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Date: November 14, 1997
Refer to: EM/ER:97-476

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION FOR THE RFI REPORT FOR TA-16, PRSs 16-003(k) AND 16-021(c) (FORMER OU 1082)

Dear Mr. Garcia:

The Environmental Restoration Project received your letter dated September 11, 1997, in which you approved a request for extension for supplemental information on the Resource Conservation and Recovery Act Facility Investigation Report for Technical Area 16, Potential Release Sites 16-003(k) and 16-021(c). In your letter, you indicated that a response should be received from the Los Alamos National Laboratory no later than November 15, 1997. Enclosed please find our response to your request.

Should you have any questions, please contact Roy Michelotti at (505) 665-7444 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/TT/gmn

Enclosure: Response to Request for Supplemental Information for RFI Report for TA-16

LANL
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Cy (w/enc.):
D. Griswold, AL-ERD, MS A906
J. Harry, EES-5, MS M992
R. Michelotti, CST-7, MS E525
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D. Neleigh, EPA, R.6, 6PD-N
C. Rodriguez, CIO/ER, MS M769
T. Taylor, LAAO, MS A316
J. White, ESH-19, MS K490
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M. Leavitt, NMED-GWQB
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G. Saums, NMED-SWQB
S. Yanicak, NMED-AIP, MS J993
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Information Only (w/o encs)
T. Baca, EM, MS J591
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J. Plum, LAAO, MS A316
S. Rae, ESH-18, MS K497
G. Rael, AL-ERD, MS A906
J. Vozella, LAAO, MS A316
EM/ER File (CT# C346), MS M992
EM/ER File, MS M992

Response to Request for Supplemental Information for PRSs 16-021(c) and 16-003(k)

General Addenda and Corrections

1) As requested in the cover letter to this request for supplemental information, LANL will continue to provide HRMB with bi-monthly briefings on the status of the investigations of PRS 16-021(c). LANL will provide more formal written documentation of materials presented in these briefings upon request of HRMB.

2) LANL would like to note that the water SALs discussed in this document, particularly in Appendix C, primarily represent drinking water MCLs. LANL currently compares analytical concentrations to water criteria appropriate for the most likely water use (e.g. wildlife use) rather than comparing to human health levels.

3) The tritium unit values in Table C-6 should all be positive rather than negative.

4) As requested by HRMB in a telecon of September 9, 1997, LANL has identified within this response programmatic issues that have arisen while preparing this request for supplemental information.

NMED Comment 1.a. Section 1.3.2 Pertinent sections of the quality assurance/quality control plan for FY 95 TA-16 field campaign should be provided for reference.

LANL response The pertinent sections of the quality assurance/quality control plan for the FY 95 TA-16 field campaign are provided as Attachment A. Please note that this plan was written by the ICF Kaiser field team for their own use. It has not been edited by a professional editor.

NMED Comment 1.b. Section 1.3.2 LANL should include in the text the frequency at which both field and laboratory QA/QC samples were obtained

LANL response Field QA/QC samples (field duplicates) were collected at a rate of 3 out of 34 laboratory samples at PRS 16-021(c) and 0 out of 10 laboratory samples at 16-003(k) for a total of 3 out of 44 for the two PRSs. Laboratory QA/QC samples such as batch-specific QC samples (blank, matrix spike, duplicates) were obtained at a rate commensurate with LANL Environmental Restoration (ER) laboratory contracts. These contracts are based either on requirements contained in the EPA SW-846 Laboratory (CLP) SOW or guidance provided in the EPA SW-846 procedures. This rate is typically a frequency of one QC sample for each instrumental method, each sample matrix, and/or each analytical batch, whichever is more frequent. Inorganic and radiochemical methods also require the analysis of a laboratory control sample with each analytical batch. Additional non-batch QC requirements for individual instrumental techniques vary widely and cannot be easily or briefly summarized in reports.

NMED Comment 1. c. Section 1.3.2 LANL should add the locations of the QA samples to Figures 5.1.4-1 and 5.2.4-1.

LANL response Locations of the field QA samples, the duplicate samples, have been added to Figure 5.2.4-1 for PRS 16-021(c). No field QA samples were taken at PRS 16-003(k), so figure 5.1.4-1 was not modified. The modified figure 5.2.4-1 is included as Attachment B.

NMED Comment 2. Section 2.3: LANL should replace all references to the "main" aquifer with "regional aquifer".

LANL response On page 9 paragraph 2 the phrase "main" aquifer will be replaced with "regional" aquifer.

NMED Comment 3. Section 2.3.1: LANL should include a figure indicating the barium and boron levels as indicated in the second to last paragraph of this section.

LANL response LANL has included as Attachment C a figure indicating the locations of the barium and boron levels as indicated in the second to last paragraph of this section.

NMED Comment 4.a. LANL should explain any possible relationship between constituents identified in SHB-3 to site-related activities. And if any possible relationship exists, LANL should provide rationale for advancing boreholes to a depth less than the static water level in SHB-3. RPMP is concerned that constituents found in SHB-3 might be related to HE-related activities and that contaminants may be present in the regional aquifer since it has not been definitely constrained.

LANL response LANL believes that a definitive relationship between constituents identified in SHB-3 and site-related activities cannot be made at this time. The following reasoning suggests that such a relationship is unlikely: (1)The constituents lead, phosphate, rubidium, and ammonium have not been extensively used in HE-related activities at TA-16. (2) These constituents are not found at elevated levels in the HE-contaminated springs at TA-16, which suggests that these constituents are not significant HE by-products in water samples known to be HE-contaminated. (3) The levels of these constituents found are low, and may not represent contamination of SHB-3 waters. The background dataset used in these comparisons was small, and based on springs/seeps. These spring/seep data may not be representative of perched/deep groundwater such as that found in SHB-3. Further investigation of this issue will occur when an improved background dataset for groundwater is available.

Although LANL does not believe that a definitive relationship between the observed constituents in SHB-3 and site activities has been proved at this time, LANL is also concerned that constituents from site-related activities could be reaching the perched/regional water table that is present in SHB-3. LANL's rationale for advancing boreholes to a depth less than the static water level in SHB-3 is that our investigations are phased. Moderate-depth (200 ft) boreholes are planned in this RFI Report to investigate shallow perched groundwaters, which discharge as springs at TA-16. Results of these investigations will be used to help locate future, deeper boreholes that intersect the static-water table present in SHB-3. LANL currently has deep boreholes at TA-16 planned in its baseline in future fiscal years (FY 99 and FY 00). In addition, 4 sitewide hydrogeologic studies boreholes to the regional aquifer are planned in and around TA-16

during the next few years; these boreholes will provide additional information on potential TA-16 impacts to the regional aquifer.

NMED comment 4.b. LANL should also clarify if the ground water interval encountered in SHB-3 will also be intercepted during drilling activities as discussed within this document.

LANL response LANL does not believe that the ground water interval encountered at SHB-3, which was at a static water depth of 664 ft during 1992, will be intersected by the 200 ft boreholes that are discussed in this document. As noted in the response to comment 4.a. LANL anticipates drilling boreholes to depths greater than 700 ft during FY 1999 and FY 2000.

NMED comment 4.c. Please present the data, sampling dates, sampling intervals, etc. for SHB-3 and the background spring data to which it was compared.

LANL response Pertinent data are present in Attachment D. SHB-3 data were originally reported by Blake et al (Blake et al. 1995, 1335). Background data were also extracted from the Blake et al. (Blake et al., 1995, 1335) document. LANL recognizes that this background dataset is small, but it was the best available dataset at the time of these comparisons. LANL hopes to repeat these comparisons with larger sample and background datasets in the future.

NMED comment 4.d. Please clarify what is meant by "swab" sample

LANL response A swab sample is merely a water sample that is taken with a device known as a swab sampler. A swab sampler is rod that has rubber cups of slightly larger diameter than the well bore that is deployed on the end of the drillstring. These cups open up during deployment downhole. When the sampler pulls up on the wireline the water samples are trapped and raised to the surface.

NMED comment 5.a. Please define the acronym TATB

LANL response TATB is triaminotrinitrobenzene, an insensitive and highly insoluble HE used in many modern weapon systems.

NMED comment 5.b. Please provide the analytical methods, detection limits, summary of QA/QC documentation for the analyses conducted.

LANL response Attachment E provides the analytical methods, detection limits and summary of QA/QC documentation for the analyses conducted.

NMED comment 6. Section 3.1.2 LANL should provide the pertinent portions of the *Technical Approach to the RFI Report* as reference documentation for this report

LANL response The reference to Knudsen et al, 1996 in Section 3.1.2 Data Verification and Validation is no longer valid. The document referenced here, "Technical Approach to the RFI Report" was an ER Policy Paper under development at the time the 260 Outfall RFI Report was in preparation. This policy paper was never finalized or released as official ER Policy.

The appropriate reference for the ER baseline data validation protocol is now the Quality Assurance Project Plan (QAPP), LANL 1996 (ER Master Reference List No. 1292). This reference is cited in the latest version of the RFI Report Framework, Section 3.1.2 Data Validation, page 10; and is cited in recent versions of LANL RFI Reports.

Attachment F provides the pertinent portions of the QAPP.

NMED comment 7. Section 3.3 LANL should include a compilation of all analytical data, including non-detectable concentrations, in Appendix A of the RFI Report.

LANL response Attachment G (2 EXCEL disks per telecon between T. Glatzmaier and J. Kieling on 10/22/97) provides a compilation of all analytical data, including non-detectable concentrations. This attachment will be included as part of Appendix A.

Provision of all data represents a programmatic issue, which may be addressed in future programmatic discussions.

NMED comment 8. Section 3.4.2 LANL should provide as reference materials attached to this document, the pertinent sections of the *Screening Assessment Methodology* (McCann et al.).

LANL response The reference to McCann et al, 1996 (1300) is no longer valid. The document referenced here, "Screening Assessment Methodology" was an ER Policy Paper under development at the time the 260 Outfall RFI Report was in preparation. This policy paper was never finalized or released as official ER Policy.

The appropriate reference for the ER Screening methodology is "Risk-Based Corrective Action Process (Dorries 1997, 1297)." This reference is cited in the latest version of the RFI Report Framework, Section 3.2.4 Risk Based Screening Assessment, page 13; and is included in recent versions of LANL RFI Reports.

Attachment H includes the pertinent sections of the document

NMED comment 9. Section 3.4.3. LANL should provide in the text of this section further explanation why site-specific human health risk assessments were not performed for 16-003(k) and 16-021(c).

LANL response No site-specific human health risk assessments were performed in this Phase I Report because of the uncertainties in conceptual model development and lacks in data collection to perform a risk assessment at this point and time of the 260 Outfall project. The Phase II Sampling and Analysis Plan presented in Section 5.2.11 of the RFI Report details the plan to collect the data necessary to validate a conceptual model for the site and perform risk assessment evaluations. Therefore, human health risk assessments will be performed in latter stages of the RFI/CMS process for this site.

NMED comment 10a. Section 4.0 LANL should ensure that all QA/QC results reported by the laboratory are present and correct in FIMAD and reported within this document.

LANL response Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997 LANL will provide information on: (1) how LANL

handles the QA/QC results in FIMAD; (2) why we handle these data in this way; and (3) indicate where this process is going.

(1) Analytical results for batch-specific QC samples are included in FIMAD. Non batch-specific QC indicators that are measured by the analytical laboratories are not currently reported electronically. Not all of the electronically available data are currently being verified. LANL's current policy is to verify all field data and some (but not all) of the batch QC results by comparing electronic data with hard copy reports. (2) LANL handles batch QC data in this fashion because data verification is an extremely labor intensive process. LANL's current contracts with the analytical laboratories do not require that electronic deliverable are 100% in agreement with hard copy deliverables. Non- batch QC indicators are not hand entered into FIMAD because most would not fit into the current FIMAD formats. (3) These deficiencies will be remedied in upcoming contracts. In addition, the DOE Environmental Management Electronic Data Deliverable Master Specifications (DEEMS), which will guide LANLs new electronic deliverable, will make more of these indicators available electronically.

LANL believes that efficient and effective QA oversight and data validation processes are more critical to the maintenance of data integrity than the capture of all QA/QC information in FIMAD. Currently all LANL data receive at least baseline validation. Data validators have access to all of the QA/QC indicators reported by the analytical laboratories, whether or not they are in FIMAD. Where these indicators demonstrate that the laboratory process may have been out of control, this is indicated to the data user both in the validation reports and in the data validation flags that are recorded in FIMAD.

NMED comment 10b. Section 4.0 LANL should collect field duplicates at a minimum rate of 10%.

LANL response 44 laboratory samples were collected for PRSs 16-003(k) and 16-021(c). Three laboratory field duplicates were collected. This is a rate of 6.8 % At the time of the 1995 TA-16 field campaign, LANL QA documents suggested taking field duplicates at a rate of 5%. The approved RFI work plan stipulated 1 out of 14 (duplicates were not addressed in the NOD) duplicates at PRS 16-021(c) and 16-003(k), which were considered together in one SAP - a rate of 7.1 %.

This represents a programmatic issue, which may be addressed in future programmatic discussions.

NMED comment 11. Section 4.3 LANL should clarify at each mentioning that "Table B-2" is located within Appendix B.

LANL response LANL will convert each citation of "Table B-2" to "Table B-2, Appendix B".

NMED comment 12. Section 5.0 For additional clarification, LANL could include a figure which references the analytical data (Appendix A - see Comment 7) and indicates the locations where contaminant concentrations were below SALs.

LANL response: Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997 1) LANL notes that the requested information is available on existing figures (e.g. Figure 5.2.4-1); 2) LANL will note in section 5.0 that analytical suites and data are available in Appendix A.

NMED comment 13. Section 5.1.3 Please include the adjective "sump" in the titles of Tables 5.1.3-1, 2 and 3

LANL response LANL will replace "water" with "sump water" in the titles of Table 5.1.3-1, 5.1.3-2. 5.1.3-3.

NMED comment 14.a. Section 5.1.4 LANL should include pertinent information such as a tabulated summary of Photo Ionization Detector/Flame Ionization Detector (PID/FID) readings, HE spot test and sodium iodide results in the RFI report.

LANL response Pertinent field information such as a tabulated summary of PID/FID readings, HE spot test, and sodium iodide detector results is provided in Attachment I, which is extracted from the Post Field Ops Report for the FY 95 TA-16 field campaign.

NMED comment 14.b. Section 5.1.4 Please provide an explanation of "Request Numbers" within the text of the RFI report.

LANL response LANL will add the following footnote to Tables 5.1.4-2 and 5.2.4-1: "All samples with the same request number were analyzed together in a single batch at an analytical laboratory"

NMED comment 14.c. Section 5.1.4 LANL should provide well construction diagrams for those boreholes and wells installed.

LANL response Well construction drawings are provided as Attachment J. These well construction drawing s represent typical alluvial and deep wells that are being implemented as part of the TA-16-260 field campaign. Well construction is guided by LANL-ER-SOP 5.01 "Monitor Well Construction".

NMED comment 15 Section 5.1.6 LANL should detail which SVOC compounds were undetected in sample 031-95-0051 and reference a figure indicating the sample's location.

LANL response The list of undetected SVOCs is provided in Table 15-1

Table 15-1 - Semivolatile Organic Compound (SVOC) Suite

Acenaphthene	Chrysene	
Acenaphthylene	Dibenzo(a,h)anthracene	Isophorone
Aniline	Dibenzofuran	2-Methylphenol
Anthracene	1,2-Dichlorobenzene	4-Methylphenol
Azobenzene	1,3-Dichlorobenzene	Naphthalene
Benzo(a)anthracene	1,4-Dichlorobenzene	2-Nitroaniline
Benzo(b)fluoranthene	3,3'-Dichlorobenzidine	3-Nitroaniline
Benzo(k)fluoranthene	2,4-Dichlorophenol	4-Nitroaniline
Benzo(g,h,i)perylene	Diethylphthalate	Nitrobenzene

Benzo(a)pyrene	Dimethylphthalate	2-Nitrophenol
Benzoic acid	Di-n-butylphthalate	4-Nitrophenol
Benzyl alcohol	Di-n-octylphthalate	N-Nitrosodimethylamine
Bis(2-chloroethoxy)methane	2,4-Dimethylphenol	N-Nitrosodiphenylamine
Bis(2-chloroethyl)ether	2,4-Dinitrophenol	N-Nitroso-di-n-propylamine
Bis(2-chloroisopropyl)ether	4,6-Dinitro-2-methylphenol	Pentachlorophenol
Bis(2-ethylhexyl)phthalate	2,4-Dinitrotoluene	Phenanthrene
4-Bromophenylphenyl ether	2,6-Dinitrotoluene	Phenol
Butylbenzylphthalate	Fluoranthene	Pyrene
Carbazole	Fluorene	Pyridine
4-Chloroaniline	Hexachlorobenzene	1,2,4-Trichlorobenzene
4-Chloro-3-methylphenol	Hexachlorobutadiene	2,4,5-Trichlorophenol
2-Chloronaphthalene	Hexachlorocyclopentadiene	2,4,6-Trichlorophenol
2-Chlorophenol	Hexachloroethane	
4-Chlorophenylphenyl ether	Indeno(1,2,3-cd)pyrene	

Note that these analytes are tabulated in Table A-4, Appendix A.

In the second sentence of Section 5.1.6 replace "031-95-0051" with "031-95-0051 (Figure 5.1.4-1)".

NMED comment 16 Section 5.1.7 LANL should clarify if any potential radiological contaminants other than uranium exist at these PRSs.

LANL response Following the last paragraph in Section 5.1.7.1, insert the following sentences: "Interviews with several site workers suggest that the only radionuclide used in TA-16-260 was uranium. These workers suggested that: (1) HE parts that were glued to depleted uranium had occasionally been machined in TA-16-260 (Jim Griffin, personal communication 1992); and (2) other radionuclides, particularly fissile radionuclides, were kept far from HE that was being processed because of the potential safety hazards of an inadvertent detonation in the presence of radionuclides."

NMED comment 17 Section 5.1.7.1 LANL should include the evaluation of lead in the Multiple Chemical Evaluation (Table 5.1.7-1). Section 3.4 indicates that the PRSs will be evaluated assuming a residential risk scenario; the risk posed by lead to children should, therefore, be included in the evaluation.

LANL response LANL agrees that lead should be included in the MCE evaluation for this PRS. It should be noted that current LANL ER Project guidance requires lead to be included in the MCE. This guidance was not in place during FY 96 when this report was generated. The revised calculation (Table 5.1.7.1 revised - below) reflects the addition of lead to the MCE calculation. With the addition of lead, the sum of the maximum concentrations detected normalized to SALs is 1.5, indicating the potential for adverse effects due to exposure to this grouping. Therefore, those contaminants with a concentration normalized to SAL greater than 0.1 will be carried forward as COPCs. These contaminants include barium, copper, lead, nickel and TNB. The presence of these COPCs will be factored into the planning for the VCA proposed for this PRS as described in Section 5.1.10 of the RFI Report.

TABLE 5.1.7.1 Revised
MCE FOR NONCARCINOGENIC EFFECTS AT PRS 16-003(k)

CONTAMINANT	MAXIMUM SOIL CONCENTRATION (mg/kg)	SOIL SAL (mg/kg)	CONCENTRATION NORMALIZED TO SAL
Barium	2030	5300	0.4
Cobalt	38.5	4600	0.0
Copper	317	2800	0.1
Lead	316	400	0.8
Nickel	103	1500	0.1
Silver	3.7	383	0.0
Zinc	200	23000	0.0
HMX	3.84	3300	0.0
TNB	0.272	3.3	0.1
Benzoic Acid	0.056	100000	0.0
Diethylphthalate	0.48	52000	0.0
Fluoranthene	0.046	2600	0.0
Pyrene	0.04	2000	0.0
TOTAL			1.5

LANL does not agree with the statement expressed in this comment "Section 3.4 indicates that the PRSs will be evaluated assuming a residential risk scenario; the risk posed by lead to children should, therefore, be included in the evaluation." The intention of Section 3.4 is to describe the methodology for performing risk assessments, not to dictate the land use decisions to be made for individual PRSs. The methodology presented in Section 3.4 does describe the screening process used, which incorporates the use of SALs based on a residential exposure scenario. However, the SAL comparison dictates the need for further evaluation at a given site, and the subsequent development of COPCs. LANL proposes to evaluate the 260 Outfall PRSs with an industrial land use scenario. This decision is based on the fact that Building TA-16-260 is an active HE machining facility, that will remain an industrial land use according to the LANL 30-Year Plan, and therefore, will not be released to the public. Access to the 260 Outfall area is very restricted due to security clearance and safety issues. Therefore, appropriate exposure modeling (to include lead) during planning for, and conducting of, the VCA for this PRS will be based on an industrial scenario with adult receptors. LANL recognizes that a risk evaluation for a residential scenario may be performed for comparative purposes, but

the results from such an analysis will not be the primary decision focus for this particular site.

NMED comment 18 Section 5.1.10 Since no ecological risk analysis was performed, LANL should provide an errata sheet indicating the following correction to the third sentence: No constituents were found above SALs and MCE calculations indicate low probability of impact to human receptors due to multiple constituent effects.

LANL response LANL will correct the indicated sentence to read: "No constituents were found above SALs and MCE calculations indicate low probability of impact to human receptors due to multiple constituent effects." Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997 LANL will not provide an errata sheet at this time.

NMED comment 19 Section 5.2.2 A schematic diagram of the drainage channel and dam would be useful in visualizing the suitability of the proposed Best Management Practices.

LANL response A schematic diagram of the drainage channel and dam, also showing locations of the implemented Best Management Practices, is included as Attachment K.

NMED comment 20 Section 5.2.7.1 LANL should include the evaluation of lead in the Multiple Chemical Evaluation (Table 5.2.7-1). Section 3.4 indicates that the PRSs will be evaluated assuming a residential risk scenario; the risk posed by lead to children should, therefore, be included in the evaluation.

LANL response Please refer to the LANL response to NMED Comment 17 above. Table 5.2.7.1-1 revised (below) reflects the addition of lead to the MCE calculation. With the addition of lead, the sum of the maximum concentrations detected normalized to SALs is 0.8, indicating a low potential for adverse effects due to exposure to this grouping.

TABLE 5.2.7.1-1 Revised
MCE FOR NONCARCINOGENIC EFFECTS AT PRS 16-021(c)

CONTAMINANT	MAXIMUM SOIL CONCENTRATION (mg/kg)	SOIL SAL (mg/kg)	CONCENTRATION NORMALIZED TO SAL
Copper	40.5	2800	0.01
Lead	107	400	0.27
Nickel	37.3	1500	0.02
Silver	4.1	383	0.01
Vanadium	55.7	540	0.10
Zinc	226	23000	0.01
1,3-Dinitrobenzene	2.04	6.5	0.31
Nitrobenzene	1.2	33	0.04
3-Nitrotoluene	2.12	650	0.00
Benzoic Acid	0.43	100000	0.00
Di-n-butylphthalate	0.054	6500	0.00
Pyrene	0.071	2000	0.00
Acetone	0.067	2000	0.00

1,2-Dichlorobenzene	0.007	2300	0.00
1,2,4-Trimethylbenzene	0.052	8	0.01
1,1,1-Trichloroethane	0.014	3000	0.00
TOTAL			0.79

It is very important to note that this PRS is being evaluated with the formal RFI/CMS process. The first step in this process, the Phase II Sampling and Analysis Plan proposed for this PRS in Section 5.2.11 of the RFI Report, requires the collection of data for full suite analysis that includes the analysis for lead and other potential contaminants such as 1,3-dinitrobenzene and chromium. Therefore, the MCE and screening decision for this PRS at this point of the process is essentially moot, and the reader is referred to the Sampling and Analysis Plan proposed. Again, LANL requires the clarification of the land use and risk assessment issues for this PRS addressed in our response to NMED Comment 17 above.

NMED comment 21.a. Section 5.2.7.2 The normalized concentrations of lead (0.145) and 1,3-dinitrobenzene (0.31) are greater than 0.1 in the MCE for noncarcinogenic effects (Table 5.2.7.1-1). LANL should carry forward these constituents, along with those that exceed SALs, into the Baseline Risk Assessment that is planned during the CMS/CMI process.

LANL response LANL will carry these constituents (lead and dinitrobenzene) forward into the Baseline Risk Assessment that is planned during the CMS/CMI process. Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997, note that this is contrary to current LANL programmatic guidance for MCEs.

This represents a programmatic issue, which may be addressed in future programmatic discussions.

NMED comment 21.b. Section 5.2.7.2 The normalized concentration of chromium is 0.55 and is the driver for the MCE for carcinogenic effects (Table 5.2.7.1-2). LANL should carry forward these constituents, along with those that exceed SALs, into the Baseline Risk Assessment that is planned during the CMS/CMI process.

LANL response LANL will carry chromium forward into the Baseline Risk Assessment that is planned during the CMS/CMI process. Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997, note that this is contrary to current LANL programmatic guidance for MCEs.

This represents a programmatic issue, which may be addressed in future programmatic discussions.

NMED comment 22.a. Section 5.2.9 Please clarify within the text of the RFI report, the intent or purpose of presenting Table 5.2.9-1.

LANL response At the end of the first paragraph of Section 5.2.9 LANL will insert the following text: "For each COPC identified during the screening assessment, Table 5.2.9-1 indicates whether the contaminant is present at levels less than SALs in the outermost laboratory samples on a bounding traverse at a specific distance downgradient

from the TA-16-260 outfall. Contaminants present at levels less than SALs are bounded laterally relative to SALs."

NMED comment 22.b. Section 5.2.9 LANL should present the traverses relative to EPA Region 9 residential PRGs in addition to the industrial PRGs.

LANL response The traverses relative to SALs are equivalent to traverses relative to EPA Region 9 PRGs. LANL would like to clarify that the traverses shown in Figure 5.2.9-1 and the status of bounding outlined in Table 5.2.9-1 are presented relative to SALs. The text as written in not clear on this point. LANL will replace the sentence "These traverses are bounded relative to EPA Region 9 industrial PRGs" with "Although these traverses are not bounded relative to SALs (EPA Region 9 residential PRGs), they are bounded relative to EPA Region 9 PRGs for industrial soil." The industrial PRG bounding traverses are not shown.

NMED comment 22.c. Section 5.2.9 LANL should include lead, chromium and 1,3-dinitrobenzene in Table 5.2.9-1.

LANL response Below is an addition to Table 5.2.9-1 that includes lead, chromium and 1,3 dinitrobenzene"

ADDITION TO TABLE 5.2.9-1
STATUS OF LATERAL BOUNDING FOR PRS 16-021(c)

COPC	OUTFALL	100 FT	200 FT	300 FT	400 FT	500 FT	600 FT
lead	Yes	Yes	Yes	Yes	Yes	Yes	Yes
chromium	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1,3 DNB	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NMED comment 23. Section 5.2.11.1 LANL should state that concentrations are "greater" not "larger".

LANL response In the last sentence of the first paragraph of Section 5.2.11-1 LANL will convert "greater" to "larger".

NMED comment 24. Section 5.2.11.2.1 Adding the pond and dam to Figure 5.2.11.2.1-1 would aid in visualizing the proposed activities.

LANL response A modified version of Figure 5.2.11.2.1-1 is included as Attachment L. This modified figure schematically shows the locations of the pond and dam relative to the sampling localities.

NMED comment 25.a. Section 5.2.11.2.3 LANL must ensure that representative and confirmatory sampling for HE will occur. The HE screening kit has a detection limit of 100 ppm, whereas the SAL for HE is 15 ppm.

LANL response All locations where HE spot test results are negative are also being screened using the RDX D-Tech immunoassay kit, which has a detection limit of less-than 1 ppm. In addition, LANL has taken additional laboratory samples in the boreholes

drilled thus far during the FY 1997 field campaign, to address concerns with the D-Tech immunoassay kits that were expressed in discussions with NMED.

