 L/sec. Four storm-water samples, taken at 30-min intervals during the peak flow where NM-4 crosses Los Alamos Canyon below the mouth of DP Canyon, showed suspended-sediment concentration ranged from 40.3 to 4.4 g/L. Mean activity concentrations for the suspended sediments (pCi/g) include 15.4 for gross beta, 2.44 for ^{90}Sr, 1.54 for $^{239/240}$Pu, 0.15 for ^{238}Pu, 1.36 for ^{241}Am and 6.63 for ^{137}Cs. Mean activity concentrations for dissolved radionuclides (pCi/L) include 17.9 for gross beta and 5.05 for ^{90}Sr; ^{238}Pu, ^{241}Am and ^{137}Cs were not detected in the dissolved phase. The radionuclide $^{239/240}$Pu was detected at or near the method or instrument detection limit (0.05 to 0.04 pCi/L). Preliminary estimates of total radionuclide transport during the first 90 min of flow include 41.5 uCi of ^{90}Sr, 26.2 uCi of $^{239/240}$Pu, 2.5 uCi of ^{238}Pu, 23.1 uCi of ^{241}Am and 112.8 uCi of ^{137}Cs. Historical data indicate transport of radionuclides with suspended sediments in Los Alamos Canyon varies from year to year. This variability may be linked to the fluctuation in discharge contributed by DP Canyon. Additional monitoring of flow and transport processes in canyons that contain contaminants is warranted.

INTRODUCTION

Historically, Los Alamos National Laboratory (LANL) has disposed of liquid radioactive waste in several ways. The early years at LANL saw untreated radioactive wastes discharged to canyons, underground storage tanks and absorption beds (Nyhan et al., 1985). More specifically, LANL's initial plutonium and uranium processing facility at Tech Area (TA) 21, located adjacent to DP Canyon, generated and disposed of treated and untreated radioactive wastes to the environment from the early 1940s to 1985 (Anonymous, 1991).

DP Canyon is a tributary to Los Alamos Canyon that extends from Sierra de los Valles downstream to the Rio Grande, and drains portions of the Los Alamos townsite and TA-21. From 1945 through 1951 untreated liquid effluent from TA-21 was discharged into on-site absorption beds. The early waste-disposal records from TA-21 are not clear as to whether untreated wastes were discharged to DP Canyon during that period; however, treated liquid effluent was discharged into DP Canyon from 1952 through 1985 (Nyhan, et al., 1985). The study area (Fig. 1) thus encompasses Los Alamos Canyon between DP Canyon and New Mexico Highway 4 (NM-4).

Previous studies have shown that storm-water runoff from DP Canyon transports radiological contaminants both in suspended sediment and solution (Purtymun, 1974, 1975). However, the relationship between radionuclide transport and the hydrologic system(s), as well as the amount of radionuclides moving off-site, are not well understood. Complete analysis of the modern hydrologic transport of contaminants in both DP and Los Alamos Canyons would be of use in characterizing and/or assessing the impacts of historical contaminant releases. For example, do storm-water data obtained from samples taken at the laboratory boundary reflect drainage from Los Alamos Canyon and/or DP Canyon?

As part of the New Mexico Environment Department's Department of Energy Oversight mission (see Stone, this volume), storm-water transport of radionuclides, especially off-site, is of concern. The purpose of this study was to estimate DP Canyon's surface- water contribution to discharge recorded in Los Alamos Canyon at NM-4, identify radionuclides in a storm-water runoff event and generate preliminary estimates of the amount of contaminants carried off-site.

THE 7-8 SEPTEMBER, 1995 FLOW EVENT

Precipitation

This two-day flow event resulted from a storm occurring in the Los Alamos townsite on 7 September, 1995. As no data are available for the area draining to DP Canyon, I assume that precipitation there was the same as recorded at TA-53 (Fig. 1), located approximately 2.5 km from TA-21. From 17:00 through 21:00 hrs precipitation data were recorded by LANL's Environment, Safety and Health Division (ESH-17) at TA-53 in 15-min increments. Precipitation peaks of 6.86 and 1.02 mm (Fig. 2) occurred during the storm. The total amount measured at TA-53 was 18.8 mm.

Discharge

DP Canyon's runoff contribution and the total runoff exiting Los Alamos Canyon at NM-4 were calculated using provisional discharge records obtained from two gaging stations (Fig. 1) equipped with continuous stage recorders (5-min frequency) installed by the U.S. Geological Survey (USGS). GS-1, operated by LANL's Environment, Safety and Health Division (ESH-18), is located in Los Alamos Canyon approximately 60 m upstream (west) of the mouth of DP Canyon. GS-2, operated by USGS at the time of the flow event, is also located in Los Alamos Canyon, approximately 4 km downstream (east) of GS-1.

At approximately 19:23 the surface-water flow-front or surge was observed in DP Canyon above its confluence with Los Alamos Canyon, while flow at GS-1 was estimated to be <2 L/sec. Approximately 2 min later the instantaneous flow at GS-1 was 227 L/sec (Fig. 2). Therefore, it is assumed that the first recorded instantaneous flow at GS-2 (651 L/sec) was contributed solely by DP Canyon. Flow at GS-1 did not end until several days later. Downstream tributaries between DP Canyon and NM-4 contributed little (< 2 L/sec) or no flow. The duration of surface-water flow at GS-2 was from 20:30 through 05:15. In addition to the initial peak at 20:30 there was a secondary peak from 22:30 to 22:40. The mean discharge for the flow event in Los Alamos Canyon at NM-4 was 106 L/sec and total runoff was 3380 m^3.

DP Canyon's contribution to total discharge was determined by calculating the difference between instantaneous and mean flows recorded at GS-1 beginning at 19:25 and ending at 00:10, and GS-2 beginning at 20:30 and ending at 00:15, assuming a lag time of 65 min and minimal infiltration between the two gages. In other words, the instantaneous flow recorded at GS-1 at 19:30 reached GS-2 at 20:35, or 5 min after DP Canyon runoff reached GS-2. The mean discharge in DP Canyon was estimated at 97 L/sec and the total runoff was estimated at 1688 m^3.

RADIONUCLIDE TRANSPORT

Sample collection

Storm-water samples (LA-I, II, III, IV) were collected at the junction of Los Alamos Canyon and NM-4 (Fig. 1). The first sample was taken at 20:34, and represents the flow-front or surge. The remaining three samples were collected at 30-min intervals after the initial sample was taken. Therefore, the sampling interval spanned 90 min. It was assumed that

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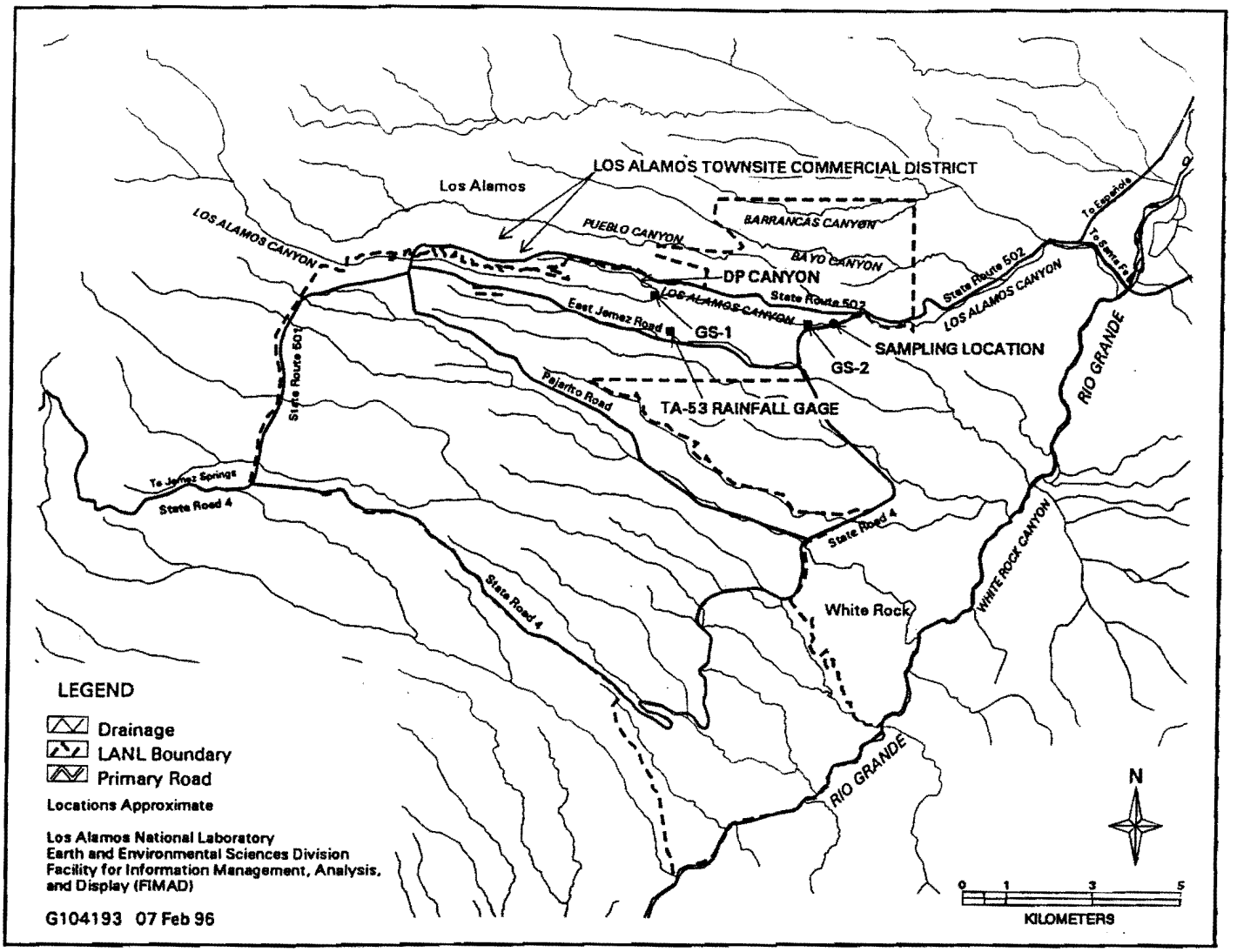

FIGURE 1. Location of streams, gages and sampling stations in the Los Alamos study area.

discharge at the sampling point correlates to discharge recorded approximately 4 min earlier at GS-2. The samples were collected at the approximate center of flow using a 1-L, wide-mouth (6-cm diameter) polyethylene container fastened to a staff (1.2 m in length) with two stainless-steel hose clamps. The opening of the container was submerged approximately 4 cm below the water surface and the container was swept parallel to flow direction in order to decrease the effects of back-washing. Approximately 7.6 L were collected per sample. The sampling container was thoroughly rinsed with deionized water prior to each sample collection. The samples were unpreserved, unfiltered, chilled to approximately 4° C and shipped on September 8, 1995, to a contract analytical laboratory. The samples were analyzed for total suspended solids and radionuclides (with both suspended sediment and dissolved; Tables 1 and 2).

Suspended sediment

Each sample was first decanted through a tared glass-fiber filter until only 1 L of slurry remained. The suspended sediment remaining on the filter was weighed. The remaining slurry was centrifuged in tared 250 ml

TABLE 1. Suspended-sediment radionuclide activity in storm-water samples collected in Los Alamos Canyon at NM-4.

SAMPLE ID	DATE	TIME	DISCHARGE *GS-2 (L/sec)	SUSPENDED SEDIMENT (g/L)	GROSS BETA (pCi/g)	unc	det	Sr-90 (pCi/g)	unc	det	Pu-239/240 (pCi/g)	unc	det	Pu-238 (pCi/g)	unc	det	Am-241 (pCi/g)	unc	det	Cs-137 (pCi/g)	unc	det
LA-I	9/7/95	20:34	651.17	40.3	13.3	1.8	0.74	1.46	0.43	0.47	1.633	0.238	0.01	0.086	0.023	0.02	0.98	0.55	0.03	4.60	0.41	0.21
LA-II	9/7/95	21:04	424.68	5.2	15.9	2.1	0.75	2.81	0.81	0.38	1.42	0.19	0.01	0.14	0.03	0.02	1.58	0.63	0.05	7.33	0.62	0.48
LA-III	9/7/95	21:34	283.30	5.7	16.5	2.2	0.75	2.78	0.62	0.45	1.50	0.19	0.01	0.14	0.03	0.02	1.44	0.03	0.04	6.85	0.54	0.48
LA-IV	9/7/95	22:04	158.55	4.4	15.9	2.1	0.75	2.69	0.60	0.42	1.39	0.19	0.03	0.22	0.05	0.03	1.44	0.05	0.03	7.74	0.53	0.32
		mean		5.1**	15.4	NA	NA	2.44	NA	NA	1.54	NA	NA	0.15	NA	NA	1.36	NA	NA	6.63	NA	NA
		standard deviation		0.54**	1.24	NA	NA	0.58	NA	NA	0.18	NA	NA	0.05	NA	NA	0.23	NA	NA	1.21	NA	NA

* - USGS gaging station # 08313042

unc - estimated total propagated uncertainties (2 sigma)

det - Method detection limit

NA - not analyzed or determined

** - mean and standard deviation values were calculated from LA-II, III and IV

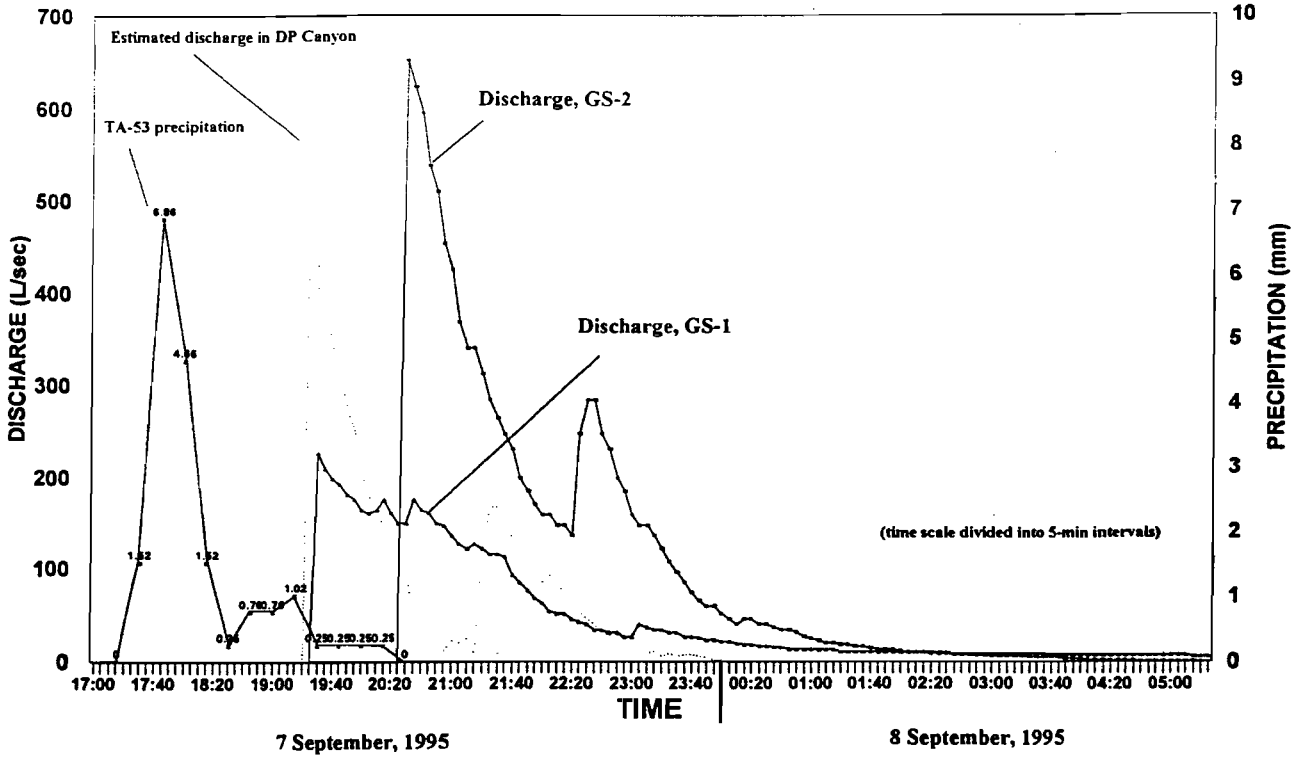

FIGURE 2. Hydrograph illustrating the relationships between precipitation at TA-53, surface-water flow at gaging stations in Los Alamos Canyon (GS-1 and GS-2), and estimated surface-water contribution by DP Canyon.

tubes: the separated water (supernate) was then filtered and added to the filtered liquids. The total volume of water was determined by summing the filtered water and supernatant. The total amount of suspended sediment was then calculated.

