

General

**RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION REPORT**

**LOS ALAMOS NATIONAL LABORATORY
ANNOTATED OUTLINE**

LANL / ER / FRAMEWORK

GENERAL GUIDELINES

The section headings in this outline were distributed to all New Mexico Environment Department (NMED) regulated facilities at a workshop on March 4 and 5, 1998. At that workshop, NMED mandated that every Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report submitted to the State after March 4, 1998, must follow the numbered and lettered section headings in this outline.

The annotation in this outline was developed by Los Alamos National Laboratory (LANL or the Laboratory) and NMED to clarify the contents in each section. The annotation addresses a wide range of site complexities, and some items may not be applicable for all sites. If the information called for in the annotation is available, it should be provided. If the information called for is currently unknown or unavailable, do what is reasonable to provide it, but do not perform a study to provide such information unless it is integral to the potential release site (PRS) decision. Check with the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov) before undertaking such a study.

Follow this outline when preparing RFI reports unless permission to deviate is obtained. All requests for deviation should be addressed to the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov), who will coordinate discussion with the State. Deviations will be permitted for cases in which adherence to the outline compromises technical quality.

Follow these general guidelines throughout the document:

- The audience is the public. Write the report so that the public can understand the rationale for each PRS decision.
- Do not submit the RFI report if the data did not meet the objectives.
- Include all details relevant to the decisions presented.
- If PRSs are near one another or potentially affect the same media with similar contaminants, treat them together rather than as isolated units. Further guidance for aggregating PRSs will be developed by the Analysis and Assessments Focus Area to ensure that cumulative ecological and human health issues are appropriately addressed.
- It is not sufficient to state that relevant information is available in the work plan or other archival documents. The reader should not have to read the work plan or other documents to understand the PRS description, operational history, or any other information relevant to the site. Include all relevant details and descriptions from previous documents using one of the following methods:
 - The preferred method is to quote the relevant material verbatim, providing enough reference information for the reader to locate the original material (include both section numbers and page numbers). If terminology in the quotation is no longer in use, provide current terms in brackets following



out-of-date terms. This should be explained in the introduction to the quotation. The following is a sample quotation introduction:

"The following information was reproduced from Section 3.4.1, pages 56–58, of the RFI Work Plan for OU 1234 (LANL 1992, ER ID12345). Certain terminology in the work plan is no longer in use. Therefore, current terms are added in brackets following the out-of-date terms in this quotation."

- When the quotation is so lengthy that it would break up the flow of the text, summarize the information, providing enough reference information for the reader to locate the original material (include both section numbers and page numbers).
- When new information has become available since the work plan was submitted, summarize the information from the work plan and discuss the changes that have occurred. The new write-up should provide a complete account that incorporates previous information with current understanding.
- Each focus area is responsible for establishing reference sets in the LANL Environmental Restoration (ER) Project Reference Library following the guidance in the reference library quality procedure (currently in preparation). These reference sets should include all archival documents, methodology documents, technical guidance, etc. referenced in Administrative Authority (AA) submittals. Note that the ER Project Office will be responsible for submitting project-wide documents such as the Installation Work Plan. Also, it is not necessary to resubmit previously submitted work plans, sampling and analysis plans, RFI reports, voluntary corrective action (VCA) plans, VCA completion reports, etc. Documents that apply only to this RFI report may be attached in Appendix G-2.0, Referenced Documents. Guidance on referencing documents and submitting reference materials to the AA can be obtained from ER Project technical editors.
- If a no further action (NFA) recommendation is based largely on archival documents and the documents can no longer be located, it will be necessary to find another basis for justifying the NFA decision.
- The body of the RFI report should include only PRS-specific information relevant to portraying the PRS and understanding the decision presented. General information that applies to all of the PRSs in the document (e.g., descriptions of the technical area (TA) or general area containing the PRSs, descriptions of the statistical approaches, etc.) should be presented in the appendixes.
- Add appendixes as needed following Appendix G to include necessary information that does not belong in the body of the report or in one of the existing appendixes.
- Add attachments to this document as needed. Be sure to include a cover sheet for each attachment that explains what the attachment contains and gives the title and date of the RFI report with which the attachment belongs.
- If a section called for in the outline does not apply to the PRS being discussed, indicate that the section is not applicable for the PRS and provide a rationale. Provide the statement and rationale under the highest appropriate section number, and omit all

sections that fall under the general section (e.g., if the statement falls under Section 2.4.3, omit Sections 2.4.3.1 and 2.4.3.2).

- The AA and the public need to be aware that we considered all of the items specified in this outline. If an item called for in the annotation is unknown or unavailable, state that it is unknown or unavailable (e.g., no interflow map is available for this PRS, the amount of liquid released is unknown, etc.).
- Present the PRSs in sequential order unless there is a reason for presenting them in a different order (e.g., it might make sense to organize related PRSs together).
- Create subheadings under the sections in this outline as needed to organize the text, but do not number the additional subheadings. Use bold font to set them apart.
- Use consistent units for all measurements in the report, especially when reporting concentrations for chemicals of potential concern in soil/sediment and water samples. Clearly identify the units for all numbers in all tables in the report.
- Provide sample identification (ID) numbers, analyte concentrations, and comparison values in text discussions. For example, it is not sufficient to say, "Mercury was present at levels exceeding the screening action level (SAL)." Say instead, "Mercury was present in sample 0153-96-4567 at 100 mg/kg, which exceeds the SAL of 23 mg/kg." Note that this bullet does not apply for summary sections where information may be presented more briefly.
- It is the data user's responsibility to present data from the Facility for Information Management, Analysis, and Display (FIMAD) in the appropriate format. This includes using the proper number of significant figures. Improper use of significant figures could indicate to the reader a lack of professionalism and inattention to the data sets being presented, thus presenting a poor image of the Laboratory. It is important to document an impact to a decision resulting from rounding data values. Make sure the data presentation is logical and defensible.
- When discussing structures, provide both the structure number and a brief statement of what the structure is. For example, it is not sufficient to refer to "structure TA-32-6." Refer instead to "structure TA-32-6, a valve house containing access points to piping at PRS 12-345." This information should be provided both on the first occurrence, and on all subsequent occurrences. If the description is too complicated to fit in the text or adds repetition to the report, a footnote may be used.
- If ongoing actions (e.g., water monitoring) are discussed, cite documents that describe the actions. In the RFI report discussion, provide the frequency of the activity, the regulatory authority that drives the activity, the expected duration of the activity, etc.
- Do not use jargon, LANL-specific terms, vague terms, or other imprecise language. Be explicit in all discussions and do not expect the reader to make assumptions or inferences based on limited information.
- Use the term "regional aquifer" instead of "main aquifer."

- When recommending a future corrective action for a PRS, use the general term “accelerated corrective action” rather than “voluntary corrective action” or “voluntary corrective measure.” Note the following:
 - VCAs are typically low-cost, short-term corrective actions. Approval for a VCA must be obtained from the AA before proposing a PRS for NFA. Sites appropriate for VCAs are typically low priority sites.
 - Voluntary corrective measures (VCMs) are performed on relatively small-scale sites with obvious remedies that require enhanced regulatory involvement because of complexity, cost, or location. the AA must approve the VCM plan before field activities, and approve the VCM report before the PRS is proposed for NFA.
- Follow ER Project formatting standards for font, type size, header and footer style, references, and other formatting issues. A template for the appropriate format is available through the ER Project technical editors.
- Format textual references using ER ID numbers rather than Master Reference List or other reference numbers, and include reference set and tab numbers for locating referenced documents in the reference library (see the General Guidelines for information about this library). Contact an ER Project technical editor for further information.
- Be sure to use an ER Project technical editor as you plan, write, and produce RFI reports. ER Project technical editors will be updated regularly on changes to this outline. Involving an editor early in the RFI reporting process will help to ensure that the document meets current standards for content and format, and that it is submitted on schedule.

EXECUTIVE SUMMARY

The executive summary should be synopsis of the entire document, including the description and history, the investigation activities, and the results, conclusions, and recommendations for each potential release site (PRS). The executive summary should be written after the document is complete. The contents of the executive summary will vary depending on the issues at the PRS, but all of the items discussed in these annotations should be included.

Briefly summarize the PRS description and operational history. Address the following items:

- Provide the PRS numbers and types for the PRSs included in the report, and indicate whether each PRS is an area of concern (AOC) or a solid waste management unit (SWMU). Identify the PRS components (e.g., leach fields, outfalls, inlet pipes, outlet pipes, manholes, etc.) and the structures and features associated with the PRS (e.g., buildings, tanks, roads, fences, paved areas, curbing, drainage features, etc.).
- If PRSs are grouped for evaluation, provide the logic for grouping them (e.g., geographic location, similar contaminants, similar unit types, contribution to the same problem, etc.).
- Explain the relationship of the PRSs to the facility, technical area (TA), or other general area that contains them, and describe the specific location of each PRS.
- If it is relevant to the recommendations, briefly describe the PRS-specific topography, surface geology, geomorphology, and hydrology.
- Indicate whether each PRS is active or inactive, and discuss the current and anticipated future operations and land use.
- Summarize the past operations at the PRS, including basic operational activities, maintenance activities, cleaning and storage of equipment, and waste management practices. Provide the dates for these activities. Discuss the processes that may have contributed to contamination and the chemicals used at the PRS that contributed to the list of chemicals of potential concern (COPCs).
- Describe how contaminants were deposited at the PRS before the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI), including quantity, physical form (i.e., solid, liquid, or gas), physical description (e.g., powder, oily sludge, etc.), and general chemical class (e.g., acid, base, solvent, etc.).
- If relevant, briefly summarize the findings of past data (e.g., contaminants previously identified) and the main implications of these findings.

Briefly summarize the investigation activities. Address the following items:

- Summarize the questions to be answered by the data, and state whether this is a first (i.e., Phase I) or continued (i.e., further or Phase II) investigation.
- Briefly describe the investigation activities and the types of data collected. Include field survey types, field screening types (both to support sampling locations and PRS decisions), and sampling types (e.g., surface, subsurface, augering, drilling, trenching, monitor-well completion, etc.).
- Summarize the analyses conducted for each PRS and summarize concerns about the quality of the data.

Briefly summarize the results and recommendations. Address the following items:

- Summarize the results of the human health screening and/or risk assessment, the ecological screening and/or risk assessment, and the other applicable assessments. Do not use screening assessment terminology or compare the data to screening action levels. Instead, focus on the conclusions of the data assessment, listing the COPCs for the PRS and making general statements such as the following:

"Based on the analytical results, barium, aluminum, and copper were identified as COPCs for this PRS. These chemicals are not anticipated to impact human health or ecological receptors based on the site assessments conducted."
- Summarize what is known about the nature and horizontal and vertical extent of contamination. State whether the extent has been bounded and whether contaminants are being transported beyond the PRS boundaries and by what mechanism.
- Identify gaps in the data and justify the assumptions that address these gaps.
- For each PRS, summarize the conclusions and recommendations and the rationale behind them, including the assumptions made in the revised site conceptual model.
- If relevant, briefly discuss how and at what point the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation.
- Provide a projected schedule of activities associated with PRSs not recommended for no further action (NFA). If PRSs need to be added to Module VIII of the Laboratory's hazardous waste facility permit, provide a projected date for the submission of a request for permit modification

Include a table following Example Table ES-1, and state that it provides summary information for each PRS. Provide the current NFA criterion in the table when NFA is recommended, and reference the *New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide* (NMED 1998, ER ID 57897).

EXAMPLE TABLE ES-1
SUMMARY OF PROPOSED ACTIONS

PRS Number	PRS Description	HSWA ^a	Radionuclide Component ^b	Proposed Action	Rationale for Recommendation	Section Number
0-001	Outfall	Yes	Yes	NFA, Criterion 5 ^c	RCRA and radionuclide contamination are below SALs.	2.0
0-003	Inactive septic tank	Yes	No	Accelerated Cleanup	RCRA contamination exceeds SALs; remedy obvious.	3.0
0-004	Drum storage area	No	No	Further Investigation	Nature and extent of contamination unknown.	4.0
0-005	Storage container area	No	Yes	Accelerated Cleanup	Radionuclide contamination exceeds SALs; remedy obvious.	5.0
0-006	Sump and drain line	Yes	Yes	Further Investigation	RCRA contamination is below SALs. Radionuclide contamination will be addressed.	6.0
<p>a. If the site is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit, then "yes" applies. Otherwise, "no" applies.</p> <p>b. If a release has occurred at the PRS and radionuclides are associated with the release, then "yes" applies. Otherwise, "no" applies.</p> <p>c. NFA Criteria are listed in Section II.B.4.a.(4).(b), "No Further Action (NFA) Proposals Criteria," in the <i>NMED RCRA Permits Management Program Document Requirement Guide</i> (NMED 1998, ER ID 57897).</p>						
<p>Note: The information in this table is example data. The footnotes should be included in the table.</p>						

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1.0 INTRODUCTION

This section is intended to be a brief overview of the contents of the report. For most reports, this section should not exceed two pages. Begin this section with the following paragraphs:

“Los Alamos National Laboratory (LANL or the Laboratory) is a multi-disciplinary research facility owned by the Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 miles northeast of Albuquerque and 20 miles northwest of Santa Fe. The Laboratory site covers 43 square miles of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 6,200 ft to 7,800 ft. The eastern portion of the plateau stands 300 to 900 ft above the Rio Grande.

The Laboratory's Environmental Restoration (ER) Project is involved in a national effort by the DOE to clean up facilities that were formerly involved in weapons production. The goal of the ER Project is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve that goal, the ER Project is currently investigating sites potentially contaminated by past Laboratory operations.

The sites under investigation are either solid waste management units (SWMUs) or areas of concern (AOCs). In the LANL ER Project, SWMUs and AOCs are collectively referred to as potential release sites (PRSs).”

Next, establish the regulatory context for the investigation by including the following text:

“This investigation, including sampling and analysis, is conducted under the requirements of the Resource Conservation and Recovery Act (RCRA).”

If the report addresses SWMUs and/or AOCs that are included in Module VIII of the Laboratory's Hazardous Waste Facility Permit, also include the following text:

“For PRSs [list PRSs], the investigation is in accordance with the Hazardous and Solid Wastes Amendments of 1984 (HSWA) and follows the requirements in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, ER ID 01585). Module VIII was issued to the Laboratory by the US Environmental Protection Agency (EPA) on May 23, 1990 and modified on May 19, 1994.”