NMED comment 25.b. Section 5.2.11.2.3 LANL should also consult NMED DOE OB in the re-siting of boreholes to the location of geophysical anomalies.

LANL response Thus far, LANL has discussed re-siting of boreholes with HRMB representatives. These discussions occurred in meetings on April 15, 1997 and October 9, 1997 and were subsequently communicated in writing to HRMB. In the future, LANL will consult with either NMED DOE OB or NMED HRMB prior to re-siting boreholes.

NMED comment 25.c. Section 5.2.11.2.3 LANL should also present the sampling locations, depths, etc. provided in the text (pages 67 and 68) as a table for clarification.

LANL response These sample locations, depths, etc. as outlined in this SAP are provided in Table 25.c.-1 (below). Note that these locations and sampling depths have been modified following discussions with HRMB during April and October of 1997. Note also that additional laboratory samples were taken in most of these boreholes.

Table 25.c.-1

Borehole	Location[a]	Proposed total depth	Screening depths[b]	Lab sample depths
1	75 ft - center	First clean screening interval	Every 5 ft.	1) 0-5 ft 2) total depth
2	75 ft - north	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth
3	75 ft - south	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth
4	100 ft - center	First clean screening interval	Every 5 ft.	1) 0-5 ft 2) total depth
5	320 ft - center	First clean screening interval	Every 5 ft.	1) 0-5 ft 2) total depth
6	320 ft - north	At least 5 ft deeper than hole 5	Every 5 ft.	1) 0-5 ft 2) total depth
7	320 ft - south	At least 5 ft deeper than hole 5	Every 5 ft.	1) 0-5 ft 2) total depth
8	450 ft - north central	First clean screening interval	Every 5 ft.	1) surface 2) 0-5 ft 3) total depth
9	450 ft - south central	First clean screening interval	Every 5 ft.	1) surface 2) 0-5 ft 3) total depth
10	450 ft - north	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth
11	450 ft - south	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth
12 (optional)	75 ft -north contingent	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth

13 (optional)	75 ft - south contingent	At least 70 ft	Every 5 ft.	1) 0-5 ft 2) total depth

a. All locations are measured downgradient from the outfall. Locations will be biased based on geophysical investigations.
b. Additional screening samples will be located in fractured zones or wet areas.

NMED comment 25.d. Section 5.2.11.2.3 LANL should also provide well construction diagrams in RFI Workplans to obtain prior regulatory approval.

LANL response Well construction diagrams are included as part of Attachment J.

NMED comment 26.a. Section 5.2.11.2.5 After one year of quarterly sampling (for HE, VOCs, Inorganics and anions), LANL should evaluate the data obtained from the alluvial wells and discuss the results with the Administrative Authority to determine if continued sampling would enhance the investigation.

LANL response After one year of quarterly sampling (for HE, VOCs, Inorganics and anions), LANL will evaluate the data obtained from the alluvial wells and discuss the results with the Administrative Authority to determine if continued sampling would enhance the investigation. LANL anticipates that the alluvial wells will be completed and developed by December 1997, thus these discussions will be tentatively scheduled for December 1998.

NMED comment 26.b. Section 5.2.11.2.3 Please clarify which of the 2 well/borehole locations are accessible and tentatively accessible and discuss what will occur if a borehole is found to be completely inaccessible.

LANL response The westernmost alluvial well location and the fourth-from-the-west (see Figure 5.2.11.2.1-2) near MDA-P are easily accessible. The other three are potentially less accessible. LANL currently anticipates being able to access all five locations using available drilling technology. If a borehole location is completely inaccessible LANL will consult with NMED DOE OB and /or NMED HRMB about alternative borehole locations.

NMED comment 27. Appendix A, Analytical Suites: See Comment 7.

LANL response Attachment G provides a compilation of all analytical data, including non-detectable concentrations. This attachment will be included as part of Appendix A

NMED comment 28. Appendix B, Table B-1 A crosswalk between request number and PRS/sample location would be extremely useful.

LANL response A crosswalk between request numbers and PRS/sample locations is provided as Attachment M.

Provision of this information is a programmatic issue, which may be addressed in future programmatic discussions.

NMED comment 29 Appendix C, Section 1 LANL should perform or otherwise include a comparison of water balances for each of the potentially affected springs and seeps included in Table C-1.

LANL response Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997 note that the cation sum/anion sum balance that is requested is available in Table C-8.

NMED comment 30.a. Appendix C, Section 2. LANL should clearly indicate the names and locations of all background springs (p. C-2, first paragraph) and provide a summary of the background water chemistry data.

LANL response LANL will replace the following sentence: "Two springs, Burning Ground and SWSC Line, appear to issue from Tshirege Subunit 3, and one spring, Martin Spring, appears to issue from Tshirege Subunit 4" with the following text "Three springs and two seeps have been identified at TA-16. Burning Ground spring, SWSC Line spring, and Martin spring all appear to issue from near the Tshirege Subunit 3/4 contact. The former two issue from the south wall of Canon de Valle northeast of TA-16-260. Martin spring discharges roughly 3000 ft southeast of TA-16-260. Two intermittent seeps, Peter Seep and Fishladder Seep, represent the alluvial discharge of water in Canon de Valle west of the intersection of PRS 16-021(c) with Canon de Valle and of water in a tributary to Canon de Valle downgradient from the TA-16-340 outfall, respectively." Current elevation data suggests that all three springs issue from very near the unit 3/4 contact.

The background water chemistry data is included as Attachment N.

NMED comment 30.b. Appendix C, Section 2. Figure C-1 should be revised to clearly indicate the sampling locations more so than NPDES outfalls.

LANL response A revised version of Figure C-1 is included as Attachment O. NPDES outfall designations have been removed and sampling locations have been more clearly delineated.

NMED comment 30.c. Appendix C, Section 2. LANL should include tritium and oxygen-18 in Table C-2.

LANL response Table 30.c.-1 (below) presents the requested information for tritium and oxygen isotopes. Note that the analytical precision of the stable isotope analyses (in per mil), rather than a detection limit, is an appropriate measure of the analytical sensitivity of this technique.

TABLE 30.c.-1
METHODS OF CHEMICAL ANALYSIS AND DETECTION LIMITS FOR WATER SAMPLES

ANALYTE	METHOD	DETECTION LIMIT
Tritium	scintillation counting	0.1 Tritium units (est.)
Oxygen isotopes	stable isotope mass spectrometer	analytical precision of .1 per mil

NMED comment 31.a. Appendix C, Section 3.0 LANL should provide a tabulation of the SALs and background concentrations for those analytes presented in paragraph 3, page C—6, Table C-3 and paragraph 3, page C-13.

LANL response Per discussion in a telecon with Kim Hill (EPA and HRMB) that occurred on September 9, 1997 LANL will provide this information on those analytes in paragraph 4 on page C-6. The analytes discussed in this paragraph are barium, manganese and RDX. These data are provided in Attachment P.

NMED comment 31.b. Appendix C, Section 3.0 LANL should define the acronym "NQ" in paragraph 3, page C-13.

LANL response NQ is nitroguanadine, a liquid HE used occasionally at TA-16.

References

Blake, W.D., F. Goff, A.I. Adams, and D. Counce, May 1995. "Environmental Geochemistry for Surface and Subsurface Waters in the Pajarito Plateau and Outlying Areas, New Mexico," Los Alamos National Laboratory Report LA-12912-MS, UC 903, Los Alamos, New Mexico. **(Blake et al. 1995, 1355)**

Attachment A - Comment 1.a.

Pertinent sections of the QA/QC plan for the FY 95 TA-16 Field Campaign

OU 1082 Site-Specific Quality Assurance Project Plan

1.0 Introduction

This site-specific Quality Assurance Project Plan (QAPP) has been written following guidance presented in the Environmental Restoration (ER) Project Quality Assurance Project Plan (QAPP). The QAPP is included in the latest version of the Installation Work Plan (IWP) currently under reveiw by the Environmental Protection Agency (EPA).

The primary objective of collecting QA/QC samples is to assess the quality of sampling and measurement techniques. The QA/QC samples may also be used to aid future decisions about specific samples and potential release sites. The following objectives will be met using QA/QC samples:

- to provide information on negative bias
- to estimate sample collection and total measurement error
- to evaluate if the data is complete, representative, and comparable

QA/QC samples typically submitted as part of environmental assessment programs that protect against false positive results will not be submitted as part of this plan. All positive results will either be accepted as accurate or, if the results are in question, will be confirmed by re-sampling the location in doubt. Re-sampling will be less expensive and more accurate than collecting numerous routine QA samples used to disqualify false positive results.

Section 2.0 discusses field QA/QC samples, Section 3.0 describes laboratory QA/QC samples, Section 4.0 discusses other significant issues. A summary of QA/QC samples is included in Table 1.

2.0 Field Quality Control Samples

Three types of field QA/QC samples will be collected at OU 1082: performance evaluation (PE) samples, collocated field duplicate samples, and Rinsate Blanks. PE samples are used to check the methods of the subcontract laboratories for data validation. Collocated samples measure spatial variation of contaminants and Rinsate blanks evaluate decontamination procedures.

Trip blanks and field blanks will not be collected. Typically, these samples identify false positives resulting from ambient conditions or cross contamination effects. At OU 1082, positive results that are suspect will be verified by re-sampling. Re-sampling is expected to be significantly more economical (and more accurate) than collecting multiple field and trip blanks due to the low probability of discovering multiple areas with contamination above screening action levels.

2.1 Performance Evaluation Samples

Material for the high explosives (HE) PE samples will be obtained from LANL sources; other PCOC PE samples will be purchased from off site sources. The PE soil will be supplied in bulk and placed in sample containers along with the environmental samples. The QA objectives of these samples are:

- to evaluate the accuracy of laboratory procedures
- to check laboratory recovery of HE constituents to evaluate matrix effects

The PE samples will be collected at a rate of 1 per 40 (2.5 %) and will provide sufficient statistical information to meet the QA objectives. However, PE samples will not be collected at OU 1082 if the ER Program begins sending PE samples for the entire program. If the ER Program begins to test off-site laboratory methods for all LANL samples, PE samples will not be necessary from individual Field Units and sampling efforts.

2.2 Collocated Field Duplicate Samples

Field duplicates will be collocated with other field assessment/characterization samples. In order to attain the maximum QA data, the field duplicate samples will be collocated with samples showing positive field screen data on indicator parameters. Field duplicates will be collected at a rate of 1 per 20 (5 %) as recommended in the Generic Quality Assurance Project Plan (QAPjP).

2.3 Rinsate Blank Samples

Two Rinsate samples will be collected during the initial sampling phase of the field campaign. One rinsate sample will be collected from manual sampling equipment and one sample will be collected from drilling equipment. The low frequency for collecting rinseate blanks is justified because rinseate blank results are only used to provide information on cross-contamination and potential false poitives. This information will be attained through resampling as explained above. In addition, decontamination procedures are controlled by a Standard Operating Procedure (SOP) and previous field efforts conducted by ICF KE at LANL has verified that present decontamination procedures are adequate. The samples will confirm that present decontamination procedures are also adequate at OU 1082.

2.4 Matrix Spike Samples

Matrix spike samples provide information on the effect of sample matrix on the laboratory analytical methodology (percent recovery) and provides a measure of the precision and accuracy of the analysis. Matrix spike samples are generally required by the method for chemical analyses. Typically, the subcontract laboratory will not require additional material in order to perform the MS/MSD; however, for organic analyses in waters, triple volumes will be required. These samples are not anticipated at TA-16 during the 1995 sampling season. Additional method specific QC may be performed by the subcontract laboratory.

3.0 Types of Laboratory QA/QC Samples

Laboratory QA/QC samples are mentioned herein to complete the QA/QC sample scheme. Four types of QA/QC samples are prepared by the laboratory to verify the quality of internal procedures. The frequency of these samples varies among laboratories and are designed by each laboratory to meet their individual needs.

3.1 Laboratory Blank Sample

The laboratory reagent blank is prepared and analyzed by the laboratory to demonstrate that identified constituents are not a result of laboratory contamination.

3.2 Calibration Standards

Calibration standards are prepared to cover the expected concentration ranges of samples being analyzed. These standards are used to provide a standard relationship between analyte concentration and instrument response.

3.3 Spike Samples

Specified concentrations of surrogate compounds are spiked into each blank calibration standard and environmental sample for organic analyses. Percent recoveries are calculated for each surrogate.

3.4 Laboratory Duplicates

Subsamples are independently analyzed and compared to determine laboratory measurement error.

4.0 Deviations from Prescribed Sample Plan and Analytical Methods

During the implementation of the RFI Work Plan in the field, unplanned instances can occur that will require deviations from prescribed Work Plan initiatives. Deviations from the sample plan occur when the nature of the sample location renders the prescribed sample requirements impossible to meet. For analytical methods, a change in method is needed when the analytical method's limit of detection for a PCOC is greater than the SAL. The following subsections will discuss proper protocol for deviating from sample and analytical method requirements prescribed by the RFI.

4.1 Contingency Plans

In any case where sample requirements prescribed by the RFI cannot be satisfied, the field team leader (FTL) will be consulted for guidance. The FTL will decide the proper course to proceed with sampling activities.

4.2 Estimated Quanitation Limits

To determine if the present analytical methods were suitable for the PCOCs at OU 1082, the detection limits for analyses were compared with the PCOC SALs. Not all the PCOCs have established SALs in LANL soils. For those that have SALs, the SAL limit is above the laboratory method detection limit. Also, the majority of PCOCs that do not have established SALs have very low laboratory method detection limits (below 5 ppm in most instances). For these reasons changes in analytical methods because of EQLs need not be requested of the subcontract laboratories.

5.0 Non-routine Chemical Analyses

Chemical analyses for HE will be performed in the mobile chemical van (chem van) for samples that test positive for HE on the HE spot test (>100 ppm). The analytical method performed in the chem van uses a high performance liquid chromatography (HPCL) method, similar to the SW-846 Method 8330. The detection limits for the chem van method are comparable to Method 8330, but this method includes less rigorous data confirmation than the specialized method. Adequate numbers of check standards will be run for QA purposes and 10% of the samples analyzed will be sent off-site for Method 8330 analysis as an additional check on the chem van method. Also, a prescribed number of the PE samples will be analyzed by the chem van. The number of PE samples will be proportional by percentage of HE unknown samples analyzed by the chem van.

6.0 Conclusions

This site-specific QAPP describes the QA/QC samples needed to assess the quality of data that will be used to support RFI decisions at OU 1082. This plan also addresses unplanned

deviations from prescribed RFI requirements and the protocol for the non-routine analyses planned at OU 1082. The field QA/QC samples defined in this plan deviate slightly from those recommended in the Generic QAPjP. The field QA/QC samples were selected to meet ER QAPP guidelines and specific OU 1082 QA objectives in the most efficient and economical manner.

Table 1: QA/QC Summary

Field QA/QC Samples		
Sample Type	**Frequency**	**QA Objective**
Performance Evaluation	Approx. 1 per 40	to evaluate accuarcy of laboratory procedures and negative bias
Field Duplicate (collocated)	Approx. 1 per 20	to evaluate contaminant spatial variability
Rinsate Blank	Approx. 2 total	to evaluate decontamination procedures
Laboratory QA/QC Samples		
Sample Type	**Frequency**	**QA Objective**
Laboratory Blank	Every batch	to evaluate laboratory contamination
Calibratiion Standard	Every 12 hours	to provide standard curve
Surrogate Spike	Every sample	to evaluate negative bias
Laboratory Duplicate	Every batvh	to determine measurement error

Attachment B - Comment 1.c.

Revised versions of Figure 5.2.4-1 showing locations of field duplicates

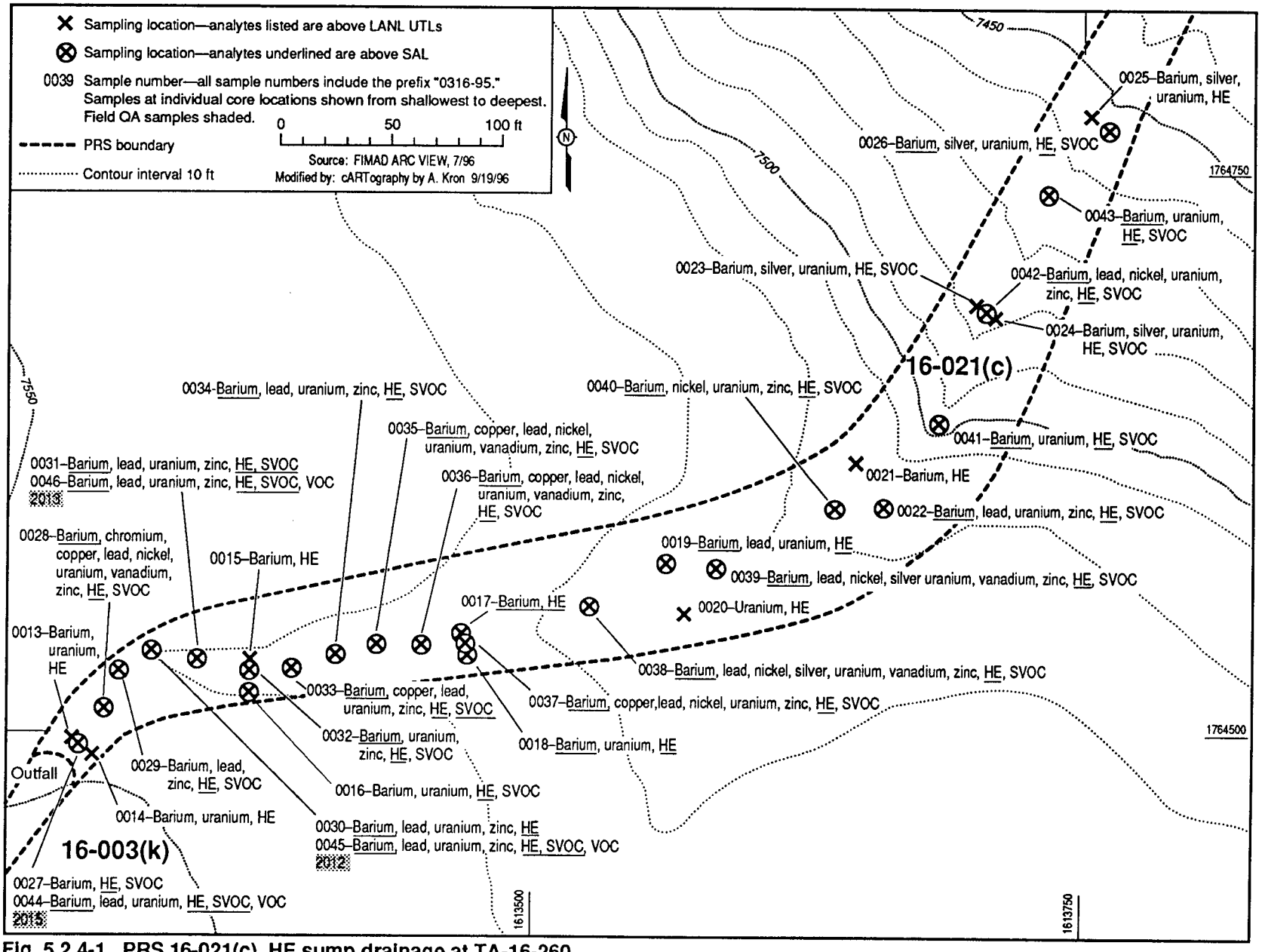


Fig. 5.2.4-1. PRS 16-021(c), HE sump drainage at TA-16-260.

Attachment C - Comment 3

Figure indicating locations of elevated barium and boron levels as indicated in Section 2.3.1

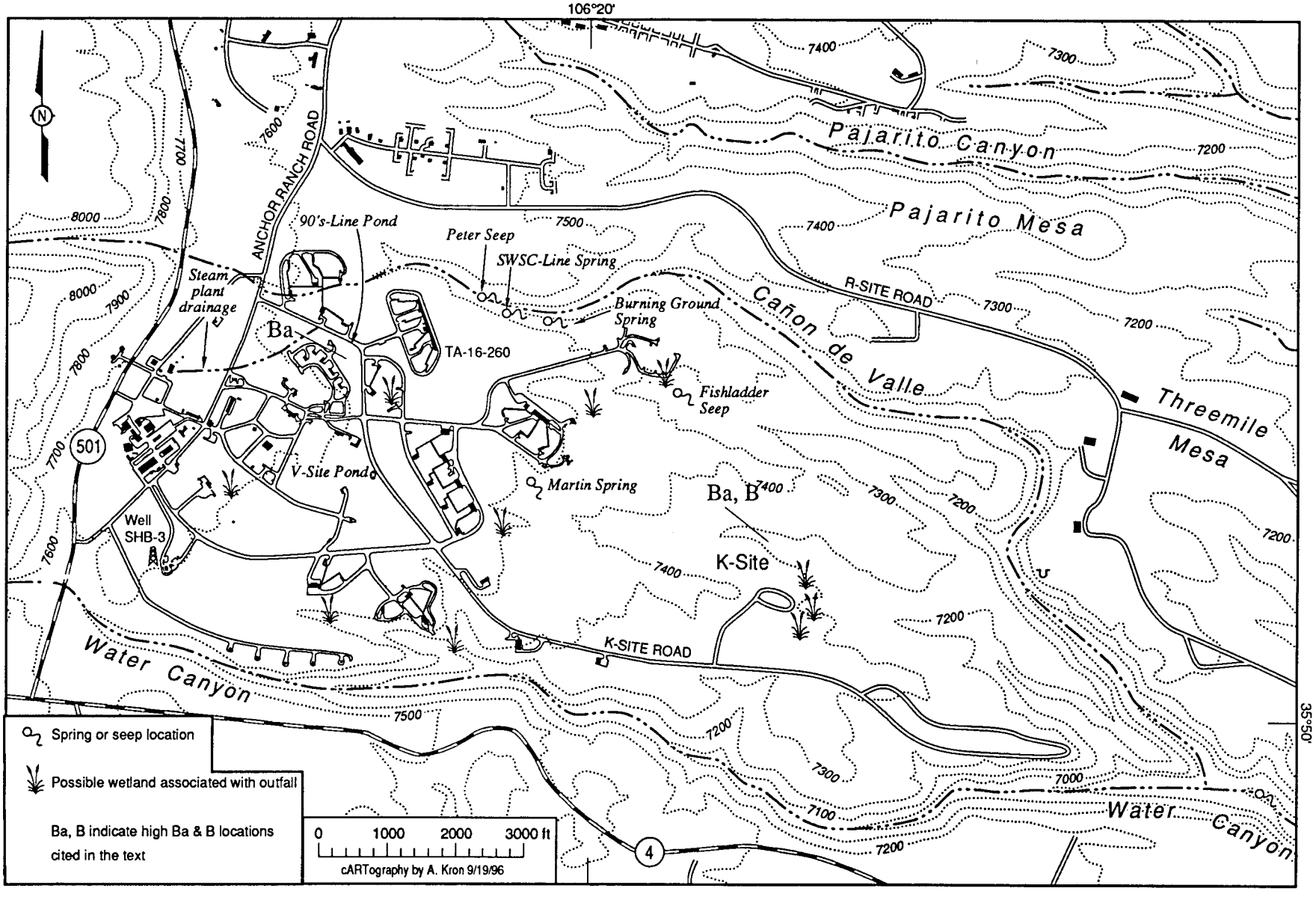


Fig. 2.3.1-1. Topography, springs, seeps, National Wetlands Inventory, and LANL-defined wetlands associated with National Pollution Discharge Elimination System (NPDES) HE outfalls (active and inactive) at TA-16.

Attachment D - Comment 4.c.

Data, sampling dates, sampling intervals, etc. for SHB-3 and the background spring data to which it was compared (all data are from Blake et al. 1995, 1355)

Attachment D Table 1 Major Cation/Anion analyses for water at SHB-3

DESCRIPTION	SAMPLE NUMBER	DATE	TEMP °C	SiO2 (ppm)	Ca (ppm)	Mg (ppm)	Sr (ppm)	Na (ppm)	K (ppm)	Li (ppm)	HCO3 (ppm)	SO4 (ppm)	Cl (ppm)	F (ppm)	Br (ppm)	B (ppm)	CO3 (ppm)	TDS	CATION SUM	ANION SUM	BALANCE
In-situ sample, SHB-3 Well 258m	SHB93-2	7/20/93	16.9	82.4	16	0.85	0.2	24	15.5	0.04	0	7.54	7.54	0.28	0.02	0.09	41.8	205.7	2.33	2.284	0.0198
Run 1, Swab SHB-3 Well	SHB93-3	7/28/93	16.4	73.6	11	0.46	0.19	28.6	13.1	0.04	0	10	8.41	0.19	0.03	<0.05	35	192.3	2.208	2.222	-0.0065
Run 2, Swab SHB-3 Well	SHB93-4	7/28/93	16.6	53.3	20.5	0.17	0.39	20.7	14	0.03	0	6.74	3.97	0.19	0.03	0.27	20.4	166.4	2.341	2.352	-0.005
Run 3, Swab SHB-3 Well	SHB93-5	7/28/93	16.9	50.5	11.6	0.85	0.16	12.2	7.7	0.01	0.2	2.78	2.43	0.11	0.02	<0.05	39.1	129.9	1.389	1.469	-0.0556
Run 4, Swab SHB-3 Well	SHB93-6	7/29/93	16.9	53.5	16.7	1.15	0.16	12.3	6	0.02	26.8	2.28	2.65	0.11	0.03	<0.05	34.2	157.8	1.631	1.735	-0.0619
Run 5, Swab SHB-3 Well	SHB93-7	7/29/93	16.9	50.3	21.9	0.68	0.21	12.2	7	0.02	0	2.59	1.99	0.1	0.03	<0.05	35.7	144.3	1.875	1.901	-0.0138

Attachment D Table 2 Trace Element analyses for water at SHB-3

DESCRIPTION	SAMPLE NUMBER	DATE	TEMP °C	Ag (ppm)	Al (ppm)	As (ppm)	Ba (ppm)	Cd (ppm)	ClO3 (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Fe (ppm)	Hg (ppm)	I (ppm)	Mn (ppm)	Mo (ppm)	NH4 (ppm)	Ni (ppm)	NO2 (ppm)	NO3 (ppm)	Pb (ppm)	PO4 (ppm)	Rb (ppm)	Sb (ppm)	Se (ppm)	Zn (ppm)
In-situ sample, SHB-3 Well 258m	SHB93-2	7/20/93	16.9	<0.001	<0.05	<0.001	0.08	<0.0005	NA*	<0.002	0.005	0.002	0.014	0.08	<0.001	<0.01	<0.01	0.11	0.46	0.005	<0.02	0.52	0.022	0.02	0.069	<0.001	<0.001	0.14
Run 1, Swab SHB-3 Well	SHB93-3	8/93	16.4	<0.0005	<0.05	<0.002	0.04	<0.0005	<0.05	<0.002	<0.002	<0.002	<0.002	0.11	<0.0002	<0.01	<0.01	0.1	0.38	<0.002	0.17	0.59	0.014	<0.02	0.09	<0.002	<0.002	0.11
Run 2, Swab SHB-3 Well	SHB93-4	8/93	16.6	<0.0005	0.06	<0.002	0.03	<0.0005	<0.05	<0.002	<0.002	<0.002	0.011	0.02	<0.0002	<0.01	<0.01	0.06	0.38	<0.002	0.06	1.63	0.007	0.02	0.11	<0.002	<0.002	0.05
Run 3, Swab SHB-3 Well	SHB93-5	8/93	16.9	<0.0005	<0.05	<0.002	0.01	<0.0005	<0.05	<0.002	<0.002	<0.002	<0.002	0.02	<0.0002	<0.01	<0.01	0.11	0.1	<0.002	0.03	1.77	0.005	0.1	0.06	<0.002	<0.002	0.01
Run 4, Swab SHB-3 Well	SHB93-6	8/93	16.9	<0.0005	<0.05	<0.002	<0.01	<0.0005	<0.05	<0.002	<0.002	<0.002	<0.002	0.04	<0.0002	<0.01	<0.01	0.006	0.09	<0.002	0.04	1.68	0.003	<0.02	0.05	<0.002	<0.002	<0.01
Run 5, Swab SHB-3 Well	SHB93-7	8/93	16.9	<0.0005	<0.05	<0.002	0.01	<0.0005	<0.05	<0.002	<0.002	<0.002	0.009	0.02	<0.0002	<0.01	<0.01	0.01	0.12	<0.002	0.01	1.59	0.005	<0.02	0.06	<0.002	<0.002	<0.01

*NA=Not analyzed.

