TA-16

Saundra Martinez

From: Saundra Martinez [saundra@lanl.gov]
Sent: Friday, February 24, 2006 12:15 PM
To: 'Dhawan, Neelam, NMENV'
Cc: 'Don Hickmott'; 'Lisa B. Levine'
Subject: RE: FW: e-copies of documents

Importance: High

Hi Neelam
I will be delivering a CD with these last two documents. This should complete your document request.

**RSI Response on CMS Plan and RFI
**CMS Plan Addendum

Thank you.

RECEIVED
MAR 2006
Hazardous
Bureau

Saundra Martinez
ENV-ECR
Tel: 505-665-6771
Fax: 505-667-5801
-----Original Message-----
From: Don Hickmott [mailto:dhickmott@lanl.gov]
Sent: Monday, January 23, 2006 4:30 PM
To: Saundra Martinez
Subject: RE: FW: e-copies of documents

Saundra, Lisa found it in RPF. I couldn't find it in my files. DOn

At 03:56 PM 1/23/2006, you wrote:
>Hi Don
>Were you able to find this document? If not, would you like for me to
>ask the RPF?
>
>Saundra Martinez
>ENV-ECR
>Tel: 505-665-6771
>Fax: 505-667-5801
>
>-----Original Message-----
>From: Don Hickmott [mailto:dhickmott@lanl.gov]
>Sent: Wednesday, January 11, 2006 7:46 AM
>To: Saundra Martinez
>Subject: Re: FW: e-copies of documents
>
>Saundra, I'll have to look for it. It should be in RPF. DOn
>
>At 04:35 PM 1/9/2006, you wrote:
>
> >Don
> >Do you have a hard copy of the NOD response? Read Lisa's email below.
> >Saundra Martinez
> >ENV-ECR
> >Tel: 505-665-6771
> >Fax: 505-667-5801
> >
> >-----Original Message-----
> >From: Lisa B. Levine [mailto:levine@lanl.gov]
> >Sent: Friday, January 06, 2006 10:11 AM
> >To: Don Hickmott; Lisa B. Levine; Saundra Martinez
> >Subject: Re: e-copies of documents
> >

6607

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63311

Los Alamos National Laboratory

UNIVERSITY OF CALIFORNIA

Environmental Restoration Project, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

Date: April 19, 1999
Refer to: EM/ER:99-092

Dr. Robert S. Dinwiddie
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: RESPONSE TO RSI FOR THE RFI REPORT AND CMS PLAN FOR PRS 16-021(C)

Dear Dr. Dinwiddie:

Enclosed is the Los Alamos National Laboratory Environmental Restoration (ER) Project's response to your Request for Supplemental Information (RSI) for Resource Conservation and Recovery Act Facility Investigation Report and the Corrective Measures Plan for Potential Release Site (PRS) 16-021(c). These documents address work performed and proposed at the 260 Outfall, PRS 16-021(c). The RSI was received at the ER Project Office on March 22, 1999.

If you have any questions, please call Dave McInroy at (505) 667-0819 or Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/VR/em

Enclosures: Response To RSI for the RFI Report and CMS Plan for PRS 16-021(C)

Cy (w/enc.):
M. Buksa, EM/ER, MS M992
D. Hickmott, EM/ER, MS M992
J. Mose, LAAO, MS A316
W. Neff, CST-7, MS M992
J. Kieling, NMED-OB
S. Yanicak, NMED-DOE OB, MS J993
EM/ER (CT#C668), MS M992
RPF, MS M707

Cy (w/o enc.):
M. Kirsch, EM/ER, MS M992
D. McInroy, EM/ER, MS M992
V. Rhodes, EM/ER, MS M992
EM/ER File, MS M992
Tracker, RM 604, MS M992

APR 26 1999

RESPONSE TO RSI
FOR THE RFI REPORT AND CMS PLAN FOR
TA-16, PRS 16-021(c)

General Comments

NMED Comment – Cover Letter

RPMP requests that LANL provide a comprehensive schedule for the corrective action activities (including the geologic mapping and fracture logging activities previously scheduled for inclusion in this report) and other related investigations for all PRSs, reaches and canyons within the RFI/CMS study area as shown in Figure 3.1-1 of the CMS Plan.

LANL Repsonse

Per the discussion between LANL representatives and HRMB representatives on April 12, 1999, LANL will provide a current schedule for these activities as derived from the ER baseline (see Table RSI-1). However, these activities are currently being rescheduled during the on-going LANL baselining exercise. LANL will provide the results of this baselining for these activities when they are complete and approved by DOE (estimated first quarter FY 01).

Table RSI-1: Schedule of Activities in the Study Area in the Current LANL ER Project Baseline

Activity	Notes	Current Schedule
MDA-P closure	Ongoing work	FY 99 & 00
MDA-R Phase I fieldwork	Scheduled to start 9/1/99	FY 99 & 00
MDA-R cleanup	If required by Phase I data	FY 01 & 02
HE Ponds (16-007(a), 16-008(a))Phase I fieldwork	Scheduled to start 9/1/99	FY 99 & 00
HE Ponds (16-007(a), 16-008(a))cleanup	If required by Phase I data	FY 02
Burning Ground South fieldwork	Completed in FY 95	FY 95
Burning Ground South cleanup	Combine with HE Ponds	FY 02
Ag outfall Phase I fieldwork	Completed in FY 95	FY 95
Ag outfall cleanup	Surface sediments moderately contaminated, little downgradient migration	FY 00
K-Site Phase I fieldwork	Scheduled to start 9/1/99	FY 99 & 00
TA-16-340 Phase I fieldwork	Completed in FY 95	FY 95
TA-16-340 sump outfall cleanup	Surface sediments not highly contaminated	FY 05
Alluvial system in Fish Ladder Seep Canyon	Canyons activity	FY 02-04
Alluvial system in Martin Spring Canyon	Portions will be completed as part of CMS activity. Remainder by Canyons	FY 99 & 00 Canyons –

		FY 02-04
Canon de Valle west of Pajarito fault	To be completed by Canyons	FY 02-04
Geomorphology of RFI/CMS study area	Portions will be completed as part of CMS activity. Remainder by Canyons	FY 99 & 00 Canyons – FY 02-04
RFI fieldwork for other PRSs in the study area	There are a number of low priority PRSs scheduled for Phase I in the outyears	FY 02-05
Cleanups for other PRSs in the study area	There are a handful of other PRSs in this area at which we anticipate cleanups	FY 08
Geologic mapping	The M.A. Roger map is adequate for ER purposes. The LANL Seismic Hazards program is completing detailed mapping this FY.	FY 99
Fracture mapping	A LANL geologist, Ken Wohletz, determined that the exposure in Canon de Valle was inadequate to complete a fracture map in that Canon. The LANL Seismic hazards program will complete fracture mapping of major fractures in Water Canyon during this FY.	FY 99

ATTACHMENT A

NMED Comment

Immediate Response Required

1. *LANL should revise all "Results..." tables in Sections 2 through 4 and Table 6.1-1 to include those COPCs prematurely eliminated from inclusion in the screening process, to address identified discrepancies, to ensure consistent handling of water quality parameters, to include a missing Table of results, to provide further useful clarification, and to ensure consistency with Appendix D.*

LANL Response

Enclosed as Attachment I are revised versions of Tables 2.4-10, 3-4-4, 9, 12, 16, 19, 22, 27, 28, 31, 35, 38, 42, 43, 46, 49; 4.4-4, 7, 10, 13, 19, 20, 26, 27, and 6.1-1. These changes resolve discrepancies, ensure consistent handling of water quality parameters, provide further clarifications, and ensure consistency with Appendix D. Table changes are consistent with the discussion in the responses to individual AA comments below. The missing table is included directly in the response to comment 1.d.i. These tables currently do not include changes to the radionuclide tables for analytes analyzed by gamma spectroscopy (Comments 1.a.1 and 1.a.ii). This issue is being resolved at a programmatic level by Cathy Smith of LANL with representatives of HRMB. LANL will provide an additional table to reflect the results of these programmatic discussions.

NMED Comment Continued

The following are a few examples:

a. Premature elimination of COPCs:

i. 3.4.2.1.2 Evaluation of Radionuclides, page 3-39, first paragraph: "Although bismuth-214, lead-212, lead-214, and thallium-208 were all detected, they are also naturally occurring and not carried forward as COPCs. Cadmium-109, potassium-40, protactinium-231, and protactinium-234M are not considered to be COPCs because they are analyzed for quality control purposes. Because they are not reliably measured by gamma spectroscopy, actinium-228, lanthanum-140, neptunium-237, radium-224, and radium-226 are also not carried forward as COPCs."

LANL Response

As discussed during the April 12, 1999 meeting between LANL representatives and HRMB personnel, this is a programmatic chemistry issue that is currently under discussion between LANL ER Project personnel (Cathy Smith) and HRMB. LANL's reponse to this comment will follow the resolution of this programmatic level discussion.

NMED Comment

ii. 3.4.3.1 COPCs, page 3-113, first bullet: Some detected radionuclides have been prematurely eliminated as COPCs.

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999. This is a programmatic chemistry issue that is currently under discussion between LANL personnel (Cathy Smith) and HRMB. LANL's reponse to this comment will follow the resolution of this programmatic level discussion.

NMED Comment

iii. 6.3.1.6 Potential Persistent Bioaccumulators and Biomagnifiers, page 6-18, third
paragraph in section: "...mercury was detected as a total concentration and not in its methylated state...thus, mercury is not considered a concern... "Although methylated mercury was not identified (or, probably analyzed for), it is still bioavailable and can become methylated in the environment. Based on the above statement, LANL should not prematurely exclude mercury from the screening assessment.

LANL Response

As the NMED's comments suggest, methylated mercury was not analyzed in soil samples during the RFI. The intent of the statement was to address concern for the potential threat that it may pose as a bioaccumulator from 260 Outfall soils. To better describe the intent of the statement, we will replace it with the following:

Mercury and selenium were detected in the 260 outfall surface soils and carried into the screening assessment as COPCs because of their detections in Cañon de Valle sediments and surface water. The maximum concentrations reported in soil, however, were below LANL soil background UTL; thus, mercury is not considered a concern as a bioaccumulator for the 260 outfall surface soils.

Section 6.3.2 states: "Mercury and selenium were detected at maximum values that are below background UTL and are not, therefore, carried forward from the screening analysis as COPECs." *This is for soils only.* Indeed, mercury was carried forward as a COPEC from the screening analysis for Cañon de Valle sediments.

The mercury plot on Figure D-1.5-1 in Appendix D erroneously includes the rejected result of 6.5 µg/l for sample AAB1602, and also shows as detects two undetected, rejected data results: 0.8(UJ) and 0.2(UJ) µg/l for samples AAB1599 and AAB1601, respectively. All three of these samples were analyzed on the same request number (17440). These results were rejected because the holding time for mercury was greatly exceeded, because control of the samples may have been compromised, and because the reported laboratory QA indicators were insufficient. The only usable detected mercury result in the surface water samples was 0.03(J) µg/l for sample 0816-96-0091.

NMED Comment

iv. *6.3.1. 6 Potential Persistent Bioaccumulators and Biomagnifers, pages 6-18 and -19: "Cesium-137 was reported from channel sediments...in surface waters of Canon de Valle, detected radiological PPBs included uranium-234 and -238..." LANL does not provide adequate rationale for excluding these radionuclides from the ecological screening assessment.*

LANL Response

These constituents were considered in the screening assessment. The following statements are extracted from Section 6.3.2:

"The only radiological constituent found greater than background in Cañon de Valle sediments was Cesium-137 (Table D-3.2-9). The methodology of Kelly et al. (1998, 57916) calls for the use of ESLs for soil to be applied to sediments when calculating a HQ based on external dose. On this basis, Cesium-137 has a HQ = 0.03, and is therefore dismissed as a COPEC for Cañon de Valle channel sediments."

and

"There were no radiological constituents detected in the dissolved (filtered) fraction of Cañon de Valle surface water samples; however, uranium-234 and –238 were detected in the unfiltered water samples from Cañon de Valle. Therefore, uranium-234 and –238 are retained as COPECs for the surface waters of Canon de Valle."

NMED Comment

v. *6.3.2 Screening Assessment, page 6-24, second paragraph: "Iron, as well as calcium, magnesium, nitrogen (nitrate), phosphorous (phosphate), and*

sodium are considered naturally occurring nutrients for aquatic systems and not retained as COPECs." Nitrates were part of the Laboratory operations at the 260 outfall area. Nitrates should be retained until evaluated in the screening assessment.

LANL Response

Per NMED's recommendation, nitrates (NO_3), as found in the dissolved fraction of water, will be evaluated quantitatively in the screening assessment.

NMED Comment

vi. *6.3.2 Screening Assessment, page 6-24, second paragraph: "Aluminum occurs in naturally high concentrations...Concentrations of aluminum in alluvial water, groundwater and spring water are not likely to have been influenced by Laboratory operations, and are, therefore considered to be naturally occurring. Thus, aluminum is not retained as a COPEC for alluvial water." Logic is faulty; speculation precedes the screening assessment.*

LANL Response

Per NMED's recommendation, aluminum, as found in the dissolved fraction of water, will be evaluated quantitatively in the screening assessment.

NMED Comment

b. *Discrepancies:*

i. *2.4.3.1.1 Inorganic Chemical Comparison with Background, page 2-28, second paragraph: "DLs were above BVs for antimony, cadmium, total cyanide, and thallium in some samples." According to Table 2.4-2, the DL for selenium was also above BV in 32 samples. Please explain the omission or revise the statement/table.*

LANL Response

The text should read: "DLs were above BVs for antimony, cadmium, total cyanide, selenium and thallium in some samples."

NMED Comment

ii. *Table 2.4-10, Results of Organic Chemical Data Review for Surface and Near-surface Drainage Samples, page 2-54: Dichlorobenzene[1,2-] is represented twice in this table; once as a volatile and once as a semi-volatile.*

LANL Response

The dichlorobenzenes (Dichlorobenzene[1,n-]) are reported in both semi-volatile and volatile suites. However, detection limits for the semi-volatile analysis are typically several orders of magnitude higher.

Sample 0316-95-0034 was not analyzed for volatiles. None of the dichlorobenzenes were detected by semivolatile analysis; the detection limit in this case was 9.2 mg/kg. The undetected result for 0316-95-0034 should not appear in Table 2.4-9, nor should it have been "retained" as a semivolatile in Table 2.4-10.

Samples 0316-95-0044, -45 and -46 were analyzed twice for volatiles due to laboratory difficulties. According to Appendix C (volatiles analysis request number 1173), focussed validation accepted the reanalysis, but as we discovered in the course of reviewing the Chapter 2 tables to respond to your request for supplementary information, the results reported in Table 2.4-9 for these samples are the results from the first analysis. There is little difference between the results for the two analyses (the second value for Dichlorobenzene[1,2-] in this sample 0316-95-0046 was 0.005(J-), for example), so we have not corrected Table 2.4-9. Dichlorobenzene[1,2-] was undetected at 130 mg/kg by the semivolatile analysis of sample 0316-95-0046. Dichlorobenzene[1,2] is correctly "retained" as a volatile chemical in Table 2.4-10.

A corrected version of Table 2.4-10 is provided in Attachment I.

NMED Comment

iii. *2.4.3.2.1 Inorganic Chemical Comparison with Background, page 2-56, third paragraph: "DLs were above BVs for antimony, selenium, silver and total cyanide." According to Table 2.4-11, the DLs for mercury and thallium were also above BVs in some samples.*

LANL Response

The text should read: "DLs were above BVs for antimony, mercury, selenium, silver, thallium and total cyanide in some samples."

NMED Comment

iv. *3.4.3.1 COPCs, page 3-113, third bullet: Nitrobenzene is not indicated as a COPC for surface water. See Table 3.4-35.*

LANL Response

Nitrobenzene should be included in the list of COPCs for surface water in the third bullet on page 3-113.

NMED Comment

v. *3.4.3.1 COPCs, page 3-113, third bullet: "Nitrotoluene (3-)" is not found in Section 3.4 or Table 3.4-35. Perhaps this is a typographical error and should be corrected to read "nitrotoluene(2-)"*

LANL Response

Nitrotoluene (3-) should be Nitrotoluene (2-) in the third bullet on page 3-113. Nitrotoluene in Table 3.4-35 on page 3-96 should read as Nitrotoluene (2-).

NMED Comment

vi. *Table 4.4-19, Results of Inorganic Data Review for Springs - Major Constituents, page 4-73: The following constituents enumerated as "major constituents" on page 4-37 and identified in Table 4.4-18 are missing from the table: lithium, chlorine, fluorine, bromine, carbonate and TDS.*

LANL Response

LANL has included these constituents in revised Table 4.4-19. LANL listed elemental chlorine, fluorine and bromine as constituents on p. 4-37 and what is reported on in this section, and what was analyzed for, are the ionic forms of these constituents, fluoride, chloride, and bromide. LANL incorrectly evaluated the data for several of these constituents (lithium, carbonate, chloride, fluoride, bromide) as minor constituents rather than major constituents in the data review. As indicated on p. 4-76, lithium, carbonate, chloride, fluoride and bromide were eliminated from further consideration as COPCs based on a statistical test.

NMED Comment

vii. *Table 4.4-20, Results of Inorganic Data Review Springs - Minor Constituents, page 4-76: The following constituents enumerated as "minor constituents" on page 4-37 and identified in Table 4.4-18 are missing from the table: silver, arsenic, cadmium, cobalt, chromium, copper, mercury, nickel, lead, antimony, selenium, uranium and zinc.*

LANL Response

LANL will include silver, arsenic, cadmium, cobalt, chromium, copper, mercury, nickel, lead, antimony, selenium, uranium, and zinc in revised Table 4.4-20. LANL inadvertantly omitted these analytes from that table. All, except uranium which was not analyzed during the Phase II RFI in these media, were not greater than background based on statistical tests.