As noted at the time of collection, the initial sample (LA-I) contained the highest amount of suspended sediment, 40.3 g/L. The remaining three samples (LA-II, III and IV) contained 5.2, 5.7 and 4.4 g/L, respectively (Table 1). The mean concentration for the last three samples was 5.1 g/L with a standard deviation of 0.54. Due to the high suspended-sediment content of LA-I, the concentrations obtained for the first 90 min of flow were divided into two separate time intervals from 20:30 through 20:40 and from 20:40 through 22:00 in order to determine suspended-sediment transport. The suspended sediment transported during the first 10 min of flow was determined by assuming that its concentration decreased linearly from the initial value (40.3 g/L) to the mean value (5.1 g/L) calculated from the last three samples. The amount of suspended sediment transported during the first 10 min of flow is estimated to be 8676 kg. The amount of suspended sediment transported during the remaining 80 min. of flow, assuming a mean suspended-sediment concentration of 5.1 g/L, is estimated at 8343 kg. Thus, the total amount of suspended sediment transported during the first 90 min. of flow is estimated to be 17,019 kg. An unknown amount of additional suspended sediment would have been transported in flow occurring after 22:00.

Radionuclides in suspended sediment

The radionuclides ^{90}Sr, $^{239/240}$Pu, ^{238}Pu, ^{241}Am, and ^{137}Cs were detected in all suspended-sediment samples, with mean activity concentrations for the first 90 min of flow of 2.44 pCi/g, 1.54 pCi/g, 0.15 pCi/g, 1.36 pCi/g and 6.63 pCi/g, respectively (Table 1). Standard deviation for the radionuclide activity concentrations in suspended sediment ranges from 0.05 to 1.21. The mean activity concentration and standard deviation for gross beta in suspended sediment are 15.4 pCi/g and 1.24, respectively. Transport amounts for the radionuclides were calculated by multiplying their mean activity concentration by the total amount of suspended sedi-

TABLE 2. Dissolved radionuclide activity in storm-water samples collected in Los Alamos Canyon at NM-4.

			DISCHARGE	GROSS																	
			*GS-2	BETA			Sr-90			Pu-239/240			Pu-238			Am-241			Cs-137		
SAMPLE ID	DATE	TIME	(L/sec)	(pCi/L)	unc	det	(pCi/L)	unc	det	(pCi/L)	unc	det	(pCi/L)	unc	det	(pCi/L)	unc	det	(pCi/L)	unc	det
LA-I	9/7/95	20:34	651.17	24.6	4.0	0.60	7.2	1.4	0.59	0.05	0.02	0.01	ND	-	0.04	ND	-	0.15	ND	-	3.91
LA-II	9/7/95	21:04	424.68	17.3	2.5	0.42	4.8	1.0	0.63	NA	-	-	NA	-	-	NA	-	-	NA	-	-
LA-III	9/7/95	21:34	263.30	14.8	2.1	0.40	4.1	0.91	0.60	0.04	0.02	0.01	ND	-	0.04	ND	-	0.06	ND	-	3.37
LA-IV	9/7/95	22:04	158.55	14.9	2.2	0.42	4.1	0.91	0.61	NA	-	-	NA	-	-	NA	-	-	NA	-	-
		mean values		17.9	NA	NA	5.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		standard deviation		4.00	NA	NA	1.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* - USGS gaging station # 08313042
unc - Estimated total propagated uncertainties (2 sigma)
det - Method detection limit
NA - not analyzed or determined
ND - not detected

ment carried during the first 90 min of flow. The estimated amount of ^{90}Sr, $^{239/240}Pu$, ^{238}Pu, ^{241}Am, and ^{137}Cs transported off-site during the run-off event are 41.5 uCi, 26.2 uCi, 2.5 uCi, 23.1 uCi and 112.8 uCi, respectively.

Dissolved radionuclides

An aliquot from each sample was passed through a 0.45 micron filter prior to analysis by the contract analytical laboratory. Following filtration, all samples were analyzed for dissolved ^{90}Sr. In addition, samples LA-I and LA-III were analyzed for dissolved ^{137}Cs, ^{241}Am, $^{239/240}Pu$ and ^{238}Pu.

^{90}Sr and $^{239/240}Pu$ were detected in the dissolved phase (Table 2); however, the sample analyses showed the activity concentration of $^{239/240}Pu$ to be at or near the method or instrument detection limits (0.05-0.04 pCi/L). Consequently, $^{239/240}Pu$ transport in the dissolved phase could not be accurately quantified. All samples were found to contain ^{90}Sr in the dissolved phase. The mean activity concentration over the period represented by the four samples was 5.05 pCi/L, with a standard deviation of 1.27. The total amount of ^{90}Sr transported during the storm event in the dissolved phase was calculated by multiplying the total volume of water that was discharged at GS-2 (3380 m^3 or 3.38 X 10^6 L) by the mean ^{90}Sr activity concentration. This assumes that the mean ^{90}Sr activity concentration remained constant throughout the run-off/discharge event. If this assumption is valid, the total amount of ^{90}Sr released in the dissolved phase is estimated to be 17.1 uCi.

Historical trends

Historical data concerning radionuclide transport by storm-water run-off in Los Alamos Canyon at NM-4 has been reported in many of LANL's annual Environmental Surveillance Reports from 1982 through 1991. A careful review of the existing data showed no noticeable trends for radionuclide activity concentration in suspended sediment. The variability may be due to differences in DP Canyon's surface-water contribution. Such differences are in turn related to the intensity and duration of the storm, water velocity, and amount of bank erosion. Few or no data exist for some dissolved constituents, such as ^{90}Sr.

SUMMARY

Discharge measurements and estimates indicate that DP Canyon contributed approximately 50% of the flow that was transmitted off-site during this particular storm event. Therefore, this preliminary study suggests that the amount of surface-water contribution by DP Canyon during a storm event may have direct influence on radionuclide activity concentrations and volumes transported off-site, both absorbed to suspended sediment and in the dissolved phase. Further work is warranted.

ACKNOWLEDGMENTS

I thank Dr. Bill Stone, Steve Yanicak, Harvey Decker and Ralph Ford-Schmid (NMED, DOE OB), and Peter Monahan (NMED, Surface Water Quality Bureau) for their assistance. Reviews by Dr. Jim Piatt of the NMED Surface Water Quality Bureau and Pat Boreland of the USGS are most appreciated. Graphic support by Douglas Walther (EES-5) is also appreciated.

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by a series of ladders. The visitor complex in the canyon is accessible by motor vehicle; Bandelier is otherwise a hiker's park. Three large canyons cross the monument, with a complex system of mesas and secondary canyons separating them. Much of the monument has been designated a unit of the National Wilderness Preservation System. **2.6**

30.7 Meadows with abundant small pine trees on left have replaced the burned areas of the 1977 La Mesa forest fire. This area is now a National Environmental Research Area set aside to observe nature's reclamation process. **0.6**

31.3 Technical Area 49 on right. **0.3**

31.6 Good view into Water Canyon on right. **0.4**

32.0 Trailhead to Burnt Mesa on left. **1.0**

33.0 Contact between Tshirege units E and F (Rogers, 1995) on right. **0.1**

33.1 Good view of Pajarito fault scarp at 12:00 (Fig. 3.16). **0.7**

33.8 Road descends into shallow graben east of Pajarito fault. **0.2**

34.0 Junction with NM-501; **continue straight ahead** (uphill) on NM-4. The following minipaper summarizes the numerous springs present to the north of NM-4 and east of NM-501 on the western side of the Pajarito Plateau. **0.1**

CHARACTERISTICS OF SPRINGS IN THE WESTERN PAJARITO PLATEAU, LOS ALAMOS NATIONAL LABORATORY, NEW MEXICO

Michael R. Dale and Steve Yanicak

New Mexico Environment Department, DOE Oversight Bureau,
35 Rover Blvd., White Rock, NM 87544

Historically, drainages that dissect the Pajarito Plateau have been thought to contain only ephemeral streams produced from snow-melt and storm-water runoff. However, recent investigations by the New Mexico Environment Department, Department of Energy Oversight Bureau (NMED, DOE OB) indicate that perennial and ephemeral springs, emanating from the Bandelier Tuff and alluvium, supply perennial flow to several canyons along the western boundary of the Pajarito Plateau. Here, we briefly summarize the characteristics of these springs. A more detailed report is in preparation through the NMED DOE OB (Dale and Yanicak, unpubl. 1996).

The area studied (in 1994 and 1995) encompasses 3 mi^2, and is located entirely within the western region of Los Alamos National Laboratory (Fig. 3.17). Spring elevations vary from 7389 to 7481 ft, with springs at the northern edge of the study area occurring at slightly higher elevations. All observed springs discharged from gray tuff associated with units D or E of the Tshirege Member of the Bandelier Tuff (Rogers, 1995), or canyon alluvium. We made no attempt to correlate these units with Bandelier Tuff nomenclature for the Laboratory's Environmental Restoration Project (Broxton and Reneau, 1995), but recommend that future correlative studies be conducted.

Flow was determined at culverts and temporary diversion structures by the bucket-and-stop-watch method. Measurements were made downstream from the springs in order to focus on the amount of water contributed to the stream. Mean flow values (Fig. 3.17) were calculated using multiple measurements (7 to 12 replications).

Field work led to the discovery of 12 perennial springs, two in the Twomile Canyon area, six in the Pajarito Canyon area, and four in the Canon de Valle area (Fig. 3.17). With few exceptions, these springs discharge from north-facing canyon walls or slopes and occur along a 1.5-mi long, NNE-SSW-trending zone that subparallels major segments of the Pajarito fault system. The estimated flow of perennial springs during 1994 and 1995 was fairly consistent, ranging from 0.06 to 1.20 L/sec. Additional observations made periodically during 1994 and 1995 showed that perennial flow in Pajarito Canyon extended east from Homestead Spring for at least 2.2 mi. During 1995, perennial flow in Canon de Valle was observed from Peter Spring to the east for approximately 1.2 mi.

Field measurements for specific conductance, pH and temperature for the perennial springs ranged from 80 to 323 µS/cm, 6.07 to 7.79 S.U. and 8.0 to 12.7°C, respectively. The water is predominately a calcium-sodium-bicarbonate type with total dissolved solids (TDS) ranging from

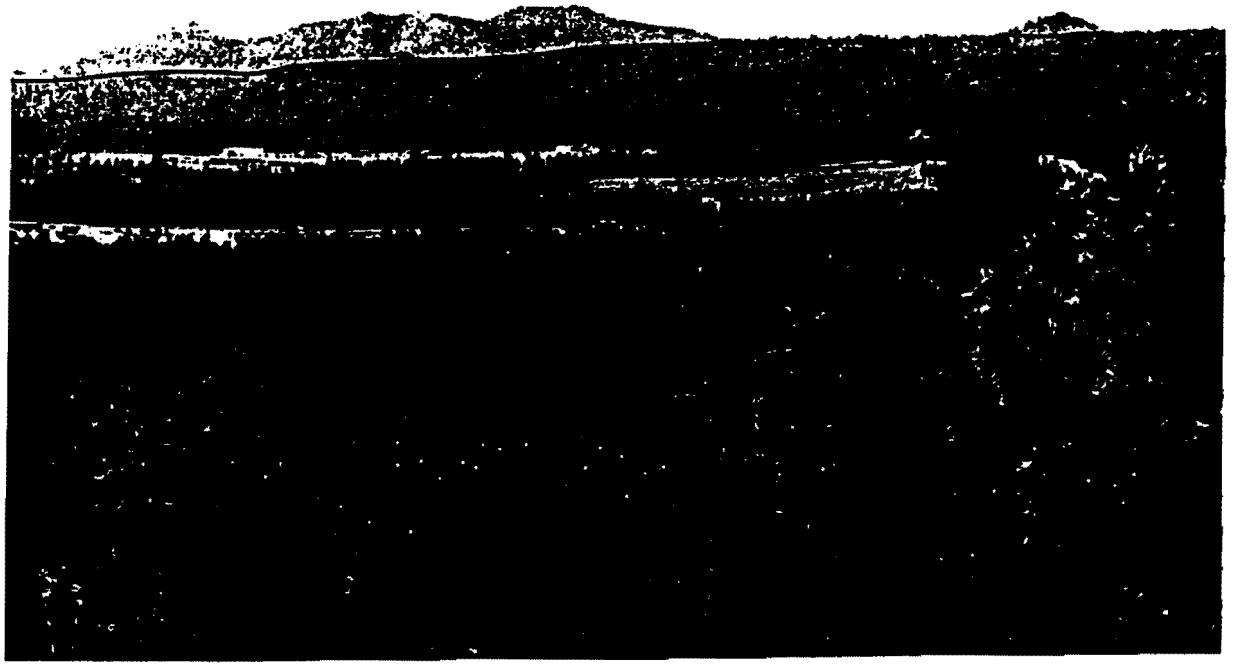

FIGURE 3.16. View, looking south, of the Pajarito fault scarp in Bandelier National Monument. Black line highlights the top of the scarp where it does not form the skyline. The Pajarito fault exhibits over 400 ft of displacement on marker horizons within the Bandelier Tuff. Pointed mountain at left is Boundary Peak, to the right is St. Peter's Dome, and at the far right is Rabbit Hill.