Table D Table 3 Stable isotope analyses for water at SHB-3

DESCRIPTION	SAMPLE NUMBER	DATE	TEMP °C	∂D (‰)	$\partial^{18}O$ (‰)	TRITIUM (T.U.)	MAX AGE (years)	MIN AGE (years)	RECHARGE ELEV. (m from ∂D)	RECHARGE ELEV. (m from $\partial^{18}O$)
In-situ sample, SHB-3 Well 258m	SHB93-2	7/20/93	16.9	-75.1	-11.28	0.88	2000	40	2218	2381
Run 1, Swab SHB-3 Well	SHB93-3	7/28/93	16.4	-79.4	-10.73	NA*	NC*	NC	2411	2208
Run 2, Swab SHB-3 Well	SHB93-4	7/28/93	16.6	NA	NA	NA	NC	NC	NC	NC
Run 3, Swab SHB-3 Well	SHB93-5	7/28/93	16.9	NA	NA	NA	NC	NC	NC	NC
Run 4, Swab SHB-3 Well	SHB93-6	7/28/93	16.9	NA	NA	NA	NC	NC	NC	NC
Run 5, Swab SHB-3 Well	SHB93-7	7/28/93	16.9	-77.8	-11.80	NA	NC	NC	2339	2544

*NA=Not analyzed.

*NC= Not calculated.

TABLE J-1 MAJOR ELEMENTS OF BACKGROUND SPRINGS

DESCRIPTION	DATE	BORON (ppm)	BROMINE (ppm)	CALCIUM (ppm)	CHLORINE (ppm)	FLUORINE (ppm)	HYDROGEN CARBONATE (ppm)	LITHIUM (ppm)	MAGNESIUM (ppm)	POTASSIUM (ppm)	SODIUM (ppm)	SILICATE (ppm) calc	SULFATE (ppm)	STRONTIUM (ppm)	TOTAL DISSOLVED SOLVENTS (ppm)	CATION SUM	ANION SUM
Apache Spring	4/03/96	0.005	0.01	10.9	7.72	0.04	69.0	<0.01	4.86	4.75	9.77	56.07	5.93	0.10	171.1	1.532	1.498
Cold Spring west cal	6/1/80	0.73	0.06	12	1.9	0.25	53.7	0.03	1.5	3	8	30.00	5.5	0.06	NC	NC	NC
Frijoles Spring #49	5/22/91	<0.01	<0.02	8	14	0.03	39	<0.01	2.98	2.9	6.8	17.00	3.85	0.09	NC	NC	NC
Frijoles Spring #50	5/22/91	<0.01	<0.02	7.9	6.11	0.04	53.6	<0.01	3.71	2.5	7.2	25.00	2.66	0.07	NC	NC	NC
Pine Spring	5/24/91	<0.01	<0.02	10.7	1.47	0.08	61	<0.01	3.55	3.6	6.4	25.00	7.7	0.08	NC	NC	NC
Pine Spring	3/26/95	0.02	<0.4	11	<5	<0.5	NA	0.01	3.6	3	5.1	NC	66	0.09	NC	NC	NC
Pine Spring	10/16/95	<0.1	NA	10	2	<0.2	48	<0.01	3	3	6	NC	<10	0.07	NC	NC	NC
Seven Springs	10/1/79	<0.003	NA	12.3	3.6	0.21	49	0.018	1.54	2.1	7.23	41.00	8.7	0.071	NC	NC	NC
Seven Springs	5/1/83	NA	0.27	11	1.9	0.25	53.7	0.05	1.4	4	8	30.00	5.9	0.05	NC	NC	NC
Seven Springs	5/10/91	<0.02	<0.02	12.9	1.22	0.16	61	<0.01	1.71	2.4	6.3	31.00	3.85	0.06	NC	NC	NC
Seven Springs	4/3/96	0.013	<0.01	12.5	1.85	0.12	59.5	<0.01	1.63	2.13	7.26	31.03	4.03	0.06	121.5	1.148	1.137
Unnamed Cold	7/1/80	<0.01	<0.2	10.6	7.1	0.3	75	0.024	3.4	3.1	9.4	65.00	3.4	0.049	NC	NC	NC
Unnamed Cold	7/1/80	<0.01	<0.2	10.4	7.5	0.35	73	0.024	3.4	3.2	9	69.00	2.4	0.051	NC	NC	NC
Unnamed Spring	5/28/91	<0.01	<0.02	9.1	1.34	0.14	56.1	<0.01	2.44	4.6	7	21.00	5.73	0.05	NC	NC	NC
Unnamed Spring	9/10/93	<0.05	0.02	11.4	4.38	0.34	80.8	0.03	2.9	2.49	16.2	60.10	4.04	0.1	NC	NC	NC
Water Canyon Gallery	8/1/78	<0.05	NA	7	NA	0.12	52	0.02	3.3	1.4	5.8	43.00	NA	0.05	NC	NC	NC
Water Canyon Gallery	8/18/92	<0.05	<0.02	7.2	0.64	0.05	52.8	<0.01	3.05	1.72	6.3	43.70	1.05	0.07	NC	NC	NC
Water Canyon Gallery	5/20/93	<0.01	0.01	6.94	0.69	0.06	44.6	0.01	2.79	1.79	4.9	39.80	2.85	0.07	NC	NC	NC
Water Canyon Gallery	4/03/96	0.004	<0.01	6.18	0.77	0.03	48.9	0.02	3.15	1.75	5.99	44.30	1.20	0.05	113.6	0.900	0.865

[a]NC = Not calculated.

[b]NA = Not analyzed.

TABLEJ-2 MINOR ELEMENTS OF BACKGROUND SPRINGS

DESCRIPTION	DATE	SILVER (ppm)	ALUMINUM (ppm)	ARSENIC (ppm)	BARIUM (ppm)	CADMIUM (ppm)	COBALT (ppm)	CHROMIUM (ppm)	CESIUM (ppm)	COPPER (ppm)	IRON (ppm)	MERCURY (ppm)	IODINE (ppm)	MANGANESE (ppm)	MOLYBDENUM (ppm)	AMMONIUM (ppm)	NICKEL (ppm)	NITRITE (ppm)	NITRATE (ppm)	LEAD (ppm)	PHOSPHATE (ppm)	RUBIDIUM (ppm)	ANTIMONY (ppm)	SELENIUM (ppm)	THIOSULFATE (ppm)	ZINC (ppm)
Apache Spring	4/03/96	<0.0002	0.28	<0.0002	0.07	<0.0002	<0.002	<0.002	<0.002	<0.002	0.10	<0.0002	<0.01	<0.01	<0.002	0.04	<0.002	0.02	1.33	<0.002	0.07	0.010	<0.0001	<0.0001	<0.01	<0.01
Cold Spring west cal	6/1/80	NA	NA	NA	0.02	0.003	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	0.19	NA	NA	NA	NA	NA	NA	NA
Frijoles Spring #49	5/22/91	<0.001	1	<0.05	0.06	<0.001	<0.002	<0.002	<0.005	0.003	2.12	<0.1	<0.01	<0.02	<0.002	0.09	<0.002	<0.02	0.3	<0.002	<0.05	0.006	<0.05	<0.1	NA	<0.01
Frijoles Spring #50	5/22/91	<0.001	0.5	<0.05	0.03	<0.001	<0.002	<0.002	<0.005	0.003	1.08	<0.1	<0.01	<0.02	<0.002	0.08	<0.002	<0.02	0.71	<0.002	0.11	0.007	<0.05	<0.1	NA	0.02
Pine Spring	5/24/91	<0.003	1.4	<0.05	0.05	<0.001	<0.002	0.004	0.006	0.004	4.17	<0.1	<0.01	<0.02	<0.002	0.24	<0.002	<0.02	0.04	0.003	<0.05	0.007	<0.05	<0.1	NA	0.07
Pine Spring	3/26/95	<0.01	1	<0.005	0.1	<0.005	<0.01	<0.01	NA	<0.01	0.5	<0.0002	NA	<0.01	<0.01	NA	<0.02	NA	0.2	<0.003	NA	NA	<0.06	<0.005	NA	<0.02
Pine Spring	10/16/95	<0.01	<0.2	<0.01	<0.1	<0.005	<0.01	<0.01	NA	<0.01	<0.1	<0.0002	NA	<0.01	<0.01	NA	<0.02	NA	0.1	<0.003	NA	NA	<0.02	<0.005	NA	<0.02
Seven Springs	10/1/79	<0.03	0.2	NA	0.036	<0.03	<0.06	0.001	NA	<0.04	0.036	NA	NA	0.001	0.001	NA	<0.05	NA	NA	<0.14	NA	NA	NA	NA	NA	<0.01
Seven Springs	5/1/83	NA	0.2	NA	0.02	0.003	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seven Springs	5/10/91	<0.001	<0.1	<0.05	0.01	<0.001	<0.002	0.011	<0.005	<0.002	0.52	<0.1	<0.01	<0.02	<0.002	0.04	<0.002	<0.02	0.47	<0.002	<0.05	0.02	<0.1	<0.1	NA	0.01
Seven Springs	4/3/96	<0.0002	0.12	0.0004	0.02	<0.0002	<0.002	<0.002	<0.002	0.002	0.02	<0.0002	<0.01	<0.01	<0.002	0.06	<0.002	<0.01	1.16	<0.002	<0.05	0.019	<0.0001	0.0003	<0.01	0.01
Unnamed Cold	7/1/80	<0.03	NA	NA	0.016	<0.001	<0.001	<0.001	NA	<0.001	0.15	NA	NA	0.002	<0.002	NA	<0.002	NA	<0.2	<0.004	<0.2	NA	NA	NA	NA	0.024
Unnamed Cold	7/1/80	<0.03	NA	NA	0.022	<0.001	<0.001	0.004	NA	<0.001	1.19	NA	NA	0.135	<0.002	NA	<0.002	NA	0.7	<0.004	<0.2	NA	NA	NA	NA	0.008
Unnamed Spring	5/28/91	<0.001	3.8	<0.05	0.08	0.001	<0.002	0.004	0.007	0.007	13.4	<0.1	<0.01	<0.02	<0.002	0.38	<0.002	<0.02	0.09	0.005	<0.05	0.01	<0.05	<0.1	NA	0.06
Unnamed Spring	9/10/93	<0.0005	0.6	0.006	0.03	<0.0002	<0.002	0.003	<0.002	0.008	0.44	<0.0002	<0.01	<0.01	<0.002	0.16	<0.002	<0.01	1.62	0.002	<0.02	0.007	<0.002	<0.002	NA	0.1
Water Canyon Gallery	8/1/78	<0.03	NA	NA	<0.12	<0.03	<0.06	<0.03	NA	<0.04	<0.04	NA	NA	<0.02	<0.1	NA	<0.05	NA	NA	<0.14	NA	NA	NA	NA	NA	<0.01
Water Canyon Gallery	8/18/92	<0.001	<0.1	<0.05	0.01	<0.001	<0.002	0.003	<0.002	<0.002	<0.01	0	<0.02	<0.01	0.009	<0.05	<0.002	<0.02	0.48	0.004	<0.05	0.004	<0.1	0	NA	0.02
Water Canyon Gallery	5/20/93	<0.001	0.2	<0.05	0.02	0.001	<0.002	<0.002	<0.002	0.002	0.05	0	<0.01	<0.01	<0.002	<0.02	<0.002	<0.01	0.98	0.005	0.07	0.006	<0.1	0	NA	0.05
Water Canyon Gallery	4/03/96	<0.0002	0.15	0.0004	0.01	<0.0002	<0.002	<0.002	<0.002	<0.002	0.05	<0.0002	<0.01	<0.01	<0.002	0.06	<0.002	0.02	0.91	<0.002	<0.05	0.006	<0.0001	<0.0001	<0.01	<0.01

*NA = Not analyzed.

TABLE J-3 HIGH EXPLOSIVES IN BACKGROUND SPRINGS

DESCRIPTION	DATE	HMX (ppm)	NQ (ppm)	PETN (ppm)	RDX (ppm)	TNT (ppm)
SAL[a]	N/A[b]	1.8	3.7	0.7	6E-04	0.0022
Apache Spring	4/03/96	<0.02	<0.01	<0.05	<0.01	<0.01
Cold Spring west cal	6/1/80	NA[c]	NA	NA	NA	NA
Frijoles Spring #49	5/22/91	NA	NA	NA	NA	NA
Frijoles Spring #50	5/22/91	NA	NA	NA	NA	NA
Pine Spring	5/24/91	NA	NA	NA	NA	NA
Pine Spring	3/26/95	NA	NA	NA	NA	NA
Pine Spring	10/16/95	NA	NA	NA	NA	NA
Seven Springs	10/1/79	NA	NA	NA	NA	NA
Seven Springs	5/1/83	NA	NA	NA	NA	NA
Seven Springs	5/10/91	NA	NA	NA	NA	NA
Seven Springs	4/3/96	<0.02	<0.01	<0.05	<0.01	<0.01
Unnamed Cold	7/1/80	NA	NA	NA	NA	NA
Unnamed Cold	7/1/80	NA	NA	NA	NA	NA
Unnamed Spring	5/28/91	NA	NA	NA	NA	NA
Unnamed Spring	9/10/93	NA	NA	NA	NA	NA
Water Canyon Gallery	8/1/78	NA	NA	NA	NA	NA
Water Canyon Gallery	8/18/92	NA	NA	NA	NA	NA
Water Canyon Gallery	5/20/93	NA	NA	NA	NA	NA
Water Canyon Gallery	4/03/96	<0.02	<0.01	<0.05	<0.01	<0.01

[a]SAL=Screening action level.

[b]N/A= Not applicable.

[c]NA=Not analyzed.

Attachment E - Comment 5.b.

Analytical Methods, detection limits, and summary of QA/QC documentation for the analyses conducted

The analytical methods used for the analyses in this report follow the SW-846 methodology approved by the EPA. The methods are detailed in Table 1 below. Further information about the specific method can be found in the appropriate SW-846 method description.

Table 1

Analytical Methods Used

EPA SW-846 Method	Analytical Method	Analytes
6010	Inductively coupled plasma emission spectroscopy	aluminum, antimony, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, magnesium, manganese, nickel, potassium, silver, sodium vanadium, zinc
7000	Graphite furnace atomic absorption spectroscopy	arsenic, lead, selenium, thallium
7470	Cold vapor atomic absorption spectroscopy	mercury
9010	Colorimetric spectrophotometry	cyanide
8081	Gas chromatography/ electron capture detection	pesticides and polychlorinated biphenyls (see Appendix A of RFI Report Table A-5)
8260	Gas chromatograph/mass spectroscopy	volatile organic compounds (see Appendix A of RFI Report Table A-3)
8270	Gas chromatograph/mass spectroscopy	semi-volatile organic compounds (see Appendix A of RFI Report Table A-4)
8330	High performance liquid chromatography	high explosives (see Appendix A of RFI Report Table A-6)
---	Inductively coupled plasma mass spectrometry or kinetic phosphorescence analysis	total uranium

Semi-volatile organics and metals were also analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) for the purposes of future waste disposal. The TCLP method is described in SW-846 Method 1311 and 40 CFR 261.20 through 261.24.

The detection limits for these methods can be seen in the attached data tables (Attachment 6 of this response). In general, the analytical methods described above were able to achieve detection limits suitable for decision making purposes.

The range of detection limits for those volatile organic compounds with the lowest detection limits (i.e. not including vinyl chloride, acetone, etc.) was 0.005 ppm - 0.008 ppm. Detected values for total uranium ranged from 1.42 to 6.98 ppm. The detection limits for those inorganic compounds which were not detected or infrequently detected are listed in Table 2. Inorganic analytes not listed in Table 2 were present in all samples at levels above the detection limit, in most cases at levels at least twice or three times the detection limit.

Table 2

Detection Limits for Inorganic Compounds

Compound	Range of Detection Limits (ppm)
Antimony	5.22 - 8.2
Beryllium	0.42 - 0.82
Cadmium	0.52 - 0.85
Cobalt	1.0 - 4.3
Cyanide	1.0 - 2
Mercury	0.01 - 0.08
Selenium	0.26 - 1.5
Silver	0.52 - 0.85
Thallium	0.21 - 0.42

In some cases involving high explosives and SVOC analyses, the detection limits are elevated. This is due to the very high amounts of high explosives found in these samples. The high levels of contamination required significant dilution of the extract down to values of 5000 times lower than the original concentration. Significant dilution, occurring in request numbers 563, 1173, and 1268 as well as sample 0316-95-0019 in request number 972 for SVOCs, causes a proportional and unavoidable increase in the detection limits. LANL acknowledges that these locations will need to be resampled in the future once the major HE contamination has been reduced. Resampling at that time will determine if minor contamination from other HE constituents remains at these sample locations. Analytical techniques should be able to achieve contract required detection limits once the significant contamination has been reduced. In the remaining HE samples, detection limits range from 0.15 ppm - 0.19 ppm for the nitrotoluenes, HMX, and RDX to 0.05 ppm - 0.10 ppm for the remaining HE analytes. In the remaining SVOC samples, the range of detection limits for those SVOCs with the lowest detection limits (i.e. not benzoic acid, benzyl alcohol, etc.) was 0.33 ppm - 0.85 ppm.

Chapter 4 and Appendix B of the report contain the QA/QC documentation associated with the data and are summarized here. All sample data presented in this report were analyzed in accordance with the LANL contractual statements of work for individual laboratories as well as the Quality Assurance Project Plan. These documents dictate specific QA/QC protocols. Table 3 contains a list of QA/QC samples used during sample analysis and the purpose of that QA/QC sample.

Table 3

QA/QC Sample Description

QA/QC Sample	Purpose
Laboratory Blank (usually a clean water sample)	To indicate the presence of contamination originating at the laboratory, not at the site.
Laboratory and Field Duplicates	To estimate analytical precision and the degree of sample heterogeneity.
Surrogate (a chemically similar compound added to a sample)	To measure the efficiency of the extraction process and to indicate a potential physical or chemical interference.
Matrix Spike (a sample containing exact additional amounts of chemicals in the suite)	To measure the efficiency of the extraction process and to indicate a potential physical or chemical interference.
Laboratory Control Samples	To assess instrument performance and indicate potential sample interferences.
Internal Standards	To assess instrument performance and indicate potential sample interferences.

The QA/QC results for each analytical suite are summarized below.

Total uranium analyses are valid for use without qualification. Duplicate results were within the acceptable range. No QA/QC problems are associated with the uranium data.

No QA/QC problems were associated with the one pesticide analysis conducted.

Many inorganic data were qualified during baseline validation for a variety of reasons. The most common reason was due to poor duplicate recovery associated with sample heterogeneity common in the highly contaminated soil samples from this site. Another common problem was poor spike recovery. These occurrences did not impact decisions made at this site, although biases due to these QA/QC problems were taken into consideration during the decision making process. The only other QA/QC problem noted concerned mercury calibration, which caused some mercury data to be U-qualified. In all cases, the inorganic data obtained is valid for the decisions made at this site.

VOC samples associated with request numbers 1102 and 1222 had no significant QA/QC problems other than minor laboratory contamination of the blank sample. VOC samples 0316-95-0044 through 0046 associated with request number 1173 were reanalyzed due to significant QA/QC problems. Although the reanalysis improved the quality of the result, the reanalyzed data were still qualified due to one low internal standard and two low surrogate recoveries. The effect of these two QA/QC results places a low bias on the few VOCs detected and adds uncertainty to the detection limits indicated for the remaining undetected compounds. In no case was any VOC data rejected during baseline or focused validation. All VOC data is useable for decision making purposes although bias indicated by qualification was taken into consideration.

QA/QC issues associated with the high explosives data are a function of the extremely high levels of HE contamination found at this site. Sample variability and poor surrogate recovery are common problems in highly contaminated samples. It is assumed that the

highly contaminated areas at this site will be mitigated and resampled in the future to ensure that the remediation was effective. Analytical data obtained from less contaminated sites showed no QA/QC problems. All HE data is considered useable although the highly contaminated sample values are not considered as accurate as other sample values at this site.

SVOC results had similar QA/QC problems as those for HE discussed above, due to the high levels of HE contamination at site.The effect of the high levels of contamination caused an increase in detection liemits as discussed above. Otherwise the most common QA/QC issue was minor laboratory contamination in the blank sample, causing a number of detected phthalate values to be qualified as undetected. The presence of phthalates in the QC blanks as well as the adequacy of the duplicate samples for SVOCs are further discussed in chapter 4 of this report. Other QA/QC issues affected a few SVOC samples. Sample 0316-95-0024 missed holding times by one day. This minor deviation from the required limit is not expected to significantly affect the quality of the sample results. Samples 0316-95-0048, -0051, and -0053 associated with request number 1102 were affected by a low internal standard recovery. This affected the following SVOCs: di-n-octylphthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene. The data for these seven compounds were rejected in sample 0316-95-0051 and -0053, and the detection limits for these seven compounds, which were undetected, were considered estimated in sample 0316-95-0048. These seven compounds were not detected in any of the 27 remaining SVOC samples.

In conclusion, the most significant QA/QC problem associated with this set of data is the elevated detection limits for HE and to a lesser extent SVOCs, due to the extreme levels of contamination in the soil samples. However, the samples affected by this will be remediated and resampled in the future. The accuracy of the data is sufficient to indicate that these samples are serious problems and need reexamination. The other QA/QC issue concerning this data set is related to poor surrogate, matrix spike, and internal standard recovery. This problem was serious enough to cause some VOC, SVOC, and inorganic data to be qualified. However, only 14 values in two SVOC samples were rejected due to this QA/QC problem. The remaining data is of sufficient quality to make the decisions presented in this report.

Attachment F - Comment 6

Pertinent Sections of the QAPP

D1 DATA REVIEW: VERIFICATION AND BASELINE VALIDATION

All data generated by ER Project data collection activities will undergo a data review process that accomplishes two goals. First, "data verification" assures that needed data are available for further evaluation, assures that contract, or other, specifications have been met (or noted where not met), and provides the information needed for prompt and appropriate payment for analytical services. Second, "baseline validation" attaches qualifiers to data that do not meet specifications and provides information on potential deficiencies of that data. Reason codes for the qualifiers are also assigned to data to help users understand why a qualifier was added and the potential impacts of the data deficiency. The product of this first process is a report in FIMAD that can be used, as is, for data quality assessment (DQA) (see Section D3 of this document) and, as necessary, to focus further validation efforts. See Figure D-1 for a portrayal of the data verification/baseline validation process and Figure D-2 for a flow diagram that shows where the process fits into the entire data collection process.

For routine analytical services (RAS), the verification and baseline validation processes are carried out simultaneously. Those processes make use of a checklist for data completeness and compliance that is based on the routine analytical contracts, and that use standard validation qualifiers based on the commonly accepted contract laboratory program (CLP), "CLP Functional Guidelines" for review of analytical data. During this process, missing items are obtained from the laboratory that generated the data and any required corrections to erroneous data are made. These error corrections include both problems with compliance and problems with data entry into FIMAD.

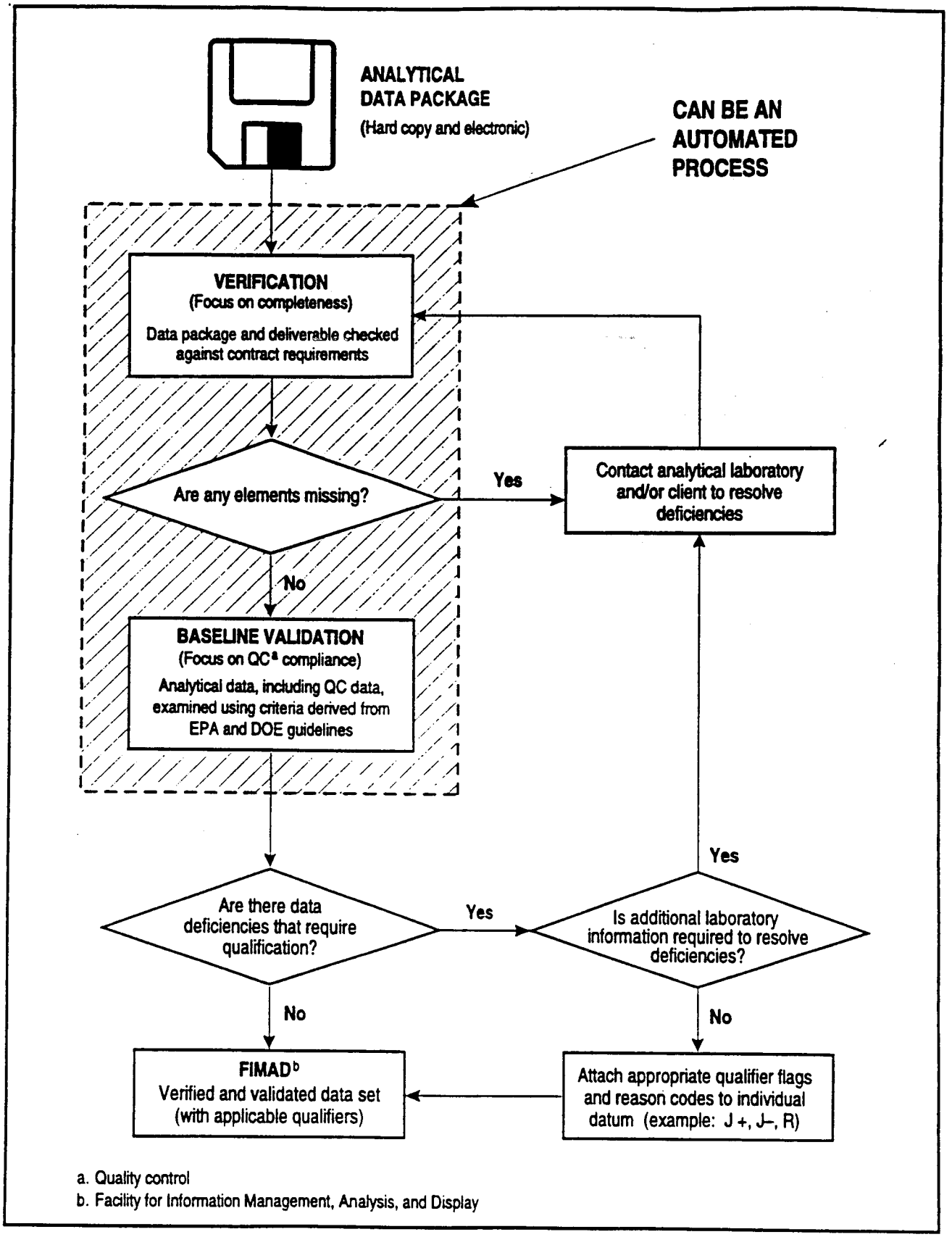
For routine analytical services, the SAP must state that the "LANL ER Checklist and Criteria for Verification and Baseline Validation" (LANL 1995, 52241), including data qualifiers and reason codes, will be used for verification and baseline validation. Forms and checklists may be provided for clarification, based on the analytical services used, e.g., organics, inorganics, high explosive (HE), radiochemistry, or commonly used mobile laboratory SOWs.