NMED Comment

viii. *Table 6.1-1, Summary of Constituents Retained as COPCs for Further Screening, page 6-1: Nitrotoluene[2-], which was retained as a COPC for surface water samples in Table 3.4-35, is missing from this table; and Trichloroethane[1,1,1-] is not identified as a COPC in any of the preceding tables.*

LANL Response

All inconsistencies between Table 6.1-1 and data review tables will be corrected. Nitrotoluene[2-] and trichloroethane[1,1,1] will specifically be addressed.

NMED Comment

c. *Inconsistent use and handling of water quality parameters:*

i. *Table 3.4-42, Results of Water Quality Inorganic Chemicals Data Review for Alluvial Water Samples in Canon de Valle - Major Constituents, page 3-107: TDS, a water quality parameter, is retained as a RCRA COPC.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, water quality parameters will be included in the revised inorganic chemicals data review tables.

NMED Comment

ii. *3.4.3.1 COPCs, page 3-113, last bullet: TDS is not included as a COPC although many other water quality parameters are.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, water quality parameters will be included in the revised inorganic chemicals data review tables.

NMED Comment

iii. *Table 4.4-20, Results of Inorganic Data Review Springs - Minor Constituents, page 4-76: Bicarbonate is retained as a RCRA COPCs.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, water quality parameters will be included in the revised inorganic chemicals data review tables.

NMED Comment

d. *Missing table:*

i. *3.4.2.1.2 Evaluation of Radionuclides, pages 3-39 and 3-40: A table indicating the "Results of Radionuclide Data Review for Canon de Valle Surface Sediments" has been omitted.*

LANL Response

Cesium 137 is retained as the only radionuclide COPC. This is mentioned in text, but not listed in a table for "Results of Radionuclide Data Review for Cañon de Valle Surface Sediments". The folowing table will be inserted at the bottom of page 3-40.

Table 3.4-6(b)
Results of Radionuclide Data Review for Cañon de Valle Surface Sediments

Analyte	Media	Result	Rationale for Retaining or Eliminating Anlyte as a COPC
Cesium-137	Sediment	Retained	Reported above background in 1 of 31 samples.

NMED Comment

e. Information required for clarification purposes:

i. LANL should define and consistently distinguish between the various types of water (surface water, alluvial water, spring water and borehole water), sediments, and soils encountered at the site in both text and tables.

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL will better identify the media in the revised data review tables provided in Attachment I. LANL has provided greater specifity in the 'media' column in each of these tables and in the discussion.

NMED Comment

ii. LANL should enhance all "Results..." tables by including more detailed information such as that found in Table 2.4-4 on page 2-42.

LANL Response

LANL will enhance all results tables with the level of detail shown in Table 2.4-4 on page 2-42. A similar level of detail is already provided in the Chapter 2 tables, and are, therefore, not included in Attachment I. This increased level of detail is provided in the revised tables for Chapters 3 and 4 in Attachment I.

NMED Comment

iii. LANL should organize the constituents in Table 6.1-1 by media and provide the descriptor of "carcinogenic" or "non-carcinogenic" in Table 6.1-1 to make a smooth transition to the next phase of the evaluation (Section 6.2).

LANL Response

Table 6.1-1 will be revised to list COPCs by medium. A column will also be added to designate whether the constituent is associated with carcinogenic or noncarcinogenic effects in humans.

NMED Comment

f. Consistency with Appendix D:

i. Tables D-2.3-1 through D-2.3-28 indicate that the the following constituents should be retained as COPCs; however, the tables in the main body of the report do not include them:

dichloroethane (may be a typographical error - dichloromethane?)
isopropyltoluene[4-]
dinitro-2-methylpheno[4,6-]
phenanthrene, and
lead

LANL Response

Tables D-2.3-1 through D-2.3-28 were checked against tables in the main body of the report to ensure consistency. The following chemicals were checked and were found in the appropriate text tables: dichloroethane (Table 3.4-38), isopropyltoluene[4-] (Table 3.4-12), dinitro-2-methylphenol[4,6-] (Table 3.4-38), phenanthrene (Table 2.4-20) and lead (Tables 2.4-13, 3.4-4, 3.4-28).

NMED Comment

2. *LANL should include in the report a master table indicating which types of analyses (radionuclide, VOC, SVOC, metals, water quality parameters, etc.) were conducted on each of the source, alluvial, and subsurface media.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL is providing a table (Table RSI2) showing the number of each type of analyte suite analyzed for each media.

Table RSI 2
Summary of Numbers of Laboratory Samples Taken During PRS 16-021(c) RFI Investigations

Media	Anions	Barium	HE	Inorganic Chemicals[1]	Nitrate	Semi-volatiles	VOA	Total U	Water Qual.
Outfall – sediment	0	0	51	51	0	51	18	37	0
Outfall – QBt4 tuff[2]	0	0	39	39	0	39	40	0	0
Outfall – QBT3 tuff	0	0	2	2	0	2	2	0	0
Outfall – Surge bed	0	0	1	1	0	1	1	0	0
Canon de Valle – surface sediment	0	0	55	55	23	36	12	31	0
Canon de Valle – Subsurface sediment/tuff	0	0	8	8	0	8	8	0	0
Canon de Valle – Surface water	3	0	47	51	48	41	37	27	3
Canon de Valle - Alluvial water	14	0	14	14	7	14	11	0	6
Intermediate Depth Borehole – tuff	0	0	8	8	0	8	7	0	0
Intermediate Depth Borehole – water	0	1	3	2	0	2	1	0	0
Springs - water	12	0	27	38	6	26	18	0	18

1. This includes both the inorganics and inorganics + cyanide suites. Not all were analyzed for cyanide.
2. This includes 15 samples from the unit that was referred to as QBT5 in the Phase II report.

NMED Comment

3. *3.3.4.2.3.1 Evaluation of Inorganic Chemicals, page 3-85, second paragraph: "The data set is not complete enough to compare concentrations of barium over time because surface water was not sampled from each location during each sampling event." The lack of comparable data sets is a setback for the ER Project as a whole. LANL should obtain periodic analytical*

"snapshots" of both the surface water and groundwater systems and should handle the sampling methodology and types of analyses for each medium consistently. That is, LANL should use the same types of pumps to obtain all groundwater samples; analyze all groundwater samples for the same analyses, etc.

LANL Response

The ER Project agrees that analytical "snapshots" of surface water and groundwater systems are necessary. We are working toward that goal by consistently using the same methods for collection, the same sampling locations, and requesting the same analyses. This is outlined in the Sampling and Analysis section, Chapter 6 of the "16-021(c) CMS Plan".

NMED Comment

4. *In order to ensure consistency between treatment of media samples and to provide a complete "picture" of the contamination present, RPMP recommends the following additional analyses be conducted:*
   a. *Radionuclides in all water samples*
   b. *Nitroglycerin*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL will add these analytes for one year of sampling and, based on whether any detects have occurred, determine whether to continue to analyze for them.

NMED Comment

5. *2.3.1 Summary, page 2-7, last paragraph of section: "Although above-background levels of uranium were reported in some Phase I samples, no uranium analyses were required by the Phase II sampling and analysis plan for the source area." LANL should explain where the elevated uranium concentrations were identified (source area, etc.) and provide a more technically valid reason for not conducting analyses for uranium other than it was not required by the Phase II SAP.*

LANL Response

About 40% of the Phase I RFI uranium results were above the background range for uranium in soil samples, and almost all of them (similar to almost all results for samples collected to date at TA-16) were above the background value for soils. The apparent lack of comparability between TA-16 and background uranium analyses represents a continuing problem in the evaluation of TA-16 data.

Although elevated by any background criteria, including the local background currently being analyzed and developed for the V-Site VCM Completion Report (in preparation), the maximum value of 8.71 mg/kg in Phase I samples from the source area was far below the level of risk-based concern that was used for screening purposes in the Phase I report. A well-defined decreasing trend in uranium concentration in sediments downgradient in the outfall was defined. Uranium in the Phase I samples was also spatially well-correlated with a number of other metals above background, including barium, copper, and zinc. These inorganic chemicals were analyzed in all Phase II RFI

samples from the source area. For these reasons, further exploration of the extent of uranium releases, which would have required an additional analytical suite, was judged unnecessary in the source area.

However, uranium was analyzed in samples collected in the Phase II RFI of the alluvial system:

- Cañon de Valle sediments. The background value used in Table 3.4-3(a) is probably too high, but the normal background value for sediments, 2.22 mg/kg, is probably too low for the same reasons that the soil background value of 1.82 mg/kg is inappropriate. Statistically, the Cañon de Valle sediment sample results are indistinguishable from the local background for soils developed for the V-Site VCM Completion Report.

- Cañon de Valle surface water. The results were statistically indistinguishable from the available surface water background data.

Uranium analyses will be included in verification sampling associated with the proposed Interim Measure at the source area. Uranium will also be added to the full suite analyses to be performed during Phase III RFI described in the CMS Plan.

NMED Comment

6. Figures 2.4-9 through -24, pages 2-79 through 2-95: LANL should clarify how to interpret the following:

- *the symbol ">" used to mean both "Dtech RDX>5 ppm" and "Dtech TNT>5 ppm"*
- *the series of "x"s (magnitude of concentration?)*

LANL Response

In the screening results column of Figures 2.4-9 through 2.4-22, immediately following the sample ID (last 7 characters only), LANL is providing the following clarification:

- the number of x's represents a detected result of the D-Tech RDX analysis rounded off to the nearest integer. (0.5 is rounded up to 1, 1.5 to 2, etc.) Thus "x" means a result between 0.5 and 1.5 ppm, "xx" means between 1.5 and 2.5 ppm, etc.
- "xxxxx>" means the measurement exceeded 5 ppm or was reported above the upper D-Tech limit (which is about 5 ppm for an undiluted sample). Higher detection limits are resolvable with diluted samples.
- Similarly, the number of #'s represents the rounded result of the D-Tech TNT analysis, and
- #####> (e.g., Figure 2.4.18) means this result was greater than 5 ppm or exceeded the D-Tech limit.

NMED Comment

7. Appendix B: A location map of all the cited springs should be included.

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL is including an additional figure (see Attachment II) showing the TA-16 water sampling localities that are shown in the Tables B-4.1-x in Appendix B, which were not included in Figure B-4.0-1. Background spring locations are available as Plate I of Blake et al. (Blake 1995, 49931).

Incorporate Into Subsequent Relevant Submittal

LANL agrees with all of HRMB's comments in this section except:

NMED Comment

8. *Appendix A, Acronyms and Glossary: LANL should provide citations for those definitions obtained from guidance or reference documents.*

LANL Response

LANL would prefer not to provide citations for all those definitions in Appendix A obtained from guidance or reference documents (some glossary defintions have citations). At this point, LANL believes there would be minimal added value in trying to determine where all the existing definitions were derived. Many date back to the early days of the LANL ER project. LANL would be glad to research the sources of definitions on a case-by-case basis. LANL would like to discuss this issue further with the HRMB at a programmatic level.

ATTACHMENT B

Immediate Response Required:

NMED Comment

1. *Institutional Controls have not been adequately addressed/evaluated as part of the remedy selection process.*

LANL Response

LANL proposes to insert a new section 3.4.6, Institutional Controls, containing the following text:

3.4.6 Institutional Controls

Controls on the use of land and other resources are often a key element of environmental cleanups. Such controls can play an important role in limiting risk, and are often needed to ensure that engineered remedies are not affected by later activities as described in "Institutional Controls: A Reference Manual," USEPA Working Group Draft, March 1998. EPA has taken the position that institutional controls under RCRA corrective actions will be consistent with institutional controls under CERCLA. A Notice published May 1, 1996 (61 Fed. Reg. 19448, May 1, 1996), states that "EPA expects to use institutional controls such as water and land use restrictions primarily to

supplement engineering and controls as appropriate for short and long term management to prevent or limit exposure to hazardous waste and constituents. EPA does not expect that institutional controls will often be the sole remedial action."

The LANL Site Development Plan (LANL 1995, 57224) designates TA-16 for continued industrial operations, such as HE research and testing. This commitment to continued industrial operations in effect provides an institutional control of the site that will be considered in the remedy selection process. The most recent version of the cited reference manual will be used during the remedy selection to guide the incorporation of institutional controls as an element of the overall strategy.

NMED Comment

2. *1.3 Conceptual Understanding and approach, page 7, last paragraph: "...potential impacts to groundwater and/or surface water quality will continue to be evaluated during the CMS process and in a site-specific risk assessment (SSRA)." Please provide an anticipated schedule date for the submittal of this SSRA.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL will implement a phased approach to the SSRA. LANL plans to complete the SSRA for the surface soil and water pathways by the end of the first quarter of FY 2001. LANL will also add a receptor based on a groundwater exposure pathway and provide an addendum to that SSRA after FY 01 following completion of deep groundwater wells located within and around TA-16.

NMED Comment

3. *4.3 Points of Compliance, page 32, top paragraph: "EPA has established that the POC for soils (and by extension, alluvium) is limited to near-surface soils because subsurface soils have limited likelihood of exposure to receptors." Please provide a reference for this statement.*

LANL Response

LANL used the following reference for this statement:

55 Fed. Reg. 30832, July 27, 1990

This statement is also consistent with the May 1, 1996 Proposed Rules (61 Fed.Reg. 19450, May 1, 1996), "Points of compliance for soils are generally selected to ensure protection of human and environmental receptors against direct exposure and to take into account protection of other media from cross-media transfer (e.g. via leaching, runoff, or airborne emissions) of contaminants."

LANL should have referenced these documents in the CMS Plan.

NMED Comment

4. *3.4.3.1 through 3.4.3, [Multiple headings], page 32: "...the preliminary POC for [alluvium, surface water, groundwater]...will be defined as...within areas of contamination defined in*

Chapter 2... "Chapter 2 does not adequately define what is meant by "areas of contamination." Please clarify.

LANL Response

The areas of contamination, by media, are as follows:

For the 260 outfall sediments - The area of contamination extends from the outfall pipe to the active channel of Cañon de Valle. The lateral extent of this area of contamination is restricted to the axis of the drainage channel, as shown in RFI figures 2.4-1 and 2.4-2.

Cañon de Valle alluvium – Limited sampling of alluvium has been conducted to-date. The Phase III sampling and analysis campaign detailed in Section 6 of the CMS Plan includes geomorphic mapping of the sediments. The current conceptual model is that all the sediments in the active channel and adjacent overbank areas contain detectable contaminants. The geomorphic mapping will include sampling to estimate contaminant concentrations.

Groundwater – The first round of sampling for the alluvial wells in Cañon de Valle show elevated HE and barium. The current conceptual model is that the alluvial groundwater is contaminated from Peter Seep to down canyon where surface flow is lost. Deep groundwater has been sampled during the advance of drill hole R-25 to a depth of 1942 ft. Preliminary results show ground water contamination in the deep aquifer. We propose addressing the alluvial aquifer contamination separately from the deeper contamination. These two aquifers are separated by a nominal 700 foot vadose zone. The technical approaches, schedules, and resource requirements for these aquifers are likely to be different.

NMED Comment

5. *Table 6.3-1, Summary of Sampling and Analysis for the Connectivity Investigation at the TA-16-260 Outfall Source Area, page 63: LANL should analyze for HE in the source area to determine the concentrations remaining in the source area.*

LANL Response

The engineering design for the Interim Measure to remove the outfall sediments will include a post-excavation sampling and analysis plan to characterize the contamination left in place, including HE.

NMED Comment

6. *6.3.4 Alluvial Water Dynamics, page 72, second paragraph: "At its eastern end, the surface water system terminates near the point where the canyon floor intersects the stratigraphic contact between units Qbt3 and Qbt2 of the Tshirege Member of the Bandelier Tuff." Please clarify if this contact is related to the Water Canyon fault system and describe any potential impacts that this fault zone might have on contaminant transport.*

LANL Response

This contact does not appear to be related to the proposed location of the Water Canyon fault, as mapped. The proposed Water Canyon fault, which does not have direct surface expression but which has been proposed based on geophysical data, is hypothesized to run north-south through the east side of the TA-16 Burning Ground (see Figure B-3.0-1 of the RFI Report for PRS 16-021(c) dated September 1998). This location is approximately 3000 feet west of the Qbt3-Qbt2 contact in Canon de Valle.

NMED Comment

7. *6.3.4.1 Investigation Design, page 74, first paragraph: "Field measurements for all samples will include pH, temperature, conductance, and RDX." Please explain why RDX, in particular, was chosen as a field measurement.*

LANL Response

Field test kits for RDX in water are reliable and have low detection limits. The other HE that is reliably detected with a field method is TNT. This test is not being performed because the maximum TNT concentration is an order of magnitude below the site-specific screening levels for the human health exposure scenarios that include the water pathway. In addition, the absolute abundance of RDX is typically much higher than that of TNT – it is a much more reliable indicator parameter for HE contamination than is TNT. The intent is to gain a cost efficiency by using a field method and to support the field methods with laboratory analysis twice a year. The samples for laboratory analysis will be collected during high baseflow and low baseflow conditions.

NMED Comment

8. *6.3.4.2 Sampling Activities, page 75, last paragraph: "The locations [of the piezometers] in the perennial reach portion of the canyon will be determined after the geomorphic survey." Please explain how the geomorphic survey will be used to site the piezometers.*

LANL Response

The piezometers are intended to monitor the water levels in the alluvium in the vicinity of the losing zone of the canyon. The geomorphic survey should identify the sediments that have been deposited during laboratory operations. If we can locate the piezometers in new sediments near the losing zone, then we will be able to assess the dynamics of alluvial groundwater in sediment packages that are likely be contaminated by laboratory practices. This is preferable to monitoring the dynamics of alluvial waters in packages that have not been impacted by the operations at TA-16.