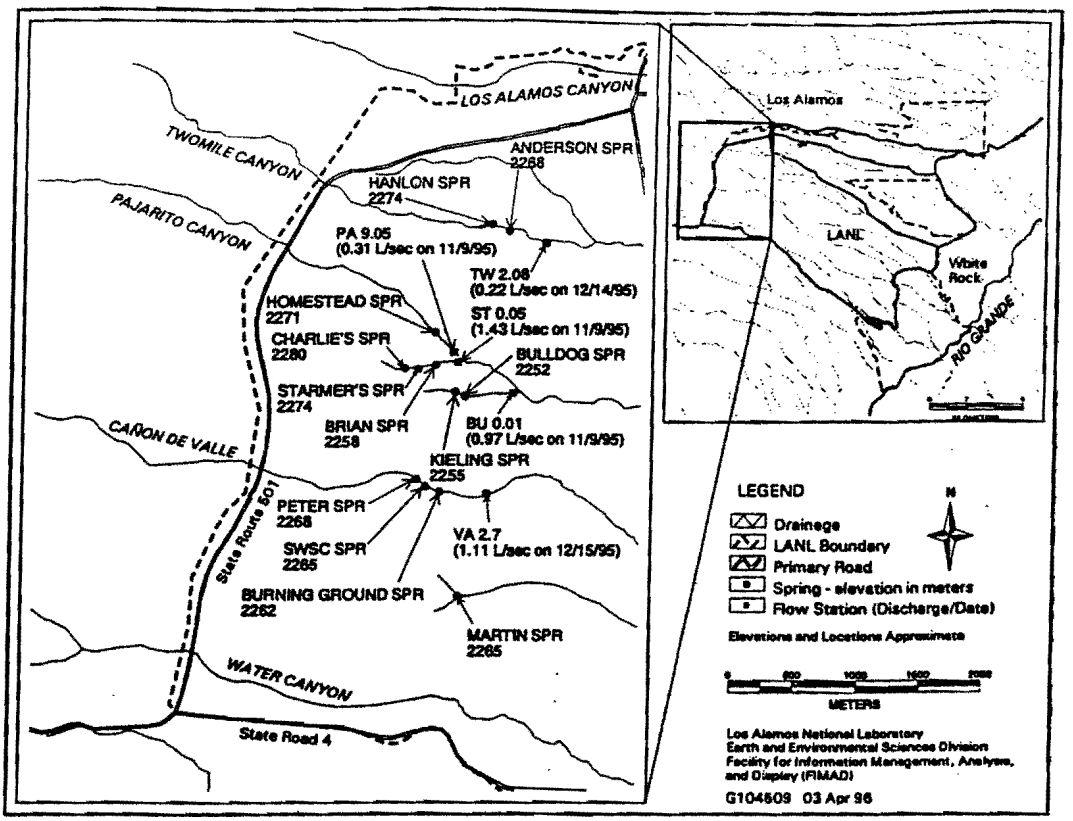

FIGURE 3.17. Locations of springs and flow-measurement stations along the western region of the Pajarito Plateau, Los Alamos National Laboratory, New Mexico.

99 to 250 mg/L. Concentrations of dissolved inorganic constituents (mg/L) ranged from 8 to 24 for calcium, 6 to 25 for sodium, 3 to 6 for magnesium, 2 to 5 for potassium, 29 to 104 for bicarbonate, 6 to 31 for chloride, <0.1 to 0.3 for fluoride, 6 to 31 for sulfate and 0.01 to 1.1 for nitrate/nitrite as total nitrogen. The high-range concentrations are predominately associated with springs in the Canon de Valle area. Springs in Pajarito and Twomile Canyons generally show lower TDS concentrations, but seasonal variations in concentration appear to be occurring. Sampling on April 28, 1995, showed an increase in specific conductance and TDS for perennial springs in the Pajarito Canyon area.

Some perennial springs were analyzed for high-explosive compounds (HE), volatile-organic compounds (VOC) as well as the radionuclides ^{90}Sr, $^{239/240}$Pu, ^{238}Pu, ^{241}Am, ^{137}Cs, ^{234}U, ^{235}U, ^{238}U and gross alpha/beta in dissolved phase. HEs and VOCs were detected at some springs in the Canon de Valle area. The concentration for the HE compounds 2-amino-4,6-dinitrotoluene and 2-amino-2,6-dinitrotoluene ranged from 2.3 to 3.3 µg/L; that for octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) ranged from 5.5 to 11.0µg/L; and that for hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) ranged from 83 to 100 µg/L. The concentration for the VOC tetrachloroethene ranged from 2.3 to 15 µg/L and that for trichloroethene ranged from 0.9 to 3.1 µg/L. Additionally, cis-1,2-dichloroethene at 21 µg/L was detected at Peter Spring. HEs and VOCs were not detected at springs in the Pajarito Canyon area. Gross beta, ^{234}U, ^{235}U, and ^{238}U were detected above the method detection limits for all springs. It is unknown if these levels are within the background range for these types of waters. Activity (pCi/L) ranged from 3.49 to 10.1 for gross beta, 0.06 to 0.77 for ^{234}U, 0.02 to 0.03 for ^{235}U and 0.09 to 0.70 for ^{238}U.

Four ephemeral springs were flowing on April 28, 1995, in the Pajarito Canyon tributary where Starmer's Spring discharges (Fig. 3.17). All springs discharged from the south-facing canyon wall. The initial estimated flow ranges from <0.06 to 0.12 L/sec. Flow of these springs gradually ceased during the summer. Field measurements for specific conductance, pH and temperature for the ephemeral springs ranged from 82 to 169 µS/cm, 6.24 to 6.98 S.U. and 8.1 to 10.6°C, respectively. TDS ranged from 70 to 148 mg/L. Concentrations of dissolved inorganic constituents (mg/L) ranged from 6 to 10 for calcium, 5 to 11 for sodium, 2 to 4 for magnesium, 2 to 3 for potassium, 37 to 40 for bicarbonate, <5 to 6 for chloride, <0.5 for fluoride, 17 to 20 for sulfate and <0.1 to 29 for nitrate/nitrite as total nitrogen.

At most discharge points, tuff beds are moderately welded and show vertical fractures common to the Tshirege Member, but horizontal fractures with aperture widths of up to 0.5 in. or more are also abundant. Spring water discharges mainly from fractures, contacts, or parting surfaces between tuff beds of similar lithology but varying competency (e.g., surge beds). Because ephemeral springs ceased flow during summer, we theorize that these springs may have some connection to surface-water infiltration during snow-melt runoff.

As flow measurements were made at some distance below the springs, they may not adequately represent spring discharge. The values may be low due to losses associated with infiltration, or high due to contributions by interflow or runoff. Since measurements were made during extremely dry conditions, the former is most likely and the data probably represent minimum spring discharge.

Preliminary chemical and benthic-invertebrate data (see Ford-Schmid, this volume) indicate that ground-water impacts, via anthropogenic sources (e.g., outfall, landfill), may be occurring in the western region of the Pajarito Plateau. Furthermore, the perennial reaches supported by the springs described herein support a saturated zone within the canyon alluvium that could transport contaminants over a wider area. Thus, additional work on the source of such contaminants is recommended.

34.1 White El Cajete Pumice exposed in soil on left. **0.5**

34.6 Viewpoint on left in sharp bend of road provides excellent view of the Pajarito Plateau, Pajarito fault, Rio Grande rift, and Sangre de Cristo range (Fig. 3.18). **0.8**

35.4 Dirt road to American and Armisted cold springs on right. **1.7**

37.1 Boundary to Bandelier National Monument. **2.9**

40.0 Intersection of NM-4 and USFS Road 289, The Dome

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

October 2, 1996

Mr. Mat Johansen, LAAO AIP
Point of Contact
Department of Energy
Los Alamos Area Office
MS A316
Los Alamos, NM 87544

SUBJECT: Review of Los Alamos National Laboratory's (LANL) Corrective Action Report for TA-18 Septic Tank Leach Field

Dear Mr. Johansen:

This conveys New Mexico Environment Department (NMED), Department of Energy Oversight Bureau's (DOE OB) review of the referenced report. The following comments are provided for the purpose of communicating the results of the DOE OB review. These comments are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department.

COMMENTS

1). Page 6, Section 3.3.2.1, First Paragraph, First Sentence

Does this statement imply that data exist concerning the most western extent of perched ground-water within Pajarito Canyon? That is, what data exist to show that the western extent of the aquifer lies 1-mile to the west of TA-18? DOE OB staff have observed perennial flow from several springs located in Pajarito Canyon (approximately 4 mi west of TA-18) that may supply recharge to a suspected saturated alluvium aquifer which may extend eastward to monitoring well PCO-3. Saturated alluvium in Threemile Canyon also exists and laterally extends an unknown distance. Characterization of these zones should be performed.

13129

(strategically located to intercept contaminants) placement of MW-13; 2 to 3 hand-held pneumatic-auger boreholes (preferably to ground water and completed as piezometers) be installed along the septic line from the septic tank to the fence north of Building 116. These stations would help determine if contaminant releases have occurred along the septic line. Quarterly monitoring is initially recommended in order to determine seasonal fluctuations in ground-water levels as they may relate to contaminant concentration variations.

7). Page 14, Section 3.5.2, Second Paragraph, Fifth Sentence

DOE OB recommends the addition of the more common high explosive (HE), and radionuclide (notably uranium) parameters to the proposed sampling and analysis listed in Table 3-5. The DOE OB has current data which indicate that HE and its breakdown products were detected in a spring (Threemile Spring referenced in Comment 2) that discharges to the main drainage of Threemile Canyon west of the PRS area. Table 3-3 (Data Comparison for PRS 18-003(d)(concluded)) presents only a limited amount (one sample #AAB4604) of radionuclide parameter ground-water data to conclude that there is no ground-water radionuclide concern. The sludge samples AAA5826 and AAA5827 that show elevated uranium concentrations would support the argument for its inclusion in the proposed sampling and analysis for these wells.

Please feel free to contact Michael Dale of our staff at 672-0449 if any question arise.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

SY:mrd
cc: Neil Weber, NMED, Chief, DOE OB
Martyne Kieling, NMED, DOE OB
Glenn Saums, NMED, Program Manager, SWQB
John Rogers, NMED, GWQB
Ken Zamora, DOE LAAO, MS A316
Theodore Taylor, DOE LAAO, MS A316
Everett Trollinger, DOE LAAO, FU-2 FPC, MS A316

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

October 25, 1996

Mat Johansen, DOE AIP POC
U.S. Department of Energy
Los Alamos Area Office, MS A316
Los Alamos, New Mexico 87545

SUBJECT: Review of Environmental Surveillance at Los Alamos during 1994, Los Alamos National Laboratory, July 1996.

Dear Mr. Johansen:

The DOE Oversight Bureau (DOE OB) has reviewed several sections from the subject document. The following comments are provided for the purpose of communicating the results of the review. They are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department.

AIR MONITORING

General Comments:

- Attempting to measure a dose that is less than ten percent of the naturally occurring dose is an exceedingly difficult task, considering the variability in natural background radiation. NMED recognizes LANL's efforts in addressing this problem, and in general agrees with the methodology chosen by LANL. NMED's monitoring data, while very much more limited but using the same basic methodology, does not disagree to any major extent with LANL's, and cannot dispute LANL's findings of compliance with all applicable regulations.

- It is NMED's hope that LANL will continue to address air monitoring by evaluating all aspects of their program, and making improvements as new technology becomes available. For the public's sake, we would recommend that LANL expedite the process of releasing data for general review.

1. **Page 110, last paragraph, line 5, Technical Area (TA) 53 Network (LAMPFNET)**

13130

The stations are 800 m north, not 800 km.

2. Page 113, Table V-1 - Footnotes

It is confusing and perhaps misleading to list an annual dose, when the total is the sum of three quarters of data, even if there is a footnote explaining it. It would be better to take a mean of the three existing quarters and add it to make a fourth quarter, and place a footnote explaining that. That way all the stations would be comparable on a time basis.

3. Page 115, Table V-2

At stations TA-50, Area C and TA-33, Area E, the minimum values are greater than the maximum values and the means are less than the minimums. There appears to be some mistake in the listing of these values.

4. Page 120, Table V-5

Mercury-195 is listed twice, with different corresponding values. Probably one of these should be a different isotope.

5. Page 125, Table V-7

The number of samples taken at the Pojoaque station should be 24, not 42.

Several of the on-site stations have different volumes than what is listed in Table V-8, the gross beta analysis. This cannot be right, since the same filter is analyzed for both gross alpha and gross beta.

The total air volume column does not take into account the fact that the filters are cut in half before analysis, and for most stations only one half is analyzed. The other half is usually archived, although sometimes it is analyzed for quality assurance purposes. There should at least be a footnote explaining this fact.

6. Page 131, Table V-10

At some stations, it is indicated that there is at least one sample above the MDL, but the maximum value is less than the stated MDL of 4 aCi/m^3.

7. Page 182, first paragraph, d. Ingestion Dose

Corrections are made to Laboratory affected sites by subtracting

background concentrations plus two standard deviations. Mean background values should be subtracted, but not mean plus two standard deviations, because that assumes that every station is at a maximum background location. Also, this is not consistent with the procedures for inhalation dose calculations that are listed in Section c. (Inhalation Dose) on the same page, which specify subtracting average background concentrations.

8. Page 183, fourth paragraph, a. Doses from Natural Background

It is stated that doses from natural background are measured with TLDs at Los Alamos and White Rock. It is not stated which particular stations are used to obtain this background value. Are all stations in Los Alamos and White Rock used for background calculations? This would make the assumption that there is no contribution from Laboratory activities, which would not be consistent with the CAP-88 calculations shown later in the report.

9. Page 183, fourth paragraph, a. Doses from Natural Background

The national average for radon dose is used. Since radon concentrations can vary widely from location to location, it would be much better to use site specific data. Surely some data for the Los Alamos area exists. The New Mexico Environment Department conducted a state wide radon survey several years ago, in cooperation with the EPA. The University of Pittsburgh has compiled large amounts of radon data from around the country, very likely including northern New Mexico.

10. Page 183, second paragraph, b. Doses to Individuals from External Penetrating Radiation from Airborne Emissions

It is stated that "the resulting data could not be statistically proven accurate compared with data from a pressurized ion chamber gamma photon detector". Which data was compared with the PIC data, the HPGe or the TLD data? Since there are three different methods of data collection at East Gate, do at least two of them have comparable results?

11. Page 183, first paragraph, c. Doses to Individuals from Direct Penetrating Radiation

It is stated that no direct penetrating radiation was detected by TLDs

at off site locations, yet the data ranges from 101 to 165 mrem per year at perimeter stations. At what point would the TLDs measure Laboratory radiation as opposed to natural variation? If there is a variation of over 60 mrem between sites in the same general area and a variation of over 30 mrem between years at some stations, it would seem that it is not possible to verify by direct measurement whether the 10 mrem per year limit (NESHAPS) has been exceeded, and that even the 100 mrem public dose limit is doubtful.

12. Page 185, first paragraph, d. Doses to Individuals from Inhalation of Airborne Emissions

The fourth line from the top of page 185 reads "occurred at the White Rock Fire station and was 0.022 mrem (0.022 mSv) ...". It should read

"occurred at the White Rock Fire station and was 0.022 mrem (0.00022 mSv) ...".

The fifth line from the top reads "mrem/yr (1 mSv/yr), and 0.7% ...". It should read "mrem/yr (1 mSv/yr), and 0.22% ...".

13. Page 187, a. Maximum Individual Dose and Page 189, Figure V-23

The maximum individual EDE to a member of the public is 3.5 mrem per year, which incorporates some reduction factors for shielding. The maximum calculated dose from CAP-88 is 7.62 mrem, which does not incorporate the reduction factors. This is not consistent and it should be clearly defined when to use the reduction factors.

14. Page 192, third paragraph, 4. Risk from Natural Background Radiation and Medical and Dental Radiation

The third paragraph states that the risk is approximately 1 in 8000, which is not consistent with Table V-40, which lists values of 1 in 7000 and 1 in 6000 for Los Alamos and White Rock.

15. Page 193, Table V-40, Natural Radiation section

Since Los Alamos has a larger radiation dose than White Rock, it should have a greater associated risk. However, the stated risk of 1 in 7000 is less than the stated risk of 1 in 6000 for White Rock.

16. Page 197, Table VI-3

Precipitation is measured in centimeters, not microns.

17. Page 272, fifth paragraph, a. Ambient Air Monitoring

It is not specified that the rotameters on the iodine samplers are calibrated.