If known, the SAP should identify anticipated needs for focused validation (see Section D2 of this document). For example, when petroleum hydrocarbons are anticipated to be an interference in semivolatile analyses, the SAP should specify that the chromatograms will be reviewed to assess the effect or potential effect of interferences on the reported data.

For nonroutine analytical services (NRAS), which include off-site analytical services, field analyses, and field measurements, verification criteria must be stated in the SAP or SOP. These verification, or acceptance, criteria are most efficiently used when they are provided as a checklist or data review SOP. The qualifiers that have been stipulated for the routine analytical services should be used to provide consistent data qualifiers within FIMAD. The SOP must also provide reason codes that are appropriate for the specific analyses. In the case of NRAS, the verification and baseline validation criteria should be combined. This will create a single set of requirements that must be met. Data failing these requirements will be qualified and reason codes will be attached.

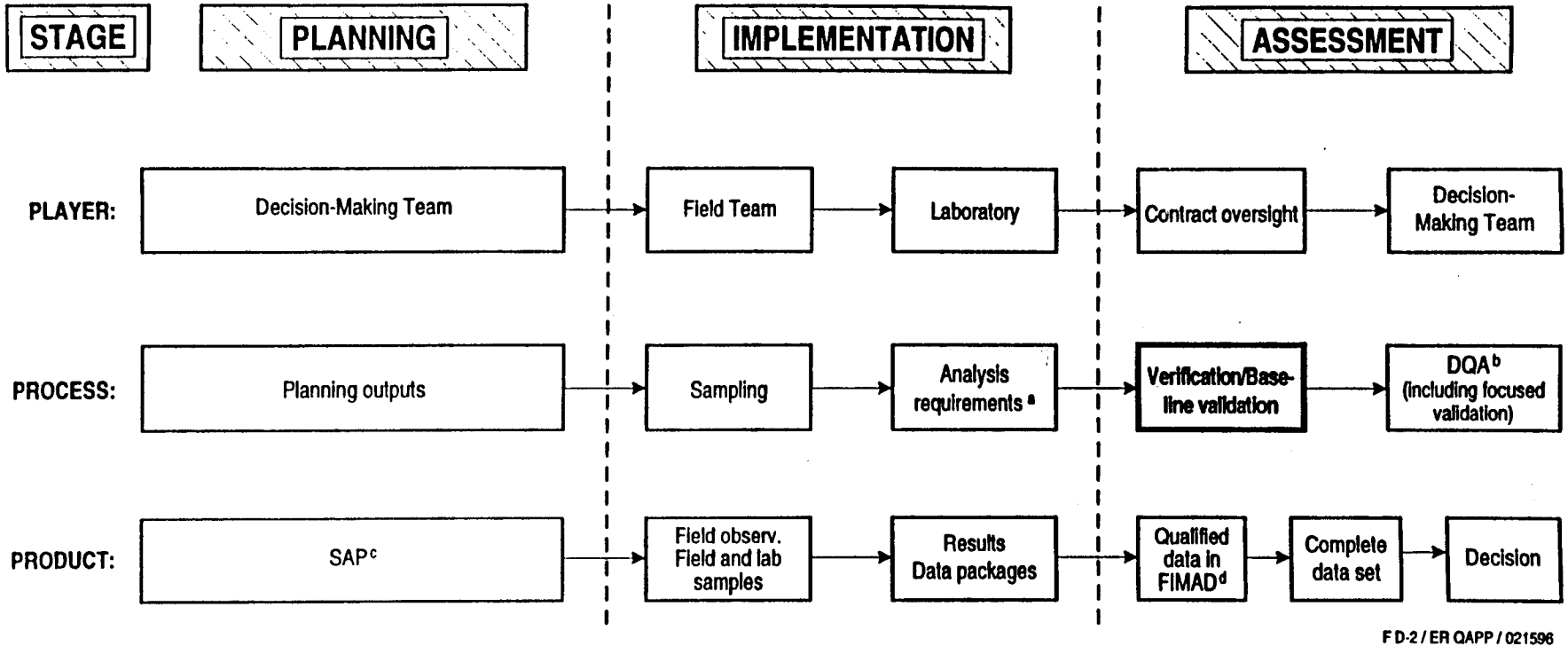
For NRAS, the SAP must provide the following:

- the problem-specific verification and baseline validation criteria (the analytical data generator must be made aware of these criteria). Note that if the nonroutine service closely resembles



F D-1 / ER QAPP / 021596

Figure D-1. The data verification/baseline validation process.



a. Analysis requirements are specified in a formal statement of work or contract.
b. Data quality assessment
c. Sampling and analysis plan
d. Facility for Information Management, Analysis, and Display

Figure D-2. Data flow diagram for the Environmental Restoration Project.

a routine service, the routine verification/baseline validation procedures may be cited, with appropriate deviations identified;

- the payment implications if measurement criteria are not met;
- the process for corrective action (e.g., completion and correction of data package); and
- if known, any need for additional focused validation (see Section D2 of this document).

These items can be provided by reference to appropriate SOPs and SOWs or by incorporating the requirements into the SAP.

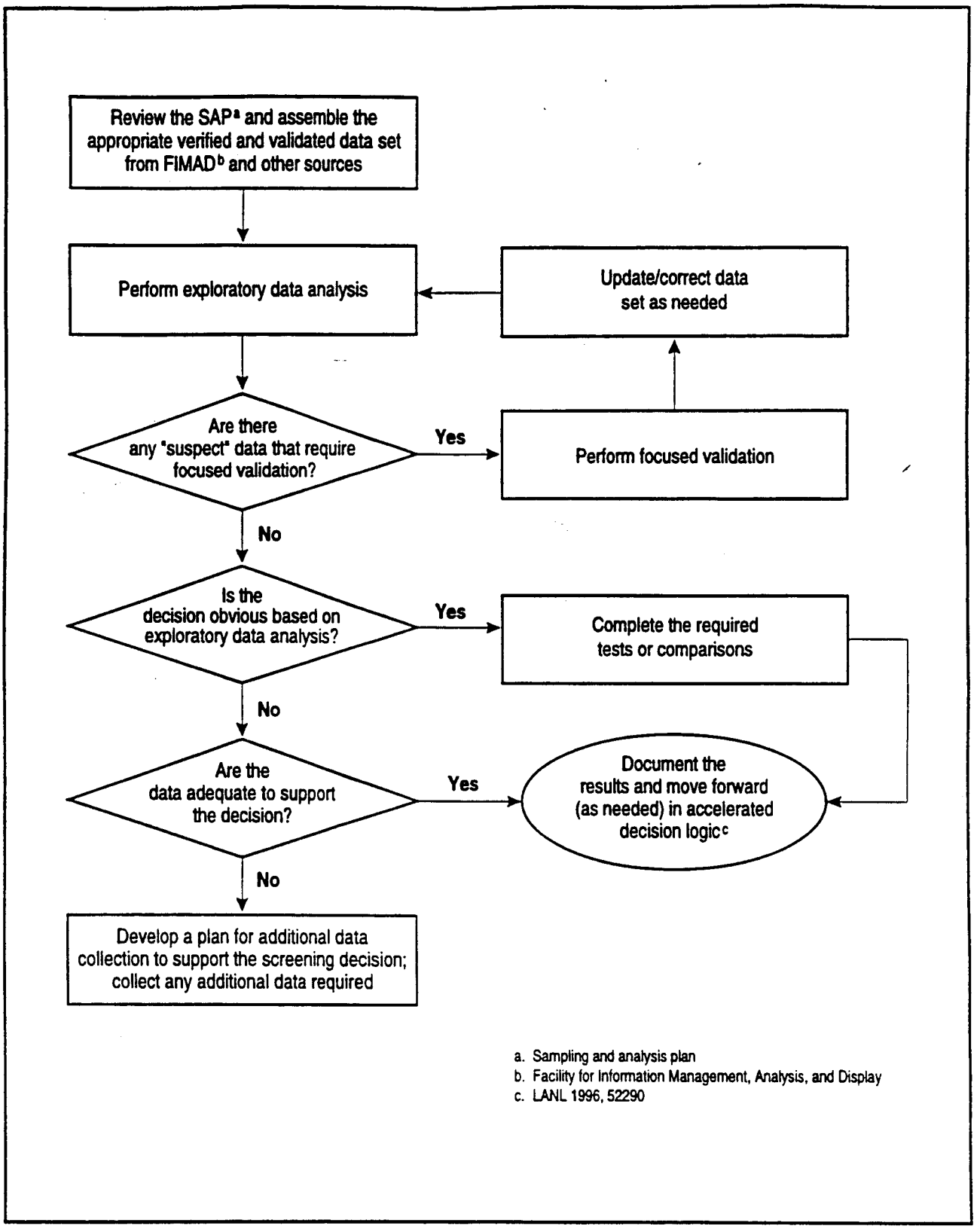
The baseline validation process focuses on the measurement data. The variability associated with the measurement process often represents only a minor component of the overall variability in the environmental data collection process. Other components of variability in a data set include, but are not limited to, spatial variability of environmental contaminants, variability in the sampling processes, and uncertainty in all other processes that occur during planning, sample collection, field data recording, and reporting. Consequently, data validation should not be overemphasized at the expense of other elements of the data collection process. To better match the cost of data validation with its comparable value, the ER Project requires only this streamlined verification/baseline validation process.

D2 FOCUSED DATA VALIDATION

The purpose of focused data validation is to determine the technical adequacy of measurement data when

- the data are qualified as deficient during the verification/baseline validation process. For example, when holding times are exceeded, interferences are present, artifacts are detected in the laboratory blank, poor sample recovery is indicated, or multiple deficiencies are noted, a focused validation may be required to assist in the determination of data adequacy for the intended use;
- the DQA process requires additional information about the variability or uncertainty of the reported data; or
- the DQA process requires additional information about the data quality prior to making a data use decision because of anomalies detected in a data set.

Figure D-3 depicts where focused validation usually occurs in the DQA process. Focused data validation usually occurs as a result of specific data use questions that arise during the DQA process, which is described in Section D3 of this document. However, unusual, excessive, or potentially fatal deficiencies noted in the report for data verification/baseline validation may trigger focused validation as an initial step in the DQA process. If this appears to be the case, the field unit technical team is notified through appropriate qualifiers and reason codes in FIMAD and must make a decision as to whether the focused validation should be initiated during DQA.



F D-4 / ER QAPP / 022096

Figure D-3. The data quality assessment process.

Focused validation for the LANL ER Project does not result in any adjustment of data (e.g., for bias), because PRS-specific data will usually be insufficient for such a purpose. However, it might be possible, based on historical ER Project-wide QA/QC data, used in conjunction with the site-specific data, to support a conclusion of a bias that can be quantitated and taken into consideration in a decision. Bias considerations must be addressed on a case-by-case basis by the DSC.

Factors which may be used to focus validation are

- qualitative QC measures,
- quantitative QC measures,
- degree of importance of the detection/quantitation limit,
- concern with detectable concentrations,
- analytical false negatives,
- analytical false positives,
- potential use of data not meeting defined performance criteria, or
- analytical uncertainly/variability, especially when results are close to action thresholds and/or detection/quantitation limits.

D3 DATA QUALITY ASSESSMENT: RECONCILIATION WITH PLANNING (SAP) OBJECTIVES

Data quality assessment (DQA) is a data analysis and interpretation process involving scientific and statistical evaluation of data sets to determine if they are sufficient to support specific decisions. To implement the DQA process, the data analyst will work closely with a multidisciplinary team, potentially including the field team leader, data manager, chemist, statistician, risk assessor, and earth scientists. Figure D-3 provides an overview of the approach the ER project uses to implement the DQA process to determine adequacy to support a decision.

The DQA process includes a review of the SAP objectives, data quality requirements, sampling design, and exploratory and confirmatory statistical analyses of the data. Initially the data analyst will assemble the data set, including field information such as sample coordinates and descriptions and associated field measurements, and review any additional reports (e.g., a data validation report).

DQA usually begins with exploratory data analysis, including a significant graphical component. An interactive statistical graphics computer program is very useful for this purpose. Because this process evaluates individual data points within the context of entire data sets, it can quickly identify both "suspect" data and critical observations that could affect decisions based on these data. If necessary, "suspect" data can be submitted for focused validation (see Section D2 of this document) to determine whether they resulted from errors in the data generation process. "Suspect" and other unusual observations may also be reviewed by experts on the natural environment and the measurement process to determine if they have scientific explanations. A third possibility is that such observations simply represent the true variability inherent in the measurement process or the environment.

Following exploratory data analyses and any required focused validation, the DQA process will determine the validity of

- removing questionable results from the data set,
- correcting incorrect data, or
- leaving the data set unaltered.

Any changes made to the data set must be fully documented.

The remainder of the DQA process is intended to reconcile the data with the requirements specified in the SAP, and to assess the adequacy of the data to support the SAP objectives. The DQA process addresses the questions "Did we get what we asked for?" and "Did we ask for what we need?" How this is done depends in part on how quantitatively the original requirements were formulated.

To assess the adequacy of the sampling design to support a decision (e.g. "Did we ask for what we need?"), the data analyst must work with other members of the DQA team to determine if the number and types of samples, as specified in the SAP and as actually collected, were appropriate. This includes

- determining if the number and location of samples required by the SAP were taken;
- determining if the appropriate media were sampled;
- judging the adequacy of the sample number and locations, given the updated understanding of the problem; and
- determining if the understanding of the problem changed since the SAP was prepared because of observations made by the field team.

While problems on one or more of the above do not automatically rule out using the data as planned, they can suggest that supplemental data must be collected before proceeding.

In some cases, the correct decision will be obvious by inspection of the data set; for example, when reported values are far above or are uniformly below SALs. Provided that the sampling design was adequate to support this obvious decision, the evaluation of data adequacy for that decision may terminate after the initial exploratory analysis and the site moves forward in the accelerated decision logic (LANL, 1996, 52290).

If the decision is not obvious, either because the data do not all point in the same direction, or because of some minor problem with the design, or if the SAP specifies that the decision will be based on the results of certain statistical tests or calculations (e.g., on upper confidence bounds for certain population parameters), further examination of the analytical data is required. Qualitative evaluation of the analytical and field data will determine if

- analytical measurements for all variables specified in the SAP were generated;
- the appropriate suite(s) of analytes were requested, given the updated understanding of the problem;

- the analytical methods used were appropriate for the analytes of interest (e.g., inductively coupled plasma atomic emission spectrometry (ICPAES) is typically considered inappropriate for measuring thallium concentrations in soil);

- the detection or quantitation limits reported for "nondetects" were less than or equal to the decision levels specified in the SAP;

- measurement performance requirements (precision and bias) specified in the SAP were met; and

- data collected at different times are consistent between sampling events and between sample request/report numbers.

Beyond these qualitative evaluations, the ER Project will use the DQA process defined by EPA (EPA 1995, 52289), or its equivalent, to assess data adequacy to support a statistically based decision. This process focuses on the adequacy of the data set for decision-making, rather than the integrity of individual measurements. The EPA DQA process assumes that a statistical approach to sampling and analysis was taken, and that the basis for this design (such as the outputs of EPA's DQO process (EPA 1994, 50288) was either recorded in the SAP or can be developed retrospectively. The first two steps of this formal DQA process, review of the sampling design and preliminary data review, are as described above. The remaining three steps are summarized below.

- The data analyst will work with the DQA team to ensure that the most appropriate statistical test will be used. (If the DQO process was followed, then a statistical test was specified in the SAP. However, additional or alternate tests may be considered at this time, particularly if the understanding of the problem has been updated.) Then the underlying assumptions that must hold for the proposed statistical procedures will be evaluated for this data set. In addition, the data analyst will consult with the appropriate scientists and site experts to make sure that the comparisons implied by the statistical test are appropriate from a scientific standpoint.

- In general, the data analyst will use the site data to generate estimates of total study error and to perform the appropriate statistical tests at a significance level consistent with the decision-makers' desire to control decision errors. (Again, if the DQO process was followed, then these limits on decision errors were among its outputs.) In cases where the data set will be used to support a no further action (NFA) proposal or some other specified decision outcome, the data analyst should evaluate the confidence associated with this decision outcome and determine if the data are sufficient to support the decision in that case.

- If an adequate level of confidence was achieved at the contaminant concentrations actually observed, this observation supports the case that data are sufficient to support the proposed decision.

Results of DQA will be documented in adequate detail for the decision-maker and peer reviewers to evaluate the effect of these results on decision-making. If a decision can be made based on the data, the documentation will include both the decision outcome and also the level of confidence that can be ascribed to the decision. The data analyst and other members of the DQA team will develop recommendations in cases where the data are not deemed sufficient to support a decision, which may be included in the documentation or presented to the decision-makers in a less formal manner. If further investigations appear to be required, the data analyst will summarize information contained in the existing data as it applies to the design of subsequent SAPs for this site. As appropriate, the DQA team may recommend that limitations be placed on current or future uses of the data.

Attachment G - Comment 7

Compilation of All Analytical Data, including non-detectable concentrations - This attachment if a Microsoft EXCEL file included on the floppy disk attached to this response.

Attachment H - Comment 8

Pertinent Sections of "Risk-based Corrective Action" Document

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RISK-BASED CORRECTIVE ACTION PROCESS

Revision 1 DRAFT

The Environmental Restoration Projects at Los Alamos and Sandia National Laboratories

Prepared by the
Los Alamos National Laboratory
Environmental Restoration Decision Support Council
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APPENDIX A: ACCELERATED CORRECTIVE ACTION PROCESS A-1

APPENDIX B: DERMAL EXPOSURE ASSESSMENT B-1

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LIST OF ACRONYMS

AL	Action level
ALARA	As low as reasonably achievable
AOC	Area of concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMI	Corrective measures implementation
CMS	Corrective measures study
COC	Contaminant of concern
COPC	Contaminant/constituent of potential concern
COPEC	Contaminants of potential ecological concern
DOE	US Department of Energy
DOE/AL	US Department of Energy /Albuquerque Operations Office
DOU	Document of Understanding
DQO	Data quality objective
EEU	Ecological exposure unit
EM/ER	Environmental Management/Environmental Restoration Group
EPA	US Environmental Protection Agency
EQL	Estimated quantitation limit
ER	Environmental restoration
HSWA	Hazardous and Solid Waste Amendments of 1984
LANL	Los Alamos National Laboratory
MCE	Multiple chemical evaluation
NFA	No further action
NMED	New Mexico Environment Department
NPL	National Priorities List
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRS	Potential release site
RAGS	Risk Assessment Guidance for Superfund
RBCAP	Risk-Based Corrective Action Process
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual radioactive material (computer code)
RFI	RCRA facility investigation
SACM	Superfund Accelerated Cleanup Model
SAL	Screening action level
SAP	Sampling and analysis plan
SSG	Soil Screening Guidelines
SNL/NM	Sandia National Laboratories, New Mexico
SWMU	Solid waste management unit
UCL	Upper confidence limit
UTL	Upper tolerance limit
VCA	Voluntary corrective action
VCM	Voluntary corrective measure

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I. INTRODUCTION

The purpose of this document is to identify the risk-based assumptions and methodologies being used by Los Alamos National Laboratory (LANL) and Sandia National Laboratories, New Mexico (SNL/NM) in the implementation of the corrective action process within their Environmental Restoration (ER) Projects. The technical approach for data collection and evaluation at LANL and SNL/NM depends on a number of assumptions related to the way in which data will be used to support decision-making and risk assessment. One of the ER Project's primary roles is to design and conduct data collection activities that will be sufficient to support each decision made during the corrective action process. LANL and SNL/NM recognize that the regulators have final decision authority and will base their decisions on data generated by the Laboratories.

Many of the assumptions that follow in the *Risk-Based Corrective Action Process* (RBCAP) are agreed upon in the Document of Understanding (DOU) (NMED et al. 1995). Specifically, Annex B, *No Further Action (NFA) Process and Criteria*; Annex C, *Voluntary Corrective Action (VCA) Process and Criteria*; Annex E, *Land Use*; Annex F, *Cleanup Levels*; Annex G, *Sampling and Analysis Guidelines*; and Annex L, *Permit Modifications (HSWA Module)* of the DOU have information relative to RBCAP assumptions. As LANL and SNL/NM regulators concur with additional RBCAP assumptions, the agreed-upon assumptions will be formalized in future annexes of the DOU or in facility-specific documents, as necessary.

The development of agreed-upon technical assumptions and definitions of terms is necessary to make RCRA requirements fully operational in planning and implementing ER work. The technical assumptions described herein are intended to supplement and be consistent with those regulations. Although the technical approaches at LANL and SNL/NM follow the same fundamental assumptions, at times the diversified nature of the environmental settings and population characteristics of the two Laboratories dictate a divergence in approach. Throughout this document, any facility-specific approaches, assumptions or nomenclature are presented in shaded boxes.

The proposed approach for implementing the corrective action process at LANL and SNL/NM is summarized in the generic decision flow illustrated in Figure 1. The overall technical approach will be carried out within the framework of a modified DOE streamlined approach that incorporates Data Quality Objectives (DQOs) and risk assessment as well as elements of EPA's Superfund Accelerated Cleanup Model (SACM) to facilitate the rapid cleanup of those units that potentially pose risk. Both the technical approach and decision logic are tied to NMED and EPA regulations and guidance. For all sites, the ultimate objective is to achieve and document that acceptable levels of risk to human health and the environment have been reached and that no further action (NFA) is necessary. Following initial identification of a solid waste management unit (SWMU) or an area of concern (AOC), archival information is reviewed to determine if existing data will support NFA. If not, sampling and analysis plans are developed and implemented. Data obtained are screened to determine whether NFA is appropriate or potential risk-based concerns exist. If so, a preliminary risk assessment may follow to determine whether potential risks suggest NFA is appropriate, or that stabilization or accelerated cleanup should be implemented. Sites posing risks but not appropriate for stabilization or accelerated action will proceed under administrative authority to a corrective measures study (CMS). Following evaluation of preliminary remediation goals, plausible remedial alternatives are evaluated and the administrative authority establishes cleanup standards and approves a remedy. Corrective measures implementation (CMI) and the results of CMI are evaluated by the administrative authority to assure that the completed remedy supports NFA.

Figure A-1 in Appendix A shows the process the Laboratories have developed with NMED to accelerate the corrective action process when appropriate. In general, the accelerated corrective action approach is the same approach stated above and shown in Figure 1. However, the intent of the accelerated approach is to undergo the standard RFI/CMS process with minimal review, thus providing more rapid decisions.

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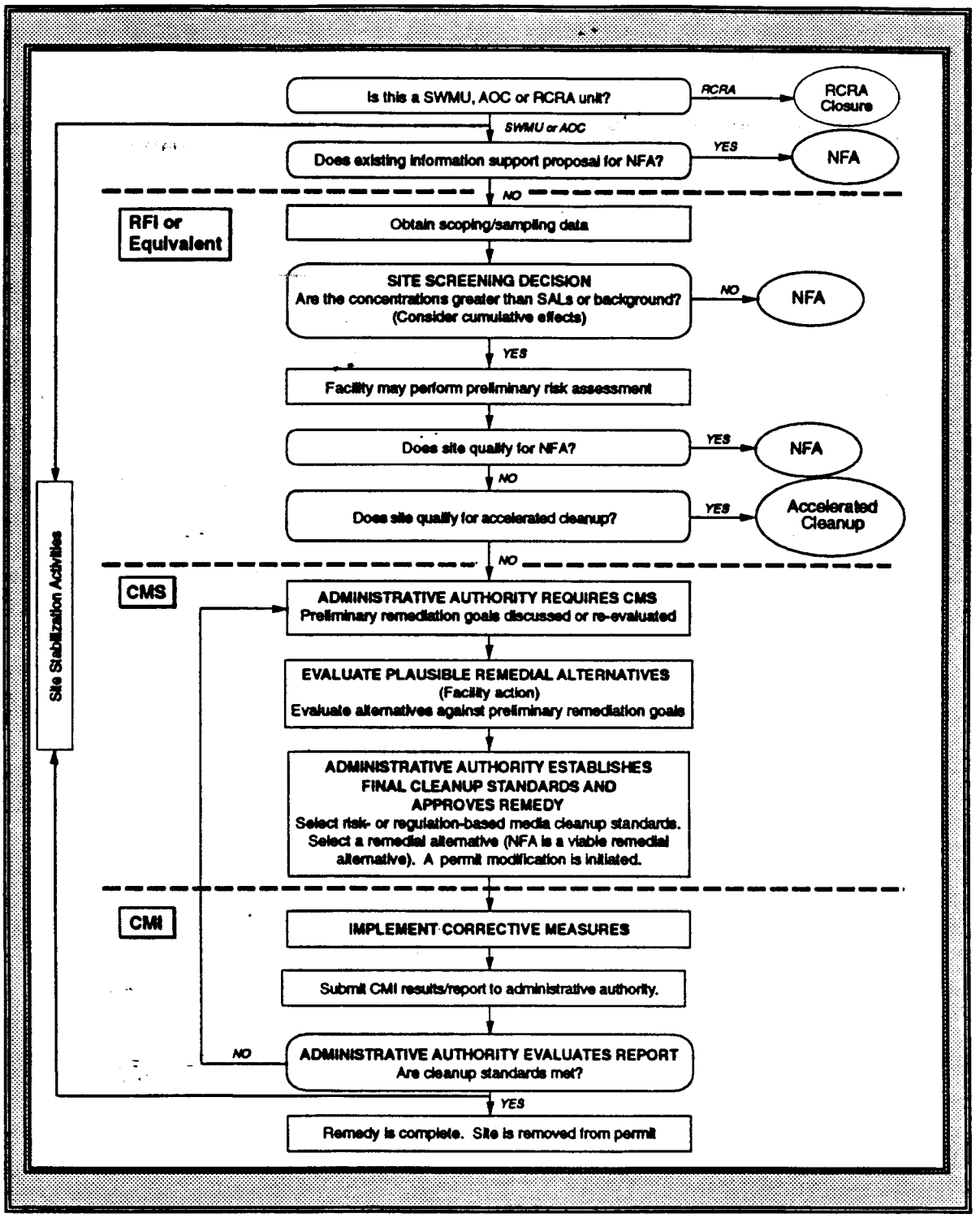
Figure 1. LANL-SNL/NM Decision Framework for the RCRA Corrective Action Process



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II. SITE SCREENING DECISION ASSUMPTIONS

i. General Assumptions

1. Sites can be proposed for NFA under the HSWA Module when sufficient archival data/ information exist(s), site characterization data is complete, or cleanup confirmation data is complete. Sufficient documentation must exist to support one or more of the five criteria listed below. These criteria were agreed upon by NMED, EPA, DOE, and the Laboratories in Annex B of the Document of Understanding (NMED et al. 1995). Upon approval from regulators, sites meeting one of the NFA criteria are removed from the HSWA Module. The same criteria are applied to sites not listed in the HSWA Module. Non-HSWA Module sites are proposed for NFA to the DOE. Upon DOE approval, the sites are removed from the total list of potential release sites (PRSs).
   - NFA Criterion 1. The site cannot be located or has been found not to exist, is a duplicate PRS, or is located within and therefore, investigated as part of another PRS.
   - NFA Criterion 2. The site has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other CERCLA hazardous substances.
   - NFA Criterion 3. No release to the environment has occurred, nor is likely to occur in the future.
   - NFA Criterion 4. There was a release, but the site was characterized and/or remediated under another authority which adequately addresses corrective action, and documentation, such as a closure letter, is available.
   - NFA Criterion 5. The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.
2. Historical process knowledge and screening samples can be sufficient to focus the analyses of samples to those chemicals that are plausible at a site, rather than performing a full-scan analysis on all samples. However, when any degree of uncertainty is involved, a full-scan analysis may be necessary.
   - For example, where historical process information clearly shows that certain chemicals (e.g., high explosives, plutonium) were never handled at a site, analyses for these constituents need not be performed.
3. Professional judgment and/or results from field survey techniques can be used to bias the location and the number of samples needed for site characterization in order to increase the probability of detecting contaminants relative to purely random sampling approaches.

ii. Background Comparison Assumptions

4. Only constituents that exceed background concentrations are considered potential contaminants. Background data sets differ for classes of contaminants and between Laboratories. Choice of appropriate background screening values is defined for each Laboratory in the boxes below. In addition,
   - Site data are considered indistinguishable from background when:
     - Site concentrations are statistically indistinguishable from background as defined below, even if observed concentrations exceed the risk-related criteria described below in Assumption 5.