NMED Comment

9. *Table 6.3-4, Summary of Annual Sampling and Analysis for the Investigation of Alluvial Water Dynamics, page 78: Please indicate which samples and analyses will be analyzed in the field or in the laboratory.*

LANL Response

Attachment III provides an enhanced Table 6.3-4 that delineates in detail which samples and analyses are field samples and laboratory samples.

NMED Comment

10. *6.3.5.2 Investigation Design, page 79, first paragraph: "Geomorphic units will be mapped in Canon de Valle and Martin Spring Canyon. In Canon de Valle, this mapping will be conducted from the head of Peter Seep to below the barium anomaly at the bottom of MDA P..." Geomorphic mapping should be conducted for the entire study area as defined in Figure 3.1-1.*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL will complete as much of the geomorphic mapping in Canon de Valle during FY 99 that the limited availability of geomorphic mapping resources allow. This will include all reached that are necessary to complete the risk assessments for the CMS. The remaining reaches in the Canon de Valle system will be mapped during the Canyons Focus Area investigations in the Water Canyon and Canon de Valle system.

NMED Comment

11. *6.4.1.2 Field Screening, page 81, top paragraph: "These two methods [Spectrace 9000 and ion specific electrodes] will be compared, and the more effective will be implemented. Please provide a description of how these methods will be compared to determine which is more effective.*

LANL Response

Sample material will be homogenized and analyzed by these two methods, as well as by laboratory-based ion chromatography. The method that produces results most consistent with ion chromatography will be used.

NMED Comment

12. *6.4.2 Field Analytical Procedures, page 82: "Above is a table of the analytical protocols for field screening analyses." No table is presented.*

LANL Response

Section 6.4.2 is not necessary and should be deleted. Table 6.4-1 provided the relevant screening information. It has been updated to include the Dtech and Ensys kits for HE and the bromide screening with an ion specific electrode.

Updated Table 6.4-1
Field Screening Procedures

Method	Standard Operating Procedure
D-Tech Screening (RDX)	Manufacturer's Instructions
Ensys Screening	Manufacturer's Instructions
Ion Specific Bromide Detector	Manufacturer's Instructions
Physical Parameters in Water (pH, Conductivity, and Temperature)	LANL-ER-SOP-06.02
Percent Moisture	ASTM, ER SOP is pending
XRF	LANL-ER-SOP-10.06

NMED Comment

13. *6.4.3 Sample Handling and Tracking, page 82: "Archived samples for potential stable isotope analysis will be stored in a glass vial with a polyseal cap and refrigerated." Please indicate if there is a standard operating procedure which governs the handling of stable isotope analysis and state at what temperature these samples must be maintained.*

LANL Response

We do not have a standard operating procedure for stable isotope sampling and analysis. The refrigerator where the samples are archived is maintained at 6-7 degrees Celcius. This is standard practice in the isotope geochemical community.

NMED Comment

14. *6.4.3 Sample Handling and Tracking, page 82: "An investigation-specific archiving procedure will be developed and presented in the field implementation plan for the Phase III investigation." Please indicate when the FIP is anticipated for submittal to the AA*

LANL Response

Per the discussion between LANL representatives and HRMB personnel on April 12, 1999, LANL will not submit the FIP to the AA. The attached DRAFT SOP for archiving of isotope samples is provided as Attachment IV.

Incorporate Into Subsequent Relevant Submittal

LANL will incorporate into the subsequent submittal all of the AA's comments from this section.

Attachment I – Revised Tables from Chapters 2, 3, 4 and 6

TABLE 2.4-10

RESULTS OF ORGANIC CHEMICAL DATA REVIEW FOR SURFACE AND NEAR-SURFACE DRAINAGE SAMPLES

Analyte	Media	Result	Rationale for Retaining as a COPC
Volatiles			
Acetone	Sediment	Retained	Reported in four samples at less than 0.07 mg/kg
Benzene	Sediment	Retained	Reported in one sample at 0.002 mg/kg
Butylbenzene[sec-]	Sediment	Retained	Reported in one sample at 0.04 mg/kg
Dichlorobenzene[1,2-]	Sediment	Retained	Reported in one sample at 0.01 mg/kg
Isopropyltoluene[4-]	Sediment	Retained	Reported in three samples at less than 0.2 mg/kg
Toluene	Sediment	Retained	Reported in one sample at 0.002 mg/kg
Trichloroethane[1,1,1-]	Sediment	Retained	Reported in one sample at 0.065 mg/kg
Trimethylbenzene [1,2,4-]	Sediment	Retained	Reported in two samples at less than 0.1 mg/kg
Semivolatiles			
Anthracene	Sediment	Retained	Reported in several samples at up to 540 mg/kg
Benzoic Acid	Sediment	Retained	Reported in several samples, less than 0.5 mg/kg
Bis(2-ethylhexyl)phthalate	Sediment	Retained	Reported in almost half of the samples, at up to 4600 mg/kg
Dinitrotoluene[2,4-]	Sediment	Retained	Reported in several samples (a high explosive)
Dinitrotoluene[2,6-]	Sediment	Retained	Reported in several samples (a high explosive)
Hexachlorocyclopentadiene	Sediment	Retained	Reported in one sample at 9.6 mg/kg
Nitrosodiphenylamine [N-]	Sediment	Retained	Reported in one sample at 0.06 mg/kg
Phenanthrene	Sediment	Retained	Reported in several samples at up to 4.6 mg/kg
Pyrene	Sediment	Retained	Reported in one sample at 0.07 mg/kg

Table 3.4-3

Results of Inorganic Data Review for Cañon de Valle Surface Sediments

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Aluminum	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Antimony	Alluvial Surface Sediment	Retained	Not detected in any sample, but detection limits exceed the sediment background value.
Arsenic	Alluvial Surface Sediment	Retained	Three samples are above the sediment background.
Barium	Alluvial Surface Sediment	Retained	52 of 55 samples well above the sediment background value, almost the full length of Cañon de Valle.
Beryllium	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Cadmium	Alluvial Surface Sediment	Retained	Four samples above the sediment background value, and statistically greater than the background distribution.
Calcium	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Chromium, total	Alluvial Surface Sediment	Retained	Two samples are above the sediment background value.
Cobalt	Alluvial Surface Sediment	Retained	26 samples are significantly above the sediment background distribution.
Copper	Alluvial Surface Sediment	Retained	26 samples above the sediment background value, and statistically greater than the background distribution.
Cyanide, total	Alluvial Surface Sediment	Retained	One sample detected, and most detection limits in these data exceed the detection limit reported in the background data set.
Iron	Alluvial Surface Sediment	Retained	Three samples reported above the sediment background value. However, only one is significantly above. (22000 mg/kg)
Lead	Alluvial Surface Sediment	Retained	Exceeds background in over half of the samples.
Magnesium	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Manganese	Alluvial Surface Sediment	Retained	Nine samples exceed the sediment background value.
Mercury	Alluvial Surface Sediment	Retained	Ten samples exceed the sediment background value.
Nickel	Alluvial Surface Sediment	Retained	Twenty-five samples exceed the sediment background value.
Potassium	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Selenium	Alluvial Surface Sediment	Retained	Detected in eleven samples above the sediment background value, however most detection limits exceed the sediment background value.
Silver	Alluvial Surface Sediment	Retained	20 samples above the background detection limit, as well as some reported as estimated below the background detection limit.
Sodium	Alluvial Surface Sediment	Eliminated	All 55 samples are below the sediment background value.
Thallium	Alluvial Surface Sediment	Retained	Ten samples exceed the sediment background value.
Uranium	Alluvial Surface Sediment	Eliminated	All 31 samples are below the sediment background value.
Vanadium	Alluvial Surface Sediment	Retained	Seven samples exceed the sediment background value.

Table 3.4-4

Results of Inorganic Data Review for Cañon de Valle Surface Sediments

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Zinc	Alluvial Surface Sediment	Retained	Six samples exceed the sediment background value.

Table 3.4-9

Results of HE Data Review for Cañon de Valle Sediments

Analyte	Media	Result	Rationale for Retaining as a COPC
Amino-2,6-dinitrotoluene[4-]	Alluvial Surface Sediment	Retained	Detected in 19 samples at levels less than 1 mg/kg.
Amino-4,6-dinitrotoluene[2-]	Alluvial Surface Sediment	Retained	Detected in 6 samples at levels up to 1.02 mg/kg.
HMX	Alluvial Surface Sediment	Retained	Detected in 19 samples at levels up to 170 mg/kg. The majority of detections are located in the stretch of Cañon de Valle from the outfall to MDA-P.
Nitrobenzene	Alluvial Surface Sediment	Retained	Detected in 1 sample at 0.088 mg/kg. This sample is located in Cañon de Valle down drainage from MDA-P.
Nitrotoluene[3-]	Alluvial Surface Sediment	Retained	Detected in 1 sample at 0.354 mg/kg. This sample is located in Cañon de Valle down drainage from MDA-P.
RDX	Alluvial Surface Sediment	Retained	Detected in 14 samples at levels up to 42 mg/kg. The majority of detections are located in the stretch of Cañon de Valle from the outfall to MDA-P.
Trinitrobenzene[1,3,5-]	Alluvial Surface Sediment	Retained	Detected in 1 sample at 0.114 mg/kg. This sample is located in Cañon de Valle down drainage from MDA-P.
Trinitrotoluene[2,4,6-]	Alluvial Surface Sediment	Retained	Detected in 10 samples at levels less than 1.5 mg/kg.

Table 3.4-12

Results of Other Organic Chemical Data Review for Cañon de Valle Sediments

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Volatiles			
Acetone	Alluvial Surface Sediment	Retained	Reported in one sample at 0.048 mg/kg at an overbank sample location just up drainage from SWSC Spring.
Dichlorodifluoromethane	Alluvial Surface Sediment	Retained	Reported in three overbank sediment samples at less than 0.006 mg/kg.
Isopropyltoluene	Alluvial Surface Sediment	Retained	Reported in one overbank sediment sample at 0.059 mg/kg, located just up drainage from SWSC Spring.
Toluene	Alluvial Surface Sediment	Retained	Reported in four overbank samples at less than 0.01 mg/kg.
Trichloro-1,2,2-trifluoroethane(1,1,2-)	Alluvial Surface Sediment	Retained	Reported in one overbank sample at 0.003 mg/kg located down drainage from Burning Ground Spring.
Trichlorofluoromethane	Alluvial Surface Sediment	Retained	Reported in two overbank samples at less than 0.004 mg/kg.
Semivolatiles			
Benzoic Acid	Alluvial Surface Sediment	Retained	Reported in three samples at less than 0.80 mg/kg. These are both overbank and canyon bottom sediments.
Benzyl Alcohol	Alluvial Surface Sediment	Retained	Reported in one overbank sample at 0.24 mg/kg located just up drainage from SWSC Spring.
Bis(2-ethylhexyl)phthalate	Alluvial Surface Sediment	Retained	Reported in 15 samples at less than 0.74 mg/kg. These detects were located in a large section of Cañon de Valle and do not appear to have a distinct trend.
Di-n-butylphthalate	Alluvial Surface Sediment	Retained	Reported in 31 samples at less than 11 mg/kg. These detects were located in a large section of Cañon de Valle.
Diethylphthalate	Alluvial Surface Sediment	Retained	Reported in six samples at less than 0.5 mg/kg.
Fluoranthene	Alluvial Surface Sediment	Retained	Reported in one sample at 0.06 mg/kg located just up drainage from SWSC Spring.
Phenol	Alluvial Surface Sediment	Retained	Reported in one sample at 0.34 mg/kg located just up drainage from SWSC Spring.
Pyrene	Alluvial Surface Sediment	Retained	Reported in one sample at 0.052 mg/kg located just up drainage from SWSC Spring.

Table 3.4-16

Results of Inorganic Data Review for Cañon de Valle Subsurface Samples

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Aluminum	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Antimony	Alluvial Subsurface Sediment/Tuff	Retained	Not detected in any sample, but detection limits exceed the sediment and tuff background values.
Arsenic	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Barium	Alluvial Subsurface Sediment/Tuff	Retained	Five of eight samples above the sediment and tuff background values, up to 300 mg/kg.
Beryllium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Cadmium	Alluvial Subsurface Sediment	Retained	Not detected in any sample, but the detection limit exceeds the sediment background value.
Calcium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Chromium, total	Alluvial Subsurface Tuff	Retained	Two samples slightly above the tuff background value, up to 8.3 mg/kg.
Cobalt	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Copper	Alluvial Subsurface Tuff	Retained	One sample above the sediment background value, at 4.99 mg/kg.
Cyanide, total	Alluvial Subsurface Tuff	Retained	Not detected in any sample, but most detection limits in these data exceed the detection limit in the background data set.
Iron	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Lead	Alluvial Subsurface Tuff	Retained	Two samples from different depths in the same borehole exceed the tuff background value, up to 22 mg/kg. This borehole is located down drainage from Burning Ground Spring.
Magnesium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Manganese	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.

Table 3.4-16

Results of Inorganic Data Review for Cañon de Valle Subsurface Samples

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Mercury	Alluvial Subsurface Sediment/Tuff	Retained	Not detected in any sample, but detection limits exceed the sediment and tuff background values.
Nickel	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Potassium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Selenium	Alluvial Subsurface Sediment/Tuff	Retained	Not detected in any sample, but detection limits exceed the sediment and tuff background values.
Silver	Alluvial Subsurface Sediment/Tuff	Retained	Not detected in any sample, but detection limits exceed the sediment and tuff background values.
Sodium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Thallium	Alluvial Subsurface Sediment/Tuff	Retained	Not detected in any sample, but detection limits exceed the sediment and tuff background values.
Vanadium	Alluvial Subsurface Sediment/Tuff	Eliminated	All eight samples reported below the sediment and tuff background values.
Zinc	Alluvial Subsurface Tuff	Retained	One sample 0.5 mg/kg above the tuff background value at 64 mg/kg.

Table 3.4-19

Results of HE Data Review for Cañon de Valle Subsurface Sediments

Analyte	Media	Result	Rationale for Retaining as a COPC
Dinitrobenzene (1,3-)	Alluvial Subsurface Sediment	Retained	Detected at a depth of 42" in one sediment sample, at 0.097 mg/kg.
HMX	Alluvial Subsurface Tuff	Retained	Detected at a depth of 109.2" in one tuff sample, at 5.3 mg/kg.
Trinitrobenzene(1,3,5-)	Alluvial Subsurface Tuff	Retained	Detected at a depth of 109.2" in one tuff sample, at 0.84 mg/kg.
Trinitrotoluene(2,4,6-)	Alluvial Subsurface Tuff	Retained	Detected at a depth of 109.2" in one tuff sample, at 0.3 mg/kg.

Table 3.4-22

Results of Other Organic Data Review for Subsurface Cañon De Valle Samples

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Volatiles			
Acetone	Alluvial Subsurface Sediment/Tuff	Retained	Reported in six of eight samples above the detection limit.
Methylene Chloride	Alluvial Subsurface Tuff	Retained	Reported in one sample at a depth of 109.2" at 0.18 mg/kg
Semivolatiles			
Bis(2-ethylhexyl)phthalate	Alluvial Subsurface Tuff	Retained	Reported in one sample at a depth of 87" at 0.0036 mg/kg

Table 3.4-27

Results of Inorganic Data Review for Surface Water—Major Constituents

Analyte	Media	Result	Rationale for Retaining as a COPC
Bromide	Surface Water	Retained	Although the 3 samples analyzed for this constituent were undetected, the detection limits appear to be significantly greater than the background range based on the Wilcoxon statistical test.
Calcium	Surface Water	Retained	54 of 55 samples were detected in the surface water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test, and appear to decrease in concentration as they move downstream in Cañon de Valle.
Chloride	Surface Water	Retained	Although the data set is small, 3 of 3 samples were detected and appear to be significantly greater than the background range based on the Wilcoxon statistical test.
Fluoride	Surface Water	Eliminated	Although the data set is small, 1 of 3 samples was detected and does not appear to be significantly greater than the background range based on the Wilcoxon statistical test.
Magnesium	Surface Water	Retained	42 of 55 samples were detected in the surface water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Potassium	Surface Water	Retained	54 of 55 samples were detected in the surface water data set. These samples are significantly greater than the background range, with the highest concentrations upstream in the canyon from the 260 outfall.
Sodium	Surface Water	Retained	45 of 55 samples were detected in the surface water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Sulfate	Surface Water	Eliminated	3 of 3 samples were detected and appear to be within the background range based on the Wilcoxon statistical test.

Table 3.4-28

Results of Inorganic Data Review for Surface Water

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Alkalinity	Surface Water	Retained	Although only one sample was analyzed for alkalinity, it appears to be quite high (67 000 ug/L).
Aluminum	Surface Water	Eliminated	42 samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Antimony	Surface Water	Retained	4 of 55 samples were detected in the surface water data set. These samples as well as many detection limits appear to be significantly higher than the background range, based on the Wilcoxon statistical test.
Arsenic	Surface Water	Eliminated	Three samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Barium	Surface Water	Retained	All samples were detected in the surface water data set. The highest concentration (6520 ug/L) is located where the 260 outfall intersects Canon de Valle.
Beryllium	Surface Water	Eliminated	Three samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Cadmium	Surface Water	Eliminated	Three samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Chromium	Surface Water	Retained	Four of 55 samples were detected in the surface water data set. The surface water data set was greater than the background range based on Wilcoxon statistical test.
Cobalt	Surface Water	Eliminated	One sample was detected in the surface water data set. This sample was not significantly different than the background range, based on the Wilcoxon statistical test.
Conductivity	Surface Water	Retained	Only one sample was analyzed for conductivity (160 UMHOS). There was no comparison made.
Copper	Surface Water	Eliminated	Six samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Cyanide	Surface Water	Eliminated	Two samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Iron	Surface Water	Eliminated	39 samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Lead	Surface Water	Retained	17 of 55 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.
Mercury	Surface Water	Retained	One of 55 samples was detected in the surface water data set. No comparison was made with the background data set.
Manganese	Surface Water	Retained	29 of 55 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.