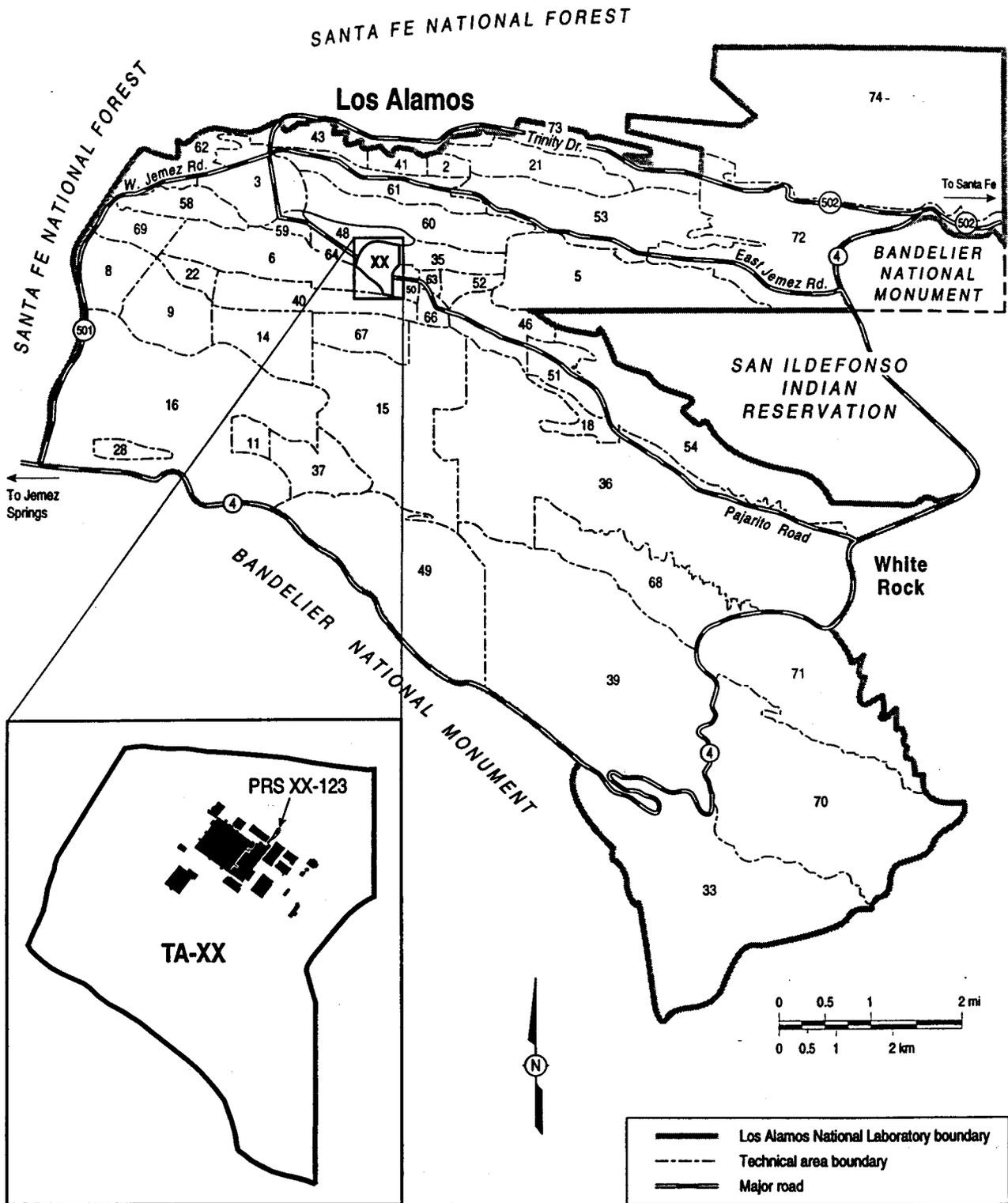
If sampling and analyses for radionuclides are discussed in this report, include the following text:

“Radionuclides are regulated under DOE Order 5400.5, ‘Radiation Protection of the Public and the Environment’ (proposed rule 10 CFR 843.5 in 58 FR 16268). In this report, PRSs [list PRSs] have a radionuclide component.”

State that the current Installation Work Plan (IWP) (LANL 1996, ER ID 55574) describes the methodologies used in the investigation and analysis. Recent changes to data review and screening assessment methodologies may not be reflected in the current IWP. If a methodology currently in use is not in the current IWP, include a description of the methodology in the relevant appendix and state that it is included.

Address the following items:

- Identify the PRS numbers and types for the PRSs included in the report. If PRSs are grouped for evaluation, present the logic for grouping them (e.g., geographic location, similar contaminants, similar unit types, contribution to the same problem, etc.)
- Include a figure following Example Figure 1.0-1 and state that it provides an overview of the Laboratory and indicates the locations the technical areas (TAs) and the general locations of the PRSs discussed in the report.
- Describe the organization of the report, and indicate that each PRS is discussed in a separate section (e.g., Sections 2.0, 3.0, etc.).
- Describe the contents of each appendix.
 - State that a list of acronyms and a glossary of terms is located in Appendix A.
 - State that the current and anticipated future land use of the general area that includes the PRSs (e.g., the facility, TA, or other general area) is discussed in detail in Appendix B-1.0, Operational History and Land Use. State that Appendixes B-2.0 through B-6.0 include a detailed discussion of the climate, geology, hydrology, ecological resources, and cultural resources for this general area.
 - State that Appendix C includes the complete quality assurance/quality control (QA/QC) results.
 - State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the Administrative Authority (AA) in electronic format.
 - If statistical calculations were conducted, state that Appendix E provides these calculations.
 - If a human health or ecological risk assessment was conducted, state that Appendix F provides risk calculations.
 - State that Appendix G-1.0 summarizes the administrative history of the PRSs and provides copies of all AA correspondence and LANL's responses. State that Appendix G-2.0 contains documents referenced in this RCRA facility investigation (RFI) report that are specific to this report. Indicate that other references are or will be included in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).



F1.0-1 / TA-XX-XXX RFI RPT / 061298

Example Figure 1.0-1. Location of TA-XX with respect to Laboratory technical areas and surrounding land holdings.

2.0 POTENTIAL RELEASE SITE X-PRS X DESCRIPTOR (e.g., PRS 12-345-INACTIVE SEPTIC TANK AND ASSOCIATED OUTFALL)

The information in the sections beginning with Section 2.0 should be PRS-specific. General information about the area that includes the PRS (e.g., the facility, TA, or other general area) should be presented in these sections only if it is relevant to the decision for the PRS. If it is not directly relevant, such information should be put in the appendixes.

2.1 Summary

This section should briefly summarize the investigation activities, results, and recommendations for the PRS. For most reports, this section should not exceed two pages. Address the following items:

- Briefly describe the PRS (one or two sentences).
- Summarize the questions to be answered by the data (this information should correspond to the problem definition section in the sampling and analysis plan [SAP]). State that details are included in Section 2.3.3, Preliminary Conceptual Model.
- Summarize the RFI activities (e.g., the types and numbers of samples collected, the analyte suites for which samples were analyzed, stabilization activities, etc.). State that details are included in Section 2.3.4.2, Field Investigation.
- Summarize what is known about the nature and extent of contamination. Briefly discuss the actual and potential migration of contaminants from the PRS. Identify gaps in the data. State that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize the results of the human health screening and/or risk assessment and the ecological screening and/or risk assessment. State that details for the screening assessments are included in Section 2.4.2.1 for human health and Section 2.4.2.2 for ecological. If applicable, state that details for the risk assessments are included in Section 2.4.3.1 for human health and Section 2.4.3.2 for ecological, and that all calculations are included in Appendix F, Risk Assessment Calculations.
- Summarize the conclusions and recommendations for the PRS and the rationale behind them, including the assumptions made in the revised site conceptual model. State that details are included in Section 2.5, Conclusions and Recommendations.
- If relevant, briefly discuss how and at what point the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation. State that details are included in Section 2.3.5.2, Environmental Fate.

2.2 Description and Operational History

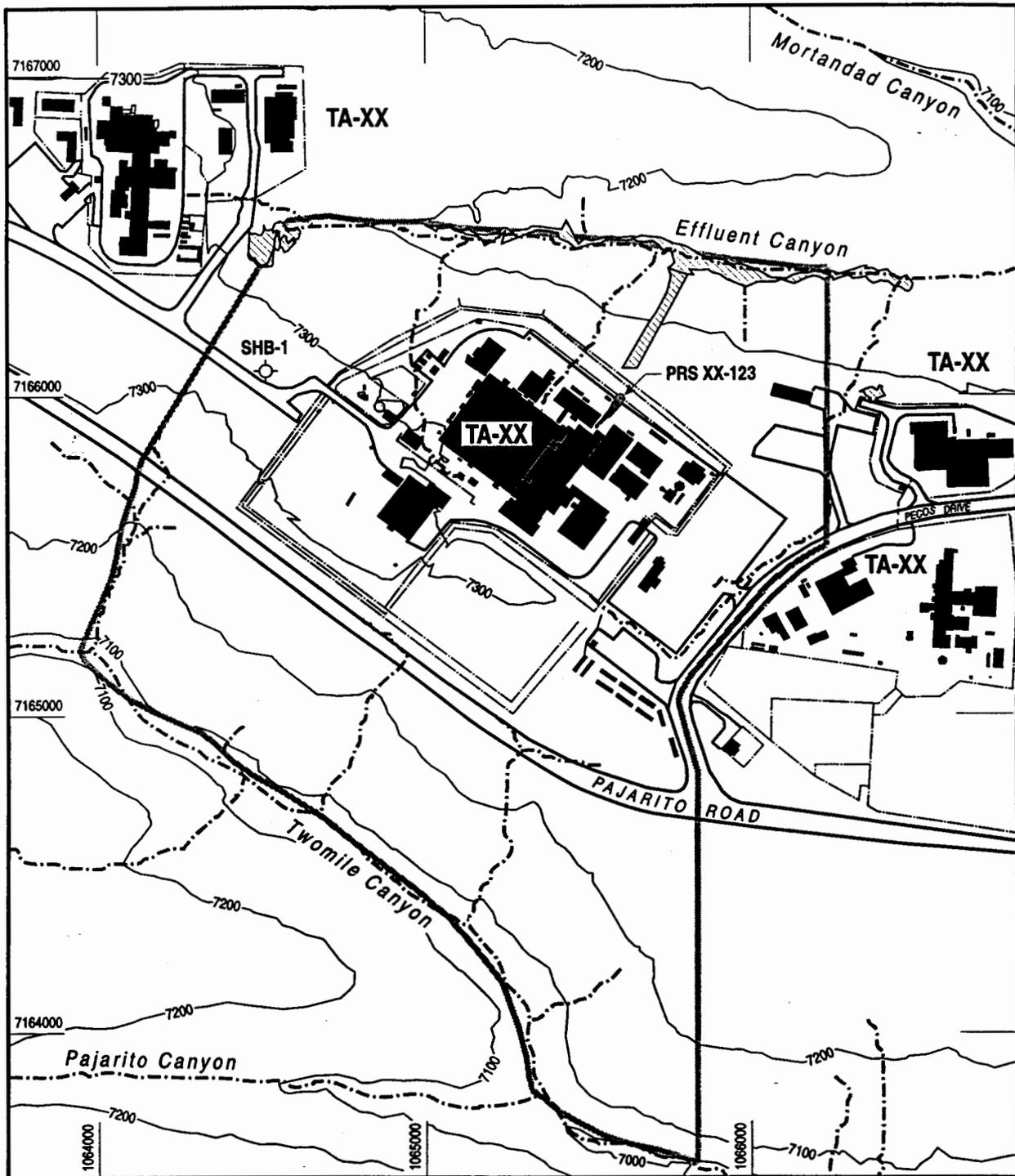
Indicate whether the PRS is an AOC or a SWMU, and state whether it is included in Module VIII of the Laboratory's Hazardous Waste Facility Permit. If it is not listed in Module VIII, explain why.

2.2.1 Site Description

This section should be a complete, stand-alone description of the PRS. The bolded headings are examples of how the site description might be organized. Authors may choose to organize this section differently, but all of the annotated items should be addressed.

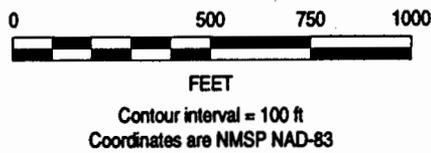
Physical Description

- Provide the PRS type (e.g., tank, dry well, firing site, etc.).
- Indicate whether the PRS is active or inactive.
- Provide the geographical location descriptor for the PRS (e.g., mesa top; mesa edge; canyon bottom; on, near, or in a water course; valley margin; flood plain; alluvial fan; colluvium; etc.).
- Explain the relationship of the PRS to the facility, TA, or other general area that contains it.
- Describe the location of the PRS (e.g., proximity to roads, location within the TA, location on the mesa top, etc.)
- If known, provide the total surface area of the PRS based on the extent of contamination. If the extent of contamination is unknown, provide an approximate estimate or state that a discussion of the extent of contamination is included in Section 2.3.5, Revised Site Conceptual Model.
- Identify all PRS components (e.g., leach fields, outfalls, inlet pipes, outlet pipes, manholes, etc.) and their construction materials. For each component, provide the dimensions and discuss the general physical condition and integrity. Discuss the spatial relationship of the PRS components.
- Identify nearby structures and features (e.g., buildings, tanks, roads, fences, paved areas, curbing, drainage features, etc.), and discuss their spatial relationship to the PRS components.
- Include a figure (or multiple figures as needed) following Example Figures 2.2-1 and 2.2-2, and state that it shows the location of the PRS relative to its TA. Multiple figures may be used if necessary. Address the following in the figure:
 - Clearly delineate the PRS boundaries. Note that the PRS boundary in the Facility for Information Management, Analysis, and Display (FIMAD) is usually a preliminary guess. The PRS boundary should be updated based on the estimated lateral extent of contamination if it has been determined.
 - Individually identify all of the PRS components and the associated structures and features.
 - Provide labeled coordinate tics for New Mexico State Plane Coordinates.
- Include photographs of the site, and state that the photographs show the PRS in the context of the surrounding area. All components and structures associated with the PRS should be labeled on the photographs. Follow Example Figures 2.2-3 and 2.2-4.