— Statistical analyses can include graphical comparisons of background and PRS data; parametric statistical procedures such as the t-test and regression analysis; and non-parametric statistical tests such as the Wilcoxon Rank Sum and Quantile tests. (Project Consistency Team [EM/ER:96-PCT-010]; Ryti et al. 1996).

- Any contaminant detected for which no background data exists will be carried to the next screening step.
- Because Laboratory-specific background data sets differ, flow charts of statistical assumptions and tests used for background comparisons have been provided to regulators by LANL and SNL separately.

At LANL,

Background can vary from site to site and for chemical classes and is defined as follows:

—LANL-wide inorganic background is used in screening comparisons. The LANL-wide background soil concentrations of inorganics have been determined for specific soil horizons; geological strata; and sediments in the canyons (Project Consistency Team [EM/ER:96-PCT-010]; Ryti et al. 1996).

—Site data are compared to the appropriate subset unless the soil horizon is neither known nor relevant (e.g., fill of unknown origin).

—Site-specific background data may be required in cases where site data exceed both LANL-wide background and screening action levels (SALs, see next section); when ecological risk is the primary decision point; or when arsenic or beryllium are known (or suspected) to have been released at the PRS (LANL-wide concentrations of these two inorganics are known to routinely exceed SALs).

—Radionuclide background values for soil, sediment, and fill material consist of the maximum and/or upper tolerance limit (UTL) from data in regional sites published in LANL environmental surveillance reports and sediment background sample data collected by the ER Project. Uranium and thorium background values for tuff are estimated based on total uranium and thorium. (Project Consistency Team [EM/ER:96-PCT-010]; Ryti et al. 1996; Ryti et al. 1997, in preparation).

—For background comparisons, contaminant values are the maximum reported values for PRS radionuclide data sets. For inorganics, the calculated 95th percentile (95% confidence) UTL for the best-fit normal, lognormal, or square root-transformed normal distribution is used when sufficient data are available to estimate a distribution. If data are insufficient, the maximum reported value is used for inorganics. UTLs are checked for consistency within the appropriate data group to ensure that inflated values are not used.

At SNL/NM,

—Site-specific contaminant concentrations (usually the maximum value obtained) are compared to background screening values as defined below. If all potential chemical of concern (COC) values are below their respective background screening values, the site is deemed suitable for an NFA proposal. Otherwise, all potential COCs are carried into the next screening step, with the exception of lead. Lead is compared to the EPA guidance screening for lead (EPA 1994).

—SNL/NM has a facility-wide background study data set approved by the NMED (IT 1996). The facility wide background study has a list of background screening values based on either the 95th UTL or percentiles, as applicable, of the populations analyzed.

—Site-specific background values may be used to compliment the site-wide background study or be used exclusively in areas where site-wide background values do not apply or exist.

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iii. Screening Assumptions

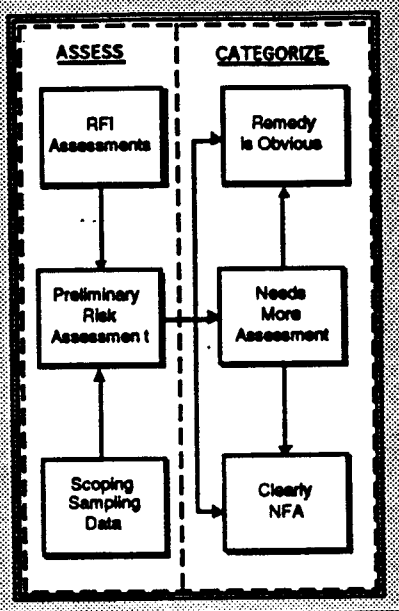
5. A screening assessment is performed to evaluate potential soil contaminants. The facility specific screening processes for LANL and SNL/NM are presented below. The basic concept for screening is similar between the facilities. Because SNL/NM has fewer potential release sites, the screening process has been completed at that facility.
   - At LANL, SALs are used as action levels. At SNL/NM, the functional equivalent of the SAL is the action level (AL).
   - SALs/ALs are used to identify chemicals of potential concern (COPCs) and determine the need for further investigation.
   - SALs are not used as target risk levels or cleanup standards unless supported by site-specific risk calculations.
   - A target dose[1] level is used to derive SALs/ALs for radioactive constituents. SALs/ALs for radioactive constituents are calculated using RESRAD.
     - — Standard residential default exposure values are used in radionuclide models for body weight, intake rate, etc.
     - — Dose is summed over multiple pathways, e.g., external irradiation, dust inhalation, and produce ingestion are considered as well as direct soil ingestion.
     - — Environmental parameters required by radionuclide models are set conservatively, but appropriately, for each Laboratory.
   - In general, the maximum observed concentration, rather than an average of several observations, is compared with SALs/ALs in order to identify COPCs. SAL/AL comparisons are based on measured concentrations, unadjusted for natural or anthropogenic (e.g., atmospheric fallout) background.
     - — In some cases (with prior approval from regulators), observations made on composite samples, or averages of closely related samples such as field duplicates, may be compared with SALs/ALs to identify COPCs.
     - — SALs are based on exposure to contaminants in surface soils.

At LANL,

- Screening action levels (SALs) are used to identify chemicals of potential concern (COPCs) and determine the need for further investigation. Analytes that exceed background require further action if they also exceed SALs or if the analyte contributes significantly to the multiple chemical evaluation (MCE).
- SALs for chemical constituents are based on EPA Region IX preliminary remediation goals for residential soil. These values are based on risk at 10^{-6} and HI <1.
  - —As required and when sufficient toxicity data are available in the peer-reviewed literature, LANL ER Decision Support Council personnel will calculate SALs for chemicals not included in the Region IX database. SALs are calculated using Region IX default parameters for the residential scenario. The scenario includes the ingestion pathway, the inhalation pathway, and dermal contact. When toxicity data are not available, surrogate chemicals will be chosen to evaluate toxicity.
  - —For PCBs, a SAL of 1 ppm will be used for field screening at industrial sites. (EPA 1994: Section [a][3][ii]). A SAL of 0.1 ppm will be used at residential sites.
- The dose level selected to calculate radionuclide SALs is 10 mrem/yr, based on it being a fraction of the DOE's annual effective dose rate of 100 mrem/yr from all sources. DOE also requires that doses to the public exceeding 10 mrem/yr at DOE facilities be reported to DOE Headquarters (DOE 5400.5, Ch. II, Section 7). Therefore, further investigation of sites exceeding 10 mrem/yr is consistent with regulatory guidance and appropriate as a screening dose level for an area such as LANL where residential land use is frequently possible.

[1] Dose is defined as the effective dose equivalent as incurred by exposure of an individual to external radiation and to internal radiation from inhalation or ingestion of radionuclides.

At SNL/NM,
The SNL/NM ER Project has already completed its screening process. As can be seen in the figure below, sites were categorized based on scoping assessments and early RFA/RFI data. A preliminary risk evaluation was conducted to determine the likely outcome of the sites (e.g., needs remediation, likely candidate for NFA). The preliminary risk evaluations were performed with probalistic techniques (Monte Carlo) in order to assess uncertainty and predict the likely range of possible risks posed by a site. If the site posed no risk, an NFA proposal was prepared. Sometimes this included confirmatory sampling to demonstrate compliance (see Assumption 1). If the site posed a significant threat, a remedy selection process was initiated (see accelerated cleanup discussion under Assumption 8). If the preliminary risk evaluation showed that the outcome was uncertain (i.e., not clearly an NFA or remediation), additional assessment activities were planned. Following the assessment activities, another risk evaluation was or will be made to ascertain whether an NFA proposal is likely or a cleanup action is warranted.



6. Multiple contaminants below SALs/ALs may together require further evaluation due to the potential for additive or synergistic toxic effects. EPA Region IX PRGs do not address potential interactions. EPA soil screening guidelines (SSG) suggest that interactions among carcinogens are unlikely to result in an excess risk greater than 10^{-4} if screened individually to a 10^{-6}-based action level, and, therefore, recommend no additional MCE for carcinogens. For non-carcinogens, the SSG recommends interactions be considered only for contaminants having the same target organ (EPA 1996a). As a screening tool, the procedure described below is seen as consistent with and more protective than these guidelines.
   - Constituents that exceed background, but are below SALs/ALs, are screened for potential additivity by summing the normalized maximum observed concentration (maximum concentration divided by respective SAL/AL) for all constituents in this group within a given PRS or PRS aggregate. This approach is conservative because it assumes simultaneous exposure to all constituents by a given receptor.
   - Multiple chemical evaluations (MCEs) are conducted separately for carcinogens, non-carcinogens, and radionuclides. Additivity is assumed within a category.
   - If the sum of the normalized maximum values (rounded to the nearest 10th) is less than 1, no further evaluation of these constituents is required.

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At LANL,

- If the sum of the normalized maximum values is greater than 1, the appropriateness of the sum-of-the-maximum approach is evaluated based on professional judgment. For example, if the PRS is larger than a predicted exposure unit (i.e., the area over which a receptor might be exposed to residual contamination), an additional evaluation such as the maximum sum of normalized values at a given sample location may also be reported to evaluate realistic exposure.
- If the results of an additional analysis (such as described in the previous bullet) also suggest that multiple chemical exposure may be of concern, then constituents will be identified as COPCs and retained for further evaluation if their individualized normalized values (i.e., the maximum or mean, for ample data sets, detected concentration divided by the SAL) are greater than or equal to 0.1. The final decision to retain a constituent as a COPC for further evaluation will also depend on other site-specific considerations and the professional judgments of the risk assessor. Constituents with normalized values less than 0.1 will be dropped from further evaluation.
- Constituents that are in more than one category (e.g., carcinogen, non-carcinogen) are typically included in the category in which they are most potent. However, when the addition of a constituent's toxicity may influence decisions in another category, it will be included in both categories. In addition, uranium is evaluated both as a radionuclide and as a noncarcinogen because these effects occur at a similar dose.
- The means of evaluating data for COPCs having concentrations less than SALs is outlined in the following table:

Detection Status	Relation Between EQLs[a] and SALs	Decision Considerations[d]	Possible Decision Actions
All non-detects	EQL > SAL[c]	Process knowledge and data for similar chemicals	COPC or elimination
All non-detects	EQL < SAL[c]	Process knowledge and data for similar chemicals	MCE[e] or elimination
Some detects[b]	EQL > SAL[c]	Process knowledge and data for similar chemicals	COPC or MCE[f]
Some detects[b]	EQL < SAL[c]	n/a	MCE[g]

a. The estimated quantitation limit (EQL) is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine analytical laboratory operating conditions.
b. Assumes none of the detects are at concentrations greater than SALs.
c. Considers the maximum reported EQL for the non-detects.
d. Process knowledge and sample data for similar chemicals are considered to determine the decision action under some scenarios. For example, under the first scenario, if process knowledge indicates that the analyte in question may be present at the site or similar analytes were detected, then this analyte may be retained as a COPC, otherwise it is eliminated from further consideration.
e. If the chemical is not eliminated from further consideration, then the value used in the MCE is the maximum reported EQL.
f. If the chemical is not retained immediately as a COPC based on the relation between EQLs and SAL, then the value used in the MCE is the maximum reported detected concentration.
g. The value used in the MCE is the maximum reported detected concentration.

At SNL/NM,

- Constituents that are both carcinogens and non-carcinogens are included in both categories in MCEs.

7. Appropriate choices of analytical chemistry methods can maximize the ability to detect constituents at or below SAL/AL concentrations.
   - SW 846 methods (when available) are used for fixed analytical laboratories unless other methods are justified.
   - Field measurement and analytic techniques are used where appropriate. If field analytical techniques are not sufficient to detect constituents at SAL/AL concentrations, EPA-approved fixed analytical laboratory methods are used.

- If the detection limit of the fixed analytical laboratory method is above the SAL/AL, and the chemical is expected to be present at the site, then the chemical will be identified as a COPC.

At LANL,
- If field measurement techniques are used to guide fixed analytical laboratory sampling locations and to support site decisions, correlation to laboratory analyticals will be statistically verified.

8. Identification of COPCs indicates only that a problem may exist.
   - Further action may take several forms, to be determined on a case-by-case basis.
     - Further Evaluation. More in-depth analysis of available data, e.g. using site-specific exposure assumptions, or collection of additional data following screening. Results of these further evaluations could be either NFA, baseline risk assessment, CMS, or accelerated cleanup.
     - Risk assessment. If one or more measurements at a site are found to be above SALs/ALs and background, a preliminary and/or baseline risk assessment may be used to determine if corrective action is required. Preliminary risk can be assessed using conservative assumptions and existing data. Additional data may be required for the baseline risk assessment if the current data are not adequate to support a risk assessment decision (see assumptions 10 - 17).
     - Accelerated Cleanup. Accelerated cleanups can proceed without further evaluation and/or a baseline risk assessment under the following conditions:
       - ◊ cleanup levels are based on background concentrations, promulgated standards, or previously determined site-specific risk-based levels;
       - ◊ the remedy is obvious and can be readily applied;
       - ◊ the remedy will be a final resolution in order to prevent potential releases or future migration of contaminants from the site;
       - ◊ acceptable knowledge is available to adequately identify COPCs, e.g., previous sampling data and/or existing data are available to adequately identify COPCs;
       - ◊ adequate waste treatment, storage or disposal capacity is available (including mixed waste if applicable);
       - ◊ the remedy is not worse for the ecosystem, worker safety, or public health than the problem;
       - ◊ uncertainties can be handled by contingencies in the accelerated cleanup plan, and stopping criteria are defined; and
       - ◊ the estimated cost of remediation is expected to be less than the cost of moving forward with further data collection and/or data analysis and risk assessment.

       In the case where extent of contamination is not adequately defined, the accelerated action planning document shall include a sampling and analysis plan (SAP) that outlines the procedures for bounding extent of contamination during field operations. These procedures will consider fate and transport properties for all site contaminants. Cleanup verification SAPs will be designed to confirm the adequacy of the accelerated action.

       The regulator may require and/or the facility may request enhanced regulatory involvement in some accelerated actions. These actions are referred to as voluntary corrective measures (VCMs). Enhanced involvement by the regulator includes review and approval of the VCM plan, potential involvement of the remediation activities, and review and approval of the VCM report.

       Those accelerated actions not requiring enhanced regulatory involvement are referred to as voluntary corrective actions (VCAs). The regulator will be informed of VCA activities. See Appendix A, Figure A-1, for details of where and how the accelerated cleanup approach fits into the overall accelerated corrective action process.

— Stabilization. At any time during the RFI/CMS process, sites may be considered for stabilization if all of the following are true:

◊ sufficient information about contaminants and the environmental setting are known, but the site fails one or more specific accelerated action criteria;

◊ near-term opportunities exist for significant risk reduction, prevention of further contamination, and/or long-term cost savings;

◊ appropriate technologies are available to deal with the known contaminants;

◊ proposed action will not impede or be inconsistent with the expected approach for the final remedy;

◊ the stabilization activity is not worse than the problem for the ecosystem, worker safety, or public health; and

◊ if waste is generated, adequate waste treatment, storage, or disposal capacity is available (including mixed waste if applicable).

At LANL,

- Special Considerations for Specific Constituents
  - — PAHs:
    - ◊ PAHs will be carried forward as COPCs when the following conditions exist:
      - PAHs are present at a site above SALs;
      - a current source for PAHs due to non-LANL industrial operations is not identified; and
      - a Laboratory release cannot be ruled out.
    - ◊ PAHs will not be carried forward as COPCs when the following conditions exist:
      - PAHs are present above SALs, but;
      - no Laboratory release is suspected; and
      - a current source for PAHs due to non-LANL industrial operations is identified.

    Thus, if PAHs are not considered COPCs, a risk assessment will not be done for the site unless warranted by the presence of other constituents. If a risk assessment is done, PAHs will not be included as COPCs. However, the risk related to the PAHs will be presented as part of the background risk characterization

9. Approaches for ecological screening and risk assessment will be consistent with guidance in the EPA *Framework for Ecological Assessment* as further detailed in the draft *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. This approach is presented in more detail under assumption 17.

III. RISK-BASED DECISION ASSUMPTIONS

10. Human health and ecological risks can only be appropriately evaluated on a scale of relevant exposure units.
    - Individual sites will be aggregated as necessary for appropriate risk evaluation.
    - Aggregate sizes may differ for human health and ecological evaluations depending on the exposure models.

11. Risks to human health and the environment posed by contamination at the site are necessary considerations in further decisions about a site (beyond identification of COPCs and stabilization activities).
    - Decisions made after comparison of individual observations to a SAL/AL are based on generic, conservative assumptions. Appropriate site-specific risk assessments may differ from screening conclusions because the exposure assumptions underlying the SAL/AL calculation are not site-specific, and also because risk depends on the extent and distribution of contamination rather than the maximum observed concentration.
    - Chemicals identified as COPCs because the detection limit was greater than the SAL/AL may be evaluated qualitatively based on process knowledge. If a chemical is not expected to be present at a site, the chemical needs no further consideration.

- If a chemical having a detection limit greater than SAL is expected to be present, it will be included in the risk assessment calculations with the assumption that it is present at a concentration equal to one-half the detection limit.

I. Human-Health Risk Assessment

12. For sites requiring risk assessment and/or cleanup decisions, appropriate land-use scenarios can be identified based on:
    - The facility Site Development Plan; Future-Use Project Report; property management including deed restriction; and current land use.
    - Conceptual models for specific sites consider all exposure pathways appropriate for the site and all populations potentially exposed in a specific scenario. See Appendix B for considerations on the evaluation of dermal exposure.

At LANL,
- Based on the LANL 30-year Site Development Plan (LANL 1994) and other avail-able information, appropriate site-specific scenarios are developed, including residential and commercial use for the townsite or other lands slated for release from DOE control; industrial use for sites of continued Laboratory use; recreational use for areas accessible to the public, but not appropriate for residential development (i.e., steep hillsides inappropriate for residential construction); and a Native American scenario developed in cooperation with the adjoining Pueblos for areas with potential impact on Pueblo populations (canyon regions). Parameters for evaluating these scenarios are being developed with the Accord Tribes.

AT SNL/NM,
- Land use in the future is recreational or industrial. These designations are consistent with those approved by the Citizen's Advisory Board.

13. Estimation of risks to human health is based on reasonable and site-specific exposure assumptions. In particular, site-specific land-use assumptions will be used.

14. The water exposure pathway is selected when data indicate that water resources may be impacted. Surface water pathways are also considered, as appropriate.

At LANL,
- Potential contaminant migration to groundwater may be modeled at those mesa-top sites where contamination is detected and the potential for transport to groundwater exists, as determined on a case-by-case basis.
- The groundwater pathway will be considered for canyon-bottom sites.
- Contaminant transport model(s), model inputs, assumptions, and uncertainties will be provided to regulators.
- When contaminant transport/migration is a problem, further action may be triggered by finding concentrations exceeding background levels or method detection limits, because this may be an indication that migration has occurred. LANL will evaluate various contaminant transport models for application and use. Transport models will be presented to regulators prior to their use for site decision-making.

AT SNL/NM,
- The water exposure pathway will be considered for every site, although most SNL/NM sites are not expected to have a groundwater pathway. For those sites with a potential groundwater pathway, flow and transport calculations will be performed to determine the potential impact.

15. Baseline risk assessment may provide a basis for NFA at sites where COPCs have been identified.
    - Superfund's RAGS (EPA 1989) provides the basic guidance for performing baseline risk assessments.
    - If the total carcinogenic risk posed by a PRS is within the 10^{-4} - 10^{-6} risk range (or lower), and the non-carcinogenic risk threshold has not been exceeded, the site may be proposed for NFA.
    - The approach used to conduct the risk assessment will be determined by preliminary information available on the site. In some cases, deterministic approaches may be the most expedient choice, e.g. where sites are well-characterized; the number of COPCs is small; or concentrations clearly indicate a health risk. For other sites, site complexity and decision consequences may necessitate the use of more complex stochastic models or alternative approaches necessary to define sources of uncertainty to guide future decisions. The choice of specific models will be determined by site characteristics. When stochastic models are used, assumptions will be explicitly stated and a reasonable maximal exposure based on deterministic calculations will be included. Models will be presented to regulators prior to their use for site decision-making.
    - Guidelines in proposed 10 CFR 834 and DOE Order 5400.5 (Radiation Protection of the Public and the Environment) establish proper procedures for determining acceptable levels of dose for radiological evaluations. Screening and cleanup level derivation and use of RESRAD and ALARA as methods of determination are supported by these regulations. For volumetric radiological contamination (soil, rubble, etc.), cleanup levels are proposed on a site-specific basis for each nuclide present and are generally calculated using the RESRAD computer code. For unrestricted release and continued Laboratory control, a target dose limit of 15 mrem/yr above background (DOE/AL 1996) is used as a basis for cleanup level calculations.
    - In most cases, radionuclide health assessments are presented in terms of dose (the DOE and EPA measure for limiting risk associated with radionuclides). In those cases for which the risk associated with radionuclides influences decisions associated with other COPCs at the site, the radionuclide risk may also be presented in terms of carcinogenic risk (for qualitative comparison only). The Laboratories caution strongly against adding radioactive risk results with hazardous chemical carcinogen risk estimates due to the marked difference in methods for establishing the respective health effects. This cautionary note is consistent with the EPA's RAGS document (EPA 1989).

16. Exposure estimates are based on the distribution of contamination throughout areas/volumes of contaminated media and over time periods that are consistent with land use assumptions
    - Current EPA guidance for deterministic models suggests using the 95% upper confidence level (UCL) for the mean concentration within such areas/volumes as an estimate of the reasonable maximum exposure associated with that area/volume.
        - When appropriate, alternative statistical models will provide estimates of reasonable maximum exposure.
    - Exposure areas/volumes are established through the DQO process using appropriate land use assumptions.
        - In general, the areas/volumes will be consistent with the selected exposure scenario. That is, the smallest area or volume to which a receptor would be exposed over the entire exposure period determined by that scenario will be used.

II. Ecological Risk Assessment

17. Ecological risk assessment will be performed on PRSs that are aggregated by vegetation type into habitat patches that form reasonable ecological exposure units (EEUs) for ecological receptors. The general approach follows a tiered process as outlined in EPA guidance (EPA 1992; 1994; and 1996b). The final process is being developed in conjunction with NMED.
    - Ecological screening assessment will proceed using a two-step approach in which immediately available data will be used to perform a preliminary screening. Requirements for further assessment will be evaluated for those PRSs that are not screened out in the first step.
    - Contaminants of potential ecological concern (COPECs) will be selected on the basis of detected presence at PRSs.
    - Representative receptors will be selected from food webs established for EEUs in order to protect Threatened and Endangered species, general ecosystem structure, and critical ecological functions.
    - Exposures will be calculated on the basis of contaminant concentrations, contaminant distribution patterns, receptor home range sizes, and receptor foraging strategies.
    - Risk will be assessed by comparing exposures to relevant toxicity data.
    - At sites where remediation is indicated, the ecological effects of leaving COPECs in place will be balanced against the ecological effects of remediation activities.

IV. REMEDY SELECTION AND IMPLEMENTATION ASSUMPTIONS

18. Site-specific land-use assumptions and exposure scenarios (Assumptions 12 and 13) are considered in establishing preliminary remediation goals and media cleanup standards, and also in risk assessments to estimate the reduction of risk realized by a potential corrective action.
19. Target risk and dose levels will be set following EPA, NMED, and DOE guidance.
    - Following EPA guidance, preliminary remediation goals and media cleanup standards for non-radioactive carcinogens are derived using EPA's target incremental risk range of 10^{-4} to 10^{-6}. A target hazard index value of 1 is used for non-carcinogens.
    - For volumetric radiological contamination (soil, rubble, etc.), cleanup levels are proposed on a site-specific and ALARA basis for each radionuclide present. For unrestricted release of residential sites, a target level of 15 mrem/yr above background is used.
    - Cleanup levels will be presented in a table of risk levels for recreational, industrial, and residential scenarios, as appropriate. All parameters used in the derivation of cleanup levels will be detailed in appropriate reports. Although cost factors will be included, these will not form the sole basis of the cleanup level decisions.
    - Risk due to background inorganics will be calculated and presented to regulators for consideration in the establishment of appropriate cleanup levels.
20. For CMSs, media cleanup standards will be established after the results of the CMS have been considered. DOE and the Laboratories will propose a remedy selection following evaluation of alternatives as described below. The administrative authority will approve the proposed plan, negotiate changes, or select an alternative remedy.
    - Remedy selection takes into consideration the potential impacts on the health and safety of workers and the public that will be associated with increased exposure during implementation of the remedy. Other considerations for selection of a remedy may include the cost of the remedial options, Laboratory land-use needs, transportation risk, future liability concerns (e.g., off-site disposal liability), and Natural Resource Damage Assessment.

21. Cleanup actions for radionuclides will incorporate ALARA considerations.
    - The principle of ALARA was developed in the occupational radiation protection discipline in order to ensure that radiation exposure remained well below standards.
    - The ALARA principle has been adapted to radiological cleanup activities as follows:
      - Dose-based cleanup goals are based upon:
        - ◊ nature and extent of contamination,
        - ◊ anticipated future use of the site, and
        - ◊ practicality of alternative cleanup techniques.
      - ALARA takes into account technical practicability, economic factors, variability of site conditions, accessibility of pockets of contamination, access controls, and other factors that influence the costs and benefits of a remedial action.
      - ALARA considerations, at this point, may lead to selecting a goal below the dose-based goal, if the lower goal can be economically and easily achieved.
      - Conversely, ALARA considerations may lead to selection of a goal above the dose-based goal (up to 100 mrem/yr) if conditions make the ultimate goal unachievable.
    - Elements of subjectivity remain in any ALARA decision.
    - ALARA decisions must be made with input and concurrence from the DOE.
    - The principle of ALARA is consistent with the CERCLA process for remedy selection.
22. The attainment of cleanup standards is based on comparison of site verification sampling data to the cleanup standards.
    - Verification sampling plans based on nature and extent will be designed to collect the appropriate number of samples to calculate a 95% UCL to compare to cleanup levels.
    - The 95% UCL will estimate average residual concentrations in appropriate risk-based areas/volumes of contaminated media. For radionuclides, identification of hot spots and evaluation of non-uniform radiological contamination will follow RESRAD and other applicable DOE guidance.
23. If media cleanup standards are unattainable using the selected remedy, an alternative remedy (e.g., conditional) and/or cleanup goals/standards will be negotiated.

V. RISK-BASED DECISION FACTORS AND RISK MANAGEMENT ASSUMPTIONS

24. The procedures described to this point are used to develop a consistent qualitative or quantitative evaluation of site risks at LANL and SNL/NM. The results of these evaluations, however, are only one part of the basis for risk-management decisions. Within the regulatory framework, ranges of acceptable risks are defined, and where in that range a management decision will fall for any given site will be modified by factors including:
    - stakeholder concerns;
    - likelihood of the exposure pathways that were evaluated existing either now or in the future;
    - the weight of scientific evidence for toxicity of site contaminants;
    - limits of the best available technologies for mitigating the problem;
    - potential interactions with other exposure sources in the vicinity;
    - feasibility and reasonable relationship of benefits to costs;
    - other political, social, legal, and cultural considerations.