GROUND-WATER

General Comments:

- We recommend that LANL include all ER ground-water data into their annual ES reports.
- It is our understanding that LANL's reported pH values are fixed-laboratory derived, and therefore, probably do not represent true ground-water pH. pH and other field data such as specific conductance, temperature, etc., should be included in LANL's data tables.
- We recommend that LANL add total suspended solids to their analyte list.
- We recommend that pumps be set just below (10-15 ft) top of water at each deep aquifer test well, and pumped at a rate which is below the recharge capability of the aquifer.

1. Page 226, seventh paragraph, A. Introduction

What intermediate depth ground water is monitored in Sandia Canyon? It is true that perched ground water was encountered during the drilling of PM-1; however, to the best of our knowledge, no monitoring of this ground water exists.

2. Page 228, second paragraph, 1. Main Aquifer

LANL's deep aquifer test well TW-3 is located in Los Alamos Canyon downstream from the confluence with DP Canyon; not upstream as stated in the report.

3. Page 229, third paragraph, 2. Perched Groundwater in Canyon Alluvium.

Additional surface-water contributions to Los Alamos Canyon include: one spring which emanates from the Bandelier Tuff at approximately 3-5 gpm, and is located on the south facing slope of Los Alamos Canyon across from the skating rink (source may be a leaking pipe and/or tank located nearby or precipitation); and one outfall from the Los Alamos Medical Center. In addition, DOE OB's field observations at the mouth of DP Canyon show that a large amount of surface water enters Los Alamos Canyon via DP Canyon during rapid snow-melt and storm events. Discharge data obtained at the mouth of DP Canyon from May through September 1967, show total runoff equaling approximately 36 800 m^3 (Purtymun, 1974).

Infiltration of DP Spring water may enter Los Alamos Canyon via underflow or through saturated alluvium within DP Canyon. This suspected saturated zone may be entirely or intermittently connected to saturated alluvium in Los Alamos Canyon at LAO-2.

4. Page 230, sixth paragraph, 2. Perched Groundwater in Canyon Alluvium

We suggest that some recharge to Pajarito Canyon's shallow aquifer (alluvium) is from perennial springs located in the upper reaches (onsite) of Pajarito Canyon and its tributaries, and from TA-18 Spring (perennial) and Threemile Springs (A) and (B) (ephemeral) located in Threemile Canyon. TA-18 Spring is located approximately 300 ft northwest of Kiva #2 at TA-18. Threemile Spring (A) and (B) are located approximately 0.5 mi west of Kiva #2. The shallow aquifer may extend from the upper perennial springs eastward to approximately PCO-3. Characterization and monitoring of this suspected aquifer is recommended.

5. Page 230, first paragraph, 3. Intermediate-Depth Perched Groundwater

What data exist to support the statement that perched intermediate ground water is of limited extent?

It should be noted that perched ground water was also encountered during the drilling of SHB-4 (Gardner et al., 1993) and supply well PM-2 (Cooper, 1965) in Pajarito Canyon.

It should be noted that perched ground water was also encountered during the drilling of SHB-4 (Garner et al., 1993) and supply well PM-2 (Cooper, 1965) in Pajarito Canyon.

6. Page 231, second paragraph, 3. Intermediate-Depth Perched Groundwater

The following statement was taken from a letter dated May 6, 1996, to DOE from DOE OB concerning LANL's ER OU-1049 Canyons Workplan:

"Several lines of evidence suggest that some recharge to Basalt Spring may be from near-by (< 0.25 mi) surface-water infiltration in Los Alamos Canyon downstream from the Pueblo confluence, and that Basalt Spring may not entirely represent intermediate ground water:

At approximately 7:30 a.m. on April 17, 1996, DOE OB personnel observed surface-water (effluent water from Los Alamos County Sewage Treatment Facility) flow in Los Alamos Canyon confluence at <1 gpm, and at 8:25 a.m., observed little or no flow in the active channel above Basalt Spring, suggesting that the outfall at the treatment facility had been temporarily turned off. Basalt Spring was flowing; however, DOE OB noted that flow had decreased due to the presence of high-water marks (still wet) on structures (boulders, sticks, etc.) within the surface-water flow path downstream from the spring discharge point. The sewage treatment facility was contacted that day, and confirmed that the outfall had been turned off at approximately 9:00 p.m. on April 16, 1996 and turned back on at approximately 9:00 a.m. on April 17, 1996.

Temperature of Basalt Spring water was 7.2° C on April 17, 1996, and does not correlate with that of intermediate ground-water at TW-1A, which has a temperature of approximately 16.3° C (measured by DOE OB on June 6, 1995). This abnormally low temperature of Basalt Spring water suggests nearby recharge.

On May 25, 1995, LANL's ESH-18 and DOE OB sampled Basalt Spring at a location considered to be the spring source; however, on November 15, 1995, DOE OB observed that flow had completely ceased at this particular location. Basalt Spring may have discharged greater volumes of water in May due to an increase in surface-water flow due to the mixing of snow-melt runoff in Los Alamos Canyon with sewage-treatment-plant outfall water.

Therefore, DOE OB cautions against the use of Basalt Spring as an intermediate ground-water monitoring location. LANL may want to utilize Los Alamos Spring, which is located approximately 0.2 mi east of Basalt Spring. This spring issues from the north-facing side of Los Alamos Canyon at an elevation approximately 40 ft directly above the active channel. Hydrochemical data obtained by DOE OB during 1994 and 1995 and general observations suggest that this spring may represent some type of intermediate ground water. Data concerning Basalt and Los Alamos Springs

were submitted to DOE and LANL in a letter dated July 28, 1995."

7. Page 231, third paragraph, 3. Intermediate-Depth Perched Groundwater

It should be noted that the hydrologic flow regime within Pueblo Canyon may have changed dramatically due to the discontinuation of discharge from several facilities: the Pueblo industrial-waste treatment plant which discharged into upper Pueblo Canyon; the Pueblo Sanitary Treatment Plant which discharged in upper Pueblo Canyon; and the Central Sanitary Treatment Plant which discharged into Pueblo Canyon approximately 0.5 mi west of TW-2. Hence, recharge mechanisms, flow paths, etc., in current-day Pueblo Canyon need to be characterized. We caution against the use of assumptions or conclusions about recharge based on historical data/information.

8. Page 231, fourth paragraph, 3. Intermediate-Depth Perched Groundwater

The Water Canyon Gallery spring and many other perennial springs which emanate from the Bandelier Tuff, such as Burning Ground and Homestead Springs, should be grouped into a fourth ground-water zone or mode of occurrence as noted by Dale et al. (in press, 1996).

9. Page 231, fifth paragraph, 4. Vadose Zone

Monitoring well SCO-1 is located near PM-3; not PM-2 as stated in the report. Field observations concerning surface-water flow from its source at TA-3 (outfalls) to approximately 2.0 mi west of PM-3 in Sandia Canyon suggest that saturated alluvium may exist within this portion of the canyon. Characterization and monitoring of this suspected aquifer is recommended.

10. Page 232, sixth paragraph, 4. Vadose Zone

How often are these wells checked for water? On August 31, 1995, DOE OB observed (mirror reflection technique) water in one well located at the northeast toe of the landfill.

Perennial flow in Canon de Valle exists, and we suggest that saturated alluvium is present within the canyon from SWSC Spring to some unknown distance downstream past MDA-P. Characterization and monitoring of this suspected aquifer is recommended.

11. Page 232, fourth paragraph, a. Radiochemical Constituents in the Main Aquifer

DOE OB's detection of ^{90}Sr at 6.6 pCi/L at TW-4 confirms LANL's detection of 6.2 pCi/L. It is the interpretation of the DOE OB that these data support the presence of ^{90}Sr in the regional aquifer at that time of sampling.

12. Page 236, third paragraph, b. Radiochemical Constituents in Alluvium Groundwater

DOE OB is curious as to what method was used to determine the high suspended sediment in samples from LAO-2?

DOE OB historical and current data show that most radionuclides such as Pu and Cs appear to be virtually insoluble in water; however, ^{90}Sr is soluble to some degree. DOE OB surface-water and associated suspended-sediment data show that the average ratio of ^{90}Sr in solution to suspended sediment is 2.81. Hence, ^{90}Sr is soluble; therefore, the unusually high ^{90}Sr detected in 1993 may not be entirely associated with suspended sediment concentrations. This report shows ^{90}Sr at 0.0 pCi/L for LAO-2, which is not typical of recent years: in 1991 and 1992, ^{90}Sr was detected at 42.0 and 23.2 pCi/L. DOE OB 1994 split-sample data for LAO-2 show ^{90}Sr at 39.23 (+/-4.30) pCi/L, and a duplicate-sample result of 35.85 (+/-3.94) pCi/L; hence, a problem concerning the LANL data may exist.

13. Page 236, fifth paragraph, b. Radiochemical Constituents in Alluvium Groundwater

The high gross alpha/beta values may be attributed to the presence of specific uranium isotopes (e.g., ^{235}U). LANL's data (Table VII-1) do show some correlation between high total-uranium concentrations and high gross alpha/beta activity concentrations.

14. Page 236, second paragraph, c. Radiochemical Constituents in Intermediate Perched Groundwater

DOE OB is curious whether Water Canyon Gallery ground-water samples were collected at the holding tanks along State Route 501 or at the actual spring which discharges to the gallery?

15. Page 248, third paragraph, 1. Main Aquifer

O-4 is the nearest supply well to TW-3; not PM-5 and PM-3 as stated in the report.

16. Page 249, third paragraph, a. Lead Evaluation in Test Well DT-5A

In addition to Pb, historical data show tritium activity concentrations (pCi/L) at 3400 in 1985 at DT-5A, 5300 in 1982 at DT-9, and 2600 in 1984 at DT-10 (LANL ES Reports); and 1994 DOE OB data show gross alpha at 9.55 pCi/L and gross beta at 14.19 pCi/L at DT-9.

17. Pages 250 through 254, b. Recharge Age of Water in Main Aquifer

All age-dating and monitoring data by both LANL and DOE OB, are extremely questionable due to the fact that most of LANL's regional aquifer test wells have screen lengths which extend deep into the aquifer, and hydrochemical data do not represent the top of water within the regional aquifer. Hence, age-dating data may be from samples retrieved from isolated or multiple zones deep within the aquifer which may be characteristically different from that of the top of saturation within the regional aquifer (recharge pathways, age, hydrochemistry, etc.).

18. Page 257, second paragraph, Test Well 4

In order to eliminate problems concerning the validity of analytical data (e.g., TW-4), DOE OB recommends that LANL purge three well volumes (only if flow rates are constant) and until geochemical parameters (turbidity, temperature, redox potential, etc.) have stabilized. On July 23, 1996, DOE OB split sampled with ESH-18 at LANL's deep test well TW-8, and data suggest that the quality of the sampled water may have not represented that of in-situ ground-water: at 17:22 ground-water temperature was 16.4° C, at the time of sampling (17:55) ground-water temperature was at 17.3° C, and at 18:05 ground-water temperature was at 18.2° C. Hence, the temperature had not stabilized. DOE OB purge test data, obtained on July 17, 1995 at TW-8, show that the well probably stabilizes at approximately 18.8° C.

We recommend that test wells TW-1, TW-1A, TW-2, TW-2A and TW-4 be purged at a rate which is below the recharge capability of the aquifer so that flow is not lost, and geochemical parameters can be monitored and documented throughout the purge event.

SURFACE-WATER

General Comment:

- We recommend that LANL present the date and time of sampling for each surface-water sample collected so that one can correlate results with other data such as discharge or precipitation data.

1. **Page 148, first paragraph, 3. Surface Water Monitoring, On-Site Stations, Other Areas**

Several outfalls that discharge to Sandia Canyon appear to be missing. There are approximately five other outfalls from the TA-3 area and eight outfalls from the TA-53 area which are not listed. Outfalls which discharge into Sandia Canyon may contribute to either perennial stream flow in certain segments of the stream or possible recharge to shallow ground water within canyon alluvium.

2. **Page 148, first paragraph, 3. Surface Water Monitoring, d. Long Term Trends**

Analysis of radionuclides in solution is justified; however, DOE OB has observed that analytical data from the suspended sediment fraction of the sample provides valuable information concerning the total amount of contaminant transported. This is especially important in storm events where large amounts of suspended sediment is transported. We recommend that LANL analyze storm-water samples for contaminants in the dissolved phase and suspended sediment phase, and present data in the ES reports.

3. **Page 198, second paragraph, 2. Water and Effluent Monitoring, a. Surface Water Monitoring and Page 199, Table VI-6**

In order to adequately compare data with regulatory standards such as the New Mexico General Stream Standards for Livestock and Wildlife, analyses should be the same as prescribed by the standard (i.e., total analysis if the standard is totals or dissolved if the standard is dissolved).

What are the units of measure for the data presented in table VI-6?

If there are any questions concerning the review of these sections, please contact me at 672-0448.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

Attachment

SY:sy
cc: Neil Weber, NMED, Chief, DOE OB
Benito Garcia, NMED, Chief, HRMB
Jim Piatt, NMED, Chief, SWQB
Marcy Leavitt, NMED, Chief, GWQB
Steve Rae, LANL ESH-18, MS K497

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State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

March 26, 1997

Mat Johansen, DOE LAAO AIP POC
U.S. Department of Energy
Los Alamos Area Office
528 35th Street, MS A316
Los Alamos, NM 87544

RE: Submittal of 1996 ground-water data related to split-sampling and independent sampling at Los Alamos National Laboratory and surrounding areas

XXS-195

Dear Mr. Johansen:

The New Mexico Environment Department of Energy Department of Energy Oversight Bureau (NMED DOE OB) collected ground-water samples throughout 1996, and the attached preliminary data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies thirty(30) days following your receipt of this letter. In addition, the NMED DOE OB would like to thank ESH-18 and Field Unit 4 personnel for their cooperation and assistance.