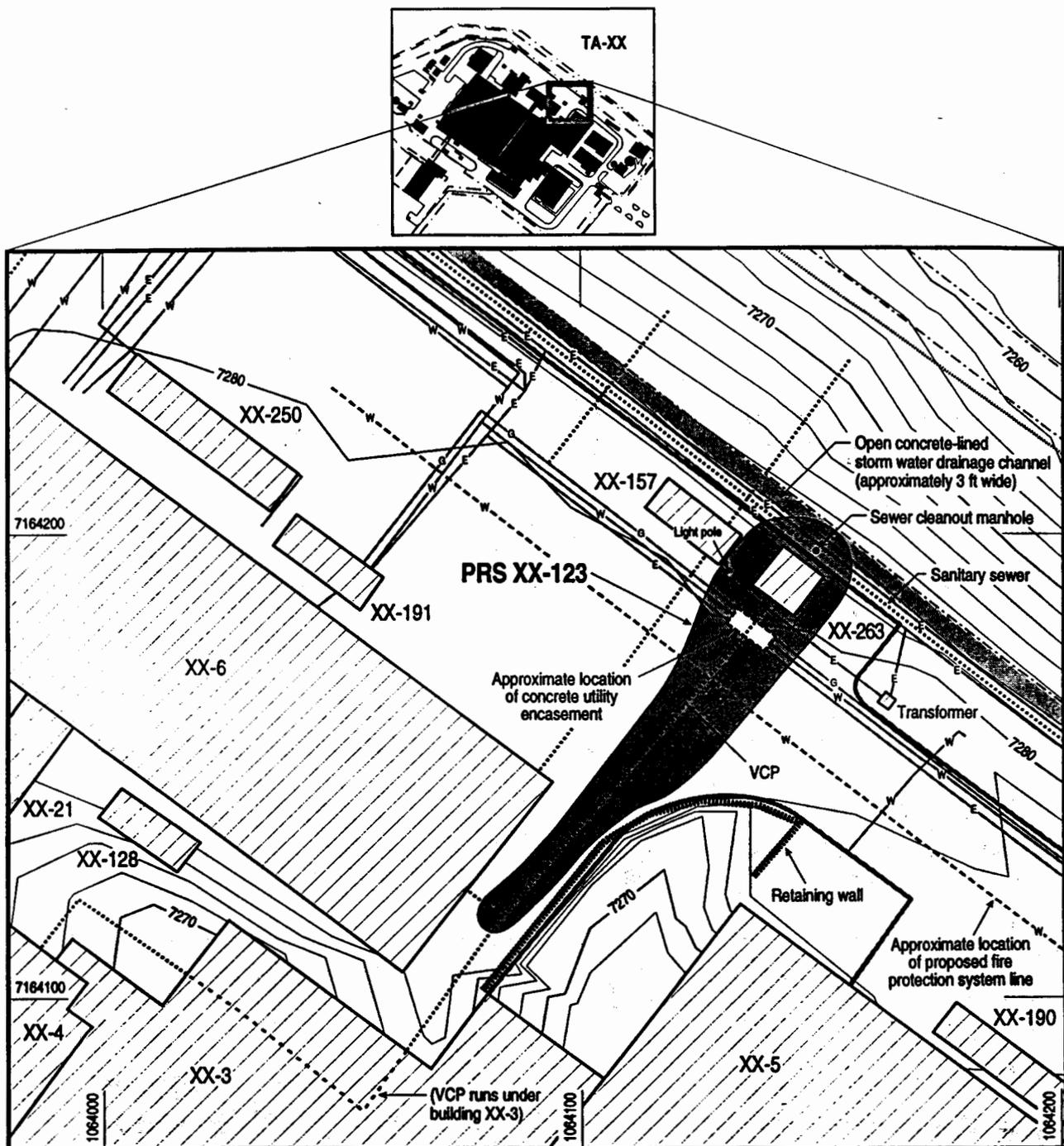
Source: FIMAD G106258

F2.2-1 / XX-123 RFI RPT / 061298



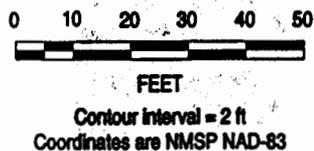
	Building or structure		Paved road
	Drainage		Fence
	ESH wetland		PRS boundary
	Borehole with stratigraphic data		TA-XX boundary

Example Figure 2.2-1. Location of PRS XX-123 and associated physical features near TA-XX.



Source: FIMAD G106258

F2.2-2 / XX-123 RFI RPT / 061298

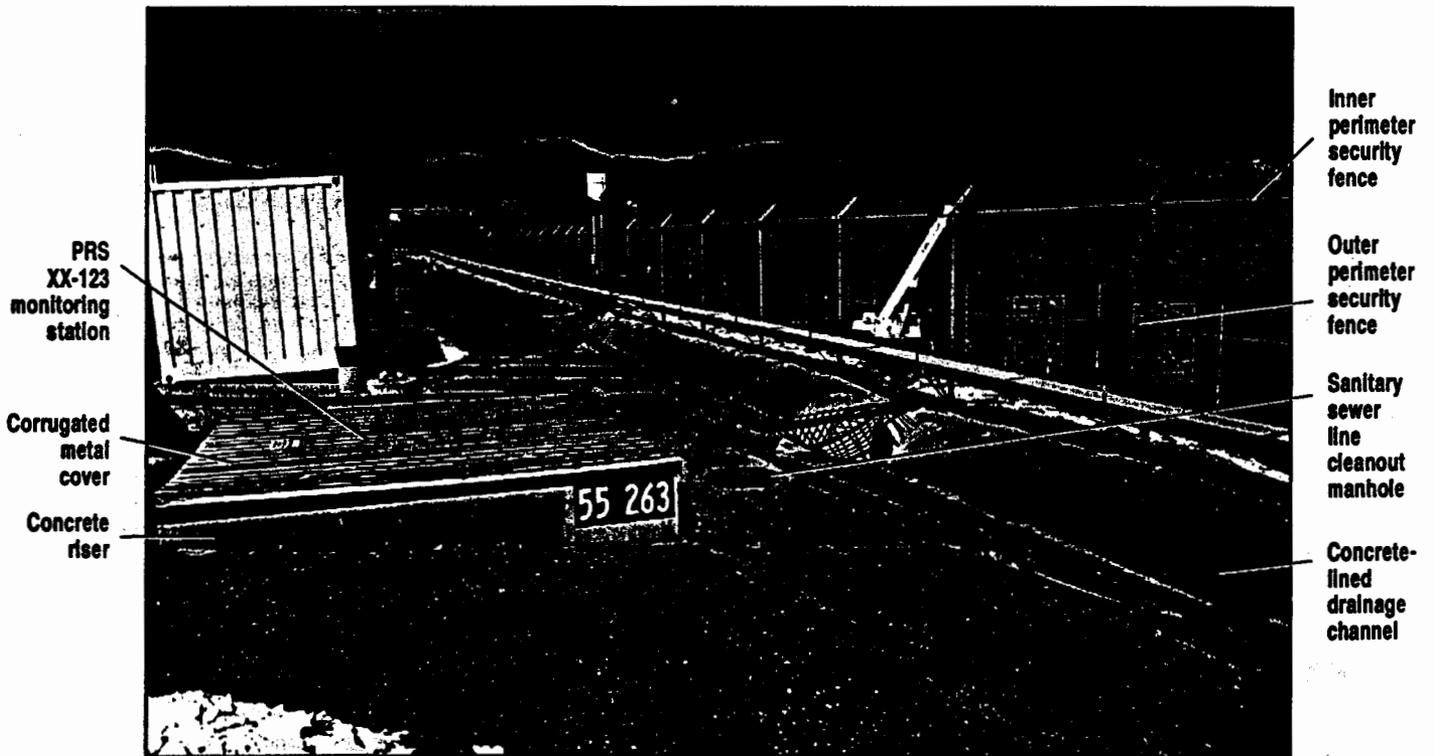


	Building or structure location		Gas line
	Paved road		Electric line
	Sewer or waste line/storm drain		Water line
	Fence		PRS boundary

Example Figure 2.2-2. Engineering features and utilities in the vicinity of PRS XX-123.



Example Figure 2.2-3. Photograph of PRS XX-123 looking east.



Example Figure 2.2-4. Photograph of PRS XX-123 looking west.

Land Use

- Discuss the current and anticipated future operations and land use of the PRS, all of the PRS components, and the associated structures and features. This information can be found in the 1995 update of the LANL Site Development Plan (LANL 1995, ER ID 57224). Briefly discuss the accessibility of the PRS. Discuss proposed Environmental Management (EM)/ER decontamination and decommissioning (D&D) activities or facility management activities and their potential impact on the PRS. Follow the example below:

"TA-12 is an industrial area currently used for plutonium research and processing. LANL does not anticipate any change from this industrial use for the operational life of the Laboratory (LANL 1995, ER ID 57224, pp. 11–12). TA-12 is a high-security area with restricted access. It is surrounded by two chain link fences, one of which is topped with barbed wire. These security measures effectively eliminate the possibility of inadvertent site intrusion. No D&D activities are currently proposed for this site."

Relation to Other PRSs

- Identify other PRSs that potentially affect the recommendations for the subject PRS (e.g., nearby outfalls, firing sites, stack emissions, etc.), and provide the operational time frames for these PRSs. If this does not apply, state that this is an isolated unit.

Environment

Discuss PRS-specific climatic information that differs from the information in Appendix B-2.0, Climate, or that might influence the decision for the PRS (e.g., wind direction for a firing site). State that detailed information is included in Appendix B-2.0.

Describe the PRS-specific geomorphology, surface geology, and topography, including PRS-specific features beyond those described in Appendix B-3.0, Geology. Address the following items:

- Provide the soil types and depth to bedrock, and state that descriptions of the soil types are included in Appendix B-3.2, Soils. If known, describe the soil properties (e.g., permeability, porosity, grain size distribution, etc.), and include an assessment of whether contaminants have affected these properties.
- If it is relevant to the conceptual model, describe the occurrence of A, B, and C horizons.
- Describe the percent and type of vegetative cover, and provide the average slope of the site. This information should be consistent with the LANL ER Administrative Procedure (AP) 4.5 assessments included in Appendix B-4.2.1, and also with the ecological scoping checklist included in Appendix F-2.0. The ecological scoping checklist should be used to develop the information in Section 2.4.2.2(a), Scoping.
- Discuss topographic features where contaminants may collect at the PRS.

Describe the PRS-specific hydrology including PRS-specific features beyond those described in Appendix B-4.0, Hydrology. Address the following items:

- Identify the watershed into which the site drains and whether the stream is ephemeral, perennial, or intermittent at the location of the PRS.

- Include a figure that shows all drainages, wetlands, springs, and streams within or adjacent to the PRS that represent potentially impacted media or are important to the conceptual model. If appropriate, this figure may be combined with Figure 2.2-1 and referred to here (see Example Figure 2.2-1). In addition to the drainages, wetlands, springs, and streams, include the following in the figure:
 - relevant groundwater and surface water monitoring stations,
 - other PRSs that potentially affect the recommendations for the subject PRS, and
 - active and inactive local water-supply and production wells.
- If applicable, discuss the potential for interflow in the soil or tuff. If interflow is a suspected contaminant migration pathway, be sure to evaluate its significance in Section 2.3.5, Revised Site Conceptual Model.
- Describe man-made or natural hydraulic structures or features that might affect the site hydrology (e.g., pipelines; French drains; ditches; unlined ponds; septic tanks; NPDES outfalls; retention areas; topographic influences; geologic features such as fractures, surge beds, and faults; etc.).
- Describe run-on and runoff at the PRS (including direction) and evidence of erosion. This information should be consistent with the LANL-ER-AP-4.5 assessments included in Appendix B-4.2.1.
- Indicate whether the PRS includes debris in a watercourse. Contact the Regulatory Compliance Focus Area (Steve Veenis at 662-0606, sveenis@merrick.com) for a determination. If there is no debris in a watercourse at the PRS, state so. This information should be consistent with the LANL-ER-AP-4.5 assessments included in Appendix B-4.2.1.

Cultural and Biological Resources

- Indicate whether PRS-specific cultural resources are present. If none are present, state so. State that general information regarding cultural resources at the facility, TA, or other general area is included in Appendix B-6.0.
- Indicate whether PRS-specific biological resources have been observed or are potentially present (e.g., threatened and endangered species, habitats, etc. as identified in the ecological scoping checklist). If none are present, state so. State that general information regarding ecological resources at the facility, TA, or other general area is included in Appendix B-5.0. State that the ecological scoping checklist is included in Appendix F-2.0.

2.2.2 Operational History

This section should be a complete, stand-alone description of the PRS-specific operational history. Include all activities associated with the PRS (e.g., stack emissions, dispersion from firing sites, activities in buildings that contributed to septic tanks, etc.). Do not simply refer to the work plan or other archival documents (see the General Guidelines for guidance on referencing archival documents).

Address the following items:

- Describe past operations at the PRS, including basic operational activities, maintenance activities, cleaning and storage of equipment, and waste management practices (including whether there was treatment, storage, or disposal of hazardous wastes at the PRS). Provide dates and durations for these activities. Discuss the processes and chemicals used at the PRS that may have contributed to contamination.
- Describe past land use at the PRS (when relevant, include land use for surrounding and/or adjacent areas).
- If the PRS is active, describe current operations and include a discussion of current waste management practices that affect the PRS.
- Provide the volumes and periods of known releases or discharges that occurred at the PRS, including both permitted and unpermitted releases or discharges (e.g., stacks, spills, etc.). Include information on quantity, physical form (i.e., solid, liquid, or gas), physical description (e.g., powder, oily sludge, etc.), and general chemical class (e.g., acid, base, solvent, etc.). If there are data for the release or discharge, include the data here. If the history of releases or discharges is unknown, state so.

2.3 Investigatory Activities

2.3.1 Summary

This section should briefly state what is included under Section 2.3. It should not exceed two short paragraphs. Use the following example:

"Section 2.3 describes the investigatory activities for PRS 12-345, including previous investigations (Section 2.3.2), the preliminary conceptual model that guided the RFI field work (Section 2.3.3), and the RFI field activities (Section 2.3.4.2). A review of the RFI data is also presented (Section 2.3.4.3) followed by a description of how the conceptual model for PRS 12-345 was revised based on information gained during the RFI (Section 2.3.5)."

2.3.2 Previous Investigations

This section should describe investigations that occurred at the PRS before the RFI. This section should not include RFI work, even if the work was conducted in multiple phases. All RFI activities and results should be discussed in Section 2.3.4, Field Investigation and Data Evaluation. Do not simply refer to the work plan or other archival documents for information regarding the previous investigations (see the General Guidelines for guidance on referencing archival documents).

Address the following items:

- Summarize the investigation history of the PRS, including all previous geophysical, analytical, and biological investigations. Include both ER investigations and non-ER investigations (e.g., ongoing LANL Environmental Surveillance work, etc.). Provide the dates of field work for all previous investigations, and identify the organization conducting the investigation (e.g., Environmental Safety and Health [ESH], ER, etc.).

- If remedial activities have occurred (e.g., Underground Storage Tank [UST] Bureau-required cleanups, Toxic Substances Control Act [TSCA] cleanups, interim measures, stabilization activities, etc.), describe these activities and indicate the RCRA corrective action status of the PRS (i.e., Phase I, Phase II, voluntary corrective action [VCA], voluntary corrective measure [VCM], etc.).
- Discuss the data and results of each investigation. Include a summary table of the analytical results (use judgment as to format). If broader data such as surveillance data, field screening data, and boring logs exist for the PRS, do one of the following: If the data are pertinent to the PRS decision, state that the data are included in Appendix D-4.0, Non-RFI Data, and include them there; if the data are not pertinent to the PRS decision, cite the document in which the data set is reported.
- If data from previous investigations are used directly in the data review, screening assessment, and risk assessment, state that the data are included in Appendix D-3.0, Other Applicable RFI Results, and include the data there.
- If relevant, include and refer to a figure (or multiple figures if needed) showing sampling locations for each investigation. Use judgment as to format.