    The goal of SNL and LANL is to ensure protection of human health and the environment from any contamination that might have occurred during past Laboratory activities. For non-radionuclide contamination, the EPA has established standards by which to judge these potential effects. For radionuclides, DOE, EPA, and the Nuclear Regulatory Commission have established or are in the process of establishing standards and guidance. These risk standards are applied considering the current and potential future land-use and the other modifying factors listed above.

Noncarcinogenic health effects are evaluated by the hazard index. Sites with a hazard index less than 1 are not associated with adverse health effects (EPA 1991a).

Carcinogenic health effects for non-radionuclides are evaluated by comparison of estimated excess cancer risk to the risk range that EPA has designated in the National Contingency Plan and RCRA Subpart S. The EPA considers an excess cancer risk level of 10^{-6} as the value below which no human health effects are likely to occur. Remedial action at a site is warranted if the risk value is above approximately 10^{-4}. For calculated risks in the range of 10^{-4} to 10^{-6}, negotiations are required with the regulatory agency to determine if the excess cancer risk is acceptable.

For sites where radioactive contamination is present, the DOE has authority to protect the public from radiation and radioactive materials. DOE has published health and safety orders of which DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE 1991), is the most pertinent to development and application of cleanup guidelines. DOE Order 5400.5 requires that doses be reduced to a level as low as reasonably achievable (ALARA) below the primary dose limit of 100 mrem/yr from all DOE sources. As stated in 5400.5, radionuclides are not managed by a risk standard, but rather by dose.

The calculated risk parameter value for the contaminated site is compared to the appropriate regulatory standard. If the risk is greater than the regulatory standard for the appropriate land-use, remedial action is generally warranted. Comparison of site risk parameter values to noncarcinogenic and radiological standards is relatively direct. For sites with potential carcinogens present as contaminants of concern, the EPA has provided a range of values for comparison. The intent of both SNL and LANL is to try to clean-up sites to the lower end of the target range as practical from both technical and economic considerations. As stated in an EPA/OSWER directive (EPA 1991b):

> "Once a decision has been made to take action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. Specific risk estimates around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider estimates slightly greater than 10^{-4} to be protective."

The concept of a range of acceptable risk is also supported in the EPA SSG which states that no evaluation of multiple contaminant interactions is deemed necessary for carcinogens screened to a 10^{-6} risk level because

> "...setting a 10^{-6} excess risk level for individual chemicals and pathways generally will lead to cumulative site risks with the 10^{-4} to 10^{-6} risk range for the combinations of chemicals typically found at NPL sites." (EPA 1996a)

Risk management decisions must involve careful consideration of the uncertainties involved in the risk assessment and the understanding of the site. For example, COPCs for which the weight of evidence for carcinogenicity in humans is high may have target risk levels that are more conservative than COPCs having a weaker weight of evidence for carcinogenicity.

As mentioned in the beginning of this section, risk management decisions must also involve the consideration of technical feasibility, cost, legal issues, potential effects on worker safety and the environment, and socio/political concerns for the remedial action. A detailed discussion of these and other risk management considerations is presented in the Presidential/Congressional Commission on Risk Assessment and Risk Management report, *Framework for Environmental Health Risk Management* (Presidential/Congressional Commission on Risk Assessment and Risk Management 1997).

DRAFT

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EPA (US Environmental Protection Agency), December 1989. "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)," Interim Final, EPA 540/1-89/002, Office of Emergency and Remedial Response, Washington, DC. (EPA 1989)

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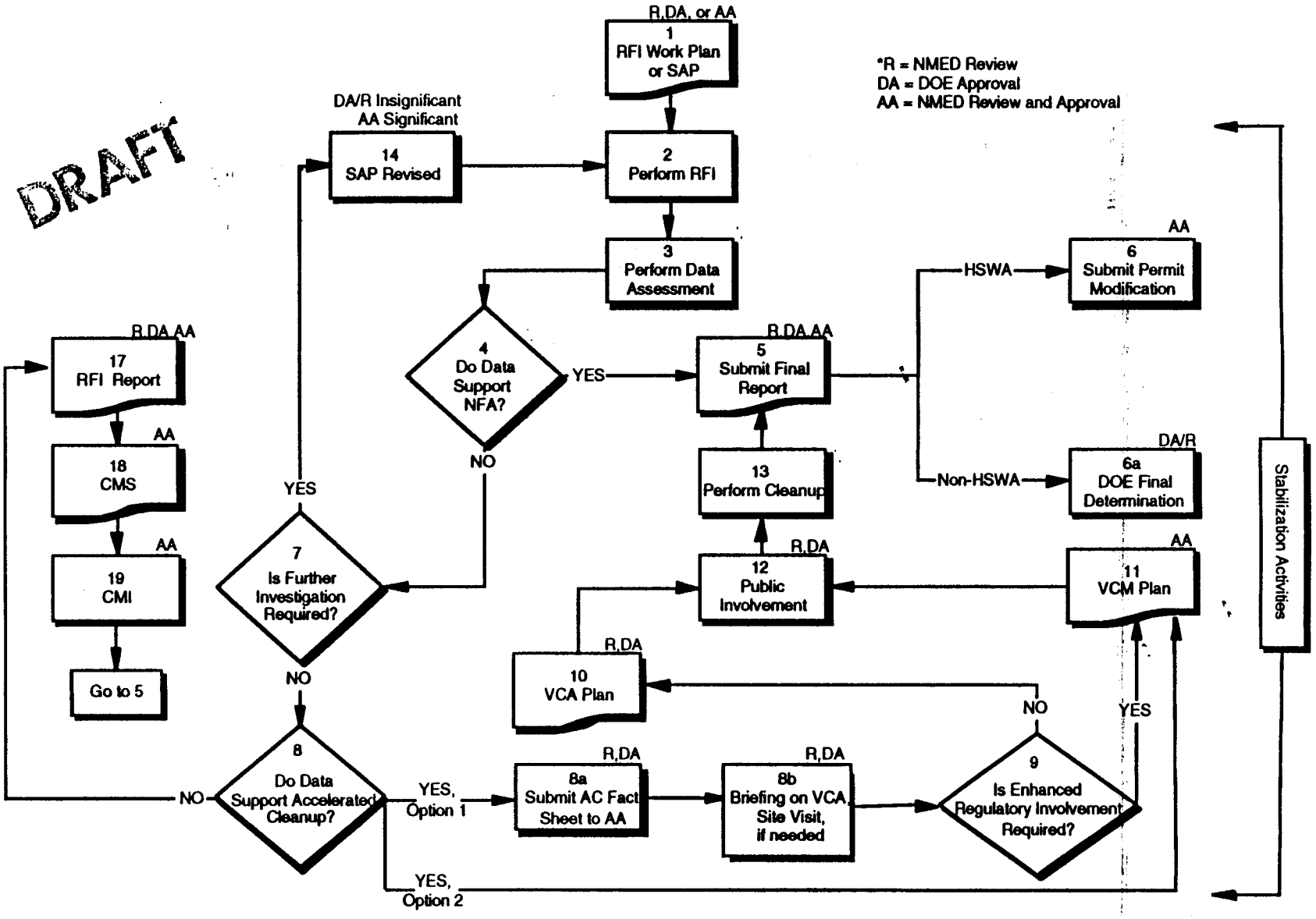
Ryti, R., P. Longmire, K. Campbell, and R. Perona, 1997. "Application of LANL Background Data to ER Project Decision-Making, Part II: Radionuclides in Soil, Sediments, and Tuff," Los Alamos National Laboratory Report LA-UR-96-????, Los Alamos, New Mexico. (Ryti et al. 1997)

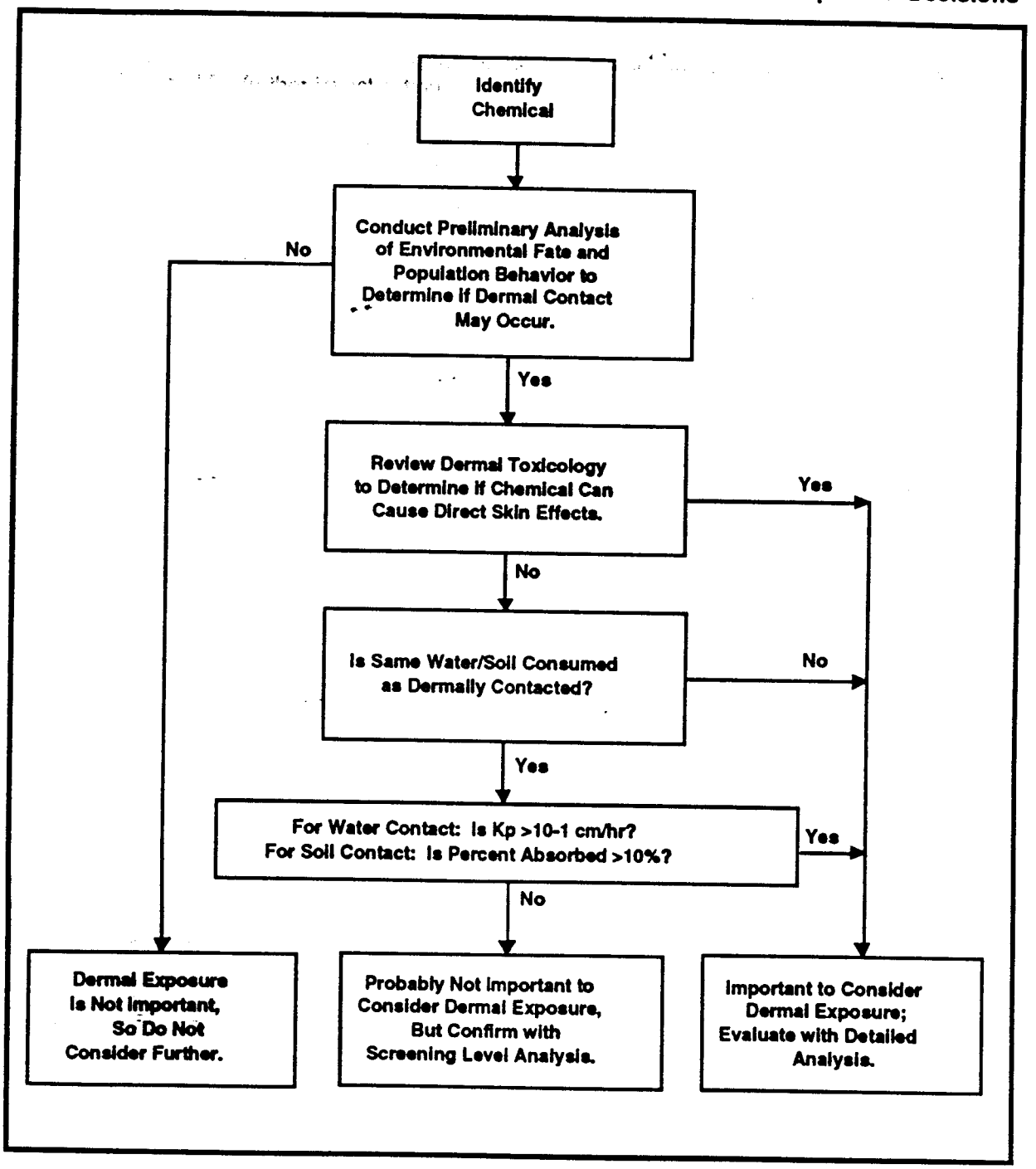
APPENDIX A: ACCELERATED CORRECTIVE ACTION PROCESS



Explanatory text for this diagram can be found in a future annex (nearly completed)of the Document of Understanding (NMED et al. 1995).

APPENDIX B: DERMAL EXPOSURE ASSESSMENT

Figure B-1. Framework to Evaluate the Importance of Dermal Exposure Decisions



Taken from EPA (EPA 1992, 1012, figure, 9-1, page 9-2)

Dermal exposure assessment is associated with substantial uncertainty. For inorganic COPCs in soil, exclusion of the soil-to-dermal pathway is not likely to affect the overall risk estimate assuming other pathways such as soil ingestion are included. This occurs because inorganics are not well absorbed across the skin due to their limited water and lipid solubilities. Also these metals tend to bind strongly to soil further reducing their availability for transport across the skin. Because there are no chemical-specific skin absorption data for inorganics (with the exception of arsenic (3%) and cadmium (1%)), all inorganics are assumed to have a default dermal absorption factor of 1%. This leads to the same percent contribution to total dose regardless of the chemical, i.e., at 1% absorption, the dermal dose is estimated to be 10% of the oral dose from soil ingestion for adults. (EPA 1992)

Dermal Absorption Dose = Csoil x Dermal Absorption Rate = Csoil x Absorption Factor x Adherence Factor x Surface Area

$$\frac{\text{Dermal Absorption Dose}}{\text{Csoil}} = \text{Dermal Absorption Rate} = \text{Absorption Factor} \times \text{Adherence Factor} \times \text{Surface Area}$$

Oral Ingestion Dose = Csoil x Oral Ingestion Rate

Using the EPA Region 9 default assumptions for Adherence Factor and Surface Area, and the default Absorption Factor of 1%:

Dermal Absorption Rate = 0.01 x 0.2 mg/cm^2-day x 5000 cm^2 = 10 mg/day

Therefore, in the case of the default Ingestion Rate of 100 mg/day, the 10 mg/day Dermal Absorption Rate is estimated to contribute 10% of the Oral Ingestion Dose from soil.

Because dermal absorption factors for organics can be significant due to their greater lipid solubility, dermal exposure will be evaluated for organic COPCs. This process is consistent with the decision framework presented in EPA's *Dermal Exposure Assessment: Principles and Applications* and reproduced in Figure B-1.

REFERENCES FOR APPENDIX B

EPA (US Environmental Protection Agency), January 1992. "Dermal Exposure Assessment: Principles and Applications," Interim Report, EPA/600/8-91/011B, Office of Research and Development, Washington, DC. (EPA 1992)

Attachment I - Comment 14.a.

Pertinent sections of the Post-Field Ops Report showing PID/FID readings, HE spot test results, and NaI results

4.21 PRS 16-021(c)

Thirty-three surface analytical samples (including two co-located duplicates) and four subsurface analytical samples (including one co-located duplicate) were collected at PRS 16-021(c). Also, eight subsurface screening samples were collected.

4.21.1 Sample Depths and Locations

Sample depths and locations are listed in Table 4.21.1. Sample locations are also illustrated in Figure 4.21.1.

TABLE 4.21.1: Sample Depths and Locations

Sample ID	Location ID	Location Description	Sample Depth
0316-95-0013	16-1397	Bldg 260 at outfall: 5' N	0-6 inches
0316-95-0014	16-1396	Bldg 260 at outfall: 10' S	0-6 inches
0316-95-0015	16-1399	Bldg 260 at 100 ft.: 5' N	0-6 inches
0316-95-0016	16-1398	Bldg 260 at 100 ft.: 10' S	0-6 inches
0316-95-0017	16-1401	Bldg 260 at 200 ft.: 5' N	0-6 inches
0316-95-0018	16-1400	Bldg 260 at 200 ft.: 5' S	0-6 inches
0316-95-0019	16-1403	Bldg 260 at 300 ft.: 10' N	0-6 inches
0316-95-0020	16-1402	Bldg 260 at 300 ft.: 15' S	0-6 inches
0316-95-0021	16-1405	Bldg 260 at 400 ft.: 15' N	0-6 inches
0316-95-0022	16-1404	Bldg 260 at 400 ft.: 10' S	0-6 inches
0316-95-0023	16-1407	Bldg 260 500 ft.: 5' N	0-6 inches
0316-95-0024	16-1406	Bldg 260 500 ft.: 5' S	0-6 inches
0316-95-0025	16-1409	Bldg 260 600 ft.: 5' N	0-6 inches
0316-95-0026	16-1408	Bldg 260 600 ft.: 5' S	0-6 inches
0316-95-0027	16-1379	Bldg 260 at outfall	0-6 inches
0316-95-0028	16-1380	Bldg 260 outfall + 20 feet	0-6 inches
0316-95-0029	16-1381	Bldg 260 outfall + 40 feet	0-6 inches
0316-95-0030	16-1382	Bldg 260 outfall + 60 feet	0-6 inches
0316-95-2012	16-1382	Bldg 260 outfall + 60 feet	0-6 inches (dup.)
0316-95-0031	16-1383	Bldg 260 outfall + 80 feet	0-6 inches
0316-95-2013	16-1383	Bldg 260 outfall + 80 feet	0-6 inches (dup.)
0316-95-0032	16-1384	Bldg 260 outfall + 100 feet	0-6 inches
0316-95-0033	16-1385	Bldg 260 outfall + 120 feet	0-6 inches
0316-95-0034	16-1386	Bldg 260 outfall + 140 feet	0-6 inches
0316-95-0035	16-1387	Bldg 260 outfall + 160 feet	0-6 inches
0316-95-0036	16-1388	Bldg 260 outfall + 180 feet	0-6 inches
0316-95-0037	16-1389	Bldg 260 outfall + 200 feet	0-6 inches
0316-95-0038	16-1390	Bldg 260 outfall + 260 feet	0-6 inches
0316-95-0039	16-1391	Bldg 260 outfall + 320 feet	0-6 inches
0316-95-0040	16-1392	Bldg 260 outfall + 380 feet	0-6 inches
0316-95-0041	16-1393	Bldg 260 outfall + 440 feet	0-6 inches
0316-95-0042	16-1394	Bldg 260 outfall + 500 feet	0-6 inches
0316-95-0043	16-1395	Bldg 260 outfall + 560 feet	0-6 inches
0316-95-0044	16-1379	Bldg 260 at outfall	1'-1'6"*
0316-95-2015	16-1379	Bldg 260 at outfall	1'-1'6"* (dup.)
0316-95-0045	16-1382	Bldg 260 outfall + 60 feet	1'6"-1'11"*
0316-95-0046	16-1383	Bldg 260 outfall + 80 feet	1'8"-2'2"*

0316-95-1637	16-1379	Bldg 260 at outfall	1'-1'6"*
0316-95-1638	16-1380	Bldg 260 outfall + 20 feet	1'9"-2'3"*
0316-95-1639	16-1381	Bldg 260 outfall + 41 feet	2.0-2.5 feet*
0316-95-1640	16-1382	Bldg 260 outfall + 60 feet	1'6"-1'11"*
0316-95-1641	16-1383	Bldg 260 outfall + 80 feet	1'8"-2'2"*
0316-95-1642	16-1384	Bldg 260 outfall + 100 feet	1'6"-1'14"*
0316-95-1643	16-1385	Bldg 260 outfall + 120 feet	0'10"-1'4"*
0316-95-1644	16-1386	Bldg 260 outfall + 140 feet	0'8"-1'2"*
0316-95-1645	16-1387	Bldg 260 outfall + 160 feet	Not Collected
0316-95-1646	16-1388	Bldg 260 outfall + 180 feet	Not Collected
0316-95-1647	16-1389	Bldg 260 outfall + 200 feet	Not Collected

*= sampled using a hand auger
dup.= QA/QC colocated duplicate sample

4.21.2 Screening Results

Significant screening results and any values above background are listed in Table 4.21.2. The other screening results were non-detects or were at or below background.

TABLE 4.21.2: Screening Results

Sample ID	Location ID	HE Spot Test	NaI2 Detector	PID Reading
0316-95-0013	16-1397	negative	22510 cpm	Background
0316-95-0014	16-1396	negative	22250 cpm	Background
0316-95-0015	16-1399	negative	24560 cpm	Background
0316-95-0016	16-1398	negative	26080 cpm	18 ppm
0316-95-0017	16-1401	negative	22550 cpm	Background
0316-95-0018	16-1400	negative	22580 cpm	20 ppm
0316-95-0019	16-1403	negative	19760 cpm	Background
0316-95-0020	16-1402	negative	23740 cpm	Background
0316-95-0021	16-1405	negative	24470 cpm	Background
0316-95-0022	16-1404	negative	26030 cpm	Background
0316-95-0023	16-1407	negative	13320 cpm	Background
0316-95-0024	16-1406	negative	13480 cpm	Background
0316-95-0025	16-1409	negative	14560 cpm	Background
0316-95-0026	16-1408	negative	14320 cpm	Background
0316-95-0027	16-1379	positive	13340 cpm	Background
0316-95-0028	16-1380	positive	10720 cpm	Background
0316-95-0029	16-1381	positive	11700 cpm	Background
0316-95-0030	16-1382	positive	9960 cpm	Background
0316-95-0031	16-1383	positive	10092 cpm	Background
0316-95-0032	16-1384	positive	13160 cpm	Background
0316-95-0033	16-1385	positive	12000 cpm	Background
0316-95-0034	16-1386	positive	11087 cpm	Background
0316-95-0035	16-1387	positive	10052 cpm	Background
0316-95-0036	16-1388	positive	10057 cpm	Background
0316-95-0037	16-1389	positive	11038 cpm	Background
0316-95-0038	16-1390	positive	12000 cpm	Background
0316-95-0039	16-1391	positive	13660 cpm	Background
0316-95-0040	16-1392	positive	11200 cpm	Background
0316-95-0041	16-1393	positive	18440 cpm	Background
0316-95-0042	16-1394	positive	19200 cpm	Background
0316-95-0043	16-1395	positive	14570 cpm	Background
0316-95-0044	16-1379	positive	9240 cpm	Background
0316-95-0045	16-1382	positive	10340 cpm	Background
0316-95-0046	16-1383	positive	10500 cpm	Background

4.21.3 Deviations from the OU 1082 RFI Work Plan

Three subsurface screening samples requiring PID analysis were not collected. The three samples were intended to be collected at sediment accumulation areas 160, 180, and 200 feet down drainage from the outfall.

TCLP extraction and metals and organics analyses were performed on samples 0316-95-0030 and 0316-95-0031 (and their duplicates) in addition to the other analyses specified in

the Work Plan . The decision to submit the TCLP analyses was made by the FU3 team during a field review of the 1995 sample locations.

4.21.4 Comments

The drainage channel (lateral) bounding samples were collected at locations that were negative for high explosives based on the HE Spot Test Kit as specified in the RFI Work Plan. The lateral bounding sample points were established by screening with the HE Spot Test Kit on five foot intervals up both banks of the drainage channel at the required down drainage distances. Multiple HE spot test analyses were conducted at each of the specified distances to determine the first HE negative horizon up on the banks of the drainage channel. The lateral sample points presented in figure 4.21.1 show the maximum width of HE contamination as determined with the HE Spot Test Kit (i.e. the figure shows the first point to test negative for HE with the spot test at the required down drainage distances).

Elevated PID readings were not observed during the subsurface screening effort in the upper 200 feet of the Building 260 outfall drainage. The subsurface analytical samples were biased to the three areas believed to have the greatest contamination. The locations are at the outfall and at the two surface sample locations within the "pond" area.

A co-located duplicate was taken at surface locations 16-1382 and 16-1383. A co-located duplicate was also taken at the hand auger location 16-1379. Sample 0316-95-2012 is a duplicate of the surface sample 0316-95-0030. Sample 0316-95-2013 is a duplicate of the surface sample 0316-95-0031. Sample 0316-95-2015 is a duplicate of the subsurface sample 0316-95-0044. All three co-located duplicates were collected at locations where an indication of contamination was observed in the field.

4.22 PRS 16-003(k)

Ten subsurface analytical samples and twenty-two subsurface screening samples were collected at PRS 16-003(k).

4.22.1 Sample Depths and Locations

Sample depths and locations are listed in Table 4.22.1. Sample locations are also illustrated in Figure 4.22.1.

TABLE 4.22.1: Sample Depths and Locations

Sample ID	Location ID	Location Description	Sample Depth
0316-95-0047	16-1361	Bldg 260 Sump 4 N corner	Not collected
0316-95-0048	16-1361	Bldg 260 Sump 4 N corner	3-4 feet^
0316-95-0049	16-1645	Bldg 260 Sump 4 S corner	0-1 feet^
0316-95-0050	16-1645	Bldg 260 Sump 4 S corner	3.5-4.5 feet^
0316-95-0051	16-1365	Bldg 260 Sump 13 N corn.	1-2 feet^
0316-95-0052	16-1365	Bldg 260 Sump 13 N corn.	2.5-3.5 feet^
0316-95-0053	16-1646	Bldg 260 Sump 13 S corn.	1'4"-2'4"^
0316-95-0054	16-1646	Bldg 260 Sump 13 S corn.	3'8"-4'3"^
0316-95-0055	16-1356	Bldg 260 trough jct.	Not Collected
0316-95-0056	16-1356	Bldg 260 trough jct.	5-6 feet^
0316-95-0057	16-1357	Bldg 260 trough jct. +12 E	3.0-4.5 feet^
0316-95-0058	16-1357	Bldg 260 trough jct. +12 E	5-6 feet^
0316-95-1656	16-1361	Bldg 260 Sump 4 N corner	0-1 feet^
0316-95-1657	16-1361	Bldg 260 Sump 4 N corner	1-2 feet^ No Recov.
0316-95-1658	16-1361	Bldg 260 Sump 4 N corner	2-3 feet^ No Recov.
0316-95-1659	16-1361	Bldg 260 Sump 4 N corner	3-4 feet^
0316-95-1664	16-1365	Bldg 260 Sump 13 N corn.	0-1 feet^ No Recov.
0316-95-1665	16-1365	Bldg 260 Sump 13 N corn.	1-2 feet^
soil/ tuff interface	16-1365	1.5 feet	See Comments
0316-95-1666	16-1365	Bldg 260 Sump 13 N corn.	2-2.5 feet^ No Rec
0316-95-1667	16-1365	Bldg 260 Sump 13 N corn.	2.5-3.5 feet^
0316-95-1668	16-1646	Bldg 260 Sump 13 S corn.	0-1 feet^ No Recov.
0316-95-1669	16-1646	Bldg 260 Sump 13 S corn.	1-2 feet^
soil/ tuff interface	16-1646	1.5 feet	See Comments
0316-95-1670	16-1646	Bldg 260 Sump 13 S corn.	2-3 feet^ No Recov.
0316-95-1671	16-1646	Bldg 260 Sump 13 S corn.	3-4'3"^
0316-95-1735	16-1645	Bldg 260 Sump 4 S corner	0-1 feet^
0316-95-1736	16-1645	Bldg 260 Sump 4 S corner	1-2 feet^
0316-95-1737	16-1645	Bldg 260 Sump 4 S corner	2-3.5 feet^
0316-95-1738	16-1645	Bldg 260 Sump 4 S corner	3.5-4.5 feet^
soil/ tuff interface	16-1645	4 feet	See Comments
0316-95-1739	16-1645	Bldg 260 Sump 4 S corner	4.5-5 feet^
0316-95-1740	16-1356	Bldg 260 trough jct.	0-1 feet^
0316-95-1741	16-1356	Bldg 260 trough jct.	1-2 feet^ No Recov.
0316-95-1742	16-1356	Bldg 260 trough jct.	2-3 feet^
0316-95-1743	16-1356	Bldg 260 trough jct.	3-4 feet^
0316-95-1744	16-1356	Bldg 260 trough jct.	4-5 feet^
0316-95-1745	16-1356	Bldg 260 trough jct.	5-6 feet^
0316-95-1763	16-1357	Bldg 260 trough jct. +12 W	0-1 feet^
0316-95-1764	16-1357	Bldg 260 trough jct. +12 W	1-2 feet^
0316-95-1765	16-1357	Bldg 260 trough jct. +12 W	2-3 feet^
0316-95-1766	16-1357	Bldg 260 trough jct. +12 W	3-4 feet^
0316-95-1767	16-1357	Bldg 260 trough jct. +12 W	4-5 feet^
soil/ tuff interface	16-1357	4.5 feet	
0316-95-1768	16-1357	Bldg 260 trough jct. +12 W	5-6 feet^

^= sampled using the split spoon

4.22.2 Screening Results

Significant screening results and any values above background are listed in Table 4.22.2. The other screening results were non-detects or were at or below background.