Contact Michael Dale at 672-0449 or Alice Mayer at 672-0447 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

SY:mrd

Attachment

13131

Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^A (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
MCO-6	493361	1769888.7	6/6/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	64	NA	NA	NA	NA	6.88	974	736	10.3
MCO-7	494388.28	1768423.87	6/6/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	29	NA	NA	NA	NA	6.74	591	450	13.9
Pueblo Canyon																						
APCO-1	509080.06	1772851.44	10/17/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.99	439	337	14.0
WATER SUPPLY																						
Offsite																						
G-2	513966	1785061	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.25	208	158	28.4
G-5	506705	1787845	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.02	171	130	28
G-6	504826.35	1786671.92	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.01	162	123	28.9
Onsite																						
PM-1	507490	1768050	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.74	258	196	26.7
PM-3	502342.75	1769325.3	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.57	260	198	27
PM-4	495472	1764612	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.34	115	87	23.7
PM-5	492839	1767747	4/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.69	155	117	24.6
San Ildefonso Pueblo																						
DON JUAN PLAYHOUS	NA	NA	8/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0	NA	NA	NA	NA	8.25	291	219	19.4
LA - 1B	527838	1776865	F 8/27/96	2	<1	NA	150	21	NA	NA	260	NA	34	NA	NA	NA	NA	NA	8.81	NA	NA	17.2
LA-5	519742.63	1772347.29	T 8/14/96	20	<1	3	16	NA	NA	NA	NA	<0.02	NA	0.42	<1	<0.2	NA	NA	7.91	160	121	21.0
OTOWI HOUSE	532332.69	1774006.29	T 8/13/96	70	6	4	44	NA	NA	NA	NA	0.02	NA	0.62	<1	<0.2	NA	NA	6.90	507	383	17.9
PAJARITO PUMP 1	NA	NA	8/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.13	1561	1187	17.5
WESTSIDE ARTESIAN	NA	NA	8/14/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.62	1785	1349	18.5
EASTSIDE A ¶IAN	NA	NA	6/13/96	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	[illegible]	[illegible]	[illegible]	

DRAFT

Table 1 - NMED DOE Oversight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^ (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
Los Alamos Canyon																						
LAO-C	481913.6	1775187.6	7/10/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.24	364	272	15.7
LAO-0.7	487625.76	1774148.81	7/10/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.79	312	234	15.4
			7/29/96	NA	NA	NA	NA	69	NA	NA	NA	NA	NA	NA	NA	NA	274	66	6.48	329	249	14.6
LAO-2	479338.59	1773037.84	9/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
			11/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA	NA	NA	7.30	283	218	12.1
LLAO-1	NA	NA	10/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	430	329	19.8
LLAO-2	NA	NA	9/25/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	444	342	21.7
LLAO-4	NA	NA	9/30/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
LLAO-5	NA	NA	7/30/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Pajarito Canyon																						
MW-12	495895.69	1760545.76 *	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.62	NA	NA	NA	NA	6.39	229	176	11.0
		*	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.70	NA	NA	NA	NA	(See above)			
MW-13	495848.59	1760564.06 * T	12/4/96	29	14	11	18	11	0.2	NA	42	<0.02	50	1.0	<1.00	<0.20	620	1800	6.19	221	170	12.5
		*	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3	NA	NA	NA	NA	(See above)			
MW-14	495849.69	1760614.76 *	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11	NA	NA	NA	NA	6.21	220	166	10.8
		*	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02	NA	NA	NA	NA	(See above)			
MW-15	495751.49	1760607.36	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.01	220	168	9.5
MW-16	495796.59	1760518.66 *	12/4/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	6.01	161	123	11.6
		*	12/4/99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.1	NA	NA	NA	NA	(See above)			
Mortandad Canyon																						
MCO-4B	491792.17	1769634.9	2/22/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.83	[illegible]	[illegible]	8.3
		* F	3/5/96	61	5	27	100	23	1.2	<1	230	0.07	26	36	<0.5	<0.05	[illegible]	8	7.19	[illegible]	[illegible]	8.1
		* F	3/5/96	57	4.7	22	97	23	1.3	<30	230	0.088	25	15	<2	0.30	[illegible]	39	7.19	[illegible]	[illegible]	8.1
MCO-5	492035.8	1769475.27	8/9/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	66	NA	NA	NA	NA	6.94	1005	761	8.4

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Table 1 - NMED DOE Oversight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^ (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
WELLS																						
DEEP AQUIFER																						
TW-1	509888.88	1771974.36	8/1/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.45	363	275	13.9
TW-2	494091.98	1777167.29	8/21/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA	NA	NA	7.81	117	90	13.6
TW-3	497506.83	1772966.97	1/29/96	NA	NA	NA	NA	5	NA	NA	NA	<0.05	<10	<0.1	NA	NA	81	<5	6.63	137	105	18.4
			7/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.40	130	101	19.8
			9/30/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.82	146	NA	19.8
			11/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.7	NA	NA	NA	NA	7.45	65	79	20.9
TW-4	483852.17	1777527.32	1/23/96	NA	NA	NA	NA	<5	NA	NA	NA	NA	<5	NA	NA	NA	NA	NA	7.76	137	105	11.9
			7/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.38	120	89	12.4
			9/27/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.03	123	95	13.6
			11/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.69	130	99	15.5
TW-8	492175.75	1769358.45	2/13/96	NA	NA	NA	NA	3	NA	NA	NA	<0.05	<10	0.3	NA	NA	160	<5	6.02	259	195	17.1
			7/23/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.43	124	94	17.3
			9/30/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.97	123	94	19.7
			11/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.69	124	95	17.9
DT-5A	485441.26	1754449.25	11/27/96	NA	NA	NA	NA	1.8	NA	NA	53§	NA	1	0.3	NA	NA	120§	<10§	7.63	100	76	20.3
DT-9	488650.79	1751336.11	F 9/18/96	9	3	1	11	2.0	<0.5	NA	55	NA	2	NA	NA	NA	130	<20	7.95	105.8	81	21.1
DT-10	488720.25	1754434.79	F 9/19/96	11	4	2	11	1.8	<0.5	NA	65	NA	2	NA	NA	NA	140	<20	8.31	119.7	91	18.5
INTERM. AQUIFER																						
(VOLCANICS/SEDIMENTARY)																						
TW-1A	509834.88	1772014.66	8/1/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.13	269	204	16.8
TW-2A	493939.78	1777236.08	8/21/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10	NA	NA	NA	NA	6.44	303	232	18.1
LADP-3	492770.64	1773254.47	12/4/96	NA	NA	NA	NA	28	NA	NA	39	NA	6	NA	NA	NA	160	NA	NA	201	NA	8.2
POI-4	509187.21	1772525.72	6/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.5	<1	<0.2	NA	NA	7.09	439	330	14.1
PERCHED AQUIFER																						
(ALL)																						

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Oversight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING		Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^A (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
HALLADAY HOUSE	830342.01	1774757.8	T	8/13/96	4	<1	<1	45	NA	NA	NA	NA	<0.02	NA	0.57	<1	<0.2	NA	NA	8.40	193	146	20.9
NEW COMMUNITY	NA	NA		8/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5	NA	NA	NA	NA	7.75	402	304	13.1
SANCHEZ HOUSE	NA	NA		8/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.85	529	406	22.6
White Rock Canyon																							
ANCHO	506879.79	1737332.22		2/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.53	129	99	19.8
			T	10/8/96	12	3	2	11	5	<0.5	NA	65	<0.05	NA	0.4	2.0	<0.2	NA	NA	7.43	120	92	20.5
SANDIA	523327.41	1761129.21	F	8/29/96	30	2	2	17	3.6	0.6	NA	115	NA	5	NA	NA	NA	NA	NA	7.31	215	165	17.7
OTOWI	532242.73	1773692.75	F	7/8/96	56	5	4	39	27	<0.5	<5	180	0.18	[illegible]	[illegible]	<1	<0.2	330	31	6.85	437	328	14.7
SPRING 1	527508.16	1768075.63	F	5/3/96	16	<1	3	29	3.2	0.8	<1	100	<0.05	7	0.47	NA	0.17	148	NA	7.90	214	163	17.0
				8/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.02	236	181	19.5
SPRING 2	526901.53	1765835.05		5/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.56	256	194	14.5*
SPRING 3	520993.04	1753739.24		4/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.24	200	152	19.3
				10/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.45	179	137	19.8
SPRING 3A	520851.35	1753453.41	F	4/3/96	21	2	3	15	3.3	0.5	<1	77	<0.05	4.5	0.79	0.08	<0.05	144	34	7.52	186	142	19.8
				10/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8	NA	NA	NA	NA	7.55	165	126	20.3
SPRING 3AA	520760.52	1751228.59		4/3/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.68	169	129	18.9
SPRING 4	517071.3	1748230	F	4/24/96	22	4.5	2.5	14	7.4	0.53	<30	63	0.20	11.0	1.4	0.47	0.08	NA	<12	6.72	213	162	15.3
				10/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.09	190	146	18.6
SPRING 4A	515729.57	1747945.45	F	4/24/96	20	4.7	2.1	12	6.3	0.55	<30	82	0.1	6.4	1.2	0.31	<0.05	NA	40	7.39	199	151	20.5
				10/8/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8	NA	NA	NA	NA	7.89	166	128	20.8
SPRING 4B	516833.23	1748091.71		4/23/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.38	231	176	16.7
SPRING 4C	516902.87	1748262.8		4/23/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.46	189	144	18.7
				10/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.89	188	144	17.2
SPRING 5	514796.39	1743250.01		2/8/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.60	181	139	20.7
			F	4/24/96	17	4.5	1.7	12	4.6	0.45	<30	82	NA	4.7	NA	NA	NA	NA	<12	7.48	181	138	21.1
				10/8/96	NA	NA	NA	NA	NA	NA		NA	NA	NA	0.7	NA	NA	NA	NA	NA	***	***	***

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Table 1 - NMED DOE Oversight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING		Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^A (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
SPRING 5A	515214.01	1741893.99		2/8/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.50	217	187	20.2
				4/24/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.43	216	164	20.5
			T	10/8/96	22	3	3	25	4.6	0.4	NA	110	<0.05	8	0.5	2.0	<0.2	NA	NA	7.26	239	NA	20.4
SPRING 6	508780.95	1735473.98		2/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.85	163	125	15.5
			T	10/8/96	12	4	2	11	2.4	0.4	NA	65	NA	2	NA	NA	NA	NA	NA	7.76	139	NA	19.7
SPRING 8A	503584.16	1734236.56	F	3/21/96	6.95	2.84	1.45	11.20	1.9	0.47	<30	57	0.2	2.3	0.76	<0.5	<0.5	130	<12	6.95	121	NA	15.0*
SPRING 9	502931.59	1733680.84	F	3/21/96	9.50	2.61	1.35	11.30	1.9	0.48	<30	54	0.1	1.9	0.11	<0.5	<0.5	160	30	7.41	124	NA	17.6
SPRING 9A	502177.69	1733748.54	F	3/21/96	9.32	2.67	1.20	11.00	1.9	0.54	<30	54	0.1	1.8	0.46	0.5	<0.5	130	48	7.29	124	NA	21.4
				10/8/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.81	114	68	20.0
Pueblo Canyon																							
PBTR-0.71	475844.51	1781723.19		9/6/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	60.1	113	86	10.8
Los Alamos Canyon																							
BASALT	516618.5	1770675.6																					
LA SPRING	517253.6	1770858.55	F	4/2/96	35	9	4	17	18.6	1	<1	77	<0.05	37.5	2.58	0.08	<0.05	210	18	7.79	343	283	10.6
				4/26/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.67	307	233	10.6
INDIAN SPRING	525700	1777200		8/19/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	246	186	21.3
			F	8/30/96	27	2	3	25	16	0.5	NA	105	NA	6	NA	NA	NA	NA	NA	6.96	246	188	21.0
Pajarito Canyon & Tributaries																							
PA-11.5	461338.45	1773134.31	F	7/26/96	7	3	2	4	0.86	NA	<5	38	0.06	2.4	<0.10	0.14	<0.05	107	<20	6.72	71.6	54	7.1
UPPER STARMER'S	472893.5	1767695.79		3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
				6/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
CHARLIE'S	473039.72	1767633.05		3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.76	199	153	7.9
			F	6/15/96	15	4.9	2.1	15	17	0.099	<30	50	NA	8.4	NA	NA	NA	NA	17	6.31	177	135	8.3
PERKINS	473270.57	1767648.06		3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
				6/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)

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... Foresight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^A (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL-N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
GARVEY	473346.84	1767647.23	3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
			5/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
JOSIE	474204.33	1767792.18	3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(low flow conditions extending 10 ft past source, unable to sample)								NA
			5/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(low flow conditions extending 10 ft past source, unable to sample)								NA
STARMER'S	473384.98	1767653.56	3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.69	154	119	7.3
			F 5/15/96	11	3.7	1.7	10	9.2	0.085	<30	43	NA	7.1	NA	NA	NA	NA	<12	8.23	129	96	8.4
BRYAN	473851.1	1767783.72	3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.21	182	140	7.3
			5/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.77	161	120	8.4
HOMESTEAD	473926.77	1768582.67	3/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.20	99	76	6.6
			F 5/15/96	7.9	2.7	1.3	6.1	3.6	0.075	<30	33	NA	3.1	NA	NA	NA	NA	<12	6.36	86	65	8.3
KIELING	474454.01	1767051.89	5/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.75	181	135	10.1
BULLDOG	474765.23	1767092.58	F 5/15/96	18	4.7	2.3	20	15	0.28	<30	67	NA	12	NA	NA	NA	NA	<12	7.12	209	156	9.7
ANDERSON SPRING	475690.41	1771290.87	F 2/20/96	10.2	3.33	2.28	11.6	4.4	0.30	<30	73	0.06	2.8	0.81	<2	<0.05	240	410	6.82	150	115	10.2
			F 4/16/96	13	NA	NA	15	3.3	NA	NA	NA	NA	2.8	NA	NA	NA	210	NA	8.32	144	110	10.5
HANLON SPRING	475271.79	1771461.01	F 2/20/96	9.62	3.18	1.87	13.7	3.4	0.34	<30	68	0.036	2.5	0.43	<2	0.059	220	730	7.44	151	116	7.8
			4/16/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.26	143	108	9.4
TA-18 SPRING	493879.97	1760608.01	F 5/13/96	9.7	3.1	2.4	13	9.2	0.13	<30	44	NA	8.2	NA	NA	NA	110	<12	5.69	147	112	8.6
THREEMILE (A)	491678.37	1761503.14	5/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(dry)
THREEMILE (B)	491678.37	1761503.14	5/13/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	(damp)
Water Canyon & Tributaries																						
CDV-5.0	463169.32	1766824.02	F 7/18/96	10	4	3	5	1.4	<0.5	NA	44.8	0.05	4.0	0.32	0.33	0.13	130	<20	7.11	92.3	70	8.1
			8/2/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.40	93	70	8.1
BURNING GROUND	473877.07	1764474.28	3/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.77	230	183	10.2
			5/24/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.50	202	151	10.5
			* F 6/4/96	16	4.7	2.9	18	13	0.24	<30	71	NA	8.6	NA	NA	NA	220	<12	6.18	201	150	10.5
			* 6/4/96	NA	NA	NA	NA	14	NA	NA	NA	NA	9	NA	NA	NA	NA	NA	(See above)			
			12/20/96	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA				

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Table 1 - NMED DOE Oversight Bureau Ground-Water Quality Results:General Chemistry.

STATION ID	X-Y COORDINATES EASTING	NORTHING	Date	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	Cl (mg/L)	F (mg/L)	CO3 (mg/L)	HCO3 (mg/L)	TOTAL PHOS^ (mg/L)	SO4 (mg/L)	NO2-NO3 AS N (mg/L)	KJEL.- N (mg/L)	AMMO (mg/L)	TDS (mg/L)	TSS (mg/L)	FIELD pH (S.U.)	FIELD SC (uS/cm)	FIELD TDS (ppm)	TEMP. (C)
SWSC SPRING	473614.58	1764567.59	3/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.03	241	184	9.5
			5/24/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.64	203	.152	10.0
			F 6/4/96	16	4.8	3.0	19	13	0.23	<30	77	NA	8.8	NA	NA	NA	130	35	6.43	201	150	10.5
			12/20/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.23	202	155	4.9
MARTIN SPRING	474492.29	1761862.85	5/24/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.25	330	247	10.1
			F 6/4/96	27	6.3	2.5	33	20	0.90	<30	100	NA	20.0	NA	NA	NA	230	22	6.29	332	248	10.9
PETER SPRING	473404.34	1764676.69	3/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.07	236	181	4.2
WC-6.25	484745.68	1757441.12	11/7/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.05	145	111	4.7
Other Springs																						
GC-10.8 (UPPER)	483905.9	1804133.22	7/15/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.96	115	NA	9.5

DRAFT

1 - sample not recieved at contract laboratory at 4 degrees celsius

2 -duplicate sample Lab 1

3 -duplicate sample Lab 2

^ - Total phosphate as phosphorus

^^ - Total kjeldahl nitrogen

* - Temperature may not represent true ground-water temperature due to low-flow conditions or measurements not taken at spring source.