Table 3.4-28

Results of Inorganic Data Review for Surface Water

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Nickel	Surface Water	Retained	25 of 55 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.
Nitrogen, nitrate + nitrite (N)	Surface Water	Retained	11 of 27 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.
Nitrate (NO3)	Surface Water	Eliminated	Two samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Nitrite (NO2)	Surface Water	Retained	Two of four samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.
Selenium	Surface Water	Eliminated	Three samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Silver	Surface Water	Eliminated	One sample was detected in the surface water data set. This sample was not significantly different than the background range, based on the Wilcoxon statistical test.
Thallium	Surface Water	Eliminated	Two samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Total Dissolved Solids	Surface Water	Eliminated	These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Total Suspended Solids	Surface Water	Eliminated	These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Turbidity	Surface Water	Eliminated	These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Uranium	Surface Water	Eliminated	24 samples were detected in the surface water data set. These samples were not significantly different than the background range, based on the Wilcoxon statistical test.
Vanadium	Surface Water	Retained	13 of 55 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.
Zinc	Surface Water	Retained	16 of 56 samples were detected in the surface water data set. The surface water data set was greater than the background range based on the Wilcoxon statistical test.

Table 3.4-31

Results of Radioisotopes Data Review for Surface Water Samples

Analyte	Media	Result	Rationale for Retaining as a COPC
Uranium-234	Surface water	Retained	One sample exceeded the detection limit at 0.144 pCi/L.
Uranium-238	Surface water	Retained	One sample exceeded the detection limit at 0.135 pCi/L.

Table 3.4-35

Results of HE Data Review for Surface Water

Analyte	Media	Result	Rationale for Retaining as a COPC
Amino-2,6-dinitrotoluene[4-]	Surface Water	Retained	Thirty-two of the 35 samples exceeded the detection limit up to 53.2 ug/L.
Amino-4,6-dinitrotoluene[2-]	Surface Water	Retained	Twenty-six of the 28 samples exceeded the detection limit up to 43.2 ug/L.
Dinitrotoluene[2,4-]	Surface Water	Retained	Twenty-one of the 48 samples exceeded the detection limit up to 0.324 ug/L.
RDX	Surface Water	Retained	Thirty-two of the 48 samples exceeded the detection limit up to 818 ug/L.
HMX	Surface Water	Retained	Thirty-two of the 48 samples exceeded the detection limit up to 160 ug/L.
Nitrobenzene	Surface Water	Retained	Two of the 48 samples exceeded the detection limit up to 0.53 ug/L.
Nitrotoluene[2-]	Surface Water	Retained	Nineteen of the 47 samples exceeded the detection limit up to 2.28 ug/L.
Trinitrobenzene[1,3,5-]	Surface Water	Retained	One of the 48 samples exceeded the detection limit at 0.207 ug/L.
Trinitrotoluene[2,4,6-]	Surface Water	Retained	Fourteen of the 48 samples exceeded the detection limit up to 3.49 ug/L.

Table 3.4-38

Results of Other Organic Compound Data Review for Surface Water

Analyte	Media	Result	Rationale for Retaining as a COPC
Acetone	Surface water	Retained	One out of 37 samples detected at 8 ug/L
Bis(2-ethylhexl)phthalate	Surface water	Retained	Three out of 40 samples detected up to 13 ug/L
Chlorophenol(2-)	Surface water	Retained	One out of 40 samples detected at 10 ug/L
Di-n-octylphthalate	Surface water	Retained	One out of 39 samples detected at 10 ug/L
Dichloroethane[1,2-]	Surface water	Retained	Three out of 37 samples detected up to 7 ug/L
Dinitro-2-methylphenol[4,6-]	Surface water	Retained	One out of 40 samples detected at 50 ug/L
Dinitrotoluene[2,6-]	Surface water	Retained	One out of 40 samples detected at 1 ug/L
Methylene chloride	Surface water	Retained	One out of 37 samples detected at 6 ug/L

Table 3.4-42

Results of Water Quality Inorganic Chemicals Data Review for Alluvial Water Samples in Cañon de Valle—Major Constituents

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Boron	Alluvial Water	Retained	Only 2 samples were analyzed and not statistically compared to the background alluvial water data set, but they appear to be high.
Bromide	Alluvial Water	Eliminated	Two of 14 samples were detected in the alluvial water data set. These samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Calcium	Alluvial Water	Retained	10 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Chloride	Alluvial Water	Retained	14 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Fluoride	Alluvial Water	Retained	10 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Potassium	Alluvial Water	Retained	14 of 14 samples were detected in the alluvial water data set. The unfiltered samples are significantly greater than the background range based on the Wilcoxon statistical test.
Magnesium	Alluvial Water	Retained	Seven of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Sodium	Alluvial Water	Retained	10 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Sulfate	Alluvial Water	Retained	14 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Silicon dioxide	Alluvial Water	Eliminated	Six of six samples were detected in the alluvial water data set. These samples do not appear to be greater than the background range based on the Wilcoxon statistical test.

Table 3.4-43

Results of Inorganic Data Review for Alluvial Water Samples in Cañon de Valle—Minor Constituents

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Alkalinity	Alluvial Water	Retained	6 of 6 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Aluminum	Alluvial Water	Eliminated	11 of 14 samples were detected in the alluvial water data set. These samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Antimony	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Arsenic	Alluvial Water	Retained	Four of 14 samples were detected in the alluvial water data set. The unfiltered samples are significantly greater than the background range based on the Wilcoxon statistical test.
Barium	Alluvial Water	Retained	14 of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Beryllium	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Cadmium	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Chromium	Alluvial Water	Eliminated	Two of 14 samples were detected in the alluvial water data set. These samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Cobalt	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Conductivity	Alluvial Water	Eliminated	Six of six samples were detected in the alluvial water data set. These samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Copper	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Cyanide	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Iron	Alluvial Water	Retained	Six of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Lead	Alluvial Water	Retained	Nine of 14 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Manganese	Alluvial Water	Eliminated	11of 14 samples were detected in the alluvial water data set. The unfiltered samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Mercury	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Nickel	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Nitrogen, Nitrate + Nitrite (N)	Alluvial Water	Retained	Six of 7 samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Selenium	Alluvial	Eliminated	No samples were detected in the alluvial water data set.

Table 3.4-43

Results of Inorganic Data Review for Alluvial Water Samples in Cañon de Valle—Minor Constituents

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
	Water		
Silver	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
Thallium	Alluvial Water	Eliminated	No samples were detected in the alluvial water data set.
TSS	Alluvial Water	Eliminated	One of six samples was detected in the alluvial water data set. The sample does not appear to be greater than the background range based on the Wilcoxon statistical test.
TDS	Alluvial Water	Retained	Six of six samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Turbidity	Alluvial Water	Retained	Six of six samples were detected in the alluvial water data set. These samples are significantly greater than the background range based on the Wilcoxon statistical test.
Vanadium	Alluvial Water	Retained	Six of 14 samples were detected in the alluvial water data set. The unfiltered samples do not appear to be greater than the background range based on the Wilcoxon statistical test.
Zinc	Alluvial Water	Eliminated	Three of 14 samples were detected in the alluvial water data set. The sample does not appear to be greater than the background range based on the Wilcoxon statistical test.

Table 3.4-46

Results of HE Data Review for Alluvial Water Samples and Seeps

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Amino-2,6-dinitrotoluene[4-]	Alluvial Water	Retained	Six of the 14 samples exceed the detection limit up to 4.9 ug/L.
Amino-4,6-dinitrotoluene[2-]	Alluvial Water	Retained	Six of the 14 samples exceed the detection limit up to 4.9 ug/L.
HMX	Alluvial Water	Retained	Eight of the 14 samples exceed the detection limit up to 21 ug/L.
RDX	Alluvial Water	Retained	Eight of the 14 samples exceed the detection limit up to 48 ug/L.
Trinitrotoluene[2,4,6-]	Alluvial Water	Retained	Four of the 14 samples exceed the detection limit up to 20 ug/L.

Table 3.4-49

Results of Other Organic Compound Data Review for Alluvial Water Samples in Cañon de Valle

Analyte	Media	Result	Rationale for Retaining as a COPC
Acetone	Alluvial Water	Retained	Three samples collected at both seeps and one alluvial well were above detection up to 41 ug/L.
Dichloroethene[cis-1,2-]	Alluvial Water	Retained	One sample collected at the Fish Ladder Seep was above detection at 19.

Table 4.4-4

Results of Inorganic Data Review for Intermediate-Depth Borehole Tuff Samples

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Aluminum	Tuff	Eliminated	All 8 samples are almost a factor of 10 below the tuff background values.
Antimony	Tuff	Retained	Detection limits greater than tuff background value in 3 out of 7 samples.
Arsenic	Tuff	Eliminated	All 9 samples are below the tuff background values.
Barium	Tuff	Eliminated	All 9 samples are well below the tuff background values.
Beryllium	Tuff	Eliminated	All 9 samples are below the tuff background values.
Cadmium	Tuff	Eliminated	All 9 samples are non-detected well below the tuff background values.
Calcium	Tuff	Retained	One out of seven analyses exceeded the tuff background value. This sample was at a depth of 125 ft.
Chromium	Tuff	Eliminated	All 9 samples are below the tuff background values.
Cobalt	Tuff	Eliminated	All 9 samples are below the tuff background values.
Copper	Tuff	Eliminated	All 9 samples are below the tuff background values. The maximum value (4 mg/kg) approaches the BV of 4.66.
Cyanide	Tuff	Eliminated	All 8 samples are non detected.
Iron	Tuff	Eliminated	All 9 samples are well below the tuff background values.
Lead	Tuff	Eliminated	All 9 samples are well below the tuff background values.
Magnesium	Tuff	Eliminated	All 8 samples are well below the tuff background values.
Manganese	Tuff	Eliminated	All 9 samples are below the tuff background values.
Mercury	Tuff	Retained	Detection limits greater than the tuff background value for two out of 6 samples. The maximum DL (0.11 mg/kg) is only slightly elevated relative to the BV (0.1 mg/kg)
Nickel	Tuff	Eliminated	All 9 samples are well below the tuff background values.
Potassium	Tuff	Eliminated	All 8 samples are well below the tuff background values.
Selenium	Tuff	Retained	Detection limits (maximum of 0.58 mg/kg) greater than the tuff background value (0.3 mg/kg) for five out of seven samples
Silver	Tuff	Retained	Detection limits (maximum of 2.1 mg/kg) greater than the tuff background value (1 mg/kg) for two out of five samples
Sodium	Tuff	Eliminated	All 8 samples are below the tuff background values.
Thallium	Tuff	Eliminated	All 6 samples are below the tuff background values.
Thorium	Tuff	Eliminated	Both samples are below the tuff background values.
Vanadium	Tuff	Eliminated	All 8 samples are below the tuff background values.
Zinc	Tuff	Eliminated	All 9 samples are below the tuff background values.

Table 4.4-7

Results of Volatile and Semivolatile Organic Data Review for Intermediate-Depth Borehole Tuff Samples

Analyte	Media	Result	Rationale for Retaining as a COPC
Acetone	Tuff	Retained	4 of the 6 samples exceed the detection limit. These detects were at depth of 68 to 124 ft and were scattered with one detect in each of the four intermediate depth boreholes.
Bis(2-ethylhexyl)phthalate	Tuff	Retained	1 sample from the SWSC cut borehole of the 6 total borehole semivolatile samples exceed the detection limit

Table 4.4-10

Results of Inorganic Data Review for Intermediate-Depth Borehole Water Samples

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Aluminum	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were not greater than the background range.
Antimony	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were not detects and therefore are not greater than the background range.
Arsenic	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were not detects and therefore are not greater than the background range.
Barium	Borehole Water	Eliminated	One of the 3 intermediate-depth borehole water data set was detected. However it was not greater than the background range.
Beryllium	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were not detects and therefore are not greater than the background range.
Cadmium	Borehole Water	Eliminated	One of the 2 samples in the intermediate-depth borehole water data set was detected. However it was not greater than the background range.
Calcium	Borehole Water	Eliminated	One of the 2 samples in the intermediate-depth borehole water data set was detected. However it was not greater than the background range.
Chromium, total	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Cobalt	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Copper	Borehole Water	Eliminated	One of the 2 samples in the intermediate-depth borehole water data set was detected. However it was not greater than the background range.
Iron	Borehole Water	Eliminated	One of the 2 samples in the intermediate-depth borehole water data set was detected. However it was not greater than the background range.
Lead	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Magnesium	Borehole Water	Retained	One of the 2 samples in the intermediate-depth borehole water data set was detected. The detected value in the Martin Spring Canyon borehole was at a level greater than the background range
Manganese	Borehole Water	Retained	One of the 2 samples in the intermediate-depth borehole water data set was detected. The detected value in the Martin Spring Canyon borehole was at a level greater than the background range
Nickel	Borehole Water	Retained	One of the 2 samples in the intermediate-depth borehole water data set was detected. The detected value in the Martin Spring Canyon borehole was at a level greater than the background range
Potassium	Borehole Water	Eliminated	One of the 2 samples in the intermediate-depth borehole water data set was detected. However it was not greater than the background range.

Selenium	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Silver	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Sodium	Borehole Water	Retained	One of the 2 samples in the intermediate-depth borehole water data set was detected. The detected value in the Martin Spring Canyon borehole was at a level greater than the background range
Thallium	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Vanadium	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.
Zinc	Borehole Water	Eliminated	The 2 samples in the intermediate-depth borehole water data set were non detects and therefore are not greater than the background range.

Table 4.4-13

Results of HE Data Review for Intermediate-Depth Borehole Water Samples

Analyte	Media	Result	Rationale for Retaining as a COPC
Dinitrotoluene[2, 4-]	Borehole Water	Retained	1 sample collected in the 90s Line Pond borehole exceeded the detection limit.
HMX	Borehole Water	Retained	1 sample collected in the 90s Line Pond borehole exceeded the detection limit.
RDX	Borehole Water	Retained	1 sample collected in the 90s Line Pond borehole exceeded the detection limit.
Trinitrotoluene[2,4,6-]	Borehole Water	Retained	1 sample collected in the 90s Line Pond borehole exceeded the detection limit.

Table 4.4-19

Results of Inorganic Data Review for Springs – Major Constituents

Analyte	Media	Result	Rationale for Retaining or Eliminating as a COPC
Boron	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Bicarbonate	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Bromide	Spring Water	Eliminated	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Calcium	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Carbonate	Spring Water	Eliminated	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Chloride	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Fluoride	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Lithium	Spring Water	Eliminated	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Magnesium	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Potassium	Spring Water	Eliminated	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Silicon dioxide	Spring Water	Retained	The spring data set was greater than the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Sodium	Spring Water	Retained	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
Strontium	Spring Water	Retained	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in Martin spring.
Sulfate	Spring Water	Retained	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.
TDS	Spring Water	Retained	The spring data set statistically overlapped the background data set based on the Wilcoxon statistical test in SWSC, Burning Ground, and Martin springs.

Table 4.4-20

Results of Inorganic Data Review Springs – Minor Constituents

Analyte	Media	Result	Rationale for Retaining or Eliminating a COPC
Alkalinity, Total (Methyl Orange [pH=4.5] end point)	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Aluminum	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Ammonium	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Antimony	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Arsenic	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Barium	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Bicarbonate	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Cadmium	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Cesium	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Chlorate	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Cobalt	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Conductivity	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Copper	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Chromium	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Cyanide, Total	Spring Water	Eliminated	All values were non detects
Iodide	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Iron	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test

Lead	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Manganese	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Mercury	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Molybdenum	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Nickel	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Nitrate	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Nitrogen, Ammonium (Expressed as NH4)	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Nitrogen, Nitrate + Nitrite (Expressed as N)	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Nitrogen, Nitrite (Expressed as NO2)	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Phosphate	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Rubidium	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Selenium	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Silicon	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
Silver	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
TDS	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Titanium	Spring Water	Retained	The spring data set was greater than the background data set in SWSC, Burning Ground, and Martin springs based on the Wilcoxon statistical test
Tin	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.
TSS	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test
Turbidity	Spring Water	Retained	A background comparison was not made for this water quality parameter.

Uranium	Spring Water	Retained	This analyte was incorrectly dropped as a COPC following the Phase I RFI sampling.
Zinc	Spring Water	Eliminated	The spring data set was not greater than the background data set in any of the 3 springs, SWSC, Burning Ground, and Martin, based on the Wilcoxon statistical test.

Table 4.4-26

Results of HE Data Review for Springs

Analyte	Media	Result	Rationale for Retaining as a COPC
Amino-2,6-dinitrotoluene[4-]	Spring Water	Retained	10 out of 27 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
Amino-4,6-dinitrotoluene[2-]	Spring Water	Retained	9 out of 21 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
Dinitrobenzene[1, 3-]	Spring Water	Retained	1 out of 27 samples exceeded the detection limit. It was detected only in SWSC spring.
Dinitrotoluene[2, 4-]	Spring Water	Retained	8 out of 27 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
HMX	Spring Water	Retained	13 out of 27 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
Nitrotoluene[3-]	Spring Water	Retained	1 out of 27 samples exceeded the detection limit. It was detected only in SWSC spring.
RDX	Spring Water	Retained	27 out of 27 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
Tetryl	Spring Water	Retained	2 out of 27 samples exceeded the detection limit. It was detected in SWSC and Burning Ground springs.
Trinitrobenzene [1, 3, 5-]	Spring Water	Retained	9 out of 27 samples exceeded the detection limit. It is present in all 3 springs, SWSC, Burning Ground and Martin.
Trinitrotoluene[2,4,6-]	Spring Water	Retained	2 out of 27 samples exceeded the detection limit. It was detected only in Martin spring.