TABLE 4.22.2: Screening Results

Sample ID	Location ID	HE Spot Test	NaI2 Detector	PID Reading
0316-95-1656	16-1361	negative	10580 cpm	13 ppm
0316-95-1659	16-1361	negative	11250 cpm	Background
0316-95-1665	16-1365	positive	N/A	5 ppm
0316-95-1667	16-1365	positive	N/A	Background
0316-95-1671	16-1646	positive	N/A	Background
0316-95-1735	16-1645	positive	11680 cpm	Background
0316-95-1736	16-1645	negative	11960 cpm	Background
0316-95-1737	16-1645	negative	11960 cpm	Background
0316-95-1738	16-1645	positive	11640 cpm	Background
0316-95-1739	16-1645	negative	11940 cpm	Background
0316-95-1740	16-1356	negative	14320 cpm	1 ppm
0316-95-1741	16-1356	no recovery	N/A	1 ppm (in hole)
0316-95-1742	16-1356	negative	N/A	2 ppm
0316-95-1743	16-1356	negative	N/A	2 ppm
0316-95-1744	16-1356	negative	N/A	2 ppm
0316-95-1763	16-1357	negative	N/A	30 ppm
0316-95-1764	16-1357	negative	N/A	30 ppm
0316-95-1765	16-1357	negative	N/A	30 ppm
0316-95-1766	16-1357	negative	N/A	110 ppm
0316-95-1767	16-1357	negative	N/A	110 ppm
0316-95-1768	16-1357	negative	N/A	1 ppm

4.22.3 Deviations from the OU 1082 RFI Work Plan

The drilling core was screened on 12 inch intervals because a 6 inch interval in a 1.55 inch ID split spoon is not enough material for full suite analysis.

Also, the borehole was drilled vertically, not at an angle. Angled boreholes were not allowed because TA-16 personnel believe there to be a greater potential for creating an HE confining hazard with this type of drilling.

The field team collected and submitted two analytical samples from borehole 16-1357 even though none of the screening samples tested positive for HE.

Boreholes were only drilled at two sumps: Sump 4 and 13. At each sump, two boreholes were drilled, one at the southeast corner and one at the northeast corner. The decision by FU3 team members not to drill and sample every sump at Building 260 was discussed with and approved by the EPA.

In addition, FU3 decided to drill only two of the feeder trough boreholes. This was also approved by the EPA.

4.22.4 Comments

Drilling at PRS 16-003(k) proved to be very challenging. The sampling team consistently met refusal at depths between 2-3 feet using the hollow-stem auger rig. The field team switched to a coring method using a specially designed carbide tipped cutting shoe and split-spoon to drill the remaining 2-3 feet in each borehole. Every borehole was drilled to the specified depth.

At the sump boreholes both the shallowest and deepest HE positive intervals were collected except at Borehole 16-1361. There was only one positive interval in Borehole 16-1361 and, therefore, only one sample was collected.

The feeder trough boreholes were biased to obvious cracks in the concrete. In both cases, the crack areas were extensive and indicated that water may have leaked at these locations. There were, however, no HE positive intervals at either of the feeder trough boreholes. Two analytical samples were collected in Borehole 16-1357.

The soil/ tuff interface in PRS 16-003(k) may be deeper than was thought during drilling. The sampling team reported finding engineering fill gravels and lenses of material more closely resembling soil horizons at deeper depths than the soil/ tuff interface. The soil horizons could be highly weathered tuff or a surge bed within the tuff. And, the engineering fill gravels and cobbles could have slid down the hole from a shallower interval. However, tuff and dacite cobbles and gravels are very common at this PRS and were identified in most of the boreholes. What was believed to be tuff (bedrock) may instead be a large tuff cobble that was intersected by the borehole. The interpretation of the depth to tuff in boreholes 16-1365 and 16-1646 is the most suspect. These boreholes have the shallowest intervals for the soil/ tuff interface and numerous dacite and tuff gravels/ cobbles were encountered during the drilling of these two boreholes.

4.23 PRS 16-030(d)

Four subsurface analytical samples and seven surface analytical samples were collected at PRS 16-030(d). Also, thirteen surface screening samples were collected.

Attachment J - Comment 14.c. & 25 d.

Well Construction Diagrams

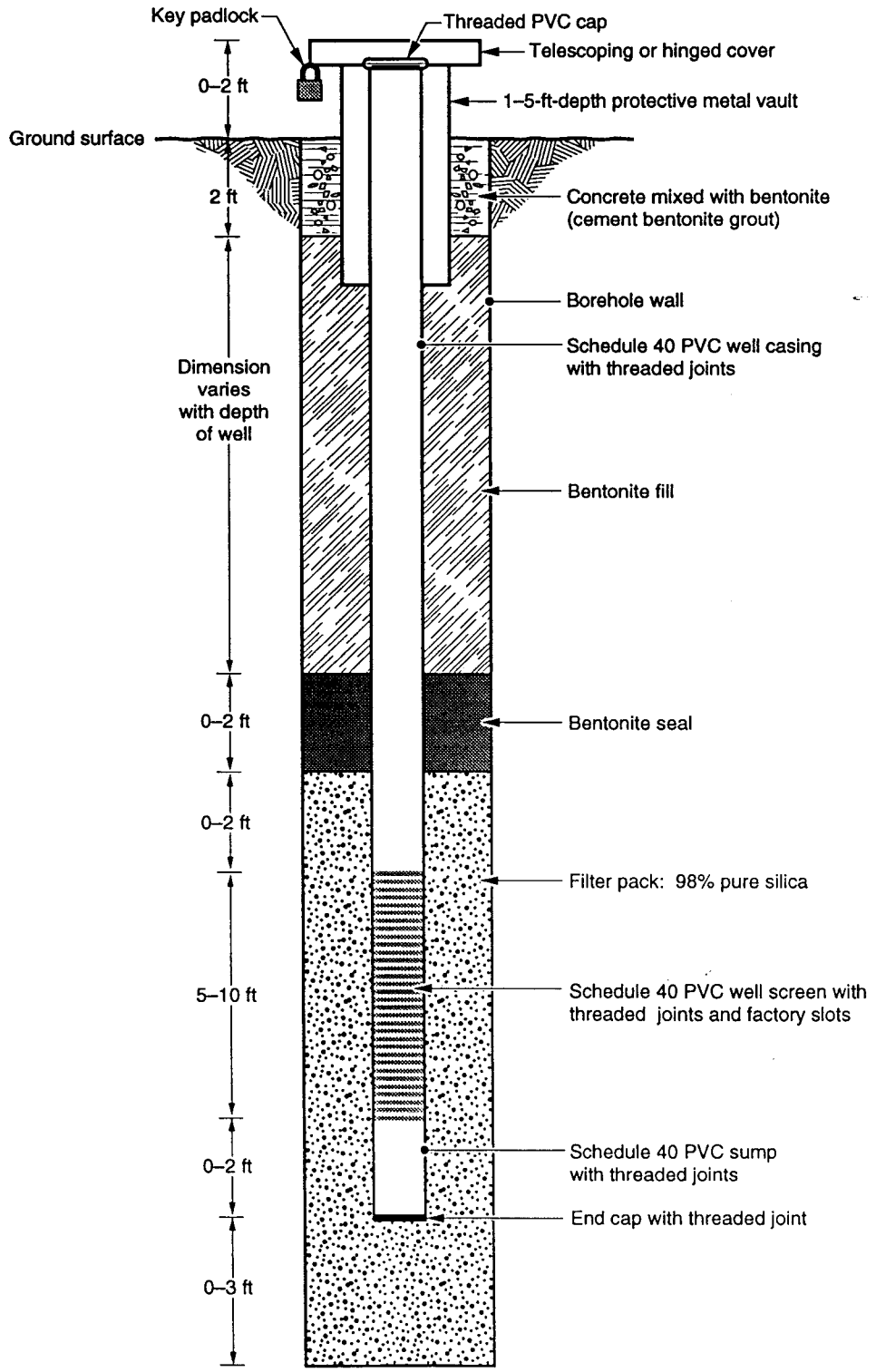


Figure **Typical construction of alluvial well.**

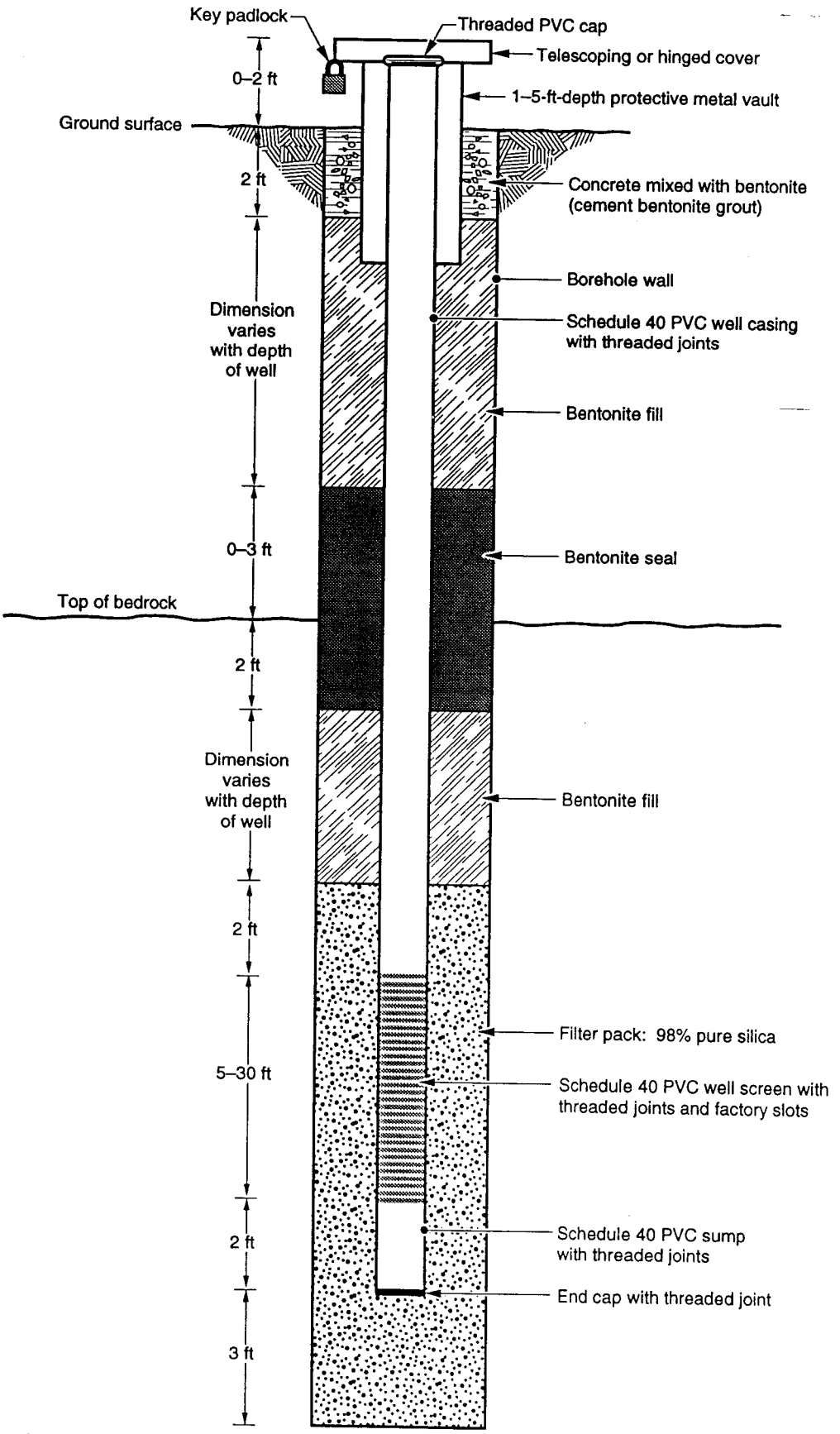


Figure **Typical construction of bedrock well.**

Attachment K - Comment 19

Schematic Diagram of the Drainage Channel and Dam

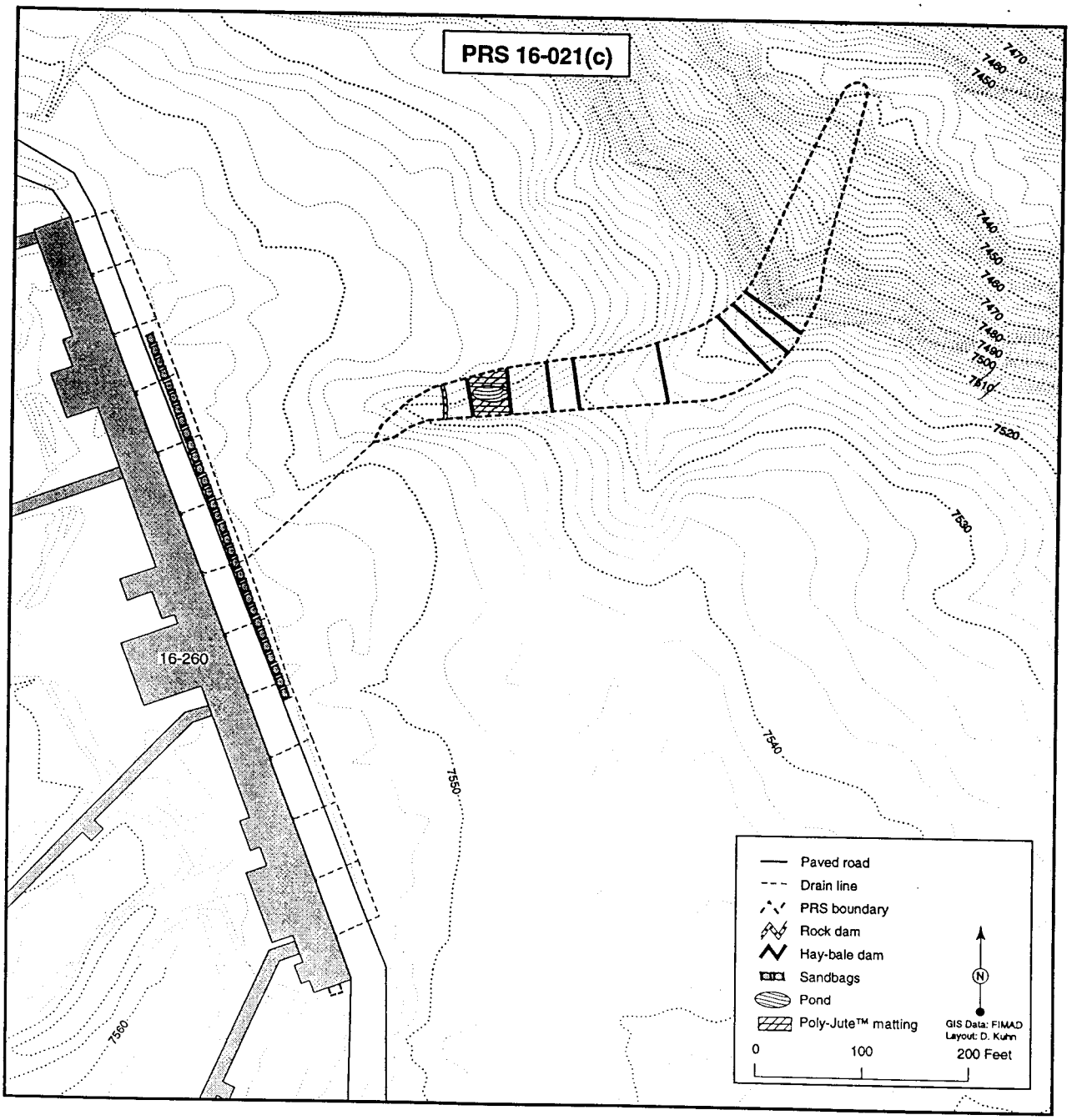


Fig. 1. PRS 16-021(c), outfall from TA-16-260.

Attachment L - Comment 24

Modified Version of Figure 5.2.11.2.1

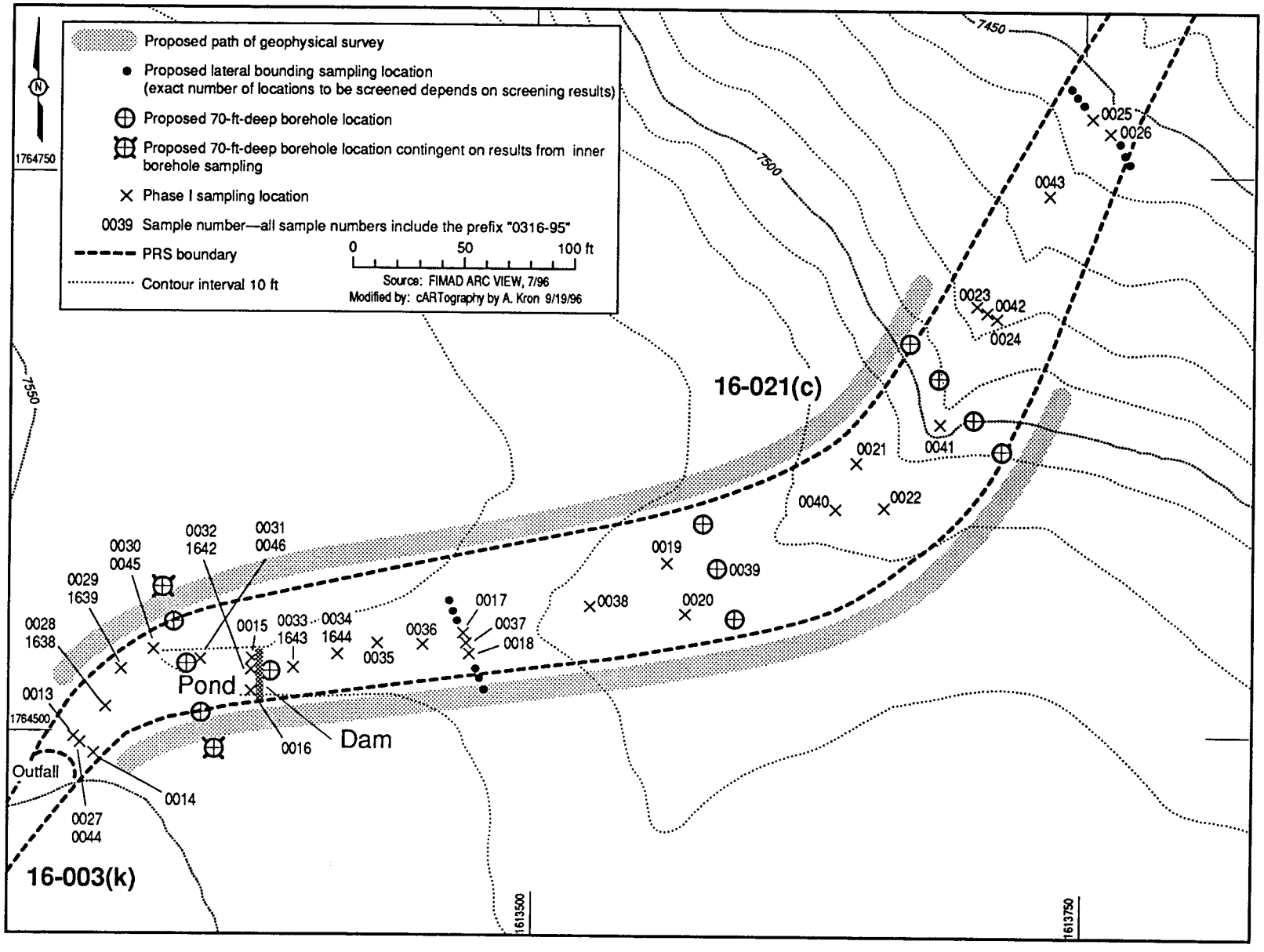


Fig. 5.2.11.2.1-1. Proposed Phase II sampling locations at PRS 16-021(c).

Attachment M - Comment 28

Crosswalk between request numbers and PRS/sample locations

Attachment M
Crosswalk between Request Numbers & PRS/sample locations

Request Number	Analyte Suite	Method [a]	PRS	Location ID	Sample
563	INORGANIC	METTCLP	16-021(c)	16-1382	0316-95-0030
563	INORGANIC	METTCLP	16-021(c)	16-1383	0316-95-0031
563	INORGANIC	METTCLP	16-021(c)	16-1383	0316-95-2013
563	ORGANIC	HEXP	16-021(c)	16-1381	0316-95-0029
563	ORGANIC	HEXP	16-021(c)	16-1382	0316-95-0030
563	ORGANIC	HEXP	16-021(c)	16-1383	0316-95-0031
563	ORGANIC	HEXP	16-021(c)	16-1383	0316-95-2013
563	ORGANIC	HEXP	16-021(c)	16-1385	0316-95-0033
563	ORGANIC	HEXP	16-021(c)	16-1386	0316-95-0034
563	ORGANIC	HEXP	16-021(c)	16-1387	0316-95-0035
563	ORGANIC	HEXP	16-021(c)	16-1388	0316-95-0036
563	ORGANIC	HEXP	16-021(c)	16-1389	0316-95-0037
563	ORGANIC	SEMI	16-021(c)	16-1381	0316-95-0029
563	ORGANIC	SEMI	16-021(c)	16-1382	0316-95-0030
563	ORGANIC	SEMI	16-021(c)	16-1383	0316-95-0031
563	ORGANIC	SEMI	16-021(c)	16-1383	0316-95-2013
563	ORGANIC	SEMI	16-021(c)	16-1385	0316-95-0033
563	ORGANIC	SEMI	16-021(c)	16-1386	0316-95-0034
563	ORGANIC	SEMI	16-021(c)	16-1387	0316-95-0035
563	ORGANIC	SEMI	16-021(c)	16-1388	0316-95-0036
563	ORGANIC	VOATCLP	16-021(c)	16-1382	0316-95-0030
563	ORGANIC	VOATCLP	16-021(c)	16-1383	0316-95-0031
563	ORGANIC	VOATCLP	16-021(c)	16-1383	0316-95-2013
564	INORGANIC	METTALCN	16-021(c)	16-1381	0316-95-0029
564	INORGANIC	METTALCN	16-021(c)	16-1382	0316-95-0030
564	INORGANIC	METTALCN	16-021(c)	16-1383	0316-95-0031
564	INORGANIC	METTALCN	16-021(c)	16-1383	0316-95-2013
564	INORGANIC	METTALCN	16-021(c)	16-1385	0316-95-0033
564	INORGANIC	METTALCN	16-021(c)	16-1386	0316-95-0034
564	INORGANIC	METTALCN	16-021(c)	16-1387	0316-95-0035
564	INORGANIC	METTALCN	16-021(c)	16-1388	0316-95-0036
564	INORGANIC	METTALCN	16-021(c)	16-1389	0316-95-0037
565	RAD	TU	16-021(c)	16-1381	0316-95-0029
565	RAD	TU	16-021(c)	16-1382	0316-95-0030
565	RAD	TU	16-021(c)	16-1383	0316-95-0031
565	RAD	TU	16-021(c)	16-1383	0316-95-2013
565	RAD	TU	16-021(c)	16-1385	0316-95-0033
565	RAD	TU	16-021(c)	16-1386	0316-95-0034
565	RAD	TU	16-021(c)	16-1387	0316-95-0035
565	RAD	TU	16-021(c)	16-1388	0316-95-0036
565	RAD	TU	16-021(c)	16-1389	0316-95-0037
972	ORGANIC	HEXP	16-021(c)	16-1396	0316-95-0014
972	ORGANIC	HEXP	16-021(c)	16-1397	0316-95-0013
972	ORGANIC	HEXP	16-021(c)	16-1398	0316-95-0016
972	ORGANIC	HEXP	16-021(c)	16-1399	0316-95-0015
972	ORGANIC	HEXP	16-021(c)	16-1400	0316-95-0018
972	ORGANIC	HEXP	16-021(c)	16-1401	0316-95-0017

Attachment M
Crosswalk between Request Numbers & PRS/sample locations

972	ORGANIC	HEXP	16-021(c)	16-1402	0316-95-0020
972	ORGANIC	HEXP	16-021(c)	16-1403	0316-95-0019
972	ORGANIC	HEXP	16-021(c)	16-1404	0316-95-0022
972	ORGANIC	HEXP	16-021(c)	16-1405	0316-95-0021
972	ORGANIC	SEMI	16-021(c)	16-1396	0316-95-0014
972	ORGANIC	SEMI	16-021(c)	16-1397	0316-95-0013
972	ORGANIC	SEMI	16-021(c)	16-1398	0316-95-0016
972	ORGANIC	SEMI	16-021(c)	16-1399	0316-95-0015
972	ORGANIC	SEMI	16-021(c)	16-1400	0316-95-0018
972	ORGANIC	SEMI	16-021(c)	16-1401	0316-95-0017
972	ORGANIC	SEMI	16-021(c)	16-1402	0316-95-0020
972	ORGANIC	SEMI	16-021(c)	16-1403	0316-95-0019
972	ORGANIC	SEMI	16-021(c)	16-1404	0316-95-0022
972	ORGANIC	SEMI	16-021(c)	16-1405	0316-95-0021
978	INORGANIC	METTALCN	16-021(c)	16-1396	0316-95-0014
978	INORGANIC	METTALCN	16-021(c)	16-1397	0316-95-0013
978	INORGANIC	METTALCN	16-021(c)	16-1398	0316-95-0016
978	INORGANIC	METTALCN	16-021(c)	16-1399	0316-95-0015
978	INORGANIC	METTALCN	16-021(c)	16-1400	0316-95-0018
978	INORGANIC	METTALCN	16-021(c)	16-1401	0316-95-0017
978	INORGANIC	METTALCN	16-021(c)	16-1402	0316-95-0020
978	INORGANIC	METTALCN	16-021(c)	16-1403	0316-95-0019
978	INORGANIC	METTALCN	16-021(c)	16-1404	0316-95-0022
978	INORGANIC	METTALCN	16-021(c)	16-1405	0316-95-0021
979	RAD	TU	16-021(c)	16-1396	0316-95-0014
979	RAD	TU	16-021(c)	16-1397	0316-95-0013
979	RAD	TU	16-021(c)	16-1398	0316-95-0016
979	RAD	TU	16-021(c)	16-1399	0316-95-0015
979	RAD	TU	16-021(c)	16-1400	0316-95-0018
979	RAD	TU	16-021(c)	16-1401	0316-95-0017
979	RAD	TU	16-021(c)	16-1402	0316-95-0020
979	RAD	TU	16-021(c)	16-1403	0316-95-0019
979	RAD	TU	16-021(c)	16-1404	0316-95-0022
979	RAD	TU	16-021(c)	16-1405	0316-95-0021
1102	ORGANIC	HEXP	16-003(k)	16-1361	0316-95-0048
1102	ORGANIC	HEXP	16-003(k)	16-1365	0316-95-0051
1102	ORGANIC	HEXP	16-003(k)	16-1365	0316-95-0052
1102	ORGANIC	HEXP	16-003(k)	16-1646	0316-95-0053
1102	ORGANIC	HEXP	16-003(k)	16-1646	0316-95-0054
1102	ORGANIC	SEMI	16-003(k)	16-1361	0316-95-0048
1102	ORGANIC	SEMI	16-003(k)	16-1365	0316-95-0051
1102	ORGANIC	SEMI	16-003(k)	16-1365	0316-95-0052
1102	ORGANIC	SEMI	16-003(k)	16-1646	0316-95-0053
1102	ORGANIC	SEMI	16-003(k)	16-1646	0316-95-0054
1102	ORGANIC	VOAGCMS	16-003(k)	16-1361	0316-95-0048
1102	ORGANIC	VOAGCMS	16-003(k)	16-1365	0316-95-0051
1102	ORGANIC	VOAGCMS	16-003(k)	16-1365	0316-95-0052
1102	ORGANIC	VOAGCMS	16-003(k)	16-1646	0316-95-0053
1102	ORGANIC	VOAGCMS	16-003(k)	16-1646	0316-95-0054