**- LANL's ER or ES field data

TDS - Total dissolved solids

TSS - Total suspendad solids

SC - Specific conductance

NA - Not analyzed

T - Indicates that the sample was acidified prior to filtration or analysis, and represents total metals.

F - Indicates that the sample was filtered through a 0.45 micon filter prior to acidification or analysis, and represents dissolved metals.

§ - Prescribed holding time not met.

NOTE X-Y Coordinates are State plane, New Mexico Central Zone, NAD 27

Sources: "Geologic and Hydrologic Records of Observation Wells, Test Holes, Test Wells, Supply Wells, Springs and Surface Water Stations in the Los Alamos Area" By W.D. Purtymun, digitized from U.S.G.S. 7.5 Minute Quadrangles, and anonymous 1998.

LOCATION ID		Date	Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Si (mg/L)	Sn (mg/L)	Sr (mg/L)	Ti (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
SPRING 6	F	4/24/96	<0.01	<0.050	<0.01	<0.1	<0.050	<0.005	<0.005	<0.01	<0.01	<0.01	<0.050	<0.0002	0.023	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	38	<0.01	0.082	NA	<0.01	<0.01	<0.020
SPRING 6A	T	10/6/95	NA	<0.2	<0.01	<0.1	<0.1	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	25	NA	0.10	NA	NA	NA	NA
SPRING 8	T	10/6/96	NA	<0.2	<0.01	<0.1	<0.1	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	35	NA	0.08	NA	NA	NA	NA
SPRING 8A	F	3/21/96	<0.01	<0.008	<0.01	<0.1	0.0180	<0.005	<0.005	<0.01	<0.01	<0.01	0.0218	<0.0002	0.0228	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	41.4	<0.02	0.0420	NA	<0.01	<0.01	0.0031
SPRING 9	F	3/21/96	<0.01	<0.008	<0.01	<0.1	0.0155	<0.005	<0.005	<0.01	<0.01	<0.01	0.0304	<0.0002	0.0229	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	40.0	<0.02	0.0451	NA	<0.01	<0.01	0.0046
SPRING 9A	F	3/21/96	<0.01	<0.008	<0.01	<0.1	0.0094	<0.005	<0.005	<0.01	<0.01	<0.01	0.0224	<0.0002	0.0224	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	36.5	<0.02	0.0445	NA	<0.01	<0.01	0.0074
Los Alamos Canyon																												
LA SPRING	F	4/2/96	NA	<0.2	<0.01	NA	<0.1	NA	NA	NA	NA	NA	<0.1	<0.0002	0.02	NA	NA	NA	<0.003	NA	NA	17	NA	0.10	NA	NA	NA	<0.02
INDIAN SPRING	F	6/30/96	NA	<0.2	<0.01	<0.1	0.2	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	20	NA	0.34	NA	NA	NA	NA
Pa[illegible] Canyon & Tributaries																												
PA-11.5	F	7/26/96	<0.01	<0.2	<0.01	<0.1	<0.1	<0.005	<0.005	<0.01	<0.01	<0.01	<0.1	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	0.007	20	<0.02	0.07	NA	<0.01	<0.01	<0.02
CHARLIE'S	F	5/15/96	NA	<0.050	NA	<0.10	<0.050	NA	NA	NA	NA	NA	<0.050	NA	NA	<0.015	NA	NA	NA	NA	NA	15	NA	0.11	NA	NA	NA	NA
STARMER'S	F	5/15/96	NA	<0.050	NA	<0.10	<0.050	NA	NA	NA	NA	NA	<0.050	NA	NA	<0.015	NA	NA	NA	NA	NA	19	NA	0.081	NA	NA	NA	NA
HOMESTEAD	F	5/15/96	NA	<0.050	NA	<0.10	<0.050	NA	NA	NA	NA	NA	<0.050	NA	NA	<0.015	NA	NA	NA	NA	NA	19	NA	0.080	NA	NA	NA	NA
BULLDOG	F	5/15/96	NA	<0.050	NA	<0.10	0.055	NA	NA	NA	NA	NA	<0.050	NA	NA	<0.015	NA	NA	NA	NA	NA	22	NA	0.11	NA	NA	NA	NA
ANDERSON SPRING	F	2/20/96	<0.001	0.0147	<0.002	0.0370	0.0317	<0.001	<0.001	0.0013	<0.001	0.002	<0.012	<0.0002	0.0179	0.0014	0.0023	0.0042	<0.001	<0.001	<0.003	33.0	<0.001	0.0533	0.004	<0.001	0.0102	0.0026
HANLON SPRING	F	2/20/96	0.0022	0.0326	<0.002	0.087	0.706	<0.001	<0.001	<0.001	<0.001	0.0023	<0.0120	0.0018	0.0194	0.0023	0.025	0.002	<0.001	<0.001	<0.003	34.3	<0.001	0.0526	0.0047	<0.001	0.010	0.0010
TA-18 SPRING	F	5/13/96	NA	<0.050	NA	<0.10	0.079	NA	NA	NA	NA	NA	1.2	NA	NA	0.40	NA	NA	NA	NA	NA	10	NA	0.083	NA	NA	NA	NA
Water Canyon & Tributaries																												
V-5.0	F	7/16/96	<0.01	0.5	<0.01	<0.1	<0.1	<0.005	<0.005	<0.01	<0.01	<0.01	0.1	<0.0002	<0.01	<0.01	<0.01	<0.02	<0.003	<0.02	0.005	23	<0.02	0.09	NA	<0.01	<0.01	<0.02
BURNING GRND. SP	F	6/4/96	NA	<0.050	NA	<0.10	0.10	NA	NA	NA	NA	NA	<0.050	<0.0002	NA	<0.015	NA	NA	NA	NA	NA	22	NA	0.11	NA	NA	NA	NA
	F	12/20/96	NA	NA	NA	<0.1	0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SWSC SPRING	F	6/4/96	NA	<0.050	NA	<0.10	0.24	NA	NA	NA	NA	NA	0.10	<0.0002	NA	<0.015	NA	NA	NA	NA	NA	22	NA	0.11	NA	NA	NA	NA
MARTIN SPRING	F	6/4/96	NA	<0.050	NA	1.8	0.10	NA	NA	NA	NA	NA	<0.050	<0.0002	NA	<0.015	NA	NA	NA	NA	NA	34	NA	0.14	NA	NA	NA	NA

[illegible] -Duplicate sample lab 1

[illegible] -Duplicate sample lab 2

NA-Not analyzed

T - Indicates that the sample was acidified prior to filtration or analysis, and represents total metals.

F - Indicates that the sample was filtered through a 0.45 micron filter prior to acidification or analysis, and represents dissolved metals.

STATION ID		Date	Ag (mg/L)	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Li (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Sb (mg/L)	Se (mg/L)	Si (mg/L)	Sn (mg/L)	Sr (mg/L)	Tl (mg/L)	Tl (mg/L)	V (mg/L)	Zn (mg/L)
WELLS																												
DEEP AQUIFER																												
TW-3	T	1/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TW-8	F	2/13/96	NA	NA	<0.01	<0.1	<0.1	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DT-5A	T	11/27/96	NA	NA	NA	<0.1	<0.1	<0.005	NA	<0.01	NA	<0.01	NA	NA	NA	NA	NA	NA	<0.003	<0.02	NA	NA	NA	NA	NA	NA	NA	0.34
	F	11/27/96	NA	NA	NA	<0.1	<0.1	<0.005	NA	<0.01	NA	<0.01	NA	NA	NA	NA	NA	<0.02	NA	<0.02	NA	NA	NA	NA	NA	NA	NA	0.22
DT-9	T	9/19/96	NA	NA	NA	NA	<0.1	<0.005	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	<0.003	NA	NA	33	NA	NA	NA	NA	NA	0.21
	F	9/19/96	NA	NA	NA	<0.1	0.1	<0.005	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	<0.003	NA	NA	36	NA	NA	NA	NA	NA	0.20
DT-10	T	9/19/96	NA	NA	NA	NA	<0.1	<0.005	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	<0.003	NA	NA	31	NA	NA	NA	NA	NA	0.10
	F	9/19/96	NA	NA	NA	<0.1	<0.1	<0.005	NA	<0.01	NA	NA	NA	NA	NA	NA	NA	NA	<0.003	NA	NA	33	NA	NA	NA	NA	NA	0.06
RCHED AQUIFER (ALLUVIUM)																												
Los Alamos Canyon																												
LAO-0.7	T	7/29/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pajarito Canyon																												
MW-13	T	12/4/96	NA	NA	<0.02	NA	0.7	0.005	NA	0.03	NA	NA	NA	<0.0002	NA	NA	NA	NA	0.046	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mortandad Canyon																												
MCO-4B	F	3/5/96	<0.01	<0.2	<0.01	<0.1	0.1	<0.005	<0.005	<0.01	<0.01	<0.01	<0.1	<0.0002	0.03	<0.01	0.15	<0.02	<0.003	<0.02	<0.005	18	<0.01	0.22	NA	<0.01	<0.01	<0.02
	F	3/5/96	<0.003	<0.027	<0.002	0.054	0.14	<0.001	0.004	0.0041	<0.004	0.0036	<0.006	<0.0002	0.025	0.0015	0.13	<0.014	<0.001	<0.002	0.0035	18	<0.036	0.29	NA	<0.003	<0.004	0.032
MCO-5	T	8/9/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WATER SUPPLY																												
an Ildefonso Pueblo																												
LA-5	T	8/14/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10	NA	NA	NA	NA	NA	NA
White Rock Canyon																												
ANCHO	T	10/8/96	NA	<0.2	<0.01	<0.1	<0.1	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	35	NA	0.06	NA	NA	NA	NA
SANDIA	F	8/29/96	NA	<0.2	NA	<0.1	0.1	NA	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	24	NA	0.34	NA	NA	NA	NA
OTOWI	F	7/8/96	<0.01	<0.2	<0.01	<0.1	0.2	<0.005	<0.005	<0.01	<0.01	<0.01	<0.1	<0.0002	0.04	<0.01	<0.01	<0.02	<0.003	<0.02	0.006	20	0.03	0.44	NA	<0.01	<0.01	<0.02
SPRING 1	F	5/3/96	NA	<0.2	<0.01	NA	0.2	NA	NA	NA	NA	NA	<0.1	NA	0.04	NA	NA	NA	NA	NA	NA	17	NA	0.20	NA	NA	NA	0.03
SPRING 3A	F	4/3/96	NA	<0.2	<0.01	NA	<0.1	NA	NA	NA	NA	NA	<0.1	<0.0002	0.02	NA	NA	NA	<0.003	NA	NA	25	NA	0.23	NA	NA	NA	<0.02
SPRING 4	F	4/24/96	<0.01	<0.050	<0.01	<0.1	<0.050	<0.005	<0.005	<0.01	<0.01	<0.01	<0.050	<0.0002	0.024	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	20	<0.01	0.13	NA	<0.01	<0.01	<0.020
SPRING 4A	F	4/24/96	<0.01	<0.050	<0.01	<0.1	<0.050	<0.005	<0.005	<0.01	<0.01	<0.01	<0.050	<0.0002	0.028	<0.01	<0.01	<0.02	<0.003	<0.02	<0.005	38	<0.01	0.000	NA	<0.01	<0.01	<0.020

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ID		Date	(pCi/L)	UNC	(pCi/L)	UNC	(pCi/L)	UNC	Pb-214 (pCi/L)	UNC	Tl-208 (pCi/L)	UNC	Na-22 (pCi/L)	UNC	U (ug/L)	UNC	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	UNC	239/240 Pu (pCi/L)	UNC	241Am (pCi/L)	UNC	237Np (pCi/L)	UNC	Gross Alpha (pCi/L)	UNC	Gross Beta (pCi/L)	UNC
WELLS																																
DEEP AQUIFER																																
TW-2	T	8/21/96	NA	-	<0.27	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
TW-3	T	1/29/96	NA	-	<0.58	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	2.09	0.90
	T	9/30/96	NA	-	0.10	0.23	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
	T	11/15/96	NA	-	<0.72	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
TW-4	T	1/23/96	NA	-	<0.61	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	2.02	0.51
	T	9/27/96	NA	-	0.08	0.20	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
	T	11/15/96	NA	-	<0.66	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
TW-8		2/13/96	NA	-	<0.42(T)	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.45(F)	<0.07(F)	0.25(F)	<0.09(T)	BDL	<0.05(T)	BDL	<0.03(T)	BDL	NA	-	<0.79(T)	BDL	<2.0(T)	BDL
	T	9/30/96	NA	-	-0.09	0.21	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
	T	11/15/96	NA	-	<0.70	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
DT-5A	T	11/27/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	<0.18	BDL	<1.5	BDL	2.0	1.1
DT-9	F	9/18/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	0.50	0.07	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	<0.60	BDL	<1.5	BDL
DT-10	F	9/19/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	1.15	0.18	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	0.66	0.22	<1.4	BDL
INTERM. AQUIFER (VOLCANIC/SEDIMENTARY)																																
LADP-3	F	12/4/96	NA	-	<0.29	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	<0.32	BDL	<1.3	BDL	8.3	1.5
TW-2A	T	8/21/96	NA	-	<0.27	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	<0.19	BDL	NA	-	NA	-
POI - 4	* F	6/7/96	NA	-	<0.52	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	1.37	0.01	0.85	NA	-	NA	-	NA	-	NA	-	4.13	0.91	10.0	2.0
PER D AQUIFER (ALLUVIUM)																																
Los Alamos Canyon																																
LAO-0.7	F	7/29/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	0.58	0.08	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
LAO-2	F	11/13/96	NA	-	18.7	3.4	NA	-	NA	-	NA	-	NA	-	NA	-	0.08	0.01	0.05	NA	-	NA	-	NA	-	<0.05	BDL	NA	-	NA	-
Pajarito Canyon																																
MW-13	* F	12/4/96	NA	-	<0.56	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.04	0.00	0.01	0.08	0.04	0.00	0.00	NA	-	NA	-	<1.5	BDL	2.5	1.4