Table 4.4-27

Results of Volatile and Semivolatile Organic Data Review for Springs

Analyte	Media	Result	Rationale for Retaining as a COPC
Acetone	Spring Water	Retained	9 of the 16 samples exceed the detection limit. It was detected in all 3 springs.
Bromomethane	Spring Water	Retained	1 of the 16 samples exceed the detection limit. It was detected only in Burning Ground spring.
Chloromethane	Spring Water	Retained	6 of the 16 samples exceed the detection limit. It was detected in all 3 springs.
Dichloroethane[1,2-]	Spring Water	Retained	4 of the 16 samples exceed the detection limit. It was detected in all 3 springs.
Di-n-butylphthalate	Spring Water	Retained	1 out of 25 samples exceeded the detection limit. It was detected only in Burning Ground spring.
Tetrachloroethene	Spring Water	Retained	1 of the 16 samples exceed the detection limit. It was detected only in SWSC spring.
Trichloroethene	Spring Water	Retained	2 of the 16 samples exceed the detection limit. It was detected in SWSC and Burning Ground springs.

TABLD 6.1-1A
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Water		
Analyte	Water Type	Human Health Effect
Inorganics		
Aluminum	spring	nc
Antimony	surface water	nc
Arsenic	alluvial	c
Barium	spring, surface water, alluvial	nc
Boron	spring, alluvial	nc
Calcium	spring, alluvial	na
Chromium, total	surface water	c
Iron	spring, alluvial	nc
Lead	surface water, alluvial	nc
Magnesium	spring, alluvial	nc
Manganese	spring, surface water	nc
Mercury	surface water	nc
Nickel	surface water	nc
Strontium	spring	nc
Titanium	spring	na
Uranium	spring	nc
Vanadium	surface water, alluvial	nc
Zinc	surface water	nc
Radionuclides		
Uranium-234	surface water	c
Uranium-238	surface water	c
HE		
Amino-2,6-dinitrotoluene[4-]	spring, surface water, alluvial	nc
Amino-4,6-dinitrotoluene[2-]	spring, surface water, alluvial	nc
Dinitrobenzene[1,3-]	spring	nc
Dinitrotoluene[2,4-]	spring, surface water	nc
HMX	spring, surface water, alluvial	nc
Nitrobenzene	surface water	nc
Nitrotoluene[2-]	surface water	nc
Nitrotoluene[3-]	spring	nc
RDX	spring, surface water, alluvial	c
Tetryl	spring	na
Trinitrobenzene[1,3,5-]	spring, surface water	nc
Trinitrotoluene[2,4,6-]	spring, surface water, alluvial	c

TABLD 6.1-1A
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Water		
Analyte	**Water Type**	**Human Health Effect**
Organics		
Acetone	spring, surface water, alluvial	nc
Bis(2-ethylhexyl)phthalate	surface water	c
Bromomethane	spring	nc
Chloromethane	spring	c
Chlorophenol[2-]	surface water	nc
Dichloroethane[1,2-]	spring, surface water	c
Dichloroethene[cis-1,2-]	alluvial	nc
Di-n-butylphthalate	spring	nc
Dinitro-2-methylphenol[4,6-]	surface water	nc
Dinitrotoluene[2,6-]	surface water	nc
Di-n-octylphthalate	surface water	nc
Methylene Chloride	surface water	c
Tetrachloroethene	spring	c
Trichloroethene	spring	c

nc = noncarcinogenic
c = carcinogenic
na = not available

TABLE 6.1-1B
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Drainage Sediment	
Analyte	**Human Health Effect**
Inorganics	
Antimony	nc
Arsenic	c
Barium	nc
Cadmium	nc
Chromium, total	c
Cobalt	nc
Copper	nc
Cyanide, total	nc
Lead	nc
Manganese	nc
Nickel	nc
Selenium	nc
Silver	nc
Uranium	c
Vanadium	nc
Zinc	nc
Radionuclides - None	
HE	
Amino-2,6-dinitrotoluene[4-]	nc
Amino-4,6-dinitrotoluene[2-]	nc
Dinitrobenzene[1,3-]	nc
Dinitrotoluene[2,4-]	nc
Dinitrotoluene[2,6-]	nc
HMX	nc
Nitrobenzene	nc
Nitrotoluene[3-]	nc
Nitrotoluene[4-]	nc
RDX	c
Trinitrobenzene[1,3,5-]	nc
Trinitrotoluene[2,4,6-]	c
Organics	
Acetone	nc

TABLE 6.1-1B
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Drainage Sediment	
Analyte	**Human Health Effect**
Anthracene	nc
Benzene	c
Benzoic Acid	nc
Bis(2-ethylhexyl)phthalate	c
Butylbenzene[sec-]	nc
Dichlorobenzene[1,2-]	c
Dinitrotoluene[2,4-]	nc
Dinitrotoluene[2,6-]	nc
Hexachlorocyclopentadiene	nc
Isopropyltoluene[4-]	nc
Nitrosodiphenylamine[N-]	nc
Phenanthrene	nc
Pyrene	nc
Toluene	nc
Trichloroethane[1,1,1-]	nc
Trimethylbenzene[1,2,4-]	nc

nc = noncarcinogenic
c = carcinogenic
na = not available

TABLE 6.1-1C
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Cañon de Valle Sediment	
Analyte	Human Health Effect
Inorganics	
Antimony	nc
Arsenic	c
Barium	nc
Cadmium	nc
Chromium, total	c
Cobalt	nc
Copper	nc
Cyanide, total	nc
Iron	nc
Lead	nc
Manganese	nc
Mercury	nc
Nickel	nc
Selenium	nc
Silver	nc
Thallium	nc
Vanadium	nc
Zinc	nc
Radionuclides	
Cesium-137	c
HE	
Amino-2,6-dinitrotoluene[4-]	nc
Amino-4,6-dinitrotoluene[2-]	nc
HMX	nc
Nitrobenzene	nc
Nitrotoluene[3-]	nc
RDX	c
Trinitrobenzene[1,3,5-]	nc
Trinitrotoluene[2,4,6-]	c
Organics	
Acetone	nc
Benzoic Acid	nc

TABLE 6.1-1C
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Cañon de Valle Sediment	
Analyte	**Human Health Effect**
Benzyl Alcohol	nc
Bis(2-ethylhexyl)phthalate	c
Dichlorodifluoromethane	nc
Diethylphthalate	nc
Di-n-butylphthalate	nc
Fluoranthene	nc
Isopropyltoluene [4-]	na
Phenol	nc
Pyrene	nc
Toluene	nc
Trichloro-1,2,2-trifluoroethane[1,1,2-]	nc
Trichlorofluoromethane	nc

nc = noncarcinogenic
c = carcinogenic
na = not available

TABLE 6.1-1D
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Tuff	
Analyte	Human Health Effect
Inorganics	
Antimony	nc
Arsenic	c
Barium	nc
Copper	nc
Cyanide, total	nc
Lead	nc
Mercury	nc
Nickel	nc
Selenium	nc
Silver	nc
Radionuclides – None	
HE	
Amino-2,6-dinitrotoluene[4-]	nc
Amino-4,6-dinitrotoluene[2-]	nc
Dinitrotoluene[2,4-]	nc
HMX	nc
Nitrotoluene[3-]	nc
RDX	c
Trinitrobenzene[1,3,5-]	nc
Trinitrotoluene[2,4,6-]	c
Organics	
Acetone	nc
Anthracene	nc
Benzo(k)fluoranthene	c
Bis(2-ethylhexyl)phthalate	c
Butanone [2-]	nc
Butylbenzylphthalate	nc
Chlorobenzene	nc
Chloromethane	c
Dichlorobenzene[1,4-]	c
Dichloroethane[1,2-]	c
Diethylphthalate	nc

TABLE 6.1-1D
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Tuff	
Analyte	**Human Health Effect**
Di-n-butylphthalate	nc
Dinitrotoluene[2,4-]	nc
Styrene	nc
Tetrachloroethene	c
Toluene	nc
Trichlorofluoromethane	nc
Trimethylbenzene[1,3,5-]	nc

nc = noncarcinogenic
c = carcinogenic
na = not available

TABLE 6.1-1E
SUMMARY OF CONSTITUENTS RETAINED AS COPCs FOR FURTHER SCREENING

Medium: Surge	
Analyte	Human Health Effect
Inorganics – None	
Radionuclides – None	
HE – None	
HMX	nc
RDX	c
Trinitrotoluene[2,4,6-]	c
Organics	
Benzo(a)pyrene	c
Benzo(b)fluoranthene	c
Benzo(g,h,i)perylene	na
Dibenz(a,h)anthracene	c
Dinitrotoluene[2,6-]	nc
Indeno[1,2,3-cd]pyrene	c
Phenanthrene	na

nc = noncarcinogenic
c = carcinogenic
na = not available

Attachment II – Revised Figure Showing Locations of Water Sampling Locations Described in Appendix B

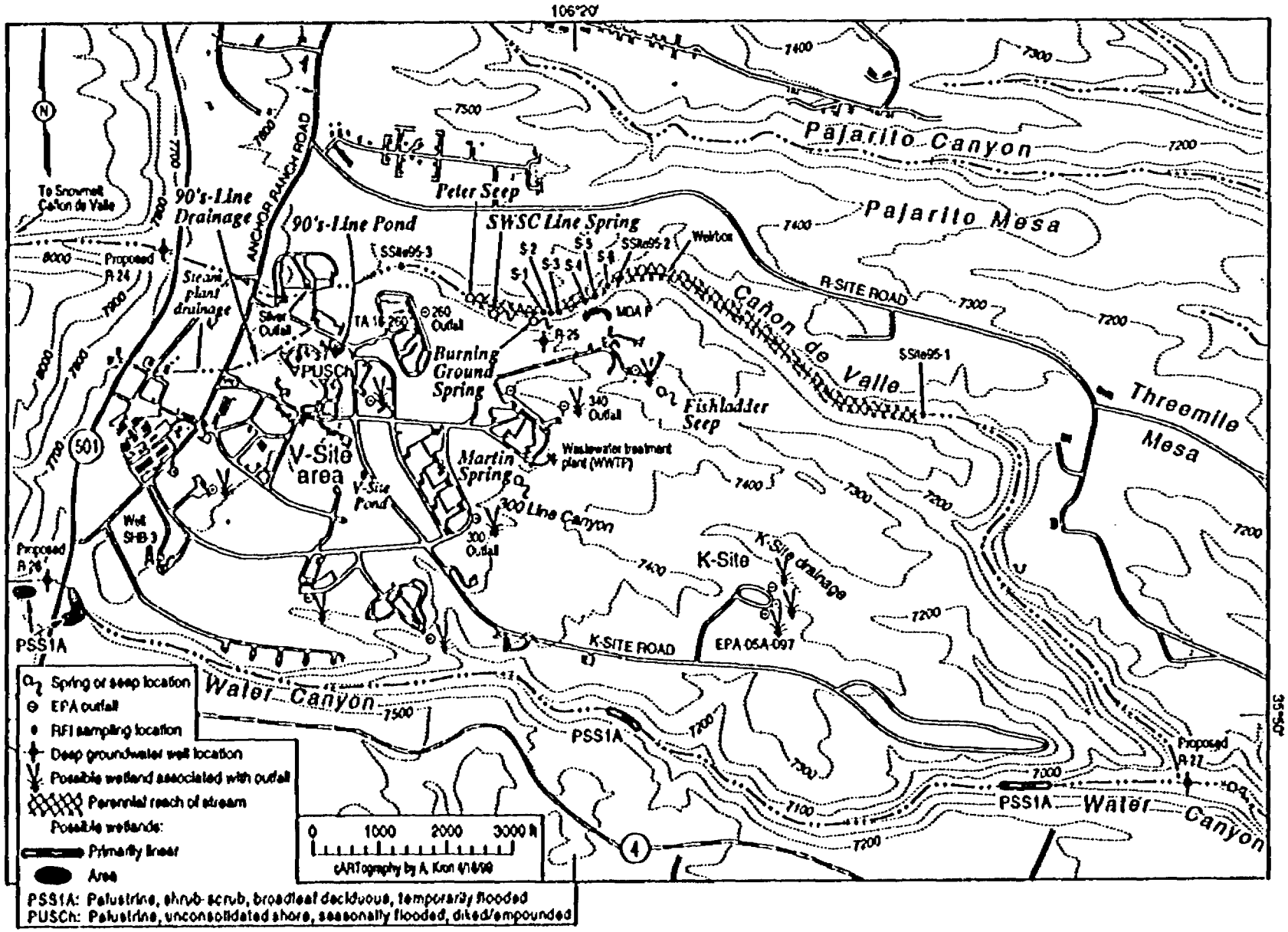

Figure B-4.0-1. Topography, springs, seeps, National Wetlands Inventory, and LANL-defined wetland at TA-16.

Attachment III – Enhancement to Table 6.3-4 Summary of Annual Sampling and Analysis for the Investigation of Alluvial Water Dynamics

Table 6.3-4 Summary of Annual Sampling and Analysis for the Investigation of Alluvial Water Dynamics

			Analytical				Field Parameters						
Sampling or Survey Activity	Number of Activities per Year	Number of Samples per Event	Anions	Bicarbonate	HE	Metals	Barium (Hach kit)	Bromide	Conductivity	pH	Temperature	RDX (D-Tech)	Discharge Measurement &Well Levels
Cañon de Valle surface water discharge profile	5 profiles	NA											X
Cañon de Valle surface water grab samples (Screening)	5	17					X	X	X	X	X	X	
Cañon de Valle surface water grab samples (Analytical)	2 (hi and low flow conditions)	6	X	X	X	X							
Martin Spring Canyon surface water discharge profile	5 profiles	NA											X
Martin Spring Canyon surface water grab samples (Screening)	5	6					X	X	X	X	X	X	
Martin Spring Canyon surface water grab samples (Analytical)	2 (hi and low flow conditions)	3	X	X	X	X							
Alluvial well sampling concurrent with the discharge profiles (Screening)	5 profiles	5					X	X	X	X	X	X	X
Alluvial well sampling concurrent with the discharge profiles (Analytical)	2 (hi and low flow conditions)	5	X	X	X	X							
SWSC Spring water grab samples concurrent with discharge profiles (Screening)	5	1					X	X	X	X	X	X	X
SWSC Spring water grab samples concurrent with discharge profiles (Analytical)	2 (hi and low flow conditions)	1	X	X	X	X							
Burning Ground Spring water grab samples concurrent with discharge profiles (Screening)	5	1					X	X	X	X	X	X	X
Burning Ground Spring water grab samples concurrent with discharge profiles (Analytical)	2 (hi and low flow conditions)	1	X	X	X	X							
Martin Spring water grab samples concurrent with discharge profiles (Screening)	5	1					X	X	X	X	X	X	X
Martin Spring water grab samples concurrent with discharge profiles (Analytical)	2 (hi and low flow conditions)	1	X	X	X	X							

Attachment IV – DRAFT SOP Describing Archiving Method for Isotope Sample

STANDARD OPERATING PROCEDURE

Title:	Identifier:	Revision:	Effective Date:
Storage Methods For Stable Isotope ($\delta^{18}O$ and δD) Samples	ER-SOP-XXX	0	

DRAFT

ER PROJECT

APPROVALS FOR USE

Author's Name (Print):	Author's Signature:	Date:
Insert Author's Name		X/xx/99
Quality Program Project Leader's Name (Print)	**Quality Program Project Leader's Signature**	**Date:**
Larry Maassen		X/xx/99

LOS ALAMOS NATIONAL LABORATORY

Procedure Title

Storage Methods For Stable Isotope ($\delta^{18}O$ and δD) Samples

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1.0 PURPOSE 3
2.0 TRAINING 3
3.0 DEFINITIONS/ACRONYMS 3
4.0 BACKGROUND AND PRECAUTIONS 3
5.0 EQUIPMENT 4
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Storage Methods For Stable Isotope ($\delta^{18}O$ and δD) Samples

NOTE: Environmental Restoration (ER) Project personnel may produce paper copies of this procedure printed from the controlled document electronic file. However, it is their responsibility to ensure that they are trained on and utilizing the current version of this procedure. The procedure author may be contacted if changes are unclear.

1.0 PURPOSE

This procedure is to describe the storage methods for stable isotope ($\delta^{18}O$ and δD) samples at TA-16.

2.0 TRAINING

You must be familiar with the sampling procedure established by the EES-15 Group to ensure that the samples have been prepared properly for storage.

3.0 DEFINITIONS/ACRONYMS

3.1 *SW1-SWSC*— Spring sample one, the next will be SW2 and so on.

3.2 *BG1*— Burning ground spring, sample one.

3.3 MS1— Martin spring, sample one.

3.4 XXXXX1— Alluvial borehole ID, sample one.

3.5 RCDV1— Runoff (Canon de Valle) sample one.

3.6 P1— Precipitation (rain) sample one.

3.7 S1— Snow sample one.

3.8 SM1— Snowmelt one, at the precipitation collector.

3.9 RCOL1— Runoff sample one, near the precipitation collector.

3.10 EES-15— Environmental Science Group.

4.0 BACKGROUND AND PRECAUTIONS

Stable isotopes of water ($\delta^{18}O$ and δD) will be used to examine residence times in the spring system and to examine mixing of various water sources in the Canon de Valle alluvial aquifer. In order to perform the residence time and mixing calculations, time series of the variation in isotopic composition for the springs, alluvial system, and precipitation must be obtained. Therefore, regularly scheduled sampling of the various waters at TA-16 is necessary. The major concern in the stable isotope storage is evaporation and freezing. All samples must be stored in glass vials with polyseal caps. If

possible, the sample should be refrigerated, although, lack of refrigeration will not affect sample results.