If no previous investigations have been performed at the PRS, state so.

2.3.3 Preliminary Conceptual Model

This section should present the preliminary conceptual model of contaminant occurrence and distribution at the site. This model is based on archival information and/or previous field investigations. This model should have been presented in detail in the SAP, and it should be summarized here to allow the reader to evaluate and interpret results in the intended context.

Address the following items:

- Briefly summarize relevant information on the history and setting of the PRS, and state that details are included in Section 2.2, Description and Operational History.
- If there are data from investigations previous to the RFI, explain how these data were used in developing and supporting the site conceptual model.
- Describe the expected nature and extent (both vertical and horizontal) of contamination. Discuss aspects of the environmental fate of contaminants, as it is understood based on information previous to the RFI, that are relevant to the PRS decision.

Investigatory Approach

- Summarize the rationale for the sampling design based on the preliminary conceptual model, and state the questions to be answered by the data.

2.3.4 Field Investigation and Data Evaluation

2.3.4.1 Summary

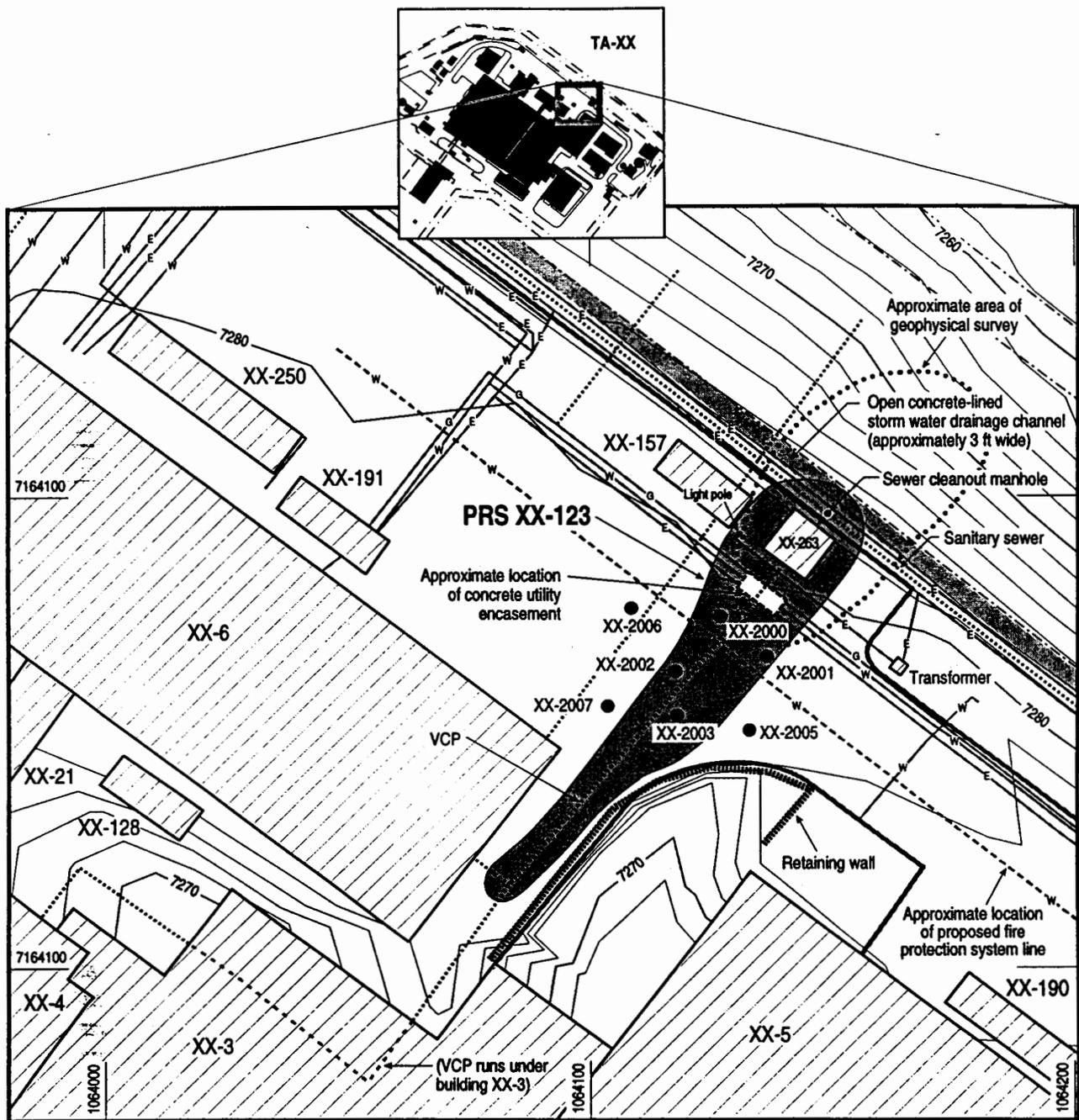
This section should briefly state what is included under Section 2.3.4.1. Use the following example:

“Section 2.3.4 describes the field investigation and data evaluation for PRS 12-345. The field investigation is discussed in Section 2.3.4.2, and the data review is included in Section 2.3.4.3.”

2.3.4.2 Field Investigation

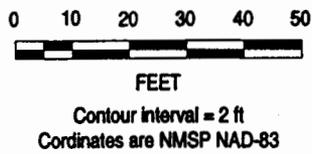
This section should describe the investigation activities. Address the following items:

- Provide the start and finish dates of the RFI field work (sampling may include one or more seasons).
- Describe the prevailing climatic conditions during sampling.
- Identify and reference the standard operating procedures (SOPs) and field procedures that were followed. Discuss deviations from the SOPs and procedures.
- Discuss deviations from the work plan or SAP that occurred during field work. Indicate whether the deviation was reported and approved and by whom (e.g., EPA, NMED, etc.). If applicable, state that the approval letter is included in Appendix G-1.2, Other Regulatory Documents, and include it there. Address the following items:
 - Indicate what was supposed to have been done based on the SAP.
 - Clearly describe the deviation.
 - Explain why the deviation was necessary.
 - Discuss the impact of the deviation on the success of the field activities.
- Identify the organizations (e.g., the ER Project team) responsible for performing the sampling.
- Summarize the nonsampling activities (e.g., core and/or borehole logging, periodic flow measurements, geophysical surveys, geomorphological surveys, etc.).
- Include a figure following Example Figure 2.3-1, and state that it shows sample locations (including field duplicate samples) and the area where nonsampling investigations (such as geophysical investigations) were conducted. If it does not detract from the presentation, use different symbols to distinguish between surface and subsurface samples.
- In the text, summarize the sampling activities, including the number of samples collected for both field screening measurements and fixed laboratory analyses, the media they were collected from, the types of samples collected, etc. If portions of the PRS were not sampled, say so and state why (e.g., the PRS was active, etc.). Indicate the rate of field QA/QC sample collection for each matrix.



Source: FIMAD G106258

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	Building or structure		Gas line
	Surface sample		Electric line
	Paved road		Water line
	Sewer or waste line/storm drain		PRS boundary
	Fence		

Example Figure 2.3-1. Locations of PRS XX-123 samples and areas of nonsampling investigation.

- Include a table following Example Table 2.3-1, and state that it summarizes the samples collected during this investigation that were submitted for fixed-laboratory analysis. Include both analytical and QA/QC samples, the analytical suites requested for each analytical sample, and the request number. State that additional information such as the analytical laboratory name was submitted to the AA in electronic format as discussed in Appendix D-2.0, RFI Analytical Results.

EXAMPLE TABLE 2.3-1

PRS 12-345

SUMMARY OF SAMPLES COLLECTED FOR FIXED-LABORATORY ANALYSIS^a

Location ID	Sample ID	Sample Type	Depth (ft)	Media ^a	VOCs	SVOCs	Inorganic Chemicals	Radionuclides
12-0001	0212-97-1285	Grab	0-0.5	Soil	11111	11111	13212	NA ^b
12-0002	0212-97-1286	Grab	0.5-1	Qbt 3	11111	11111	13212	NA
12-0003	0212-97-4691	Grab	0-0.5	Soil	11211	11211	13212	13222
12-0004	0212-97-4692	Grab	0.5-1	Soil	11211	11211	13212	13222
12-0004	0212-97-4693	Grab/duplicate	0.5-1	Soil	11111	11111	13212	13222
12-0005	0212-97-4700	Grab	0-0.5	Soil	11211	11211	13212	13222
NA	0212-97-4701	Trip blank	NA	NA	11234	11234	13212	13222
12-0008	AAA1000	Grab	0.5-1	Soil	11111	11111	13212	13222

a. Numbers in the cells for each analytical suite are request numbers.

b. NA = Not applicable.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

- If composite samples (either horizontal or vertical) were collected for the PRS, state whether or not composite sampling was included in the approved work plan or SAP. If so, state that the approval documents are included in Appendix G-1.0, Documentation of Regulatory History, and include them there. If the composite sampling was not included in the work plan or SAP, then prior approval of this deviation must be obtained from the AA. Contact the Regulatory Compliance Focus Area Leader (Tori George at 5-6953, torig@lanl.gov) for guidance in cases where composite sampling was conducted without AA approval.
- In the text, describe the numbers and types of field screening measurements and/or surveys (e.g., field instrument for the detection of low-energy radiation [FIDLER], in-situ x-ray fluorescence [XRF], etc.), and discuss the QA/QC procedures and detection limits used for field screening.
- Include a table following Example Table 2.3-2, and state that it summarizes the field screening samples. Include the types of field screening performed for each field screening sample, the sampling location, and the concentration or field indicator for each

measurement. It is not necessary to include data collected exclusively for health and safety purposes unless such data were used to select sampling locations. If field screening samples are paired with analytical samples, correlate this information in the table.

EXAMPLE TABLE 2.3-2
PRS 12-345
SUMMARY OF FIELD SCREENING SAMPLES COLLECTED^a

Location ID	Screening Sample ID	Depth (ft)	Media [*]	HE Spot Test Result	Fixed-Laboratory Sample ID
12-0001	0212-97-0003	0-0.5	Soil	Positive	0212-97-1285
12-0002	0212-97-0034	0.5-1	Qbt 3	Negative	NA ^b
12-0003	0212-97-0051	0-0.5	Soil	Negative	0212-97-4691
<p>a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.</p> <p>b. NA = Not applicable.</p> <p>[*]Indicate the specific soil master horizon or, if appropriate, the geologic subunit.</p>					
<p>Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.</p>					

- In the text, state the rationale for selecting samples for fixed-laboratory analyses. Provide the type of field-screening instrument(s) used and the general frequency and range of levels detected for the chemicals investigated with each type of instrument. State that the correlation, if any, between field screening and fixed-laboratory results is discussed and interpreted in Section 2.3.4.3(d), Other Applicable Data.
- Indicate whether there were zones of visible staining or possible contaminant-related odors. If so, state that soil boring/logging descriptions containing photoionization detector (PID)/organic vapor analyzer (OVA) readings (as well as background PID/OVA readings for reference) are included in Appendix D-3.0, Other Applicable RFI Data, and include them there.
- Provide information concerning water encountered during drilling.
- Discuss stabilization activities conducted as part of the RFI.

2.3.4.3 Data Review

Sections 2.3.4.3(a) through 2.3.4.3(d) should present the evaluation of the PRS data set, which is aimed at determining whether a release has occurred. For inorganic chemicals and radionuclides, the data review is conducted by determining whether chemicals are present at levels exceeding background and/or fallout concentrations. Sample concentrations for inorganic chemicals and radionuclides are compared with background values (BVs) and/or fallout concentrations. For organic chemicals, the data review is conducted by identifying which organic chemicals have been detected at the PRS.

The reviews of inorganic chemicals, radionuclides, and organic chemicals are conducted separately under the following required section headings.

(a) Inorganic Chemical Comparison with Background

This section should present the comparison of inorganic chemical concentrations in RFI samples to BVs, and it should summarize the results of statistical analyses conducted for the inorganic data review. This section should contain only information relevant to background comparisons. There should be no references to screening action levels (SALs) in the text or tables. SAL comparisons (or comparisons to one-tenth of the SAL for noncarcinogens) should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for inorganic chemicals by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E, and include the discussion in the appropriate section. Provide rationales for using (or not using) qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, describe the background data set. Address the following items:

- Identify the background data subset with which the PRS data are compared, and cite the source (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58093]). Briefly state the rationale used for selecting the appropriate background data subset.
- If the analytical results are not directly comparable to the background data (e.g., if there was a difference in the analytical method or sample preparation, backfill of unknown origin, etc.), provide an explanation.
- If uranium or thorium concentrations (mass or activity) were measured during the investigation, explicitly identify the analytical method, including sample preparation, and use the appropriate BV. (Note that the analyte descriptions "total uranium" and "total thorium" are used when samples have undergone a complete digest before analysis.) If conversions are made between total and isotopic uranium, provide the LANL or PRS data that support the assumptions and conversion factors. Cite the source for the conversion factors (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58093]).

Thirdly, present the detected inorganic chemicals. Address the following items:

- List the inorganic chemical suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0.
- Summarize the frequency of detected inorganic chemicals and nondetected chemicals with detection limits exceeding BVs.
- Include a table following Example Table 2.3-a1, and state that it summarizes all inorganic chemicals detected at the PRS. If the detection limit for a nondetected inorganic chemical exceeds the BV, include the chemical in the table.

EXAMPLE TABLE 2.3-a1

PRS 12-345

FREQUENCY OF DETECTED INORGANIC CHEMICALS

Analyte	Media*	Number of Analyses	Number of Detects	Concentration Range (mg/kg) ^a	Background Value (mg/kg)	Frequency of Detects Above Background Value ^b
Aluminum	Soil	13	13	14590–24600	29200	0/13
Antimony	Soil	13	0	[0.7–1.1]	0.83	DL > BV ^c (for 12/13 results)
Arsenic	Soil	13	13	2.2–7.1	8.17	0/13
Barium	Soil	13	13	68–215	295	0/13
Cadmium	Soil	13	13	0.1–0.3	0.4	0/13
Copper	Soil	13	13	2.9–12.2	14.7	0/13
Lead	Qbt 3	13	13	11.4–30.2	22.3	1/13
Manganese	Soil	13	13	173–562	671	0/13
Mercury	Soil	13	13	[0.02]–0.06	0.1	0/13
Potassium	Soil	13	13	821–2810	3460	0/13
Silver	Soil	13	0	[0.16–0.18]	1	0/13
Sodium	Soil	13	13	148–779	915	0/13
Thallium	Soil	13	0	[0.99–1.1]	0.73	DL > BV ^c
Vanadium	Soil	13	13	8.2–30	39.6	0/13
Zinc	Soil	13	13	23.4–35.6	48.8	0/13

a. Values in square brackets indicate nondetected results.

b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.

c. The detection limit for this analyte exceeded the background value.