DRAFT

STATION ID		Date	H3 (pCi/L)	UNC	90Sr (pCi/L)	UNC	137Cs (pCi/L)	UNC	Pb-214 (pCi/L)	UNC	Tl-208 (pCi/L)	UNC	Na-22 (pCi/L)	UNC	U (ug/L)	UNC	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	UNC	239/240 Pu (pCi/L)	UNC	241Am (pCi/L)	UNC	237Np (pCi/L)	UNC	Gross Alpha (pCi/L)	UNC	Gross Beta (pCi/L)	UNC
Mortandad Canyon																															
MCO-4B	F	3/5/96	19100	2500	111	12	<1.72	BDL	18.7	7.12	9.22	3.78	24.7	2.88	NA	-	6.43	0.18	1.36	<0.23	BDL	<0.15	BDL	0.47	0.08	NA	-	6.9	2.3	611	60
	F	3/5/96	18060	878	105.2	8.7	0.0	2.4	0.9	0.2	1.7	2.8	24.9	5.2	NA	-	5.88	0.29	1.70	0.030	0.028	0.040	0.034	0.54	0.11	NA	-	8.7	4.3	534	30
MCO-5	F	8/9/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	<0.11	BDL	10.8	2.8	538	60
	T	8/9/96	sample acidified with nitric acid, filtered, and then analyzed on 8/30/96									-	NA	-	NA	-	NA	NA	NA	0.04	0.03	0.03	0.02	0.31	0.06	NA	-	14.2	3.0	534	61
	T	8/9/96	sample acidified with nitric acid, and then analyzed on11/18/96									NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	6.9	2.3	433	44
WATER SUPPLY																															
San Ildefonso Pueblo																															
LA-5	T	8/14/96	NA	-	<0.57	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	<0.64	BDL	<2.4	BDL
OTOWI HOUSE	T	8/13/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	2.9	1.9	<6.7	BDL
HALLADAY HOUSE	T	8/13/96	NA	-	<0.60	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	<1.3	BDL	<3.3	BDL
White Rock Canyon																															
ANCHO	T	10/8/96	NA	-	-0.04	0.20	NA	-	NA	-	NA	-	NA	-	NA	-	0.11(F)	0.06(F)	0.06(F)	NA	-	NA	-	NA	-	0.00	0.18	<1.2(F)	BDL	2.6(F)	1.3
SANDIA	F	8/29/96	NA	-	0.00	0.21	NA	-	NA	-	NA	-	NA	-	NA	-	0.32	0.01	0.21	NA	-	NA	-	NA	-	NA	-	<1.4	BDL	<4.7	BDL
OTOWI	F	7/8/96	NA	-	<0.51	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	1.12	0.05	0.71	0.00	0.03	0.01	0.02	0.01	0.03	NA	-	4.6	1.8	5.7	2.0
SPRING 1	F	6/3/96	NA	-	<0.62	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	1.46	0.04	0.77	NA	-	NA	-	NA	-	NA	-	2.00	0.48	<2.5	BDL
SPRING 3A	F	4/3/96	NA	-	<0.58	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.63	<0.06	0.42	NA	-	NA	-	NA	-	NA	-	0.65	0.33	4.2	1.0
	T	10/7/96	NA	-	0.01	0.20	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
SPRING 4	F	4/24/96	NA	-	<0.87	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	6.1	0.38	6.5	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
SPRING 4A	F	4/24/96	NA	-	<1.3	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.75	0.04	0.33	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
		10/8/96	NA	-	-0.02(T)	0.20	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	<1.6(F)	BDL	<2.9(F)	BDL
SPRING 5	F	4/24/96	NA	-	<0.65	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.46	0.02	0.23	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
SPRING 5A		10/8/96	NA	-	0.27(T)	0.21	NA	-	NA	-	NA	-	NA	-	NA	-	0.85(F)	0.04(F)	0.64(F)	NA	-	NA	-	NA	-	-0.20(F)	0.13	NA	-	NA	-
SPRING 8A	F	3/21/96	NA	-	<0.60	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	0.52	<0.09	0.27	NA	-	NA	-	<0.91	BDL	NA	-	<0.67	BDL	3.51	0.90
SPRING 9	F	3/21/96	NA	-	<0.63	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	1.61	<0.06	0.85	NA	-	NA	-	<0.46	BDL	NA	-	1.71	0.62	2.60	0.61
SPRING 9A	F	3/21/96	NA	-	<0.69	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	3.21	<0.06	1.64	NA	-	NA	-	<0.58	BDL	NA	-	1.39	0.47	<2.5	BDL

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ID		Date	(pCi/L)	UNC	(pCi/L)	UNC	(pCi/L)	UNC	(pCi/L)	UNC	(pCi/L)	UNC	(pCi/L)	UNC	(ug/L)	UNC	234U (pCi/L)	235U (pCi/L)	238U (pCi/L)	238Pu (pCi/L)	UNC	239/240 Pu (pCi/L)	UNC	241Am (pCi/L)	UNC	237Np (pCi/L)	UNC	Gross Alpha (pCi/L)	UNC	Gross Beta (pCi/L)	UNC
		10/9/96	NA	-	-0.07(F)	0.20	NA	-	NA	-	NA	-	NA	-	NA	-	0.56(F)	0.05(F)	0.2(F)	NA	-	NA	-	NA	-	0.16(T)	0.22	NA	-	NA	-
Los Alamos Canyon																															
LA SPRING	F	4/2/96	NA	-	<0.59	BDL	NA	-	NA	-	NA	-	NA	-	NA	-	1.33	0.05	0.86	NA	-	NA	-	NA	-	NA	-	0.90	0.51	4.5	1.5
INDIAN SPRING	F	8/30/96	NA	-	0.13	0.21	NA	-	NA	-	NA	-	NA	-	NA	-	0.94	0.00	0.39	NA	-	NA	-	NA	-	NA	-	<1.4	BDL	<4.6	BDL
Pajarito Canyon & Tributaries																															
PA-11.5	F	7/26/96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	0.86	0.26	3.27	0.93
ANDERSON SPRING	T	2/20/96	NA	-	0.07	0.29	NA	-	NA	-	NA	-	NA	-	NA	-	0.190	0.040	0.107	NA	-	NA	-	NA	-	NA	-	12.2	0.6	29.6	5.2
	F	4/16/96	NA	-	-0.2	1.6	NA	-	NA	-	NA	-	NA	-	NA	-	1.14	0.66	1.14	NA	-	NA	-	NA	-	NA	-	0.2	1.0	2.9	1.4
HA[illegible]N SPRING	T	2/20/96	NA	-	0.15	0.33	NA	-	NA	-	NA	-	NA	-	NA	-	3.00	0.30	2.40	NA	-	NA	-	NA	-	NA	-	79	16	77	12
	F	4/16/96	NA	-	-0.8	1.6	NA	-	NA	-	NA	-	NA	-	NA	-	0.43	0.04	-0.06	NA	-	NA	-	NA	-	NA	-	-0.16	0.76	2.5	1.5
TA-16 SPRING	F	5/13/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	0.27	0.01	0.09	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Water Canyon & Tributaries																															
CDV-5.0	F	7/18/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	NA	NA	NA	-	NA	-	NA	-	NA	-	0.72	0.39	2.91	0.64
BURNING GRND. SP	F	5/24/96	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	0.50	0.03	0.16	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-

DRAFT

* -Duplicate sample lab 1

* -Duplicate sample lab 2

UNC - Uncertainties (2 Sigma)

NA - Not analyzed

BDL - Below method detection limit

F - Preserved prior to filtration

T - Indicates that the sample was acidified prior to filtration or analysis, and represents total radionuclides.

F - Indicates that the sample was filtered through a 0.45 micron filter prior to acidification or analysis, and represents dissolved radionuclides.

Table 4 - NMED DOE Over ht Bureau Ground-Water Quality Resul High Explosive Compounds.

WELLS						
SAMPLE ID:	DT-10		MW-13		MW-15	
SAMPLING DATE:	9/19/96		12/4/96		12/4/96	
	*RESULT (ug/L)	DL	*RESULT (ug/L)	DL	*RESULT (ug/L)	DL
2-AMINO-4,6-DNT & 4-AMINO-2,6-DNT	ND	0.25	ND	0.25	ND	0.25
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE (HMX)	ND	1.0	ND	1.0	ND	1.0
HEXAHYDRO-1,3,5-TRINITRO-1,3,5-TRIAZINE (RDX)	ND	0.84	ND	0.84	ND	0.84
1,3,5-TRINITROBENZENE (1,3,5-TNB)	NA	-	NA	-	NA	-
1,3-DINITROBENZENE (1,3-DNB)	ND	0.25	NA	-	NA	-
TETRYL	NA	-	NA	-	NA	-
NITROBENZENE (NB)	NA	-	NA	-	NA	-
2,4,6-TRINITROTOLUENE (2,4,6-TNT)	ND	0.25	ND	0.25	ND	0.25
2,4-DINITROTOLUENE(2,4-DNT) & 2,6-DINITROTOLUENE(2,6-DNT)	ND	0.25	ND	0.25	ND	0.25
o-NITROTOLUENE (2-NT)	NA	-	NA	-	NA	-
p-NITROTOLUENE (4-NT)	NA	-	NA	-	NA	-
m-NITROTOLUENE (3-NT)	NA	-	NA	-	NA	-

* - Modified Method 8330

NA - Not analyzed

DL - Detection limit (ug/L)

Table 5 - NMED DOE Ov[illegible]t Bureau Ground-Water Quality Results: Volatile Organic [illegible]mpounds.

SAMPLE ID:	DT-9		DT-10		SWSC Spr.	
SAMPLING DATE:	9/18/96		9/19/96		12/20/96	
UNITS	ug/L	RL	ug/L	RL	ug/L	RL
PARAMETER						
ACETONE	ND	20	ND	20	ND	20
BENZENE	ND	5.0	ND	5.0	ND	5
BROMOBENZENE	ND	5.0	ND	5.0	ND	5
BROMOCHLOROMETHANE	ND	5.0	ND	5.0	ND	5
BROMODICHLOROMETHANE	ND	5.0	ND	5.0	ND	5
BROMOFORM	ND	5.0	ND	5.0	ND	5
BROMOMETHANE	ND	10	ND	10	ND	10
2-BUTANONE (MEK)	ND	20	ND	20	ND	20
n-BUTYLBENZENE	ND	5.0	ND	5.0	ND	5
sec-BUTYLBENZENE	ND	5.0	ND	5.0	ND	5
tert-BUTYLBENZENE	ND	5.0	ND	5.0	ND	5
tert-BUTYL METHYL ETHER (MTBE)	NA	-	NA	-	NA	-
CARBON DISULFIDE	ND	5.0	ND	5.0	ND	5
CARBON TETRACHLORIDE	ND	5.0	ND	5.0	ND	5
CHLOROBENZENE	ND	5.0	ND	5.0	ND	5
CHLOROETHANE	ND	10	ND	10	ND	10
2-CHLOROETHYL VINYL ETHER	ND	10	ND	10	ND	10
CHLOROFORM	ND	5.0	ND	5.0	ND	5
CHLOROMETHANE	ND	10	ND	10	ND	10
2-CHLOROTOLUENE	ND	5.0	ND	5.0	ND	5
4-CHLOROTOLUENE	ND	5.0	ND	5.0	ND	5
1,2-DIBROMO-3-CHLOROPROPANE	ND	10	ND	10	ND	10
DIBROMOCHLOROMETHANE	ND	5.0	ND	5.0	ND	5
1,2-DIBROMOETHANE (EDB)	ND	5.0	ND	5.0	ND	5
DIBROMOMETHANE	ND	5.0	ND	5.0	ND	5
1,2-DICHLOROBENZENE	ND	5.0	ND	5.0	ND	5
1,3-DICHLOROBENZENE	ND	5.0	ND	5.0	ND	5
1,4-DICHLOROBENZENE	ND	5.0	ND	5.0	ND	5
DICHLORODIFLUOROMETHANE	ND	10	ND	10	ND	10
1,1-DICHLOROETHANE	ND	5.0	ND	5.0	ND	5
1,2-DICHLOROETHANE (EDC)	ND	5.0	ND	5.0	ND	5
1,1-DICHLOROETHENE	ND	5.0	ND	5.0	ND	5
CIS--1,2-DICHLOROETHENE	ND	5.0	ND	5.0	ND	5
TRANS--1,2-DICHLOROETHENE	ND	5.0	ND	5.0	ND	5
1,1-DICHLOROPROPENE	ND	5.0	ND	5.0	ND	5
1,2-DICHLOROPROPANE	ND	5.0	ND	5.0	ND	5
1,3-DICHLOROPROPANE	ND	5.0	ND	5.0	ND	5
CIS--1,3-DICHLOROPROPENE	ND	5.0	ND	5.0	ND	5
2,2-DICHLOROPROPANE	ND	5.0	ND	5.0	ND	5
2,2-DICHLOROPROPENE	NA	-	NA	-	NA	-
TRANS--1,3-DICHLOROPROPENE	ND	5.0	ND	5.0	ND	5
ETHYLBENZENE	ND	5.0	ND	5.0	ND	5
2-HEXANONE	ND	20	ND	20	ND	20
HEXACHLOROBUTADIENE	ND	5.0	ND	5.0	ND	5
IODOMETHANE	ND	5.0	ND	5.0	ND	5
ISOPROPYLBENZENE	ND	5.0	ND	5.0	ND	5
p-ISOPROPYLTOLUENE	ND	5.0	ND	5.0	ND	5
METHYL-t-BUTYL ETHER	ND	5.0	ND	5.0	ND	5
4-METHYL-2-PENTANONE	ND	20	ND	20	ND	20
1-METHYLNAPHTHALENE	NA	-	NA	-	NA	-
2-METHYLNAPHTHALENE	NA	-	NA	-	NA	-
4-ISOPROPYLTOLUENE	NA	-	NA	-	NA	-
METHYLENE CHLORIDE	ND	5.0	ND	5.0	ND	5
NAPHTHALENE	ND	5.0	ND	5.0	ND	5
n-PROPYLBENZENE	ND	5.0	ND	5.0	ND	5
PROPYLBENZENE	NA	-	NA	-	NA	-
STYRENE	ND	5.0	ND	5.0	ND	5
1,1,1,2-TETRACHLOROETHANE	ND	5.0	ND	5.0	ND	5
1,1,2,2-TETRACHLOROETHANE	ND	5.0	ND	5.0	ND	5
TETRACHLOROETHENE	ND	5.0	ND	5.0	ND	5
TETRAHYDROFURAN (THF)	NA	-	NA	-	NA	-
TOLUENE	ND	5.0	ND	5.0	ND	5
1,2,3-TRICHLOROBENZENE	ND	5.0	ND	5.0	ND	5
1,2,4-TRICHLOROBENZENE	ND	5.0	ND	5.0	ND	5
1,1,1-TRICHLOROETHANE	ND	5.0	ND	5.0	ND	5
1,1,2-TRICHLOROETHANE	ND	5.0	ND	5.0	ND	5
TRICHLOROETHENE	ND	5.0	ND	5.0	ND	5
TRICHLOROFLUOROMETHANE	ND	5.0	ND	5.0	ND	5
1,2,3-TRICHLOROPROPANE	ND	5.0	ND	5.0	ND	5
TRICHLOROTRIFLUOROETHANE	ND	5.0	ND	5.0	ND	5
1,1,2-TRICHLORO-2,2,1-TRIFLUOROETHAN	NA	-	NA	-	NA	-
1,2,4-TRIMETHYLBENZENE	ND	5.0	ND	5.0	ND	5
1,3,5-TRIMETHYLBENZENE	ND	5.0	ND	5.0	ND	5
VINYL ACETATE	ND	20	ND	20	ND	20
VINYL CHLORIDE	ND	10	ND	10	ND	10
o-XYLENE	ND	5.0	ND	5.0	ND	5
p- & m-XYLENE	ND	5.0	ND	5.0	ND	5
TOTAL XYLENES	NA	-	NA	-	NA	-

DRAFT

RL- Reporting limit
NA - Not analyzed
ND - Not detected
- sample not recieved at contract laboratory at 4 degrees celsius

Table 6 - NMED DOE Oversight Bureau Ground-Water Quality Results: Additional Organic Compounds.