5.0 EQUIPMENT

Descriptions of a few pieces of equipment and their advantages or limitations are listed below:

5.1 Glass containers with polyseal caps — Preferably 40 ml glass containers, must have a polyseal cap and sealed with a chain of custody seal to eliminate possible evaporation

5.2 Labels — To be used on the bottle cap and cylindrical surface

5.3 Chain of custody seals — Place around the cap to ensure the seal of the cap

5.4 Refrigerator— To be used if possible, but not necessary

5.5 Log book— All of the stored samples must be entered into a log book in accordance with the sampling procedure memo issued by Brent Newman of EES-15 (memo EES-15-99-02).

6.0 PROCEDURE

After the isotope samples have been collected in accordance with the EES-15-99-02 memo, they will be labeled, sealed with a chain of custody tape and stored in a refrigerator (if one is available). Storage can be as long as one to two years without any compromising of the sample if there is not any evaporation or freezing of the contents.

7.0 REFERENCES

The following procedures and documents directly relate to this procedure and should be reviewed before field operations.

EES-15-99-02, memorandum addressing stable isotope sampling at TA-16 to support Phase 3 activities in the 260 Corrective Measures Study (CMS) Plan.

CMS Plan for Potential Release Site 16-021c,La-UR-98-3918, September 1998.

Water Resources Research, Vol. 34, No 12 Pages 3485-3496, December 1998.

8.0 RECORDS

The field team leader is responsible for submitting the following records (processed in accordance with QP-4.3, Records Management) to the Records Processing Facility.

8.1 A field log book generated by the field technician, which has all of the information required by the sampling procedure.

9.0 ATTACHMENTS

None

LA-UR-98-3918
September 1999

Addendum to CMS Plan for Potential Release Site

16-021(c)

Environmental Restoration Project
A Department of Energy Environmental Cleanup Program
ER19990107

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

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Produced by the Remedial Actions Focus Area

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Insert the new section below on p. 57 of CMS Plan (Environmental Restoration Project 1998, 62413.3) within Section 6.1, "Objectives and Scope".

6.1.7 Regional Groundwater Investigations

The principal goal of this investigation is to determine the extent of contamination in the deep perched and regional aquifers associated with constituent discharges at Technical Area (TA) –16 and possibly other nearby sites. Subsidiary goals include: (1) determining how fast is that contamination moving downgradient toward the Pajarito well field or other potential exposure points; and (2) investigating the directions of groundwater flow and the hydrologic gradients within the regional and deep perched saturated zones at TA-16. These investigations will be used to evaluate the effects of regional groundwater contamination on human health or ecological assessment endpoints. The risk assessment for the surface soils, alluvial system, and vadose zone that will be completed under the 260 CMS will be augmented to include information on deep groundwaters derived from the investigations outlined in this CMS addendum. Thus, these data will be used to determine the necessity and feasibility of implementing cleanup remedies within the contaminated deep perched and regional groundwater systems associated with high explosives (HE) and other constituent discharges at TA-16 and potentially other nearby sites.

Insert the new section below on p. 59 of CMS Plan (Environmental Restoration Project 1998, 62413.3) within Section 6.2, "Approach and Implementation".

6. Regional groundwater

   Additional deep boreholes that intersect the regional aquifer will be drilled near TA-16. These borehole investigations are directly associated with the TA-16-260 CMS, but will also provide data relevant to investigations of other potential HE sources at TA-16 (Fish Ladder Canyon, Martin Spring Canyon, 90s Line Pond) and at TA-9. Data from these wells will be closely integrated with data from regional wells planned to be drilled under the Hydrogeologic Workplan (LANL 1998, 59599.1). Data from all these wells will be used to (1) determine the presence or absence of contamination and the concentrations of HE and other constituents at locations in the vicinity of regional well R-25; (2) investigate the seasonal variations of contaminant concentrations at these locations; (3) better define the hydrologic gradients, flow directions, and hydrologic properties in both the deep perched and regional saturated zones in the TA-16 region; (4) support modeling efforts designed to predict the movement of the HE plume(s) at TA-16; (5) design a monitoring program for the deep perched and regional aquifers; and (6) help evaluate whether multiple plumes exist in the deep perched zone and regional aquifer.

   Hydrologic information will be obtained during drilling. Water level measurements, packer or slug tests, and hydrologic parameter analyses of core from the saturated zones will be completed. Core/cuttings will be used to

determine lithologies. Downhole geophysics will be carried out where feasible in each borehole.

Multiple-port wells compliant with HSWA Module VIII Permit will be installed within these boreholes. Following well development, water from each screened interval will be sampled and submitted for HE, metal, and anion analysis. These analyses will be performed quarterly until completion of the CMS/CMI for PRS 16-021(c). The wells will be instrumented with pressure transducers. Seasonal water level data may be used to investigate any connectivity between portions of the deep perched and regional saturated zones.

Insert the following sections on p. 80 of CMS Plan (Environmental Restoration Project 1998, 62413.3), just before Section 6.4, "Data Collection Procedures".

6.3.6 Regional Groundwater Investigations

6.3.6.1 Overview

Background and Conceptual Model

High explosives were detected in regional well R-25 during fiscal year 1999. R-25 is located approximately 1700 ft east of the TA-16-260 outfall, PRS 16-021(c) (Figure 6.3-8). A major perched saturated zone was present between 747 ft and 1132 ft (Figure 6.3-9), and the regional aquifer extended from 1286 ft to the total depth of the borehole at 1942 ft. A zone of numerous alternating saturated zones and dry rock separates the two major saturated zones. The nature and degree of connectivity between these two major zones is unknown. Both of the major saturated zones appeared to contain HE constituents, including RDX, TNT, HMX, and amino-DNTs. RDX is the most abundant constituent; RDX concentrations range from non detect to above 75 ug/L (Figure 6.3-9). The two highest HE concentrations were in the middle of the perched zone and near the top of the regional aquifer, although until a developed well is complete it is difficult to evaluate whether any leakage from the upper zone to the lower zone has occurred.

As noted in Section 2 of this plan, HE contamination of shallow alluvial groundwater in Cañon de Valle and in the TA-16 springs is ubiquitous. RDX and other HE constituents are present in these media at levels greater than those observed in R-25. HE constituents at low levels (< 10 ug/L RDX) have also been observed in springs at TA-9, in springs at TA-18, and in surface and alluvial waters within Pajarito Canyon. It is assumed that liquid discharges at the TA-16 surface constitute the primary historic source for the HE observed at R-25.

Multiple sources of high explosives contamination have been identified in soils at several technical areas in the western portion of the Laboratory through RCRA Facility Investigation (RFI) studies completed to date. Based on these RFI studies, the largest HE contaminant source term in soils appears to be at the TA-16-260 outfall (see Section 2 of this CMS plan). Other sites with significant (greater than a few hundred ug/g HE in soils)

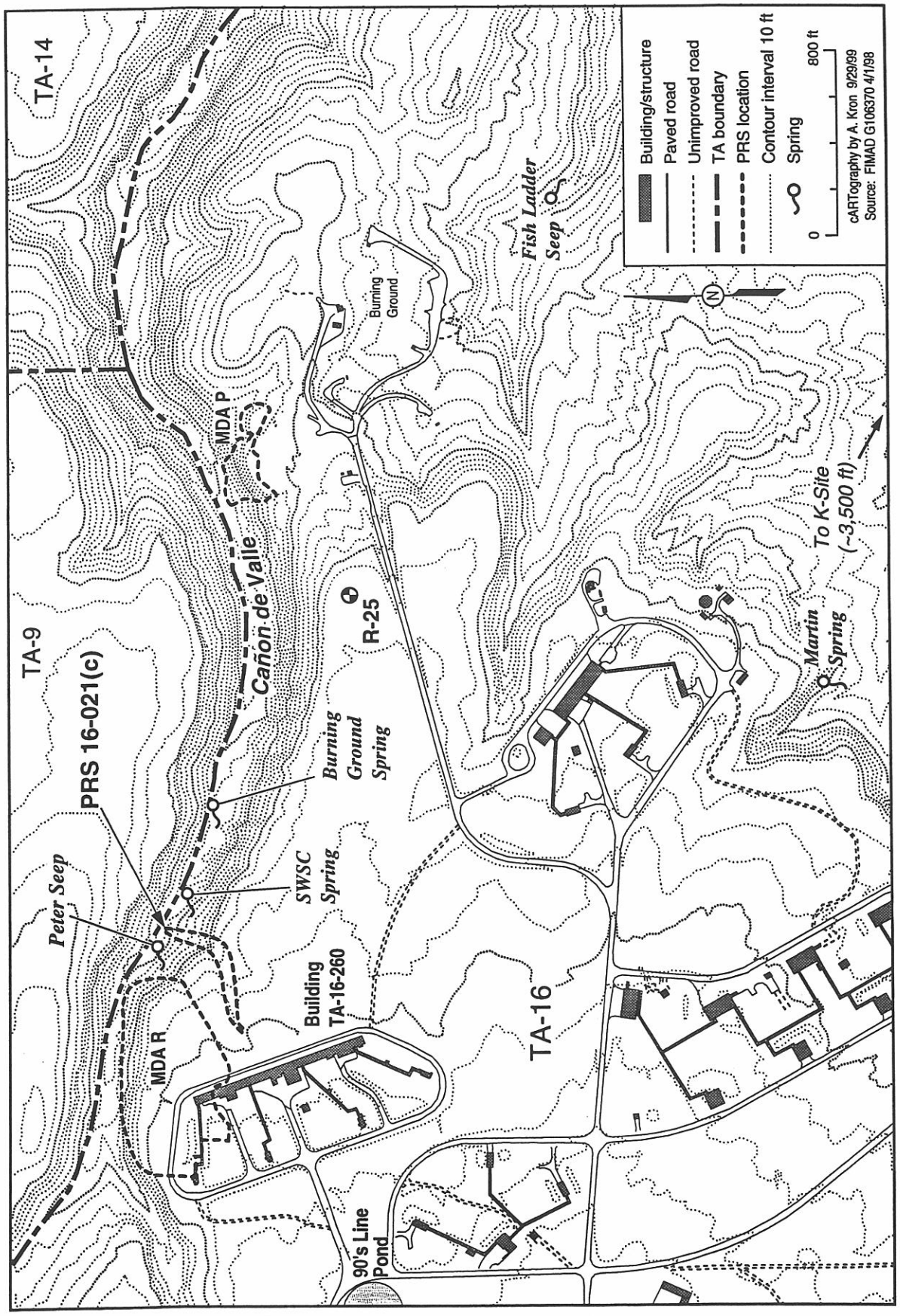

Figure 6.3-8. Location of PRS 16-021(c) and associated physical features

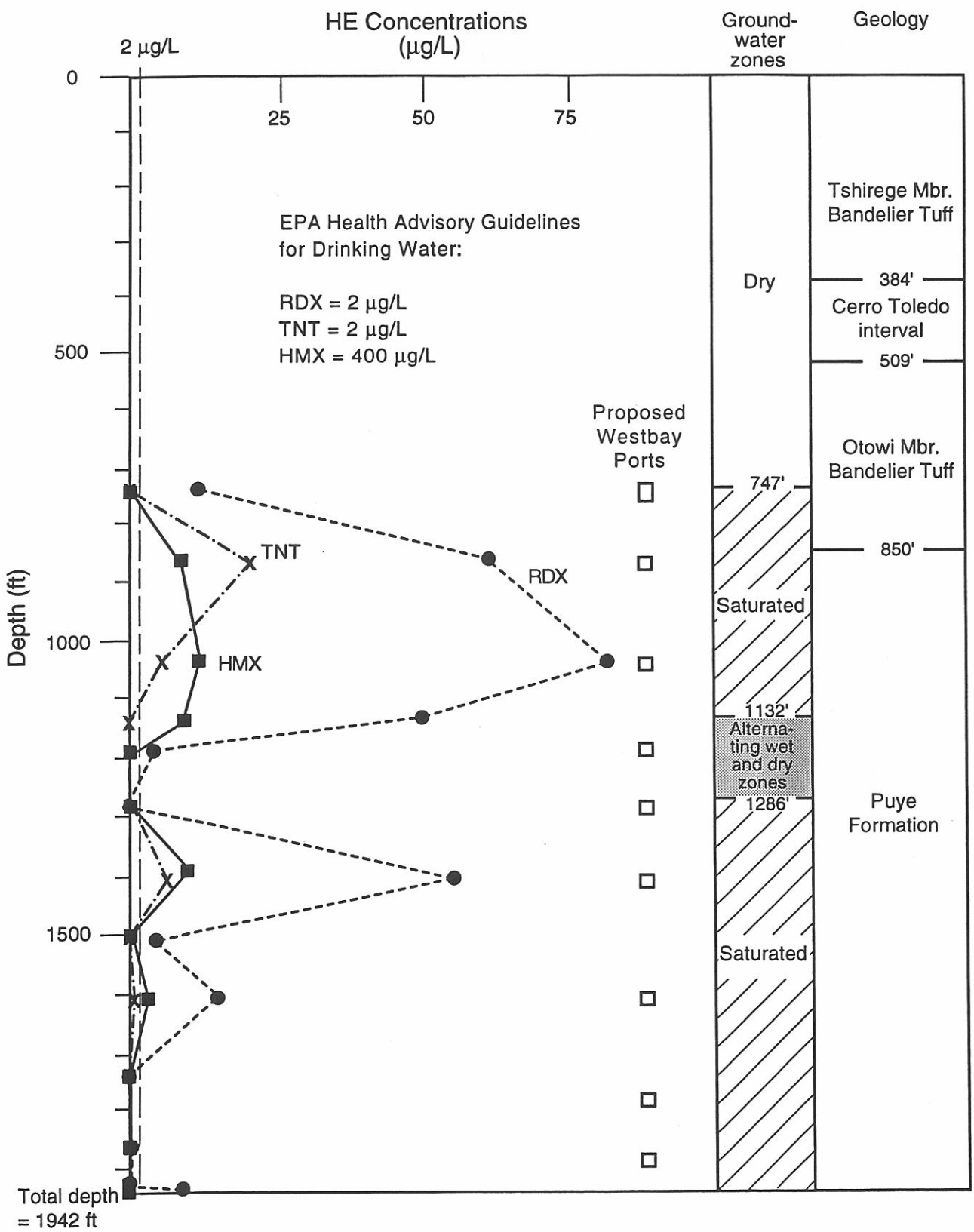

Figure 6.3-9. Distribution of HE compounds detected in deep groundwater at TA-16, borehore R-25

identified HE source terms include: the TA-16 Burning Ground and MDA P, MDA R, the TA-11 drop tower (K-Site), the 90s Line Pond, and TA-9-48 outfall at TA-9 (Figure 6.3-8). Although these, and other yet unidentified, sources may all be contributing HE to deep perched and regional saturated zones, the large contaminant mass at the TA-16-260 outfall and its location directly upgradient from regional well R-25 (Figure 6.3-8) suggest that it is the major source of HE in the deep perched and regional saturated zones in the TA-16 region.

The horizontal hydrologic gradient and flow directions in the regional aquifer are generally eastward from the mountain front of the Jemez Mountains, west of TA-16 (Purtymun 1995, 45344.1) (Figure 6.3-10). The gradient and flow directions in the TA-16 deep perched saturated zone are poorly defined. This deep perched saturated zone was found in seismic hazards borehole SHB-3. Water-level data from this borehole, coupled with that from R-25, suggest that the gradient in the deep perched zone is also from the west to east, perhaps with northerly and/or southerly components. Water-level data collected during the drilling of R-25 also suggest a vertical component to hydrologic gradients in the TA-16 area. There appears to be downward head gradients in both major saturated zones that might transport contamination to depth (Stone et al. 1999, 64010).

The principal recharge zone for the regional aquifer at TA-16 is hypothesized to lie to the west of TA-16, perhaps in association with the Pajarito Fault zone. Multiple recharge sources for the shallow perched zones at TA-16 were postulated [see Section 5 of the second TA-16-260 outfall RFI Report (Environmental Restoration Project 1998, 59891.3)]. These sources include the Cañon de Valle alluvial system and other surface saturated zones (90s Line Pond, steam plant drainage), diffuse surface recharge, recharge from TA-16 outfalls, and fracture-zone recharge. Inasmuch as the shallow saturated zones impact the deep perched zone and the regional aquifer, the deep perched zone and regional aquifer also must have multiple recharge zones. The ultimate surface discharge of the regional aquifer is in the White Rock Canyon springs and the Rio Grande.

Problems

The detection of HE in the deep perched and regional saturated zones at TA-16 raises questions concerning potential impacts on receptors. For the purpose of this CMS addendum, these two major saturated zones will be referred to as separate zones; however, whether they are distinct zones or both represent parts of the regional aquifer, is unknown. The principal question is whether there is a realistic pathway to exposure at concentrations above a threshold level of concern (or damage to a natural resource) from the HE found in deep groundwater underlying TA-16.

The primary initiative is to define the boundaries of any existing plumes, rather than (for instance) maximum concentrations within the plume (i.e., to determine the highest level of contamination at the present time). A key issue is whether HE constituents are likely to impact drinking water wells in the Pajarito well field that lies 7-8 km to the east of R-25 (Figure 6.3-10).