*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

Finally, present the inorganic chemicals with concentrations exceeding BVs. Note that inorganic chemicals that exceed BVs should be referred to as "COPCs." All inorganic chemicals retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- Discuss the results of statistical analyses performed to evaluate whether a release has occurred (e.g., distribution shift tests). Data for analytes with concentration ranges that fall below the BV (which represents the upper end of the background distribution) should be plotted to evaluate the data distribution and the comparability of the sample values with the background data set. When the PRS data fall within the range of the LANL background concentrations, they are consistent with and comparable to the background data set. Plots of each data set with appropriate explanations should be provided in Appendix E to demonstrate this point and validate the choice of the background data set selected for comparison with the PRS data. Summarize the statistical analyses here and state that the details are included in Appendix E.
- Consider the following when evaluating nondetected inorganic chemicals with sample-specific detection limits exceeding the BV (e.g., antimony, cadmium, and thallium).
 - Review the data on a PRS-by-PRS basis considering the analytical methods employed and the distribution of detection limits reported.
 - Determine whether the same analytical methods were used for the PRS data and the LANL background data. If different analytical methods were used, discuss the comparability of the methods, including the expected detection limits. If the data sets are not comparable for a particular chemical, carry it forward for further evaluation in Section 2.4, Site Assessments.
 - Determine whether the detection limits for the PRS data fall within or below the range of reported detection limits and detected concentrations from the background data set. If so, explain why the analyte can be eliminated as a COPC.
- Include a table following Example Table 2.3-a2 (or multiple tables as needed), and state that it presents the data for inorganic chemicals with concentrations at or exceeding BVs. Address the following items in the table:
 - Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.
 - Indicate units for all numerical values.
 - Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported with a "<" symbol (e.g., in hard-copy Chemical Science and Technology [CST] reports before April, 1995), use U qualifiers rather than a "<" symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV.

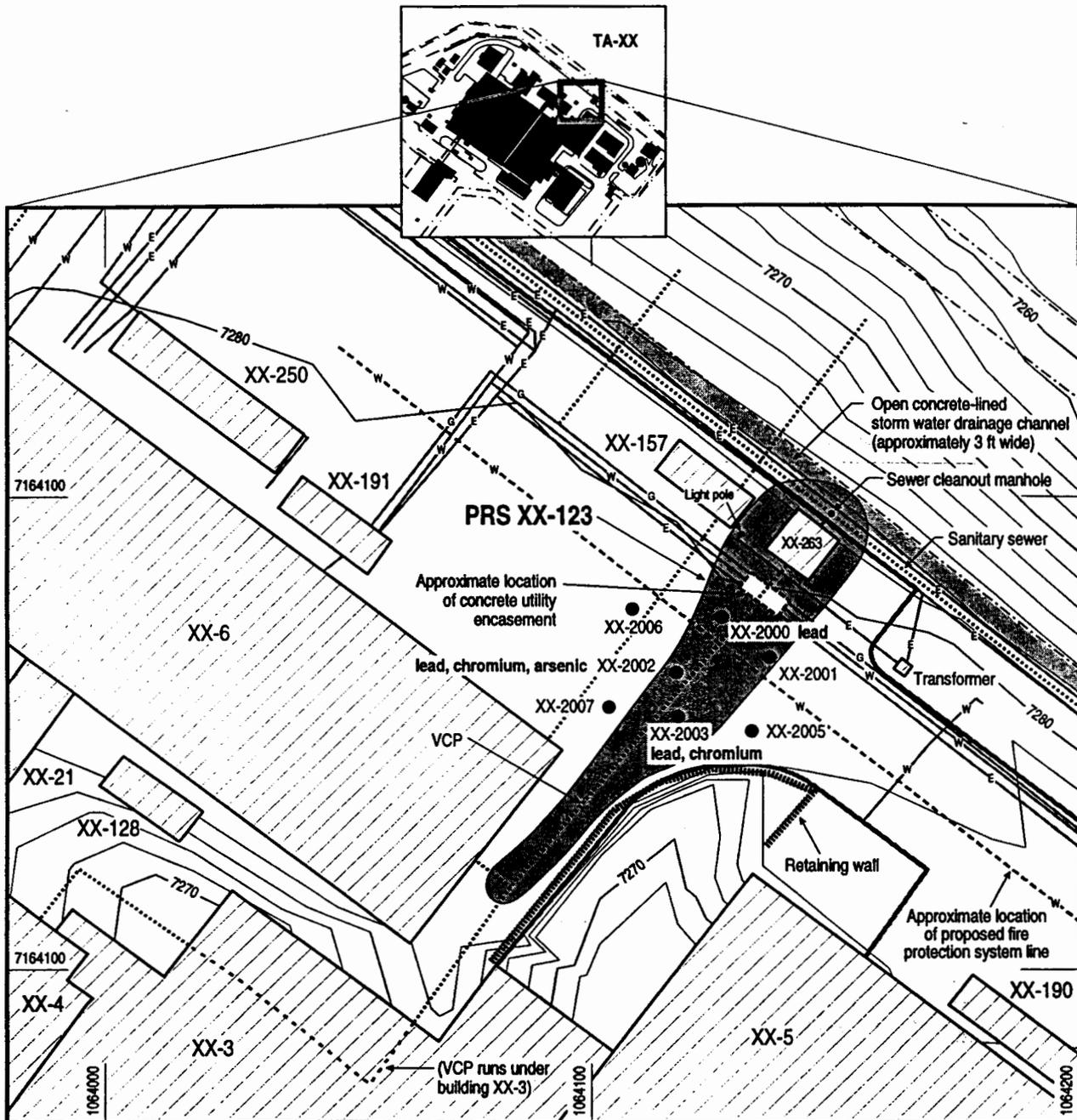
EXAMPLE TABLE 2.3-a2

PRS 12-345

**INORGANIC CHEMICALS WITH
CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES***

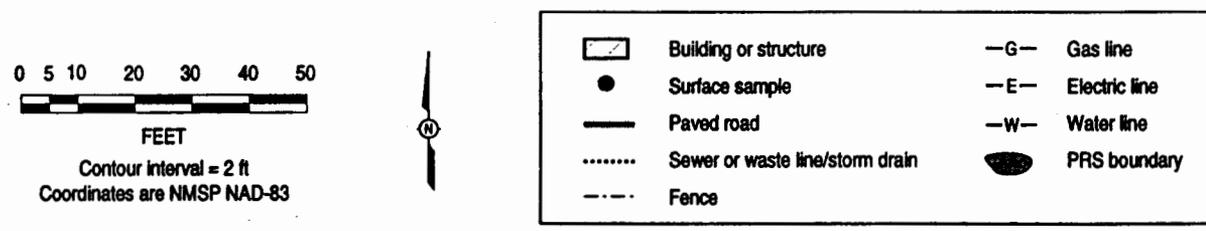
Analyte	Location ID	Sample ID	Sample Concentration (mg/kg) ^b	Background Value (mg/kg)	Media ^a	Depth (ft)
Antimony	12-2000	0212-97-0002	1 (UJ)	0.83	Soil	2-3
	12-2000	0212-97-0003	1 (UJ)		Soil	4.5-5.5
	12-2001	0212-97-0004	0.99 (UJ)		Soil	2-3
	12-2001	0212-97-0005	1.1 (UJ)		Soil	5-6
	12-2002	0212-97-0006	1 (UJ)		Soil	2-3
	12-2002	0212-97-0007	1.1 (UJ)		Soil	5-6
Lead	12-2003	0212-97-0009	30.2	22.3	Qbt 3	2-3
Thallium	12-2000	0212-97-0002	1 (U)	0.73	Soil	2-3
	12-2000	0212-97-0003	1 (U)		Soil	4.5-5.5
	12-2001	0212-97-0004	0.99 (U)		Soil	2-3
	12-2001	0212-97-0005	1.1 (U)		Soil	5-6
	12-2002	0212-97-0006	1 (U)		Soil	2-3
	12-2002	0212-97-0007	1.1 (U)		Soil	5-6
<p>a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.</p> <p>b. Data qualifier flags are defined in the Glossary, Appendix A-2.</p> <p>*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.</p>						
<p>Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.</p>						

- Include a figure (or multiple figures as needed) following Example Figure 2.3-a1. State that the figure summarizes the inorganic chemicals retained as COPCs in the data review. Address the following items:
 - Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
 - Identify locations where inorganic chemicals were retained as COPCs.
 - As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-a3, and state that it summarizes the inorganic chemicals retained as COPCs in the data review. If no inorganic chemicals were retained as COPCs, state so in the text and do not include the table.



Source: FIMAD G106258

F2.3-a1 / XX-123 RFI RPT / 061298



Example Figure 2.3-a1. Sample locations with detected inorganic chemicals in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-a3

PRS 12-345

RESULTS OF INORGANIC DATA REVIEW

Analyte	Media*	Result	Rationale
Antimony	Soil	Eliminated	Not detected in any samples. Eliminated as COPC because sample detection limits fall within the range of nondetected values in the background data set.
Lead	Qbt 3	Retained	Retained as COPC because one sample value exceeded the BV.
Thallium	Soil	Retained	Not detected in any samples. Retained as COPC because sample detection limits exceeded the BV and fall at the upper end of the range of nondetected values in the background data set.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.			
Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.			

- In the data review, do not eliminate chemicals as COPCs based on site history, process knowledge, or the presence or absence of other inorganic chemicals with concentrations exceeding BVs. These decisions should be introduced in Section 2.4, Site Assessments.

(b) Radionuclide Comparison with Background/Fallout Radionuclide Concentrations

This section should present the comparison of radionuclide levels in RFI samples to BVs and/or fallout concentrations, and it should summarize the results of statistical analyses conducted for the radionuclide data review. This section should contain only information relevant to background comparisons. There should be no references to SALs in the text or tables. SAL comparisons should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for radionuclides by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E. Provide rationales for using (or not using)

qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, describe the background/fallout data set. Address the following items:

- Identify the background/fallout data subset with which the PRS data are compared, and cite the source (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58039]). Briefly state the rationale used for selecting the appropriate background/fallout data subset.
- If the analytical results are not directly comparable to the background/fallout data (e.g., if there was a difference in the analytical method or sample preparation, backfill of unknown origin, etc.), provide an explanation. Note that fallout radionuclide activity concentrations are compared to fallout values only if they are representative of surface (0–6 in.) materials.
- If uranium or thorium concentrations (mass or activity) were measured during the investigation, explicitly identify the analytical method, including sample preparation, and use the appropriate BV. (Note that the analyte descriptions "total uranium" and "total thorium" are used when samples have undergone a complete digest before analysis.) If conversions are made between total and isotopic uranium, provide the LANL or PRS data that support the assumptions and conversion factors. Cite the source for the conversion factors (i.e., "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at LANL" [LANL 1998, ER ID 58039]).

Thirdly, present the detected radionuclides. Address the following items:

- List the radionuclide suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0
- Summarize the frequency of detected radionuclides.
- If gamma spectroscopy data are included, follow the procedure outlined in the appropriate SOP (in preparation) for identifying potential contaminants from the gamma spectroscopy results.
- Include a table following Example Table 2.3-b1, and state that it summarizes all radionuclides detected at the PRS. If a BV or fallout concentration is not available for a detected radionuclide, the radionuclide should still be included in the table.

EXAMPLE TABLE 2.3-b1

PRS 12-345

FREQUENCY OF DETECTED RADIONUCLIDES

Analyte	Media*	Number of Analyses	Number of Detects	Concentration Range (pCi/g) ^a	Background Value/Fallout (pCi/g)	Frequency of Detects Above Background Value/Fallout ^b
Plutonium-239,240	Soil	13	1	[-0.003]–0.142	0.054	1/13
Ruthenium-106	Soil	13	1	[0.542] –1.32	NA	1/13
Uranium-234	Soil	13	13	0.22–1.48	2.59	0/13
Uranium-235	Soil	13	5	[0.008]–0.07	0.20	0/13
Uranium-238	Soil	13	13	0.21–0.51	2.29	0/13

a. Values in square brackets indicate nondetected results.
 b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.
 *Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

Finally, present the radionuclides with concentrations exceeding BVs and/or fallout concentrations. Note that radionuclides that exceed BVs should be referred to as "COPCs." All radionuclides retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- Discuss the results of statistical analyses performed to evaluate whether a release has occurred (e.g., distribution shift tests). Data for analytes with concentration ranges that fall below the BV (which represents the upper end of the background/fallout distribution) or fallout concentrations should be plotted to evaluate the data distribution and the comparability of the sample values with the background/fallout data set. When the PRS data fall within the range of the LANL background/fallout concentrations, they are consistent with and comparable to the background/fallout data set. Plots of each data set with appropriate explanations should be provided in Appendix E to demonstrate this point and validate the choice of the background/fallout data set selected for comparison with the PRS data. Summarize the statistical analyses here and state that the details are included in Appendix E.
- Include a table following Example Table 2.3-b2 (or multiple tables as needed), and state that it summarizes the radionuclides with concentrations at or exceeding BVs or fallout concentrations. Address the following items in the table:
 - Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.
 - Indicate units for all numerical values.

- Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported with a "<" symbol (e.g., in hard-copy CST reports before April, 1995), use U qualifiers rather than a "<" symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV or fallout concentration.