SAMPLE ID:	DT-9	
SAMPLING DATE:	9/18/96	
UNITS	ug/L	DL
PARAMETER		
1,2,4,-TRICHLOROBENZENE	ND	10
1,2,4,5-TETRACHLOROBENZENE	NA	-
1,2-DICHLOROBENZENE	ND	10
1,2-DIPHENYLHYDRAZINE	NA	-
1,3,-DICHLOROBENZENE	ND	10
1,4,-DICHLOROBENZENE	ND	10
1-CHLORONAPTHALENE	NA	-
1-NAPTHYLAMINE	NA	-
2,2,3,3,4,5,6,6-OCTACHLOROBIPHENYL	NA	-
2,2,3,3,4,4,6-HEPTACHLOROBIPHENYL	NA	-
2,2,4,4,5,5-HEXACHLOROBIPHENYL	NA	-
2,2,3,4,6-PENTACHLOROBIPHENYL	NA	-
2,2,4,4-TETRACHLOROBIPHENYL	NA	-
2,3,4,6-TETRACHLOROPHENOL	NA	-
2,4,5-TRICHLOROBIPHENYL	NA	-
2,4,5-TRICHLOROPHENOL	ND	10
2,4,6-TRICHLOROPHENOL	ND	10
2,3-DICHLOROBIPHENYL	NA	-
2,4-DICHLOROPHENOL	ND	10
2,4-DIMETHYLPHENOL	ND	10
2,4-DINITROPHENOL	ND	50
2,4-DINITROTOLUENE	ND	10
2,6-DICHLOROPHENOL	NA	-
2,6-DINITROTOLUENE	ND	10
2-CHLORONAPHTHALENE	ND	10
2-CHLOROBIPHENYL	NA	-
2-CHLOROPHENOL	ND	10
2-METHYLNAPHTHALENE	ND	10
2-METHYLPHENOL	ND	10
2-NAPTHYLAMINE	NA	-
2-NITROANILINE	ND	50
2-NITROPHENOL	ND	10
2-PICOLINE	NA	-
3,3-DICHOLOROBENZIDINE	ND	50
3-METHYLCHOLANTHRENE	NA	-
3-NITROANILINE	ND	50
4,6-DINITRO-2-METHYLPHENOL	ND	50
4-AMINOBIPHENYL	NA	-
4-BROMOPHENYL PHENYL ETHER	ND	10
4-CHLORO-3-METHYLPHENOL	ND	10
4-CHLOROANILINE	ND	25
4-CHLOROPHENYL PHENYL ETHER	ND	10
4-METHYLPHENOL	ND	10
4-NITROANILINE	ND	50
4-NITROPHENOL	ND	50
7,12-DIMETHYLBENZO(A)ANTHRACENE	NA	-
A-,A-DIMETHYLPENETHYLAMINE	NA	-
ACENAPHTHENE	ND	10
ACENAPHTHYLENE	ND	10
ACETOPHENONE	NA	-
ALACHLOR	NA	-
ALDRINE	NA	-
ALPHA-CHLORDANE	NA	-
ANILINE	ND	25
ANTHRACENE	ND	10
AROCLOR 1016	NA	-
AROCLOR 1221	NA	-
AROCLOR 1232	NA	-
AROCLOR 1242	NA	-
AROCLOR 1248	NA	-
AROCLOR 1254	NA	-
AROCLOR 1260	NA	-
ATRAZINE	NA	-
AZOBENZENE	ND	10
BENZIDINE	NA	-

UNITS	ug/L	DL
PARAMETER		
BENZO(A)ANTHRACENE	ND	10
BENZO(A)PYRENE	ND	10
BENZO(B)FLUORANTHENE	ND	10
BENZO(G,H,I)PERYLENE	ND	10
BENZO(K)FLUORANTHENE	ND	10
BENZOIC ACID	ND	50
BENZYL ALCOHOL	ND	10
BIS (2-CHLOROETHOXY) METHANE	ND	10
BIS (2-CHLOROETHYL) ETHER	ND	10
BIS (2-CHLOROISOPROPY) ETHER	ND	10
BIS(2-ETHYLHEXYL)PHTHALATE	ND	10
BUTYL BENZYL PHTHALATE	ND	10
BUTACHLOR	NA	-
CARBAZOLE	ND	10
CHLORDANE (TOTAL)	NA	-
CHRYSENE	ND	10
DI(2 ETHYLHEXYL) ADIPATE	NA	-
DI(2 ETHYLHEXYL) PHTHALATE	NA	-
DI-N-BUTYL PHTHALATE	ND	10
DI-N-OCTYL PHTHALATE	ND	10
DIBENZO(A,H)ANTHRACENE	ND	10
DIBENZO(A,J)ACRIDINE	NA	-
DIBENZOFURAN	ND	10
DIELDRIN	NA	-
DIETHYL PHTHALATE	ND	10
DIMETHYL PHTHALATE	ND	10
DIPHENYLAMINE	NA	-
ENDRIN	NA	-
FLUORANTHENE	ND	10
FLUORENE	ND	10
GAMMA-CHLORDANE	NA	-
HEPTACHLOR	NA	-
HEPTACHLOR EPOXIDE	NA	-
HEXACHLOROBENZENE	ND	10
HEXACHLOROBUTADIENE	ND	10
HEXACHLOROCYCLOPENTADIENE	ND	10
HEXACHLOROETHANE	ND	10
INDENO(1,2,3-CD)PYRENE	ND	10
ISOPHORONE	ND	10
LINDANE	NA	-
N-NITROSO-DI-N-PROPYLAMINE	ND	10
N-NITROSODI-N-BUTYLAMINE	NA	-
N-NITROSODIMETHYLAMINE	ND	10
N-NITROSODIPHENYLAMINE	ND	10
N-NITROSOPIPERIDINE	NA	-
NAPHTHALENE	ND	10
NITROBENZENE	ND	10
METOLACHLOR	NA	-
METHOXYCHLOR	NA	-
METRIBUZIN	NA	-
P-DIMETHYLAMINOAZOBENZENE	NA	-
PENTACHLOROBENZENE	NA	-
PENTACHLORONITROBENZENE	NA	-
PENTACHLOROPHENOL	ND	50
PHENACETIN	NA	-
PHENANTHRENE	ND	10
PHENOL	ND	10
PRONAMIDE	NA	-
PROPACHLOR	NA	-
PYRENE	ND	10
PYRIDINE	ND	10
SIMAZINE	NA	-
TOXAPHENE MIXTURE	NA	-
TRANS NONACHLOR	NA	-

DRAFT

DL- Method detection limit
NA - Not analyzed
ND - Not detected
- sample not recieved at contract laboratory at 4 degress celsius

Michael's Copy

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

April 8, 1997

Mat Johansen, DOE LAAO AIP POC
U.S. Department of Energy
Los Alamos Area Office
528 35th Street, MS A316
Los Alamos, NM 87544

RE: Request for access to Water Canyon, Los Alamos National Laboratory

Dear Mr. Johansen:

The DOE OB is requesting approval to gain access to Water Canyon in order to assess flow conditions and/or collect surface-water samples. We are requesting access to Water Canyon from the east via a jeep trail connecting with SR 4. The DOE OB would like to perform the above activities on April 16, 1997. Justification for this request is due to the following:

On February 21, 1997, DOE OB inspected the Water Canyon Gallery Spring (WCG Spring), which is located in a northern tributary to Water Canyon. A break in the water-line approximately 400' downstream from the spring source (bulkhead) was discovered, and flow was continuous for approximately 300' downstream. We inspected the site again on March 23, 1997, and noted that flow had now extended to the junction of Water Canyon and SR 501. Less than 0.01 cfs was observed flowing above or upstream of the northern tributary and Water Canyon confluence; therefore, it is assumed that the majority of flow observed at the Water Canyon and SR 501 junction was derived from localized snowmelt and WCG Spring. These observations may indicate that perennial conditions have now been established in the upper reach of Water Canyon.

Please contact Michael Dale at 672-0449 or Ralph Ford-Schmid at 827-1536 with your response.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

13132

SY:mrd
cc: Joe Mose, DOE LAAO, FU-3 & FU-6 FPC, MS A316
Ted Taylor, DOE LAAO, Program Manager, EM/ER, MS A316
Bob Simeone, DOE LAAO, FU-4 FPC, MS A316
Everett Trollinger, DOE LAAO, FU-2 FPC, MS A316
Steve Rae, LANL, ESH-18, MS K497
Gene Gould, LANL, FU-2 FPL, MS G787
Brad Martin, LANL, FU-3 FPL, MS E525
Allyn Pratt, LANL, FU-4 FPL, MS J521
Ed Kelley, NMED, Chief, SWQB
John Parker, NMED, Chief, DOE OB
Benito Garcia, NMED, Chief, HRMB
Marcy Leavitt, NMED, Chief, GWQB

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LANL/ES/SEDIMENT

General

State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

April 9, 1997

Mat Johansen, DOE LAAO AIP POC
U.S. Department of Energy
Los Alamos Area Office
528 35th Street, MS A316
Los Alamos, NM 87544

RE: Release of 1996 DOE OB Environmental Restoration split-sampling and independent sampling (sediments) results at Los Alamos National Laboratory and surrounding areas

Dear Mr. Johansen:

The New Mexico Environment Department of Energy Department of Energy Oversight Bureau (NMED DOE OB) collected independent and ER split-samples during 1996, and the attached data are being submitted for your thirty-day review as stated in the Agreement-in-Principle Umbrella Protocol. After you have had the opportunity to review and comment on the data, it will be released to applicable agencies thirty (30) days following your receipt of this letter. In addition, the NMED DOE OB would like Mr. Steve Reneau (FU 4) for his cooperation and assistance.

Contact Michael Dale at 672-0449 if you have any questions concerning this matter.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

SY:mrd

Attachment

13133

cc: Ted Taylor, DOE LAAO, Program Manager, EM/ER, MS A316
Bob Simeone, DOE LAAO, FU-4 FPC, MS A316
Joe Mose, DOE LAAO, FU-3 & FU-6 FPC, MS A316
Steve Rae, LANL, ESH-18, MS K490
Jorg Jansen, LANL, Project Manager, EM/ER, MS M992
Allyn Pratt, LANL, FU-4 FPL, MS J521
John Parker, NMED, Chief, DOE OB

C:\...\96seddat.doe

TABLE 1 - NMED DOE Oversight Bureau sediment analytical results: Radionuclides.

STATION ID	Date	X-Y COORDINATES EASTING	NORTHING	90Sr (pCi/g	unc	137Cs (pCi/g)	unc	22Na (pCi/g	unc	U (pCi/g)	unc	234U (pCi/g	235U (pCi/g	238U (pCi/	238Pu (pCi/g	unc	239/240Pu (pCi/g)	unc	241Am (pCi/g)	unc	237Np (pCi/g)	unc	Gross Alpha (pCi/g)	unc	Gross Beta (pCi/g)	unc
ES																										
LA - 0.01	7/3/96	531826.18	1773577.47	NA	-	0.206	0.086	0.094	BDL	NA	-	NA	NA	NA	NA	-	NA	-	<0.330	BDL	NA	-	5.65	0.79	5.19	0.74
Rio Grande @ Medio (a)	10/10/96	481059.88	1704608.93	NA	-	0.703	0.103	NA	-	NA	-	NA	NA	NA	<0.07	BDL	0.03	0.02	<0.02	BDL	0.00	0.04	NA	-	NA	-
Rio Grande @ Medio (b)	10/10/96	481059.88	1704608.93	NA	-	<0.039	BDL	NA	-	NA	-	NA	NA	NA	<0.04	BDL	<0.01	BDL	<0.06	BDL	0.01	0.01	NA	-	NA	-
#31	5/15/96	497419.24	1772944.86	31.3	5.70	186	11.8	NA	-	5.26	0.71	1.82	0.12	1.79	0.08	0.02	5.40	0.66	1.55	0.20	NA	-	11.2	1.4	211	23
#48	5/15/96	497419.24	1772944.86	1.06	0.47	4.23	0.302	NA	-	3.53	0.48	1.36	0.06	1.27	0.10	0.03	0.44	0.08	0.69	0.10	NA	-	4.19	0.50	7.71	0.86

NA - Not analyzed or not available

BDL - Below method detection limits

UNC - Estimated total propagated uncertainty (2 sigma)

Represents:

(a) - fine grained deposit 0"-4" below top of mud flat.

(b) - courser deposit 4"-8" below (a).

#31 and #48 - ER FU4 canyon's split sampling

NOTE: X-Y Coordinates are State plane, New Mexico Central Zone, NAD 27

Source: Digitized from U.S.G.S. 7.5 Minute Quadrangles.

TABLE 2 - NMED DOE Oversight Bureau sediment analytical results: Metals.

STATION ID	Date	As^ (mg/L)	(RL)	Ba^ (mg/L)	(RL)	Be^ (mg/L)	(RL)	Cd^ (mg/L)	(RL)	Cr^ (mg/L)	(RL)	Hg^^ (mg/L)	(RL)
#31	5/15/96	3	1.0	110*	10	0.9	0.5	<0.5	0.5	29*	1	0.2	0.1
#48	5/15/96	2	1.0	40	10	<0.5	0.5	<0.5	0.5	6	1	<0.1	0.1

(RL) - Reporting limit

^ - USEPA method 6010

^^ - USEPA method 7410

* - Duplicate precision not within control limits

#31 and #48 - ER FU4 canyon's split sampling

TABLE 1 - NMED DOE Oversight Bureau sediment analytical results: Radionuclides.

STATION ID	Date	X-Y COORDINATES EASTING	NORTHING	90Sr (pCi/g	unc	137Cs (pCi/g)	unc	22Na (pCi/g	unc	U (pCi/g)	unc	234U (pCi/g	235U (pCi/g	238U (pCi/	238Pu (pCi/g	unc	239/240Pu (pCi/g)	unc	241Am (pCi/g)	unc	237Np (pCi/g)	unc	Gross Alpha (pCi/g)	unc	Gross Beta (pCi/g)	unc
ES																										
LA - 0.01	7/3/96	531826.18	1773577.47	NA	-	0.206	0.066	0.094	BDL	NA	-	NA	NA	NA	NA	-	NA	-	<0.330	BDL	NA	-	5.65	0.79	5.19	0.74
Rio Grande @ Medio (a)	10/10/96	481059.88	1704608.93	NA	-	0.703	0.103	NA	-	NA	-	NA	NA	NA	<0.07	BDL	0.03	0.02	<0.02	BDL	0.00	0.04	NA	-	NA	-
Rio Grande @ Medio (b)	10/10/96	481059.88	1704608.93	NA	-	<0.039	BDL	NA	-	NA	-	NA	NA	NA	<0.04	BDL	<0.01	BDL	<0.06	BDL	0.01	0.01	NA	-	NA	-
#31	6/18/96	497419.24	1772944.86	31.3	5.70	186	11.8	NA	-	5.26	0.71	1.82	0.12	1.79	0.08	0.02	5.40	0.66	1.55	0.20	NA	-	11.2	1.4	211	23
#48	6/18/96	497419.24	1772944.86	1.06	0.47	4.23	0.302	NA	-	3.53	0.48	1.36	0.06	1.27	0.10	0.03	0.44	0.08	0.69	0.10	NA	-	4.19	0.50	7.71	0.86

NA - Not analyzed or not available

BDL - Below method detection limits

UNC - Estimated total propagated uncertainty (2 sigma)

Represents:

(a) - fine grained deposit 0"-4" below top of mud flat.

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#31 and #48 - ER FU4 canyon's split sampling

NOTE: X-Y Coordinates are State plane, New Mexico Central Zone, NAD 27

Source: Digitized from U.S.G.S. 7.5 Minute Quadrangles.

TABLE 2 - NMED DOE Oversight Bureau sediment analytical results: Metals.

STATION ID	Date	As^ (mg/L)	(RL)	Ba^ (mg/L)	(RL)	Be^ (mg/L)	(RL)	Cd^ (mg/L)	(RL)	Cr^ (mg/L)	(RL)	Hg^^ (mg/L)	(RL)
#31	5/15/96	3	1.0	110*	10	0.9	0.5	<0.5	0.5	29*	1	0.2	0.1
#48	5/15/96	2	1.0	40	10	<0.5	0.5	<0.5	0.5	6	1	<0.1	0.1

(RL) - Reporting limit

^ - USEPA method 6010

^^ - USEPA method 7410

* - Duplicate precision not within control limits

#31 and #48 - ER FU4 canyon's split sampling