Four classes of data needs are identified. Each type of data bears on problems related to contaminant distribution, fate, and transport. Ultimately, the objective of collection of all of these data is to be able to accurately predict contaminant concentrations in the deep

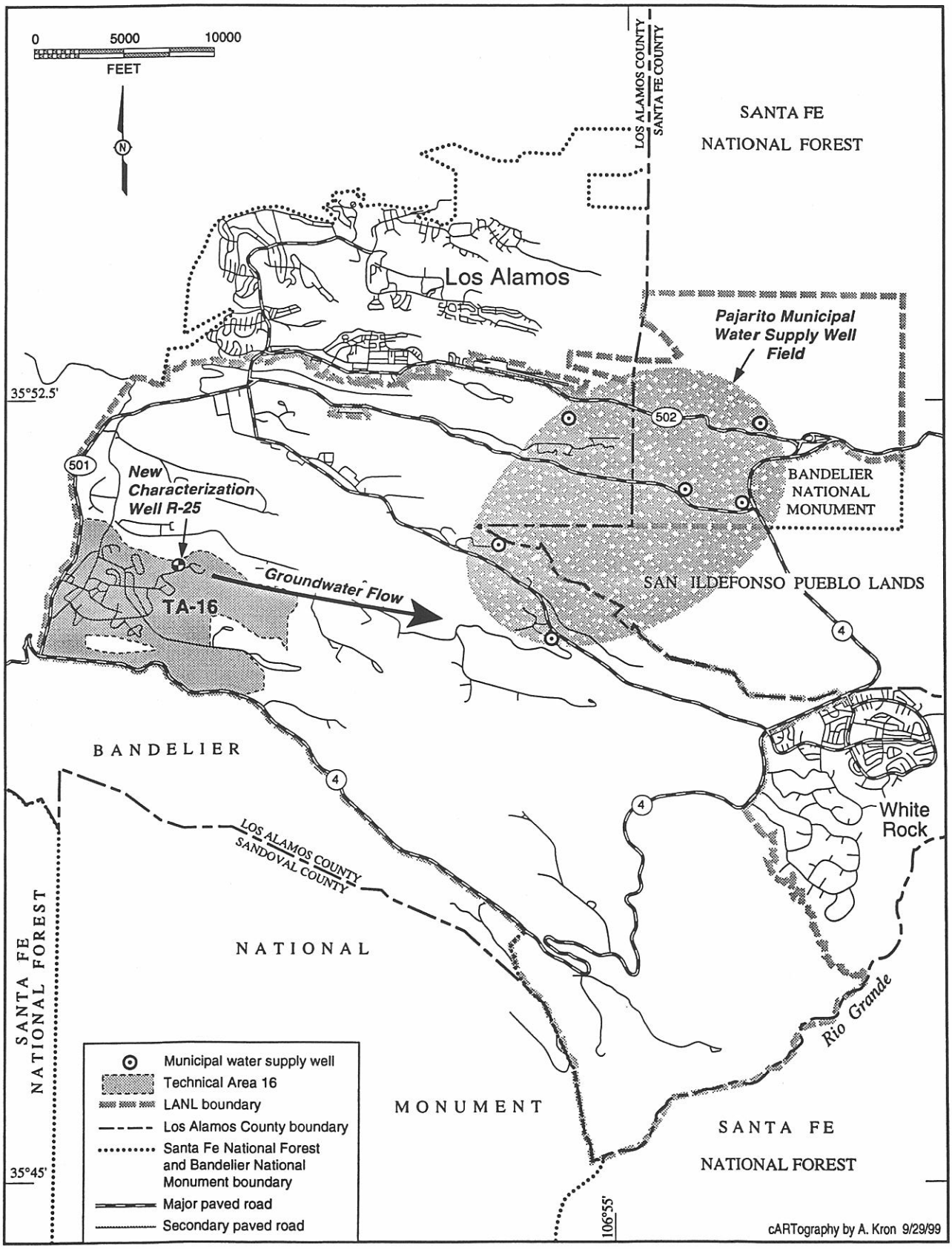

Figure 6.3-10. Location of Pajarito Municipal Water Supply Well Field relative to TA-16

perched and regional groundwater zones with a high degree of confidence. Such information on contaminant concentrations is needed to determine what type of remedy will be required for the deep perched and regional saturated zones.

1. The concentrations of HE and other anthropogenic constituents need to be determined at additional locations in the western portion of the Laboratory. The spatial boundaries of and contaminant distributions within the HE plume need to be defined for both major saturated zones. Based on the range of flow velocities calculated for the regional aquifer, the HE plume could extend as far as 7-8 km to the east of R-25.

   In addition, the constituent concentration data in additional wells are needed to define a monitoring baseline, to define trends in contaminant concentration both laterally and with depth, and to examine other aspects of the temporal and spatial variability of the contaminants in the deep perched and regional saturated zones. All of these data will be used both as input into models and for model validation.

   These concentration data will help determine: (1) whether contaminant concentrations decrease with distance from TA-16, or whether there is evidence for a high "pulse" of HE contamination associated with historic HE discharges; (2) if HE-degradation byproducts are present in the deep perched and regional aquifers, and whether information about this be used to investigate natural attenuation as a corrective action remedy; (3) to what degree the deep perched zone retards or enhances the flow of contaminants to the regional aquifer; (4) how water chemistry provides insight into the geochemical processes occurring in the deep perched and regional aquifers; and (5) how the mesatop HE sources and the Cañon de Valle and other alluvial systems may recharge the deeper saturated zones.

2. The hydrologic gradients (both vertical and lateral) need to be determined in both the regional and the deep perched saturated zones. Such data help define directions of groundwater flow and help optimize placement of monitoring and characterization wells. These data also provide key information for groundwater-modeling efforts.

   The gradient data will be used : (1) to determine whether contaminants enter the system at the top of the deep perched zone and if they are then transported by saturated flow through to the bottom of the zone; (2) to help identify fast pathways within the saturated zones; (3) to determine whether the significant downward vertical gradients identified in R-25 continue to the east or whether they are restricted to the west of the Laboratory near the Pajarito fault zone and the Jemez Mountain front.

3. The horizontal extent and geometry of the deep perched zone need to be determined. The deep perched zone was present in SHB-3 (1-2 km southwest of R-25) but is not found in the deep test wells that were drilled at TA-49 (4-6 km southeast of R-25) in the late 1950s and early 1960s.

   Information on saturated zones extent and geometry will be used to determine: (1) the eastward extent of the deep perched zone; and (2) whether the deep perched zone is a continuous unit that extends for several km from the mountain front eastward, or whether it is a "tongue" projecting eastward across TA-16. "Tongue" geometry

implies the existence of regions within the deep perched zone with northward and southward hydrologic gradients.

4. Hydrologic parameters within the two major saturated zones need to be defined in order to support groundwater-modeling efforts. The groundwater modeling efforts may provide better understanding of contaminant transport in the deep perched and regional saturated zones. Such information needs to be determined at additional points within potential contaminant flow paths downgradient from TA-16.

   Hydrologic parameter data will be used to determine: (1) whether the hydrologic properties of the Otowi and Puye formations in the western portions of the Laboratory are heterogeneous; (2) whether lateral variations in lithology are consistent with the current 3-D hydrogeologic model for the Laboratory; and (3) how that model can be refined.

6.3.6.2 Investigation Design

Data from deep wells within and downgradient from TA-16 will be used to address questions concerning HE sources, contaminant extent, transport and recharge pathways, contaminant concentration dynamics, and hydrologic gradients. The data will also support efforts to model the deep perched and regional saturated zones. These data will be derived from both the regional wells outlined within the Hydrogeologic Work Plan (LANL 1998, 59599.1) and the additional 260 CMS wells that are described below. Ultimately, these data will be used to support risk assessments that include the deep perched saturated zone and regional aquifers as pathways in the risk assessment.

The Hydrogeologic Work Plan includes plans to drill a series of regional aquifer wells, known as the 'R' wells (Figure 6.3-11). Five of these are approximately downgradient of TA-16: (1) regional well R-27, planned for the confluence of Cañon de Valle and Water Canyon, approximately 3-4 km southeast of R-25; (2) regional well R-19, planned for a mesatop location south of Threemile Canyon, approximately 4-5 km east of R-25; (3) regional well R-18, planned for a location in, or just south of, Pajarito Canyon, approximately 3-4 km northeast of R-25; (4) regional well R-28, planned for a location in Water Canyon, approximately 6-7 km southeast of R-25; and (5) regional well R-30, planned for a location at TA-49, approximately 4-5 km southeast of TA-16 (Figure 6.3-11).

Two regional wells, R-24 and R-26, are also planned for locations west of TA-16: these represent upgradient wells for the purposes of the TA-16 investigations (Figure 6.3-11). All of these regional wells will be characterized hydrogeologically. Water and core samples taken from them will be analyzed for a comprehensive suite of constituents, including HE, metals, water quality parameters, and radionuclides. Planning specifications for these Hydrogeologic Work Plan wells can be found in Table 6.3-6. Note that Laboratory-wide background values for groundwater are currently being developed by the ER project. Both these Laboratory-wide values, and data from the upgradient wells at TA-16, will be used to evaluate, in both the regional and 260 CMS wells, which anthropogenic constituents have been released to groundwater.

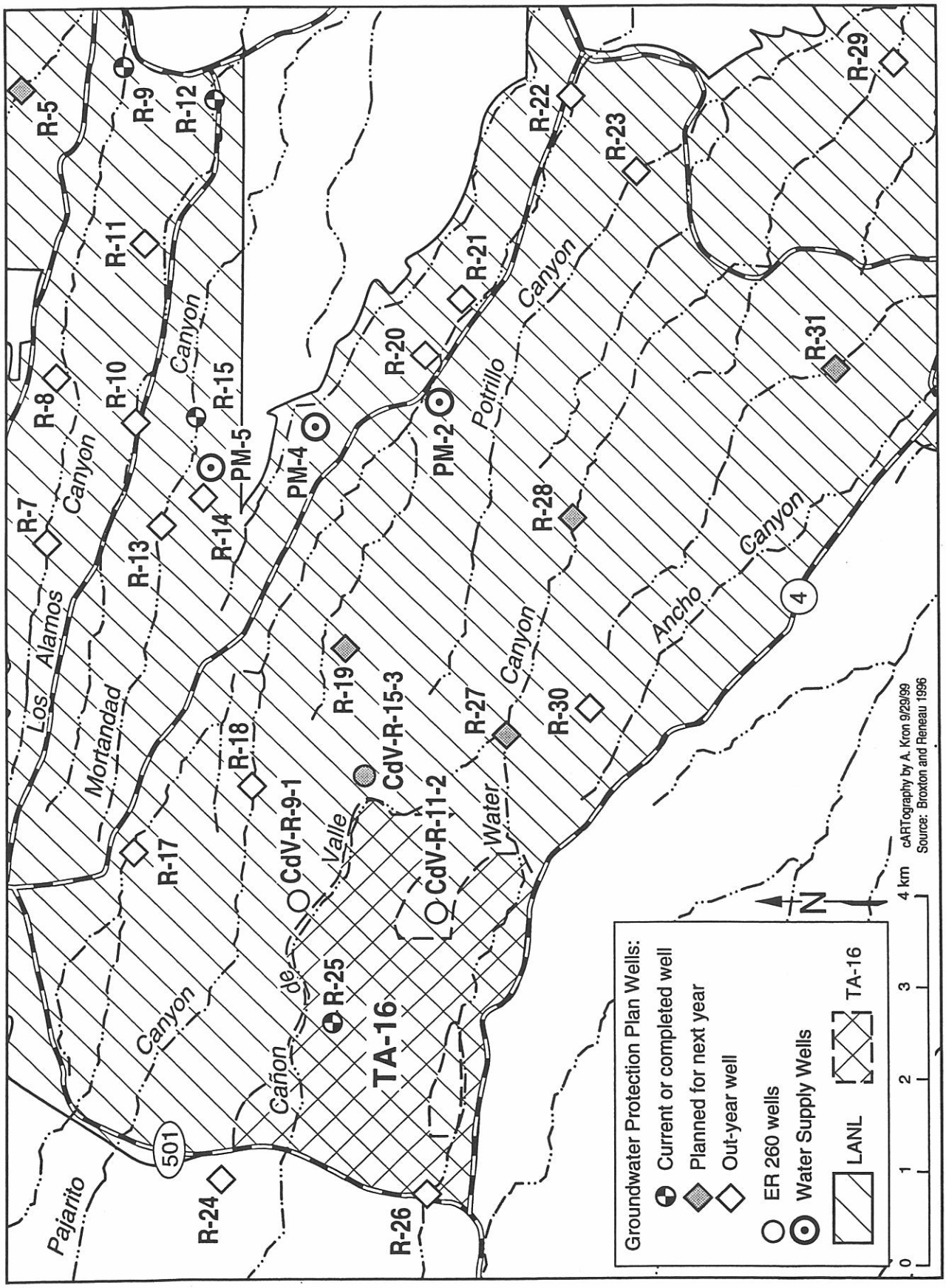

Figure 6.3-11. Proposed deep wells in the vicinity of TA-16

Table 6.3-6

Planning Specifications for Groundwater Protection Plan Wells That are Relevant to TA-16 Investigations

Regional Well Designation	Location	Estimated Depth (ft)	Well Completion Type	Current Estimated Start Date for Drilling
R-27	Water Canyon/Cañon de Valle confluence	1840	Multiple	FY 00
R-19	TA-15	1945	Multiple	FY 00
R-28	Water Canyon	4020	Multiple	FY 00
R-18	Pajarito Canyon	1945	Multiple	FY 01
R-30	TA-49	1580	Single	FY 05
R-24	West of TA-16	1476	Multiple	FY 05
R-26	West of TA-16	1280	Multiple	FY 05

Note: Specifications are based on the Hydrogeologic Work Plan.

The 260 CMS wells, as described below, will be used to augment the regional wells proposed under the Hydrogeologic Work Plan. The 260 CMS deep drilling program addresses the problem of contamination in the deep perched zone and regional aquifer. To focus on this problem most effectively, this CMS plan addendum minimizes, for the time being, consideration of the near-surface source term. This exclusion pertains not only to historic or ongoing surface releases, but also to any contamination that is presently in the vadose zone. However, data from both the Hydrogeologic Work Plan wells and the 260 CMS wells will provide crucial information on recharge sources and transport pathways within the near surface. Whereas assessment of sources (especially in the vadose zone) ultimately is crucial to resolving the "global" problem associated with TA-16 HE discharges, it is not the primary goal of the investigations outlined in this document. The near-surface source term and vadose zone in the vicinity of TA-16-260 are currently being addressed through the ongoing CMS process for PRS 16-021(c). Other sources will be investigated through the ongoing RFIs at TA-16 and other TAs in the western half of the Laboratory.

A minimum of three 260 CMS wells are proposed in this CMS Plan addendum. These three wells will be located to the east of TA-16-260 and R-25 at TA-15 (Well CdV-R-15-3), to the southeast of TA-16-260 and R-25 at TA-11 (Well CdV-R-11-2), and to the northeast of TA-16-260 at TA-9 (Well CdV-R-9-1) (Figure 6.3-11). The exact locations of these wells are not finalized. The Laboratory intends to continue to use the data quality objectives (DQO) process throughout the implementation of this CMS addendum. As

each well is installed, and after characterization data are acquired, the results from each well will be discussed with NMED personnel to reassess the 260 CMS deep groundwater characterization and the ongoing well installation project. At that time, locations of upcoming wells will be reviewed.

The siting of the initial three 260 CMS wells was based on the boreholes' ability to investigate key problems associated with the TA-16 groundwater investigations: (1) the nature, extent, and dynamics of HE contamination in the deep perched zone and regional aquifer; (2) the hydrologic gradients in the TA-16 area; (3) the extent and geometry of the deep perched zone; and (4) the hydrologic properties of subsurface geologic units in the deep perched and regional aquifers. Equally important siting criteria included the ability of the wells to complement the Hydrogeologic Work Plan wells and logistical issues. Key logistical issues that influenced decisions on well siting included whether a location can be accessed by a large drill rig, whether a location falls within the blast radius of an active firing site, and whether a location lies within the nesting area of a threatened and endangered species.

Table 6.3-7 outlines the rationale for drilling the three well locations. Based on those assessments, the first well that will be drilled is CdV-R-15-3, the TA-15 well; the second will be CdV-R-11-2, the TA-11 well; and the third will be CdV-R-9-1, the TA-9 well. Drilling at CdV-R-15-3 will be initiated during fiscal year 2000, the other two wells will be initiated as soon as funding allows, probably during fiscal year 2002.

Table 6.3-7 Assessment of Well Sites Candidates

Location/ Well ID	PROS	CONS
TA-15/ CdV-R-15-3	• Could provide insight into TA-18 HE observations • Downgradient from TA-16-260, generally upgradient from supply wells • Downgradient from water-losing section of Cañon de Valle • Lies on east-west transect that includes TA-16-260, R-25, R-19 and PM-2/PM-4 • Could provide insight into geologic "basement structure"	• In concert with R-25 and SHB-3, not optimal for defining principal deep perched aquifer gradient
TA-11/ CdV-R-11-2	• Easy access • Area is not covered by planned "R" wells • Should define hydrologic gradient, and could help define the plumes' southern boundaries	• May not be directly downgradient from TA-16-260 in regional aquifer

Location/ Well ID	PROS	CONS
	• Should help in evaluation of other sources (Martin Spring Canyon) • Lies on transect between TA-16-260 and R-27 • Provides information on conditions near southern Laboratory boundary	
TA-9/ CdV-R-9-1	• Assesses flow to north of R-25 area • Ties to HE findings in Pajarito Canyon springs • Would help define gradients	• May not lie in direction of flow from TA-16-260 to water-supply wells • May reflect mixed sources

If the data from these 260 CMS wells and the Hydrogeologic Work Plan wells listed above suggest that the HE plumes within the deep perched zone and regional aquifer are not bounded, additional regional 260 CMS wells may be drilled. This strategy will be applied whether HE in perched and regional groundwater is derived solely from TA-16-260 or from multiple sources, including sources at TA-9. The locations of any additional wells will be developed in consultation with NMED personnel, as well as with members of the public and other stakeholders. Ongoing modeling efforts will also be used to optimize well location selection.