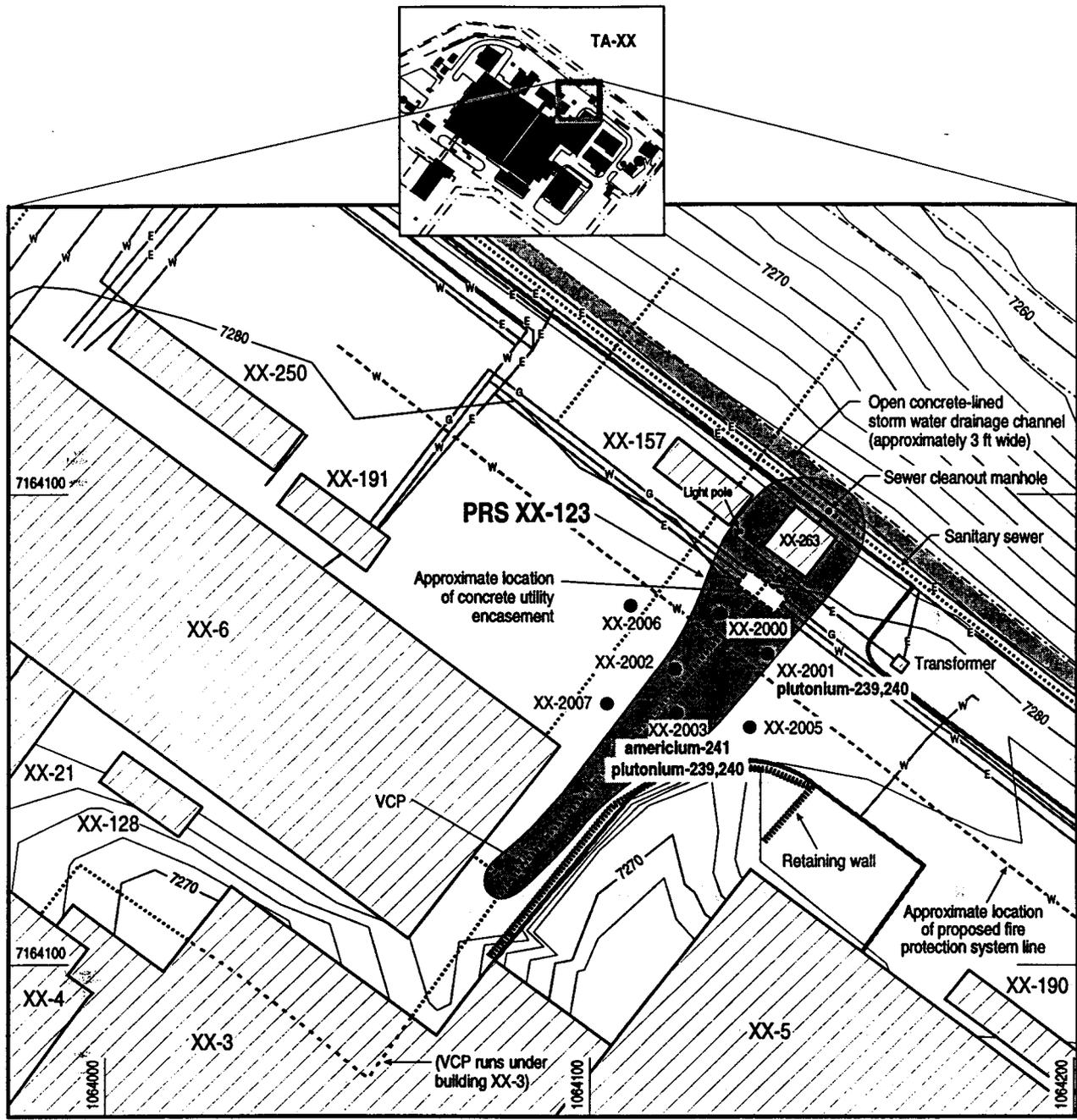
EXAMPLE TABLE 2.3-b2

PRS 12-345

**RADIONUCLIDES WITH CONCENTRATIONS
AT OR EXCEEDING BACKGROUND VALUES/FALLOUT CONCENTRATIONS***

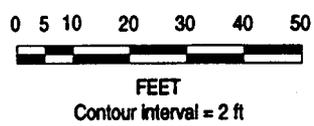
Analyte	Location ID	Sample ID	Sample Concentration (pCi/g)	Background Value/Fallout (pCi/g)	Media*	Depth (ft)
Plutonium-239,240	12-2005	0212-97-0013	0.142	0.054	Soil	2-3
Ruthenium-106	12-2005	0212-97-0013	1.32	NA ^b	Soil	2-3
<p>a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.</p> <p>b. NA = Not applicable.</p> <p>*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.</p>						
<p>Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.</p>						

- Include a figure (or multiple figures as needed) following Example Figure 2.3-b1, and state that it summarizes the radionuclides retained as COPCs in the data review. Address the following items:
 - Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
 - Identify locations where radionuclides were retained as COPCs.
 - As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-b3, and state that it summarizes the radionuclides retained as COPCs in the data review. If no radionuclides were retained as COPCs, state so in the text and do not include the table.



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F2.3-b1 / XX-123 RFI RPT / 061298



	Building or structure		Gas line
	Surface sample		Electric line
	Paved road		Water line
	Sewer or waste line/storm drain		PRS boundary
	Fence		

Example Figure 2.3-b1. Sample locations with radionuclides at or above background values/fallout concentrations in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-b3

PRS 12-345

RESULTS OF RADIONUCLIDE DATA REVIEW

Analyte	Media*	Result	Rationale
Plutonium-239,240	Soil	Retained	Detected in one sample at concentration exceeding baseline fallout value.
Ruthenium-106	Soil	Retained	Detected in one sample; no background value available.
*Indicate the specific soil master horizon or, if appropriate, the geologic subunit.			
Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.			

- In the data review, do not eliminate radionuclides as COPCs based on site history, process knowledge, or the presence or absence of other chemicals with concentrations exceeding BVs and/or fallout concentrations. These decisions should be introduced in Section 2.4, Site Assessments.

(c) Evaluation of Organic Chemicals

This section should summarize the results of the data review for organic chemicals. This section should not refer to SALs in the text or tables. SAL comparisons (or comparisons to one-tenth of SAL for noncarcinogens) should be discussed separately in Section 2.4, Site Assessments.

Introduce the data review for organic chemicals by describing the RFI data. Address the following items:

- State that Appendix D provides an abridged version of the data for the investigation, and that the complete data have been submitted to the AA in electronic format.
- Overview and interpret the QA/QC findings. Discuss data validated as having bias (in direction or relative magnitude), problems with meeting planned detection or quantitation limits, etc. If focused validation resulted in modification of routine data validation qualifiers, state that a detailed discussion of this modification is included in Appendix C, and provide one there.
- Describe conditions that occurred during sampling that may have affected the analytical results (e.g., climatic conditions). State that the details are included in Section 2.3.4.2, Field Investigation.
- Summarize the impacts of problems identified during data validation and/or focused validation and during the data quality assessment. State that a detailed discussion is included in Appendix C and/or Appendix E. Provide rationales for using (or not using) qualified data, and discuss the data adequacy for determining whether a release has occurred at the PRS.

Secondly, present the detected organic chemicals. Note that detected organic chemicals should be referred to as "COPCs." All organic chemicals retained as COPCs require further evaluation in Section 2.4, Site Assessments. Address the following items:

- List the organic chemical suites for which samples were analyzed, and state that a complete list of the analytes for each suite is included in Appendix D-1.0. Explain that this section only includes data for detected analytes, and that results for nondetected analytes are included in Appendix D-2.0
- Summarize the frequency of detected organic chemicals.
- Note that detected organic chemicals may have been measured at concentrations either greater than or less than their respective estimated quantitation limits (EQLs). The EQL is not equivalent to an MDL and may be five to ten times greater than the minimum detection limit (MDL) (see EPA SW-846). EQLs and MDLs are both analyte specific and sample matrix dependent. Organic chemicals that were detected at concentrations less than the sample EQL must be included in this data review.
- Include a table following Example Table 2.3-c1, and state that it summarizes the detection frequency for detected organic chemicals at the PRS.

EXAMPLE TABLE 2.3-c1

PRS 12-345

FREQUENCY OF DETECTED ORGANIC CHEMICALS

Analyte	Media ^a	Number of Analyses	Number of Detects	Concentration Range (mg/kg) ^a	EQL (mg/kg)	Frequency of Detects ^b
Acetone	Soil	13	3	[0.020]–0.088	0.020	3/13
Toluene	Soil	13	2	[0.005]–0.008	0.005	2/13

a. Values in square brackets indicate nondetected results.
b. Value is the ratio of the number of detected values exceeding the BV to the number of analyses.
* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.

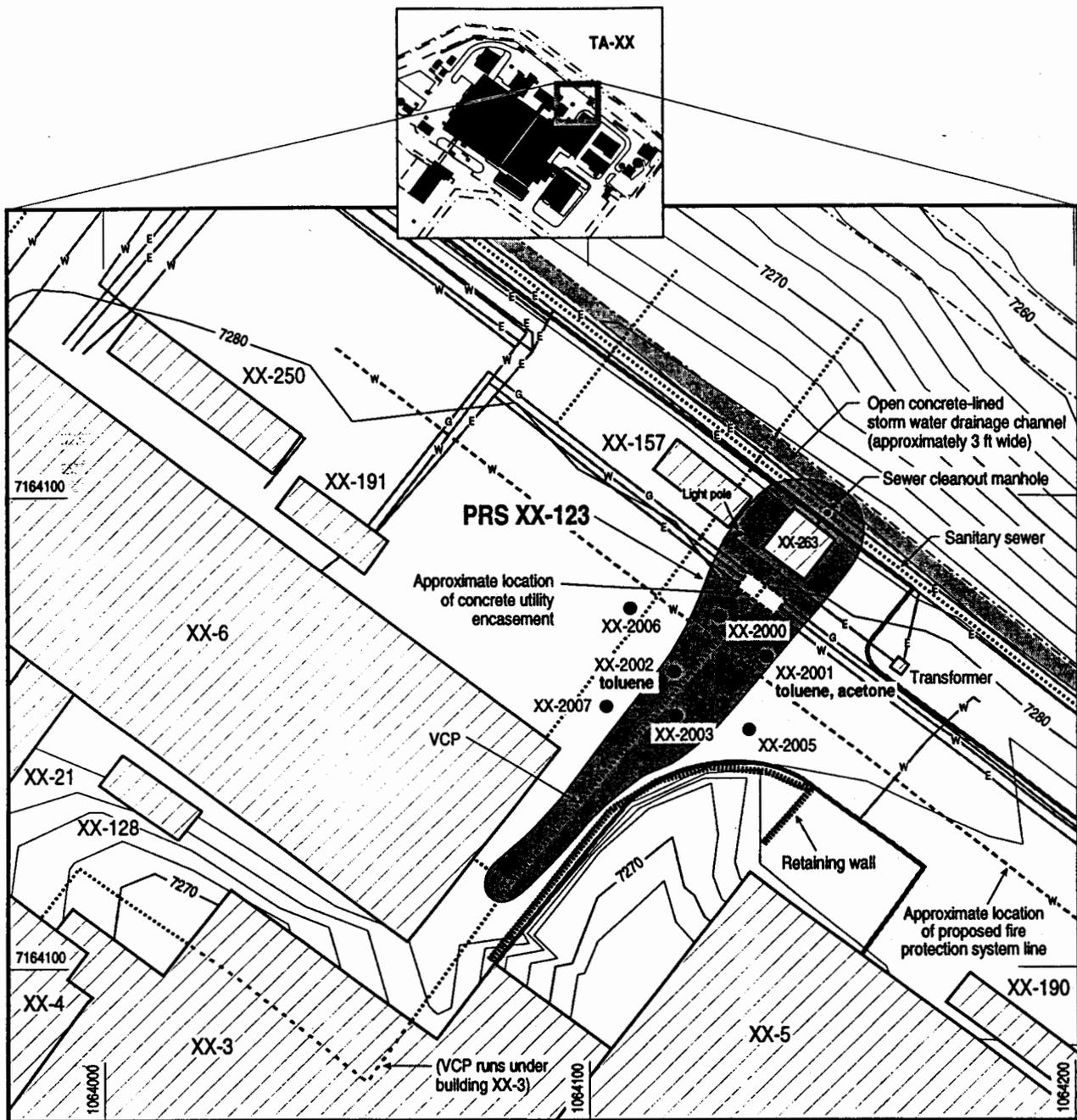
- Include a table following Example Table 2.3-c2 (or multiple tables as needed), and state that it summarizes the results for detected organic chemicals. Address the following items in the table:
 - Use a footnote to refer to the table in Appendix C that shows the analytical method ID and method description, and to the table in Appendix D that compiles the matrix-specific detection and/or quantitation limits.
 - Indicate units for all numerical values.
 - Include qualifiers assigned during routine and/or focused data validation (not analytical laboratory qualifiers). If results for nondetected analytes were reported with a "<" symbol (e.g., in hard-copy CST reports before April, 1995), use U qualifiers rather than a "<" symbol. Do not include chemicals for which all data are U-qualified unless one or more of the U-qualified values exceeds the BV.

- Organic chemicals that are detected at concentrations less than the EQL value may be J-qualified by the laboratory. If the J-qualifier flag is not modified during focused validation, include it in the table and provide an explanation in the text.

EXAMPLE TABLE 2.3-c2
PRS 12-345
DETECTED ORGANIC CHEMICALS*

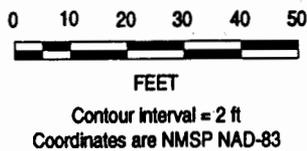
Analyte	Location ID	Sample ID	Sample Concentration (mg/kg) ^b	Media ^a	Depth (ft)
Acetone	12-2000	0212-97-0002	0.088	Soil	2-3
	12-2005	0212-97-0014	0.026	Soil	5-6.5
	12-2005	0212-97-0015	0.057	Soil	5-6.5
Toluene	12-2002	0212-97-0006	0.007 (J)	Soil	2-3
	12-2004	0212-97-0011	0.008	Soil	2-3
<p>a. Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.</p> <p>b. Data qualifier flags are defined in the Glossary, Appendix A-2.</p> <p>* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.</p>					
<p>Note: The information in this table is example data. Footnotes designated by letters are part of the example. Footnotes designated by asterisks are guidance for preparing the table.</p>					

- Include a figure (or multiple figures as needed) following Example Figure 2.3-c1, and state that it summarizes the detected organic chemicals retained as COPCs in the data review. Address the following items:
 - Delineate the boundaries of the PRS, individually identifying all PRS components and associated structures and features.
 - Identify locations where organic chemicals were retained as COPCs.
 - As appropriate, identify the location or sample ID number for each data point included in the figure (e.g., location IDs may be more appropriate for borehole sampling, while sample IDs may be more appropriate for surface samples).
- Include a table following Example Table 2.3-c3, and state that it summarizes the detected organic chemicals retained as COPCs in the data review. If no organic chemicals were retained as COPCs, state so in the text and do not include the table.



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	Building or structure		Gas line
	Surface sample		Electric line
	Paved road		Water line
	Sewer or waste line/storm drain		PRS boundary
	Fence		

Example Figure 2.3-c1. Sample locations with detected organic chemicals in the vicinity of PRS XX-123.

EXAMPLE TABLE 2.3-c3

PRS 12-345

RESULTS OF ORGANIC DATA REVIEW

Analyte	Media*	Result	Rationale
Acetone	Soil	Retained	Detected in three of 13 samples.
Toluene	Soil	Retained	Detected in two of 13 samples.

* Indicate the specific soil master horizon or, if appropriate, the geologic subunit.

Note: The information in this table is example data. Footnotes designated by asterisks are guidance for preparing the table.

- In the data review, do not eliminate chemicals as COPCs based on site history or process knowledge. These decisions should be introduced in Section 2.4, Site Assessments.

(d) Other Applicable Data

This section should provide data gathered during the RFI that are not covered in Sections 2.3.4.3(a), (b), or (c). Address the following items:

- Summarize and provide core logs, flow rates, geophysical reconstructions, etc. Use judgment as to format. State that details are included in Appendix D-3.0, Other Applicable RFI Results, and include the details there (e.g., foot-by-foot neutron logging results or fracture density calculations, daily flow rates, raw geophysical data, etc.).
- If field screening samples collected during the RFI are used to support the PRS decision (e.g., they are used for determining the extent of contamination), discuss the results and defend their adequacy for supporting the decision. If field screening samples were paired with fixed-laboratory analyses, discuss and interpret the correlation, if any, between the results. State that fixed-laboratory analytical results are presented in Tables 2.3-a2, 2.3-b2, and 2.3-c2. Summarize the QA/QC findings for field screening data, and state that details are included in Appendix C.