Attachment M
Crosswalk between Request Numbers & PRS/sample locations

1106	INORGANIC	METTALCN	16-003(k)	16-1361	0316-95-0048
1106	INORGANIC	METTALCN	16-003(k)	16-1365	0316-95-0051
1106	INORGANIC	METTALCN	16-003(k)	16-1365	0316-95-0052
1106	INORGANIC	METTALCN	16-003(k)	16-1646	0316-95-0053
1106	INORGANIC	METTALCN	16-003(k)	16-1646	0316-95-0054
1108	RAD	TU	16-003(k)	16-1361	0316-95-0048
1108	RAD	TU	16-003(k)	16-1365	0316-95-0051
1108	RAD	TU	16-003(k)	16-1646	0316-95-0053
1108	RAD	TU	16-003(k)	16-1646	0316-95-0054
1173	ORGANIC	HEXP	16-021(c)	16-1379	0316-95-0044
1173	ORGANIC	HEXP	16-021(c)	16-1379	0316-95-2015
1173	ORGANIC	HEXP	16-021(c)	16-1382	0316-95-0045
1173	ORGANIC	HEXP	16-021(c)	16-1383	0316-95-0046
1173	ORGANIC	SEMI	16-021(c)	16-1379	0316-95-0044
1173	ORGANIC	SEMI	16-021(c)	16-1379	0316-95-2015
1173	ORGANIC	SEMI	16-021(c)	16-1382	0316-95-0045
1173	ORGANIC	SEMI	16-021(c)	16-1383	0316-95-0046
1173	ORGANIC	VOAGCMS	16-021(c)	16-1379	0316-95-0044
1173	ORGANIC	VOAGCMS	16-021(c)	16-1379	0316-95-2015
1173	ORGANIC	VOAGCMS	16-021(c)	16-1382	0316-95-0045
1173	ORGANIC	VOAGCMS	16-021(c)	16-1383	0316-95-0046
1174	INORGANIC	METTALCN	16-021(c)	16-1379	0316-95-0044
1174	INORGANIC	METTALCN	16-021(c)	16-1379	0316-95-2015
1174	INORGANIC	METTALCN	16-021(c)	16-1382	0316-95-0045
1174	INORGANIC	METTALCN	16-021(c)	16-1383	0316-95-0046
1175	RAD	TU	16-021(c)	16-1379	0316-95-0044
1175	RAD	TU	16-021(c)	16-1379	0316-95-2015
1175	RAD	TU	16-021(c)	16-1382	0316-95-0045
1175	RAD	TU	16-021(c)	16-1383	0316-95-0046
1203	ORGANIC	HEXP	16-003(k)	16-1645	0316-95-0049
1203	ORGANIC	HEXP	16-003(k)	16-1645	0316-95-0050
1203	ORGANIC	SEMI	16-003(k)	16-1645	0316-95-0049
1203	ORGANIC	SEMI	16-003(k)	16-1645	0316-95-0050
1203	ORGANIC	VOAGCMS	16-003(k)	16-1645	0316-95-0049
1203	ORGANIC	VOAGCMS	16-003(k)	16-1645	0316-95-0050
1204	INORGANIC	METTALCN	16-003(k)	16-1645	0316-95-0049
1204	INORGANIC	METTALCN	16-003(k)	16-1645	0316-95-0050
1205	RAD	TU	16-003(k)	16-1645	0316-95-0049
1205	RAD	TU	16-003(k)	16-1645	0316-95-0050
1222	ORGANIC	HEXP	16-003(k)	16-1361	0316-95-0056
1222	ORGANIC	HEXP	16-003(k)	16-1361	0316-95-0057
1222	ORGANIC	HEXP	16-003(k)	16-1361	0316-95-0058
1222	ORGANIC	HEXP	16-021(c)	16-1406	0316-95-0024
1222	ORGANIC	HEXP	16-021(c)	16-1407	0316-95-0023
1222	ORGANIC	HEXP	16-021(c)	16-1408	0316-95-0026
1222	ORGANIC	HEXP	16-021(c)	16-1409	0316-95-0025
1222	ORGANIC	SEMI	16-003(k)	16-1361	0316-95-0056
1222	ORGANIC	SEMI	16-003(k)	16-1361	0316-95-0057
1222	ORGANIC	SEMI	16-003(k)	16-1361	0316-95-0058

Attachment M
Crosswalk between Request Numbers & PRS/sample locations

1222	ORGANIC	SEMI	16-021(c)	16-1406	0316-95-0024
1222	ORGANIC	SEMI	16-021(c)	16-1407	0316-95-0023
1222	ORGANIC	SEMI	16-021(c)	16-1408	0316-95-0026
1222	ORGANIC	SEMI	16-021(c)	16-1409	0316-95-0025
1222	ORGANIC	VOAGCMS	16-003(k)	16-1361	0316-95-0056
1222	ORGANIC	VOAGCMS	16-003(k)	16-1361	0316-95-0057
1222	ORGANIC	VOAGCMS	16-003(k)	16-1361	0316-95-0058
1223	INORGANIC	METTALCN	16-003(k)	16-1361	0316-95-0056
1223	INORGANIC	METTALCN	16-003(k)	16-1361	0316-95-0057
1223	INORGANIC	METTALCN	16-003(k)	16-1361	0316-95-0058
1223	INORGANIC	METTALCN	16-021(c)	16-1406	0316-95-0024
1223	INORGANIC	METTALCN	16-021(c)	16-1407	0316-95-0023
1223	INORGANIC	METTALCN	16-021(c)	16-1408	0316-95-0026
1223	INORGANIC	METTALCN	16-021(c)	16-1409	0316-95-0025
1224	RAD	TU	16-003(k)	16-1361	0316-95-0056
1224	RAD	TU	16-003(k)	16-1361	0316-95-0057
1224	RAD	TU	16-003(k)	16-1361	0316-95-0058
1224	RAD	TU	16-021(c)	16-1406	0316-95-0024
1224	RAD	TU	16-021(c)	16-1407	0316-95-0023
1224	RAD	TU	16-021(c)	16-1408	0316-95-0026
1224	RAD	TU	16-021(c)	16-1409	0316-95-0025
1268	ORGANIC	HEXP	16-021(c)	16-1379	0316-95-0027
1268	ORGANIC	HEXP	16-021(c)	16-1380	0316-95-0028
1268	ORGANIC	HEXP	16-021(c)	16-1384	0316-95-0032
1268	ORGANIC	HEXP	16-021(c)	16-1390	0316-95-0038
1268	ORGANIC	HEXP	16-021(c)	16-1391	0316-95-0039
1268	ORGANIC	HEXP	16-021(c)	16-1392	0316-95-0040
1268	ORGANIC	HEXP	16-021(c)	16-1393	0316-95-0041
1268	ORGANIC	HEXP	16-021(c)	16-1394	0316-95-0042
1268	ORGANIC	HEXP	16-021(c)	16-1395	0316-95-0043
1268	ORGANIC	SEMI	16-021(c)	16-1379	0316-95-0027
1268	ORGANIC	SEMI	16-021(c)	16-1380	0316-95-0028
1268	ORGANIC	SEMI	16-021(c)	16-1384	0316-95-0032
1268	ORGANIC	SEMI	16-021(c)	16-1390	0316-95-0038
1268	ORGANIC	SEMI	16-021(c)	16-1391	0316-95-0039
1268	ORGANIC	SEMI	16-021(c)	16-1392	0316-95-0040
1268	ORGANIC	SEMI	16-021(c)	16-1393	0316-95-0041
1268	ORGANIC	SEMI	16-021(c)	16-1394	0316-95-0042
1268	ORGANIC	SEMI	16-021(c)	16-1395	0316-95-0043
1269	INORGANIC	METTALCN	16-021(c)	16-1379	0316-95-0027
1269	INORGANIC	METTALCN	16-021(c)	16-1380	0316-95-0028
1269	INORGANIC	METTALCN	16-021(c)	16-1384	0316-95-0032
1269	INORGANIC	METTALCN	16-021(c)	16-1390	0316-95-0038
1269	INORGANIC	METTALCN	16-021(c)	16-1391	0316-95-0039
1269	INORGANIC	METTALCN	16-021(c)	16-1392	0316-95-0040
1269	INORGANIC	METTALCN	16-021(c)	16-1393	0316-95-0041
1269	INORGANIC	METTALCN	16-021(c)	16-1394	0316-95-0042
1269	INORGANIC	METTALCN	16-021(c)	16-1395	0316-95-0043
1270	RAD	TU	16-021(c)	16-1379	0316-95-0027

Attachment M
Crosswalk between Request Numbers & PRS/sample locations

1270	RAD	TU	16-021(c)	16-1380	0316-95-0028
1270	RAD	TU	16-021(c)	16-1384	0316-95-0032
1270	RAD	TU	16-021(c)	16-1390	0316-95-0038
1270	RAD	TU	16-021(c)	16-1391	0316-95-0039
1270	RAD	TU	16-021(c)	16-1392	0316-95-0040
1270	RAD	TU	16-021(c)	16-1393	0316-95-0041
1270	RAD	TU	16-021(c)	16-1394	0316-95-0042
1270	RAD	TU	16-021(c)	16-1395	0316-95-0043

a. METTCLP = TCLP metals; HEXP = high explosives; SEMI = semivolatile organics; VOAGCMS = volatile organics; METTALCN = inorganics and cyanide; TU = total uranium.

Attachment N - Comment 30.a.

Background water chemistry data
(all data from Blake et al. 1995, 1355)

TABLE J-1 MAJOR ELEMENTS OF BACKGROUND SPRINGS

DESCRIPTION	DATE	BORON (ppm)	BROMINE (ppm)	CALCIUM (ppm)	CHLORINE (ppm)	FLUORINE (ppm)	HYDROGEN CARBONATE (ppm)	LITHIUM (ppm)	MAGNESIUM (ppm)	POTASSIUM (ppm)	SODIUM (ppm)	SILICATE (ppm) calc	SULFATE (ppm)	STRONTIUM (ppm)	TOTAL DISSOLVED SOLVENTS (ppm)	CATION SUM	ANION SUM
Apache Spring	4/03/96	0.005	0.01	10.9	7.72	0.04	69.0	<0.01	4.86	4.75	9.77	56.07	5.93	0.10	171.1	1.532	1.498
Cold Spring west cal	6/1/80	0.73	0.06	12	1.9	0.25	53.7	0.03	1.5	3	8	30.00	5.5	0.06	NC	NC	NC
Frijoles Spring #49	5/22/91	<0.01	<0.02	8	14	0.03	39	<0.01	2.98	2.9	6.8	17.00	3.85	0.09	NC	NC	NC
Frijoles Spring #50	5/22/91	<0.01	<0.02	7.9	6.11	0.04	53.6	<0.01	3.71	2.5	7.2	25.00	2.66	0.07	NC	NC	NC
Pine Spring	5/24/91	<0.01	<0.02	10.7	1.47	0.08	61	<0.01	3.55	3.6	6.4	25.00	7.7	0.08	NC	NC	NC
Pine Spring	3/26/95	0.02	<0.4	11	<5	<0.5	NA	0.01	3.6	3	5.1	NC	66	0.09	NC	NC	NC
Pine Spring	10/16/95	<0.1	NA	10	2	<0.2	48	<0.01	3	3	6	NC	<10	0.07	NC	NC	NC
Seven Springs	10/1/79	<0.003	NA	12.3	3.6	0.21	49	0.018	1.54	2.1	7.23	41.00	8.7	0.071	NC	NC	NC
Seven Springs	5/1/83	NA	0.27	11	1.9	0.25	53.7	0.05	1.4	4	8	30.00	5.9	0.05	NC	NC	NC
Seven Springs	5/10/91	<0.02	<0.02	12.9	1.22	0.16	61	<0.01	1.71	2.4	6.3	31.00	3.85	0.06	NC	NC	NC
Seven Springs	4/3/96	0.013	<0.01	12.5	1.85	0.12	59.5	<0.01	1.63	2.13	7.26	31.03	4.03	0.06	121.5	1.148	1.137
Unnamed Cold	7/1/80	<0.01	<0.2	10.6	7.1	0.3	75	0.024	3.4	3.1	9.4	65.00	3.4	0.049	NC	NC	NC
Unnamed Cold	7/1/80	<0.01	<0.2	10.4	7.5	0.35	73	0.024	3.4	3.2	9	69.00	2.4	0.051	NC	NC	NC
Unnamed Spring	5/28/91	<0.01	<0.02	9.1	1.34	0.14	56.1	<0.01	2.44	4.6	7	21.00	5.73	0.05	NC	NC	NC
Unnamed Spring	9/10/93	<0.05	0.02	11.4	4.38	0.34	80.8	0.03	2.9	2.49	16.2	60.10	4.04	0.1	NC	NC	NC
Water Canyon Gallery	8/1/78	<0.05	NA	7	NA	0.12	52	0.02	3.3	1.4	5.8	43.00	NA	0.05	NC	NC	NC
Water Canyon Gallery	8/18/92	<0.05	<0.02	7.2	0.64	0.05	52.8	<0.01	3.05	1.72	6.3	43.70	1.05	0.07	NC	NC	NC
Water Canyon Gallery	5/20/93	<0.01	0.01	6.94	0.69	0.06	44.6	0.01	2.79	1.79	4.9	39.80	2.85	0.07	NC	NC	NC
Water Canyon Gallery	4/03/96	0.004	<0.01	6.18	0.77	0.03	48.9	0.02	3.15	1.75	5.99	44.30	1.20	0.05	113.6	0.900	0.865

[a]NC = Not calculated.

[b]NA = Not analyzed.

TABLEJ-2 MINOR ELEMENTS OF BACKGROUND SPRINGS

DESCRIPTION	DATE	SILVER (ppm)	ALUMINUM (ppm)	ARSENIC (ppm)	BARIUM (ppm)	CADMIUM (ppm)	COBALT (ppm)	CHROMIUM (ppm)	CESIUM (ppm)	COPPER (ppm)	IRON (ppm)	MERCURY (ppm)	IODINE (ppm)	MANGANESE (ppm)	MOLYBDENUM (ppm)	AMMONIUM (ppm)	NICKEL (ppm)	NITRITE (ppm)	NITRATE (ppm)	LEAD (ppm)	PHOSPHATE (ppm)	RUBIDIUM (ppm)	ANTIMONY (ppm)	SELENIUM (ppm)	THIOSULFATE (ppm)	ZINC (ppm)
Apache Spring	4/03/96	<0.0002	0.28	<0.0002	0.07	<0.0002	<0.002	<0.002	<0.002	<0.002	0.10	<0.0002	<0.01	<0.01	<0.002	0.04	<0.002	0.02	1.33	<0.002	0.07	0.010	<0.0001	<0.0001	<0.01	<0.01
Cold Spring west cal	6/1/80	NA	NA	NA	0.02	0.003	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	0.19	NA	NA	NA	NA	NA	NA	NA
Frijoles Spring #49	5/22/91	<0.001	1	<0.05	0.06	<0.001	<0.002	<0.002	<0.005	0.003	2.12	<0.1	<0.01	<0.02	<0.002	0.09	<0.002	<0.02	0.3	<0.002	<0.05	0.006	<0.05	<0.1	NA	<0.01
Frijoles Spring #50	5/22/91	<0.001	0.5	<0.05	0.03	<0.001	<0.002	<0.002	<0.005	0.003	1.08	<0.1	<0.01	<0.02	<0.002	0.08	<0.002	<0.02	0.71	<0.002	0.11	0.007	<0.05	<0.1	NA	0.02
Pine Spring	5/24/91	<0.003	1.4	<0.05	0.05	<0.001	<0.002	0.004	0.006	0.004	4.17	<0.1	<0.01	<0.02	<0.002	0.24	<0.002	<0.02	0.04	0.003	<0.05	0.007	<0.05	<0.1	NA	0.07
Pine Spring	3/26/95	<0.01	1	<0.005	0.1	<0.005	<0.01	<0.01	NA	<0.01	0.5	<0.0002	NA	<0.01	<0.01	NA	<0.02	NA	0.2	<0.003	NA	NA	<0.06	<0.005	NA	<0.02
Pine Spring	10/16/95	<0.01	<0.2	<0.01	<0.1	<0.005	<0.01	<0.01	NA	<0.01	<0.1	<0.0002	NA	<0.01	<0.01	NA	<0.02	NA	0.1	<0.003	NA	NA	<0.02	<0.005	NA	<0.02
Seven Springs	10/1/79	<0.03	0.2	NA	0.036	<0.03	<0.06	0.001	NA	<0.04	0.036	NA	NA	0.001	0.001	NA	<0.05	NA	NA	<0.14	NA	NA	NA	NA	NA	<0.01
Seven Springs	5/1/83	NA	0.2	NA	0.02	0.003	NA	NA	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seven Springs	5/10/91	<0.001	<0.1	<0.05	0.01	<0.001	<0.002	0.011	<0.005	<0.002	0.52	<0.1	<0.01	<0.02	<0.002	0.04	<0.002	<0.02	0.47	<0.002	<0.05	0.02	<0.1	<0.1	NA	0.01
Seven Springs	4/3/96	<0.0002	0.12	0.0004	0.02	<0.0002	<0.002	<0.002	<0.002	0.002	0.02	<0.0002	<0.01	<0.01	<0.002	0.06	<0.002	<0.01	1.16	<0.002	<0.05	0.019	<0.0001	0.0003	<0.01	0.01
Unnamed Cold	7/1/80	<0.03	NA	NA	0.016	<0.001	<0.001	<0.001	NA	<0.001	0.15	NA	NA	0.002	<0.002	NA	<0.002	NA	<0.2	<0.004	<0.2	NA	NA	NA	NA	0.024
Unnamed Cold	7/1/80	<0.03	NA	NA	0.022	<0.001	<0.001	0.004	NA	<0.001	1.19	NA	NA	0.135	<0.002	NA	<0.002	NA	0.7	<0.004	<0.2	NA	NA	NA	NA	0.008
Unnamed Spring	5/28/91	<0.001	3.8	<0.05	0.08	0.001	<0.002	0.004	0.007	0.007	13.4	<0.1	<0.01	<0.02	<0.002	0.38	<0.002	<0.02	0.09	0.005	<0.05	0.01	<0.05	<0.1	NA	0.06
Unnamed Spring	9/10/93	<0.0005	0.6	0.006	0.03	<0.0002	<0.002	0.003	<0.002	0.008	0.44	<0.0002	<0.01	<0.01	<0.002	0.16	<0.002	<0.01	1.62	0.002	<0.02	0.007	<0.002	<0.002	NA	0.1
Water Canyon Gallery	8/1/78	<0.03	NA	NA	<0.12	<0.03	<0.06	<0.03	NA	<0.04	<0.04	NA	NA	<0.02	<0.1	NA	<0.05	NA	NA	<0.14	NA	NA	NA	NA	NA	<0.01
Water Canyon Gallery	8/18/92	<0.001	<0.1	<0.05	0.01	<0.001	<0.002	0.003	<0.002	<0.002	<0.01	0	<0.02	<0.01	0.009	<0.05	<0.002	<0.02	0.48	0.004	<0.05	0.004	<0.1	0	NA	0.02
Water Canyon Gallery	5/20/93	<0.001	0.2	<0.05	0.02	0.001	<0.002	<0.002	<0.002	0.002	0.05	0	<0.01	<0.01	<0.002	<0.02	<0.002	<0.01	0.98	0.005	0.07	0.006	<0.1	0	NA	0.05
Water Canyon Gallery	4/03/96	<0.0002	0.15	0.0004	0.01	<0.0002	<0.002	<0.002	<0.002	<0.002	0.05	<0.0002	<0.01	<0.01	<0.002	0.06	<0.002	0.02	0.91	<0.002	<0.05	0.006	<0.0001	<0.0001	<0.01	<0.01

*NA = Not analyzed.

TABLE J-3 HIGH EXPLOSIVES IN BACKGROUND SPRINGS

DESCRIPTION	DATE	HMX (ppm)	NQ (ppm)	PETN (ppm)	RDX (ppm)	TNT (ppm)
SAL[a]	N/A[b]	1.8	3.7	0.7	6E-04	0.0022
Apache Spring	4/03/96	<0.02	<0.01	<0.05	<0.01	<0.01
Cold Spring west cal	6/1/80	NA[c]	NA	NA	NA	NA
Frijoles Spring #49	5/22/91	NA	NA	NA	NA	NA
Frijoles Spring #50	5/22/91	NA	NA	NA	NA	NA
Pine Spring	5/24/91	NA	NA	NA	NA	NA
Pine Spring	3/26/95	NA	NA	NA	NA	NA
Pine Spring	10/16/95	NA	NA	NA	NA	NA
Seven Springs	10/1/79	NA	NA	NA	NA	NA
Seven Springs	5/1/83	NA	NA	NA	NA	NA
Seven Springs	5/10/91	NA	NA	NA	NA	NA
Seven Springs	4/3/96	<0.02	<0.01	<0.05	<0.01	<0.01
Unnamed Cold	7/1/80	NA	NA	NA	NA	NA
Unnamed Cold	7/1/80	NA	NA	NA	NA	NA
Unnamed Spring	5/28/91	NA	NA	NA	NA	NA
Unnamed Spring	9/10/93	NA	NA	NA	NA	NA
Water Canyon Gallery	8/1/78	NA	NA	NA	NA	NA
Water Canyon Gallery	8/18/92	NA	NA	NA	NA	NA
Water Canyon Gallery	5/20/93	NA	NA	NA	NA	NA
Water Canyon Gallery	4/03/96	<0.02	<0.01	<0.05	<0.01	<0.01

[a]SAL=Screening action level.

[b]N/A= Not applicable.

[c]NA=Not analyzed.

Attachment O - Comment 30.b.

Revised version of figure C-1

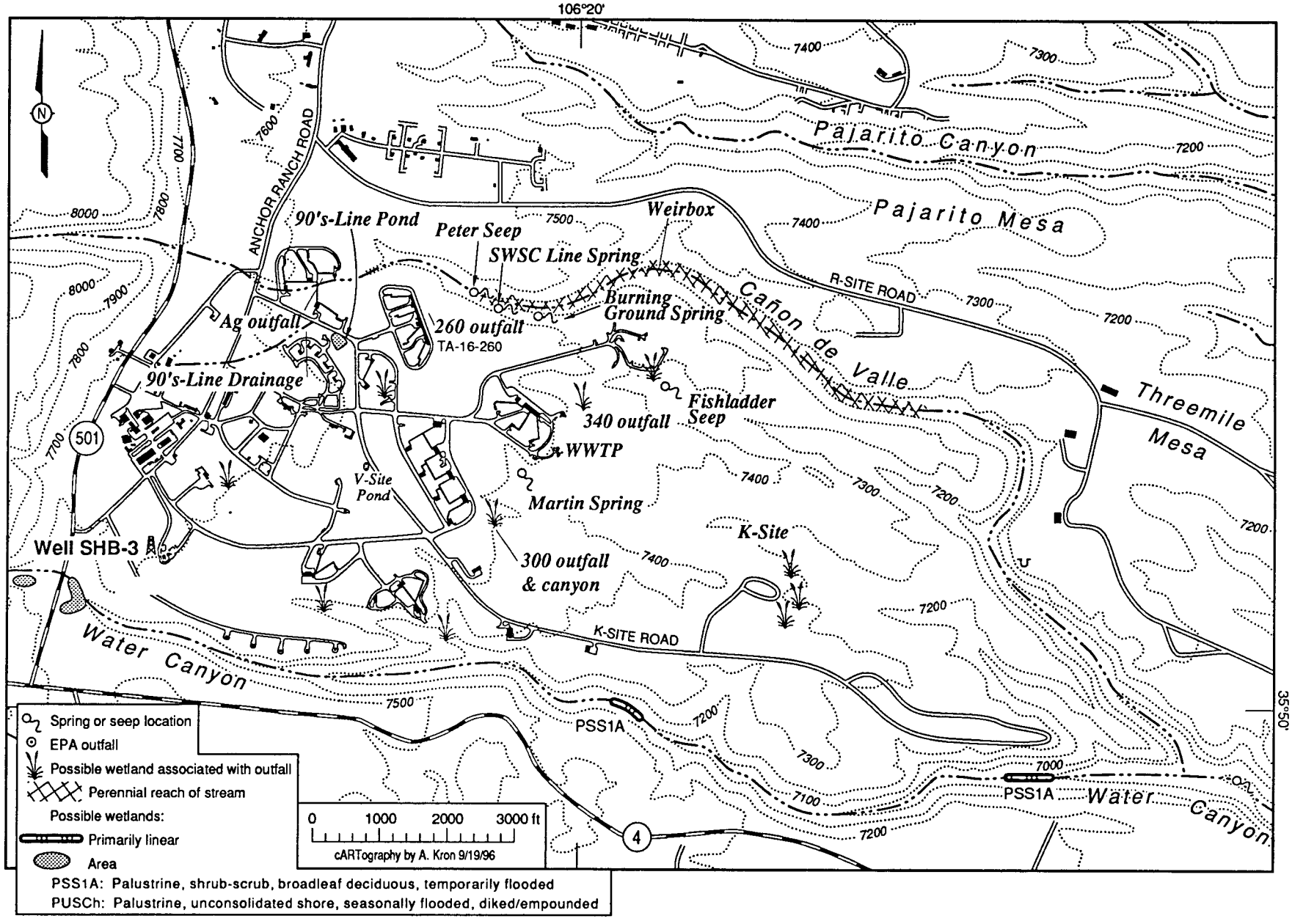


Fig. C-1. Spring, surface water and assorted sampling locations.

Attachment P - Comment 31.a.

Tabulation of SALs and background values for barium, manganese and RDX

Attachment P

DESCRIPTION	DATE	BARIUM (ppm)	MANGANESE (ppm)	RDX (ppm)
MCL[a]	N/A[b]	2	0.05	NC[c]
SAL[d]	N/A	1	1.7	0.00061
Apache Spring	4/03/96	0.07	<0.01	<0.01
Cold Spring west cal	6/1/80	0.02	NA[e]	NA
Frijoles Spring #49	5/22/91	0.06	<0.02	NA
Frijoles Spring #50	5/22/91	0.03	<0.02	NA
Pine Spring	5/24/91	0.05	<0.02	NA
Pine Spring	3/26/95	0.1	<0.01	NA
Pine Spring	10/16/95	<0.1	<0.01	NA
Seven Springs	10/1/79	0.036	0.001	NA
Seven Springs	5/1/83	0.02	NA	NA
Seven Springs	5/10/91	0.01	<0.02	NA
Seven Springs	4/3/96	0.02	<0.01	<0.01
Unnamed Cold	7/1/80	0.016	0.002	NA
Unnamed Cold	7/1/80	0.022	0.135	NA
Unnamed Spring	5/28/91	0.08	<0.02	NA
Unnamed Spring	9/10/93	0.03	<0.01	NA
Water Canyon Gallery	8/1/78	<0.12	<0.02	NA
Water Canyon Gallery	8/18/92	0.01	<0.01	NA
Water Canyon Gallery	5/20/93	0.02	<0.01	NA
Water Canyon Gallery	4/03/96	0.01	<0.01	<0.01

[a]MCL=US EPA maximum contaminant levels (drinking water standards)

[b]N/A=Not applicable

[c]NC=Not calculated

[c]SAL=Screening action level

[d]NA=Not analyzed