6.3.6.3 Sampling Activities

The Data Quality Objectives (DQOs) for data collection for these 260 CMS wells are similar, although reduced in scope, from those outlined in the Hydrogeologic Work Plan (LANL 1998, 59599.1). If relevant changes to the DQOs in the Hydrogeologic Work Plan are agreed upon with NMED, similar changes will be implemented for these 260 CMS wells. For the three wells, data needs are ranked as follows, in descending order of priority:

1. Contaminant profiles (for HE, metals, and anions) and water levels

2. General lithology (the zone that would be most beneficial to understand from a hydrogeologic perspective would be the layers between the two major saturated zones)

3. Various hydrogeologic parameters (e.g., saturated zone thicknesses, saturation levels, head gradients, permeability, and porosity)

One reason for the hydrogeologic parameters receiving the lowest priority is that, by the time the TA-15 well has been drilled, relevant information from other adjacent wells will be available. Another reason is that the primary use for these parameters is as input to models. Due to the heterogeneities of hydrologeologic parameters within lithologies on the Pajarito Plateau, modelers will have to compensate for poorly constrained data through the use of sensitivity analyses.

Borehole Advancement and Well Installation Specifications

The 260 CMS wells will be drilled and completed similarly to Type 2 wells, using the terminology of the Hydrogeologic Work Plan (LANL 1998, 59599.1). The following description of the proposed wells has been modified from the Hydrogeologic Work Plan, Section 4.1.1.2.

Each of the three wells will be a multiple-completion regional aquifer well. The boreholes for these wells will be drilled to an estimated depth of 1800 ft or at least 200 ft into the regional aquifer. A principal control on the depth of drilling will be whether the HE plume has been bounded in the vertical direction based on screening results. Approximately 5% of the borehole will be cored, with emphases on the deep perched groundwater zone, stratigraphic contacts within the saturated zones, and the top of the regional aquifer. The number and length of screened intervals will be finalized in the field, in consultation with NMED personnel based on site-specific findings. Screened zones will be installed in both the deep perched zone and regional aquifer. The selection of slot size for screens and the selection of filter pack materials will be made following sieve analysis of geologic cuttings in the zone to be screened.

Applicable borehole advancement/well installation specifications are as follows:

- A carbon steel surface casing, approximately 16 in. in diameter, will be set from the land surface to approximately 10 ft deep. In locations where alluvium is present, the surface casing will extend approximately 10 ft into the underlying competent layer and will be grouted in place.
- During borehole advancement, the drilling method will employ an outer temporary casing advanced to the total depth of the borehole. This is done to: 1) maintain borehole integrity, aid circulation of drilling fluids, and 2) minimize migration of fluids between the deep perched zone and the regional aquifer.
- The well will be constructed of 5.56 in. outer diameter mild carbon steel casing from land surface to the top of the stainless steel screen. A transitional coupling will be installed between the two casing types to minimize the potential for corrosion. An annulus ≥ 2 in. will be provided. Approximately 10 ft of blank casing with an end cap will be set at the base of the screen. Centralizers will be used at approximately 100-ft intervals.

- All backfill materials (grout, bentonite, sand) will be tremied/pressure grouted in place.
- A lockable steel protective cover will be cemented, in place, over the well casing and extending at least 2 ft below ground surface.
- The top of the well will be finished with a concrete pad 4 ft x 4 ft x 4 in. The well head will be surrounded by 8-ft chainlink fencing, topped with barbed wire, 15 ft on a side, with one side gated and padlocked.

Figure 6.3-12 is a general prototype drawing of Type 2 wells. Figure 6.3-13 is a depiction of the multiple-completion configuration.

HSWA Module VIII Requirements

LANL anticipates that these boreholes will be completed compliant with the HSWA Module VIII permit and that they will ultimately be used for long-term monitoring. Thus, they will fulfill all HSWA Module special permit conditions that concern the construction of monitoring wells. As cited in the Hydrogeologic Work Plan Section 4.1.2, the following permit language is relevant to the typical construction of the wells proposed in this CMS Plan addendum:

> "The monitoring wells installed under this and following sections of this permit shall be constructed using flush-joint, internal upset, threaded (or an equivalent method of joining without rivets, screws and glues) casing manufactured from inert materials. The boreholes for casings and screens shall be a minimum of six (6) inches greater in diameter than the well casing or screen outer diameter. Filter pack and screen slot openings shall be sized based on formation grain size and characteristics. Well screen lengths shall be no more than ten (10) feet in length. The filter pack shall extend no more than two (2) feet above the top of the screen and shall not cross any clay layers which may act as aquitards. If a bentonite seal is used, the bentonite shall be allowed to hydrate a minimum of twelve (12) hours before emplacement of grout. Grout shall be emplaced using a tremie pipe to ensure a consistent seal at depths greater than 5 feet, and grout shall be allowed to set a minimum of twelve hours before initiating development.
>
> Development procedures shall include purging of the well until contaminants introduced during drilling can be assured of being removed. Development shall also include surging with a surge plug, and either bailing or pumping until the nephelometric turbidity units (N.T.U.) can be consistently measured at five (5) or less, if possible. Well head construction shall include a well pad keyed into the well annulus and a system to secure the well from traffic and unauthorized access. Within thirty (30) days of construction and development of the last well required under this section, the Permittee shall submit to the Administrative Authority a report and map including:

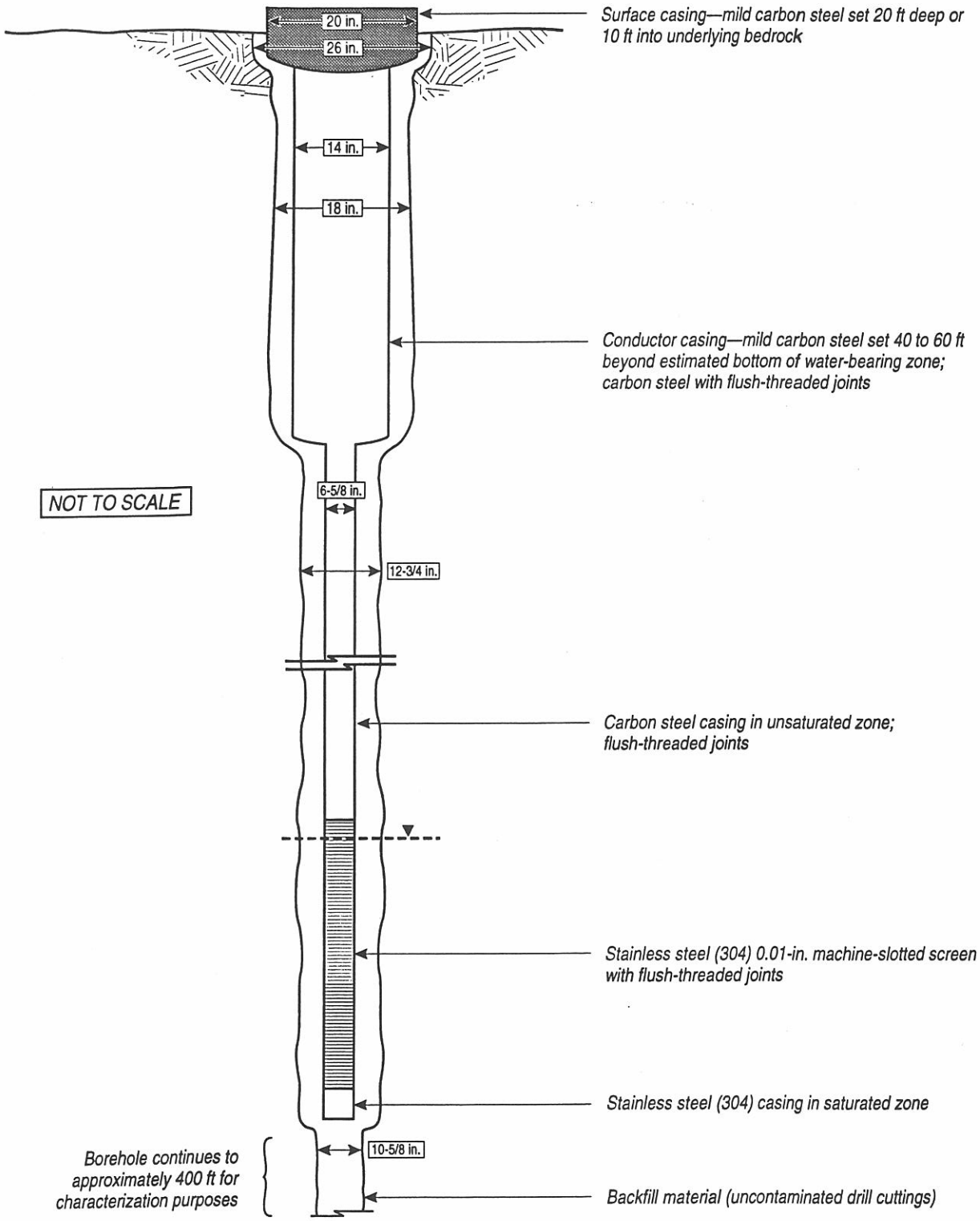

Figure 6.3-12. Schematic types 2 and 3 (regional) well design; all dimensions are approximate.

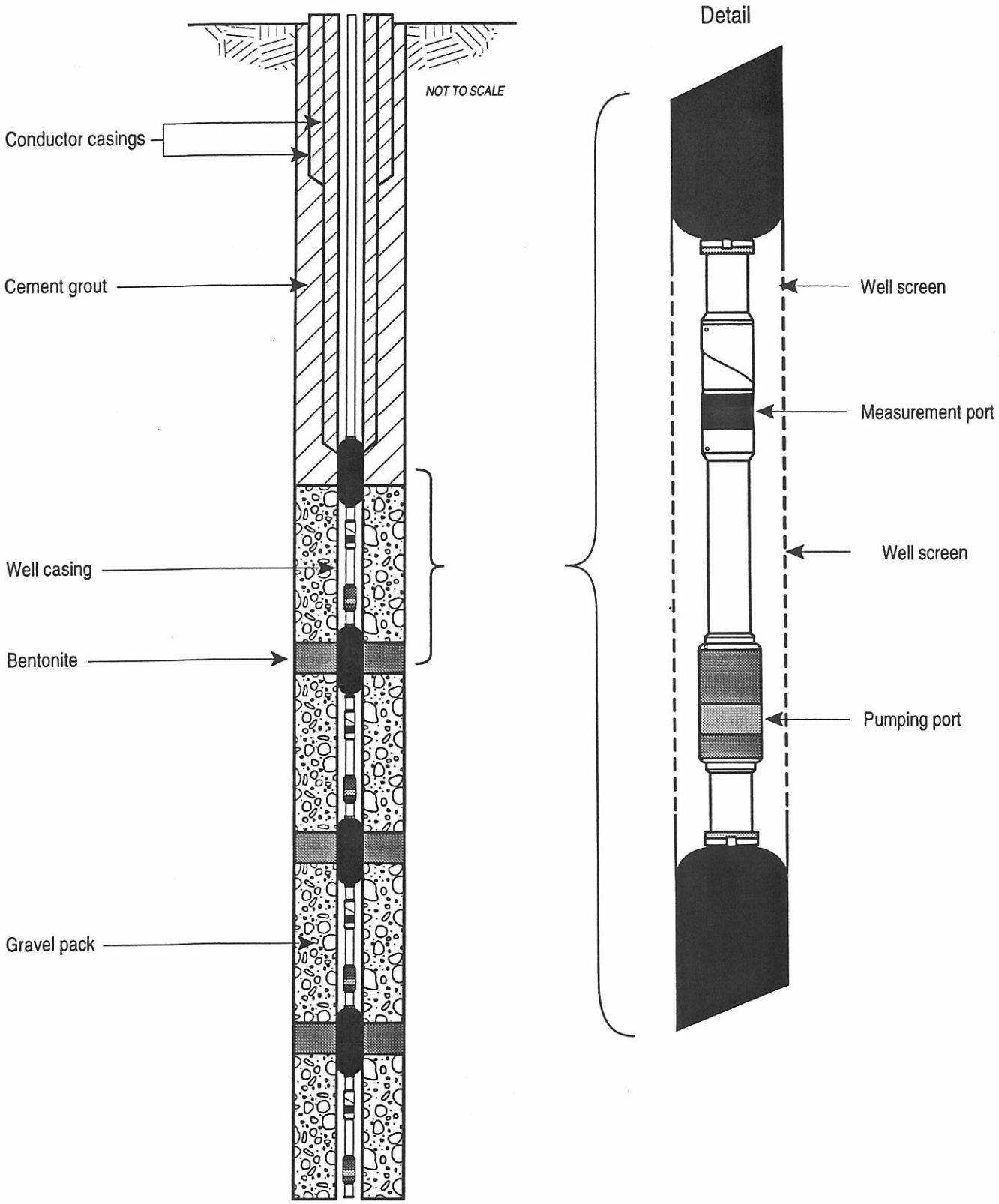

Figure 6.3-13. Westbay-type design for multi-level monitoring

1. Survey of location of each well;
2. Surveyed ground level, top of casting and top of well pad referenced to known elevation datum (NGVD, 1929);
3. Static water level, referenced to mean sea level;
4. Well construction data (including a diagram for each well, detailing total depth, screen placement, gravel pack, annular seal, borehole and casing size [all measured to within 0.1 foot], and well log data; and
5. Well development data.

Any saturated condition encountered will require grouting in a surface casing to prevent any downward migration of surface contamination along the wellbore. Any boring drilled into the main aquifer that encounters perched water shall set conductor pipe to the top of the main aquifer and hydraulically isolate the main aquifer from the deep perched aquifer. The annular space must be sealed with a bentonite grout or equivalent to prevent shrinkage cracking."

Renewal of the HSWA Module is currently being addressed with the NMED. The specifications of the 260 CMS wells as outlined in this CMS addendum will be modified to reflect changes in the new HSWA Module that are applicable to regional or monitoring wells.

Borehole and Groundwater Sampling

The well sampling specified for these three wells is a subset of that proposed for the regional wells specified in the Hydrogeologic Work Plan (LANL 1998, 59599.1). The key data needs are characterization of contaminant profiles, lithology, and hydrogeologic parameters. These needs will be met through sampling core and cuttings as well as groundwater, and through geophysical logging methods.

The following guidelines for sampling, which have been extracted from the Hydrogeologic Work Plan, apply to these 260 CMS wells:

- A comprehensive cased-hole geophysical logging suite will be run through the drill string immediately prior to completion of each well.
- Core and cutting samples will be field screened for HE using the spot test and D-Tech immunoassay methods. Field screening will be conducted at regular intervals during well advancement.
- Physical properties analyses will be conducted on five core samples per borehole. A list of hydraulic properties to be determined on core samples collected from saturated

zones includes: *in situ* water content, porosity, particle density, bulk density, saturated hydraulic conductivity, and water retention characteristics from 0 to 15300 cm suctions.

- Packer and slug tests will be completed at key geologic intervals as defined by the technical team hydrologist. These may be completed following well completion.
- Five samples of cuttings or core will be collected from saturated zones for petrographic, X-ray fluorescence (XRF), and X-ray diffraction (XRD) analyses.
- Following completion and development of the wells, groundwater samples will be collected on a quarterly basis from each screened interval or Westbay-type port and analyzed for the presence of HE, metals, and anions. One quarterly round of samples per year will be analyzed for volatile organic compounds, gross alpha beta, and a full suite of geochemical parameters as required for geochemical modeling.

Geophysical logging will be conducted on each of the wells. Two logging runs will be conducted for each borehole. The upper 300-500 ft of each borehole will be logged with open-hole logging tools if borehole stability is such that the borehole can be advanced without casing. After logging, casing will be set in this interval, and the borehole will be advanced to the nominal total depths identified above. Due to the unconsolidated nature of the subsurface strata and the use of air-rotary drilling, these boreholes will be cased prior to wireline logging. Cased-hole logging will be performed from land surface to total depth.

The following geophysical logs will be generated for all open-hole sections if possible:

- Caliper
- Electromagnetic induction
- Natural gamma
- Magnetic susceptibility
- Borehole color video (axial and sidescan)
- Fluid temperature (saturated zone only)
- Fluid resistivity (saturated zone only)
- Single point resistivity (saturated zone only)
- Spontaneous potential (saturated zone only)

The following geophysical logs may be generated for all cased-hole sections, if needed:

- Gamma-gamma density
- Natural gamma
- Thermal neutron

Insert the following revised table on p. 83 of CMS Plan (Environmental Restoration Project 1998, 62413.3), in Section 6.4, "Data Collection Procedures".

Table 6.4-3

Analyte Suites, Methods, and Protocols for Analysis of Soil and Water Samples

Analyte Suite	Analytical Method	Analytical Protocol*
HE	HPLC	SW-846, Method 8330
Metals	Inductively coupled plasma emission spectroscopy (ICPES) or Inductively coupled plasma mass spectroscopy (ICPMS)	SW-846, Methods 6010 and 6020
Anions (nitrate, sulfate)	Ion Chromatography	EPA Method 300
Fluoride	Ion Chromatography	EPA WW 340 series
Chloride	Ion Chromatography	EPA WW 325 series
Bromide	Ion Chromatography	EPA Method 300, EPA Method 320.1
HCO_3 (bicarbonate)	Titration	SW-846, Method 4500 – CO_2
Volatile organic compounds	Gas Chromatography Mass Spectrometry	SW-846, Method 8240
Gross alpha/beta	Gas Proportional or Liquid Scintillation Counting	Not available

* Or latest equivalent EPA method

Additional References

Environmental Restoration Project, September 1998. "CMS Plan for Potential Release Site 16-021(c)," Los Alamos National Laboratory Report LA-UR-98-3918, Los Alamos, New Mexico. **(Environmental Restoration Project 1998, 62413.3)**

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Stone, W., D. Broxton, and D. Rogers, 1999. "Water Level Observations During Drilling and Vertical Head Distribution – Experience at R-25. A Deep Regional Borehole." Los Alamos National Laboratory, Unpublished Report, Los Alamos, New Mexico. **(Stone et al. 1999, 64010)**