2.3.5 Revised Site Conceptual Model

Sections 2.3.5.1 and 2.3.5.2 should present the revised site conceptual model for contaminant occurrence and distribution at the PRS. Based on information from the RFI, these sections should present revisions or refinements to the preliminary conceptual model in Section 2.3.3.

The components of a conceptual model listed in Sections 2.3.5.1 and 2.3.5.2 are not universally applicable at all PRSs. For example, the level of detail in discussing environmental fate processes will depend on their impact to human and ecological receptors. Authors should use judgement to ensure that the level of detail in Sections 2.3.5.1 and 2.3.5.2 is appropriate to adequately address the complexity of the PRS and support the available information.

Sections 2.3.5.1 and 2.3.5.2 should accomplish the following:

- Present the refined understanding of the nature and vertical and horizontal extent of contamination.

- Provide an interpretation of the data distribution. When data are in conflict with the hypotheses stated in the preliminary conceptual model, provide an explanation.
- Provide a logical basis for conducting the site assessments described in Section 2.4, Site Assessments.
- Provide a conceptual framework for assessing data sufficiency and interpreting spatial and temporal trends in the analytical data.
- Both the conceptual model and the data should support the PRS decision presented in Section 2.5, Conclusions and Recommendations.

2.3.5.1 Nature and Extent of Contamination

This section should describe the nature (type) of contaminants at the PRS, and the spatial and/or temporal trends in contaminant concentrations in sampled environmental media.

Summarize relevant information about the operational history and physical setting from Section 2.2, Description and Operational History, and Appendix B-1.0, Operational History and Land Use. This may include the following:

- the boundaries of the investigation (e.g., the toe of the colluvial slope below an outfall, a topographic feature constraining migration, the boundary of an adjacent investigation or remedial action, etc.);
- the time period of releases at the PRS;
- the estimated types, quantities, and physical form of environmental media potentially receiving contaminant releases;
- the topography, soil properties, vegetative features, and hydrological properties of the PRS (if relevant, identify alluvial or perched aquifers; the distance to the regional aquifer; the locations of nearby springs, seeps, etc.; and the potential hydraulic interconnections between these springs, seeps, etc.); and
- anthropogenic activities that may have disturbed the PRS subsequent to releases.

Describe the current understanding of the nature and extent (both vertical and horizontal) of COPCs carried forward from Section 2.3.4.3, Data Review. This may include the following items:

- when appropriate and feasible, a graphical representation of the extent of contamination (e.g., a cross section showing vertical definition and a topographic map showing horizontal definition);
- a discussion of the adequacy of sample analyses to identify potential contaminants at the PRS;
- a discussion of whether the observed types and locations of contaminants are consistent with the preliminary conceptual model; and
- an analysis of spatial and/or temporal trends to establish extent, which might include answering questions such as whether complicating factors (e.g., variability in soil characteristics such as organic carbon content) are potentially affecting the observed

spatial distribution. State that Appendix E includes the specific statistical methods and calculations employed.

If statistical methods (e.g., kriging or some other method) are used to model contaminant concentrations, briefly discuss the methods used and why they were used. Address the following items:

- Discuss uncertainties inherent in these statistical methods and in the modeling results.
- State that a detailed description of the methodology is included in Appendix E and/or the IWP.
- If applicable, include isopleth maps of contaminant distributions here or, if they interfere with the flow of the text, state that they are in Appendix E and include them there.

Describe information gaps or uncertainties in the site conceptual model. Address the following items:

- Identify where the current understanding of the PRS remains incomplete or limited by the quantity, location, or quality of the data; the spatial variability of PRS contamination; incomplete site history; etc.
- If the horizontal and vertical extent of contamination are not fully defined by this investigation, state so and discuss the necessity and feasibility of collecting further data to adequately define the extent. Do not discuss recommendations resulting from this assessment in this section. Discuss them in Section 2.5, Conclusions and Recommendations.

2.3.5.2 Environmental Fate

This section should identify and discuss the chemical and physical aspects of environmental fate.

Discuss the consequences that environmental distribution of contaminants had on the sampling activities.

Identify and discuss the chemical and physical aspects of transport and partitioning among various environmental media. Discuss chemical and biological transformation and degradation in various environmental media, including what is known about chemical speciation, biotic and abiotic mechanisms of environmental transformation, and transfer of contaminants among environmental media. (The bioavailability of contaminants following intake should be discussed in the human health and ecological risk assessments in Sections 2.4.3.1 and 2.4.3.2 rather than in the conceptual model.) In addition, address the following items as appropriate:

- Predict and identify chemical valence states and associated complexes based on pH and redox conditions.
- Discuss the susceptibility of contaminants to chemical degradation such as hydrolysis and photolysis and the biological significance of possible breakdown products.
- Discuss the susceptibility of contaminants to biotic (microbial) degradation and the biological significance of possible breakdown products.
- Discuss the mobility (e.g., adsorption, solubility, volatility, etc.) of contaminants in relevant media. Discuss the likely fate of contaminants among these media and, if possible, their residence time in the environment.

- Describe and interpret the chemical characteristics affecting contaminant migration (including vapor pressure, solubility, organic carbon partitioning coefficient, etc.). This discussion may also include volatilization potential for individual contaminants, sorption, desorption, and bioconcentration in biota.
- Describe relevant atmospheric parameters including wind roses, measured airborne particulate concentrations, etc.
- Discuss vertical migration in the saturated zone and erosion of potentially contaminated soil as potential contaminant transport pathways.
- Evaluate the infiltration and leaching of contaminants into soil and/or tuff containing surface water. This evaluation may include, if applicable, retardation characteristics, fracture flow dynamics, etc.
- Discuss groundwater transport parameters, if applicable, such as flow direction, hydraulic conductivity, retardation factors, etc.
- Discuss the potential for transport in surface water/runoff including sheet flow and channels as identified in LANL-ER-AP-4.5. State that the complete LANL-ER-AP-4.5 assessment is included in Appendix B-4.2.1.
- Discuss the potential for uptake transport of contaminants in the food chain with particular emphasis on biomagnification.
- In a generic sense, identify pathways by which exposure can occur for both human and ecological receptors.

If relevant, discuss in detail the point at which the Canyons Focus Area (or other potential analysis area) will supplement or take over the investigation. Provide the rationale for the hand off.

2.4 Site Assessments

2.4.1 Summary

This section should list the assessments performed and briefly summarize each assessment. The results of each assessment should be summarized in no more than a few sentences. Follow the example below:

"A human health screening assessment, a human health risk assessment, and an ecological screening assessment were conducted for PRS 12-345. The human health screening assessment identified one COPC, lead. A human health risk assessment was performed, and the results indicate that lead does not exceed the target risk level. No chemicals of potential ecological concern (COPECs) were identified in the ecological screening assessment. Therefore, no ecological risk assessment was performed.

A LANL-ER-AP-4.5 surface water assessment was also conducted for PRS 12-345. The results of this assessment indicate a low erosion potential (see Appendix B-4.2.1). No groundwater issues have been identified at the site.

A UST assessment was not performed because it is not applicable for PRS 12-345."

If no COPCs were carried forward from the data review and no site assessments were performed, state so. Follow the example below:

"No COPCs were identified in the Data Review (see Section 2.3.4.3). Therefore, human health and ecological screening and risk assessments were not performed for this PRS."

2.4.2 Screening Assessments

Sections 2.4.2.1 and 2.4.2.2 should evaluate current and reasonable potential future risk to human and ecological receptors from COPCs retained in the data review. In this section, address the following items:

- State that a human health screening assessment is presented in Section 2.4.2.1 and an ecological screening assessment is presented in Section 2.4.2.2.
- State that the human health and ecological screening assessments follow the Hazardous and Radioactive Materials Bureau (HRMB) Risk-Based Decision Tree (NMED 1998, ER.ID 57761) and appropriate EPA guidance. Cite the appropriate NMED and EPA documents.

If no COPCs were carried forward from data review, state that this section is not applicable.

2.4.2.1 Human Health

This section should present the human health screening assessment. If a human health risk assessment is performed, complete only parts (a) and (b). If no human health risk assessment is performed, complete parts (a) through (d).

(a) Scoping

Describe the selection of current and reasonable potential future land-use assumptions and receptors, including exposure pathways. Provide the supporting rationale. (Note that the phrase "professional judgment" is insufficient as the only supporting justification.)

(b) Screening Evaluation

Perform the screening evaluation in accordance with the HRMB Risk-Based Decision Tree and appropriate EPA guidance. Use the appropriate LANL ER screening levels (consult with an ER Project risk assessor to identify the appropriate SALs). Note that EPA guidance requires that when two or more noncarcinogens are present, one-tenth of the screening level must be used.

The COPCs addressed in this evaluation should be those identified in Section 2.3.4.3, Data Review.

(c) Uncertainty Analysis

If no human health risk assessment is performed, this section should include a qualitative uncertainty analysis to assist the reviewer in interpreting the screening outcome. This analysis should provide supporting rationale for the recommendations offered in Section 2.5, Conclusions and Recommendations.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that the selected receptors will be exposed, etc.);

- the data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.); and
- environmental fate and transport models.

In addition, the following sources should be addressed if they impact the PRS decision:

- constituent toxicity values (or the lack thereof) and interactions;
- intake/exposure parameters and their assumed values; and
- multiple pathway exposure assumptions.

If a human health risk assessment is performed, omit this section.

(d) Interpretation

If no human health risk assessment is performed, summarize the human health screening assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, leading to conclusions about the risk to human receptors, and supporting the recommendations in Section 2.5, Conclusions and Recommendations.

If a human health risk assessment is performed, omit this section.

2.4.2.2 Ecological

This section should present the ecological screening assessment. Complete parts (a) through (d).

(a) Scoping

Summarize the results of the preliminary ecological evaluation of the PRS, referencing relevant historical information (e.g., site biotic composition, potential receptors, toxicant pathways, etc.). Summarize relevant information from site visits and from the ecological scoping checklist. State that the completed scoping checklist is included in Appendix F-2.0. Address the following items:

- Summarize the ecological exposure model.
- Identify the presence of threatened and endangered species or other populations of special concern.

(b) Screening Evaluation

Perform the screening evaluation in accordance with the HRMB Risk-Based Decision Tree (NMED 1998, ER ID 57761). Present the results of hazard quotient and hazard index calculations and identify COPECs. Use a table if it facilitates the presentation (use judgment as to table format).

(c) Uncertainty Analysis

This section should include a qualitative uncertainty analysis to assist the reviewer in interpreting the screening outcome. This analysis should provide supporting rationale for the recommendations offered in Section 2.5, Conclusions and Recommendations.

The uncertainty analysis should focus on the key sources of uncertainty. Relevant sources of uncertainty may include but are not limited to the following:

- the presence of screening receptors (or receptors in the respective feeding guild) and their relevance to the site biota;
- the environmental monitoring data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- maximum contaminant concentration per media (i.e., the likelihood that the maximum represents a reasonable or true maximum exposure concentration);
- models used to evaluate environmental fate and transport of contaminants;
- evaluated exposure pathways;
- exposure pathways eliminated from consideration (e.g., dermal contact, inhalation exposure pathway, etc.);
- chemical form or speciation of constituents present at the site;
- constituent disposition in the body and constituent uptake or transfer factor values used;
- other exposure parameter values used (e.g., size of the contaminated area relative to the receptor home range);
- constituent toxicity values and applied safety/uncertainty factors;
- cumulative (or additive) effects from exposure to multiple contaminants and through multiple pathways and routes;
- contaminant interactions (e.g., synergistic, antagonistic, etc.) other than additive; and
- other environmental factors (e.g., extreme temperatures, drought, diet, etc.) contributing to exposure and constituent toxicity.

(d) Interpretation

Summarize the ecological screening assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, leading to conclusions about the risk to ecological receptors, and supporting the recommendations in Section 2.5, Conclusions and Recommendations.

2.4.3 Risk Assessments

Sections 2.4.3.1 and 2.4.3.2 should evaluate current and reasonable potential future risk to human and ecological receptors from COPCs retained in the data review. In this section, address the following items:

- State that a human health risk assessment is presented in Section 2.4.3.1 and an ecological risk assessment is presented in Section 2.4.3.2.
- State that the human health and ecological risk assessments follow the HRMB Risk-Based Decision Tree (NMED 1998, ER ID 57761) and appropriate EPA guidance. Cite the appropriate NMED and EPA documents.

If no COPCs were carried forward from data review, state that this section is not applicable.

2.4.3.1 Human Health

(a) Selection of Chemical(s) of Potential Concern

Describe how COPCs were selected for the human health risk assessment. Cite all documents that provided guidance for this selection.

(b) Exposure Assessment

Address the following items:

- Describe the appropriate land-use assumptions, including receptors, exposure pathways, and PRS-specific exposure parameters. Provide the supporting justification.
- Refer to relevant portions of the revised site conceptual model (Section 2.3.5).
- Cite Risk Assessment Guidance for Superfund (RAGS) and any other guidance for conducting the exposure assessment.
- Before using probabilistic methods in addition to deterministic calculations, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov) who will discuss the technical basis and applicability of these methods with the AA.
- Provide the results of modeling for predicting exposure point concentrations at different times, locations, or media than those associated with the available analytical data.

(c) Toxicity Assessment

Provide the source of the toxicity values used in the risk assessment, and summarize the derivation of these values.

Provide a toxicity profile for each COPC including, but not limited to the following:

- an assessment of contaminant absorption rates;
- an evaluation of contaminant distribution and clearance rates;
- a discussion of ambient environmental contaminant sources and normal dietary intake; and
- a toxicity evaluation consisting of a discussion of critical effects; extrapolation procedures, safety/uncertainty factors, and their technical basis; an assessment of the strength of studies underlying toxicity values; and the potential for synergistic, additive, or antagonistic effects with other PRS contaminants.

(d) Risk and Dose Characterization

Quantify risk to human health by calculating cancer risk, annual dose rate, and/or hazard quotients/indices. Risk associated with exposure to background levels of COPCs may also be calculated to assess the relative impact of PRS contamination.

(e) Uncertainty Analysis

Provide a qualitative and/or quantitative uncertainty analysis and a supporting rationale for the recommendations in Section 2.5, Conclusions and Recommendations.

Identify key model parameter assumptions (based on professional judgment and/or numerical sensitivity analyses) contributing to risk and/or dose. If more than one land-use scenario is used in the risk assessment, interpret the significance of the variability in risk and/or dose estimates. The results of the uncertainty analysis should be incorporated into the risk characterization to form the basis for the conclusions and recommendations in Section 2.5.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that selected receptors will be exposed, etc.);
- data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- environmental fate and transport models;
- constituent toxicity values (or the lack thereof) and interactions;
- intake/exposure parameters and their assumed values; and
- multiple pathway exposure assumptions.

(f) Interpretation

Summarize the findings of the human health risk assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, supporting conclusions regarding the risk to human receptors at the PRS. Note that all chemicals retained after the risk assessment should be referred to as chemicals of concern (COCs).

2.4.3.2 Ecological

(a) Selection of Chemical(s) of Potential Concern

Describe how COPECs were selected for the ecological risk assessment. Cite all documents that provided guidance for this selection.

(b) Exposure Assessment

Address the following items:

- Describe the appropriate land use assumptions, including habitats and food webs, receptors, exposure pathways, and PRS-specific exposure parameters. Provide the supporting justification.
- Refer to relevant portions of the revised site conceptual model discussed in Section 2.3.5.

- Cite Ecological Risk Assessment Guidance for Superfund (ERAGS) and any other guidance for conducting the exposure assessment.
- Before using probabilistic methods in addition to deterministic calculations, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov) who will discuss the technical basis and applicability of these methods with the AA.
- Provide the results of modeling for predicting exposure point concentrations at different times, locations, or media than those associated with the available analytical data.

(c) Toxicity Assessment

Provide the source of toxicity values used in the risk assessment, and summarize the derivation of these values.

Provide a toxicity profile for each COPEC including, but not limited to the following:

- an assessment of absorption/uptake rates and bioavailability;
- an evaluation of accumulation and clearance rates;
- a discussion of ambient environmental sources; and
- a toxicity evaluation consisting of a discussion of critical effects; extrapolation procedures, safety/uncertainty factors, and their technical basis; an assessment of the strength of studies underlying toxicity values; and the potential for synergistic, additive, or antagonistic effects with other PRS contaminants.

(d) Risk and Dose Characterization

Quantify risk to ecological receptors. Risk associated with exposure to background levels of COPECs may also be calculated to assess the relative impact of PRS contamination.

(e) Uncertainty Analysis

Provide a qualitative uncertainty analysis and a supporting rationale for the recommendations in Section 2.5, Conclusions and Recommendations.

Identify key model parameter assumptions (based on professional judgment and/or numerical sensitivity analyses) contributing to risk and/or dose. The results of the uncertainty analysis should be incorporated into the risk characterization to form the basis for the conclusions and recommendations in Section 2.5.

At a minimum, the uncertainty analysis should address the following key sources of uncertainty:

- definition of the PRS physical setting (e.g., exposure assumptions such as the likelihood of exposure pathways and land uses actually occurring, the likelihood that selected receptors will be exposed, etc.);
- data set (e.g., media-contaminant distribution, use of laboratory or other qualified data, lack of quantitation, high detection limits, etc.);
- environmental fate and transport models;
- constituent toxicity values (or the lack thereof) and interactions;

- intake/exposure parameters and their assumed values;
- multiple pathway exposure assumptions; and
- other ecological factors identified in the scoping check list.

(f) Interpretation

Summarize the findings of the ecological risk assessment with an emphasis on the results of the uncertainty analysis. Interpret these results, supporting conclusions about the risk to ecological receptors at the PRS. Discuss potential effects on populations/communities. Note that all chemicals retained after the risk assessment should be referred to as COCs.

2.4.4 Other Applicable Assessments

2.4.4.1 Surface Water

The intent of this section is to facilitate the Surface Water Quality Bureau's review of surface water issues at the PRS. This section should completely describe the surface water issues, investigations, and results for the PRS. Address the following items:

- Summarize parts A and B of the LANL-ER-AP-4.5 Surface Water Assessment for the PRS (be sure to include the score from part B). State that Parts A and B of the LANL-ER-AP-4.5 Surface Water Assessment are included in Appendix B-4.2.1, and include them there.
- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- Summarize activities in the field investigation that are relevant to surface water, and state that details are included in Section 2.3.4.2, Field Investigation.
- Provide a table that includes all surface water chemistry data (e.g., storm water sampling results, information about debris in a watercourse, etc.). Use judgment as to table format. Include field measurements of pH, conductivity, temperature, etc. Indicate whether samples were filtered or unfiltered. Include the applicable surface water standards for the constituents presented in the table.
- State that data from matrixes other than water are presented in Section 2.3.4.3, Data Review, and/or Appendix D-2.0, RFI Analytical Results. Summarize any relevant results from these data.
- Summarize the portions of the revised site conceptual model that are relevant to an understanding of surface water, and state that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize information from the human health and ecological evaluations that is relevant to surface water, and state that details are included in Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and/or 2.4.3.2.

- Discuss decisions presented in the document that are relevant to surface water, and discuss the resulting conclusions and recommendations. Discuss whether applicable surface water standards have been exceeded. Briefly discuss any proposed surface water investigations.
- Provide a Water Quality Control Commission (WQCC) 1203 Release/Discharge Notification date when applicable, and describe the subsequent corrective action.
- Include figures and tables as needed to facilitate this discussion. Use judgment as to format.

2.4.4.2 Groundwater

The intent of this section is to facilitate the Groundwater Quality Bureau's review of groundwater issues at the PRS. This section should completely describe the groundwater issues, investigations, and results for the PRS. Address the following items:

- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included in Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- Summarize activities in the field investigation that are relevant to groundwater, and state that details are included in Section 2.3.4.2, Field Investigation.
- Provide a table that includes all groundwater chemistry data. Use judgment as to table format. Indicate whether samples were filtered or unfiltered. Include the applicable groundwater standards for the constituents presented in the table.
- State that data from matrixes other than water are presented in Section 2.3.4.3, Data Review, and/or Appendix D-2.0, RFI Analytical Results. Summarize any relevant results from these data.
- Summarize the portions of the revised site conceptual model that are relevant to an understanding of groundwater, and state that details are included in Section 2.3.5, Revised Site Conceptual Model.
- Summarize information from the human health and ecological evaluations that is relevant to groundwater, and state that details are included in Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and/or 2.4.3.2.
- Discuss decisions presented in the document that are relevant to groundwater, and discuss the resulting conclusions and recommendations. Discuss whether applicable groundwater standards have been exceeded. Briefly discuss any proposed groundwater investigations.
- Include figures and tables as needed to facilitate this discussion. Use judgment as to format.

2.4.4.3 Underground Storage Tanks

The annotation for this section is currently under negotiation with the UST Bureau. Please consult with Linda Nonno (5-0725, lnonno@lanl.gov) to ensure that changes to this section are reflected in your document. A finalized version will be distributed once it is available.

The intent of this section is to facilitate the UST Bureau's review of UST issues at the PRS. This section should completely describe issues that are relevant to UST investigations, and it should summarize the results for the PRS. Address the following items:

- State that a description of the PRS, the operational history, and the PRS-specific topography, surface geology, geomorphology, and hydrology is included in Section 2.2, Description and Operational History. Also refer to relevant portions of Appendix B, Operational and Environmental Setting. Summarize any relevant information from these sections.
- State that the regulatory history of the PRS, including all mandatory UST notifications and reporting, is described in Appendix G-1.0, Documentation of Regulatory History.
- Summarize activities in the field investigation that are relevant to UST investigations, and state that details are included in Section 2.3.4.2, Field Investigation.
- State that data from sampling and analysis of soil, sediments, surface water, and groundwater are presented in Section 2.3.4.3, Data Review; Section 2.4.4.1, Surface Water; Section 2.4.4.2, Groundwater; and/or Appendix D-2.0, RFI Analytical Results.
- Discuss the decisions presented in the document, how they are supported by the data, and the results of those decisions relevant to UST investigation and removal. Cite the New Mexico UST Regulations (20 NMAC 5).
- Summarize information from the human health and ecological evaluations that is relevant to the investigation and remediation of the PRS, and refer to Sections 2.4.2.1, 2.4.2.2, 2.4.3.1, and 2.4.3.2 for the details of these assessments.
- Summarize Parts A and B of the LANL-ER-AP-4.5 assessment for the PRS, and state that the LANL-ER-AP-4.5 assessment for this PRS is included in Appendix B-4.2.1.

2.4.4.4 Other

This section should include relevant information for other applicable assessments such as air quality, solid waste, etc.

2.5 Conclusions and Recommendations

This section should provide the complete conclusions and recommendations for the PRS, referencing the PRS-specific data review, screening assessments, risk assessments, and any other applicable assessments. Address the following items:

- In giving the recommendations for the PRS, indicate that a formal letter will be sent to the AA at a later date requesting the recommended action.
- Develop conclusions to provide a comprehensive and logical rationale for the recommendations. If a risk assessment was not performed, the rationale supporting the

decisions should put the quantitative screening results (i.e., BV comparisons, evaluation of organic chemicals, and SAL comparisons) into a logical framework that interprets the results from the perspective of the revised site conceptual model describing contaminant distribution and potential human and ecological exposures at the PRS.

- Possible factors to be addressed in the rationale may include the following:
 - **Analytical Issues.** Is the analyte list complete? Do accuracy and/or precision problems impact PRS recommendations?
 - **Spatial Characterization.** Has the location of the PRS been positively identified? Are the number, location, and depth of soil samples adequate to determine nature and extent? (Consider patterns observed in the data, possible contaminant redistribution since the time the PRS was active, release mechanisms, volumes of releases, etc.) Should additional media be sampled? Are the analytical data biased high or low?
 - **Environmental Fate.** (Related to spatial characterization.) Could chemical or biological degradation and/or re-speciation impact decisions? Could chemical adsorption, precipitation, dissolution, etc., impact redistribution in the environment? How could PRS-specific hydrologic and geologic conditions impact contaminant transport and hence PRS decisions?
 - **Exposure and Toxicity.** How do PRS location, accessibility, and current and potential future land use affect PRS decisions? How do assumptions concerning exposure mechanisms and model parameters impact PRS decisions? How does uncertainty in contaminant toxicity impact PRS decisions?
- If the above factors were addressed in previous sections of this report (in particular if a risk assessment was performed), a brief summary of these evaluations and how they support the final recommendations is sufficient. Minimize the introduction of new information. This section should primarily interpret information from previous sections and connect it into a logical explanation to support the conclusions derived and the recommendations proposed.
- Clearly state the recommendation(s) for proposed actions and summarize the justification for these proposals.
- Provide a projected schedule of anticipated activities associated with PRSs not recommended for no further action (NFA). Provide a projected date for the submission of a request for permit modification to add PRSs to the HSWA Module of the RCRA permit. If deferral of a PRS is necessary, request AA approval.

3.0 PRS Y-PRS Y DESCRIPTOR

4.0 PRS Z-PRS Z DESCRIPTOR

Continue adding sections following this numbering scheme until all PRSs are addressed. Number the following section according to the next consecutive number.

X.0 REFERENCES

Include the following text before the reference list:

"The following list includes all of the documents cited in the body and appendixes of this RFI report. The parenthetical information following each reference provides the author, publication date, and ER ID number, and, if applicable, the LANL ER Project Reference Library reference set number and tab number for each document. This information is also included in the citations in the text. This information can be used to locate the documents on this list as follows.

The ER ID number is assigned by the Laboratory's ER Project to track material associated with LANL PRSs. This number can be used to locate the actual document at the ER Project's Records Processing Facility. All cited documents are assigned ER ID numbers.

The reference set number and tab number are assigned to locate material in the LANL ER Project Reference Library, which is housed at NMED HRMB, DOE, and the ER Project Office. This library is a living document that was developed to insure that the AA has all of the necessary material to review the decisions and actions proposed in documents submitted by the Laboratory's ER Project. Documents previously submitted to the AA and documents that are specific to this RFI report are not included in the Reference Library, and their citations do not include reference set and tab numbers. Documents that are specific to this RFI report are attached in Appendix G-2.0, Referenced Documents."

Following this introduction, include the reference list. The reference list below is for documents referenced in this annotated outline. For guidance on formatting references, consult with an ER Project technical editor.

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. **(EPA 1990, ER ID 01585)**

EPA (US Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94-013, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID 48639)**

EPA (US Environmental Protection Agency), December 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (ILMO 1.0) and Low Concentration Water (OLCO 1.0)," EPA/540/R/94/090, Office of Solid Waste and Emergency Response, Washington, DC. **(EPA 1994, ER ID 48640)**

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work – Analytical Support," Revision 2, RFP No. 9-XS1-Q4257, Los Alamos, New Mexico. **(LANL 1995, ER ID 49738)**

LANL (Los Alamos National Laboratory) 1995. "Site Development Plan, Annual Update 1995," Los Alamos National Laboratory Publication, LALP-95-113, Los Alamos, New Mexico. **(LANL 1995, ER ID 57224)**

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory Report LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, ER ID 53450)

LANL (Los Alamos National Laboratory), December 1996. "Installation Work Plan for Environmental Restoration," Revision 6, Los Alamos National Laboratory Report LA-UR-96-4629, Los Alamos, New Mexico. (LANL 1996, ER ID 55574)

NMED (New Mexico Environment Department), March 3, 1998. *New Mexico Environment Department RCRA Permits Management Program Document Requirement Guide*, Santa Fe, New Mexico. (NMED 1998, ER ID 57897)

NMED (New Mexico Environment Department), March 3, 1998. *Risk-Based Decision Tree*, Santa Fe, New Mexico. (NMED 1998, ER ID 57761)

Ryti, R. T, P. A. Longmire, D. E. Broxton, S. L. Reneau, and E. V. McDonald, in preparation. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory Report, Los Alamos, New Mexico. (LANL 1998, ER ID 58093)

APPENDIX A LIST OF ACRONYMS AND GLOSSARY

A-1.0 LIST OF ACRONYMS

Define all acronyms used in the document. Contact an Environmental Restoration (ER) Project technical editor for a standard list of ER Project acronyms. Use the standard list, adding additional acronyms used and removing acronyms that were not used.

A-2.0 GLOSSARY

Define terms used in the document that need clarification. Contact an ER Project technical editor for a standard glossary of ER Project terms. Use the standard glossary, adding additional terms and removing terms that were not used.

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APPENDIX B OPERATIONAL AND ENVIRONMENTAL SETTING

This appendix should describe the facility, technical area (TA), or other general area in which the potential release sites (PRSs) included in this Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report are located. PRS-specific information should be included in the body of the report.

B-1.0 OPERATIONAL HISTORY AND LAND USE

Discuss the operational history (including current activities) of the facility, TA, or other general area in which the PRSs in this report are located.

- Provide the length of time that the facility or TA was operational and the associated start and end dates.
- Identify the types of PRSs included in the general area, and the types of facility processes that may have contributed to contamination at the PRSs. (The description of the operational history should support the list of potential contaminants and their release mechanisms at the PRSs in question).
- Discuss the historical use of chemicals at the facility or TA, including the estimated inventory if known.
- Discuss the current activities and land use at the facility, TA, or other general area encompassing the PRSs.

State that future and current land-use maps can be found in the 1995 update to the LANL Site Development Plan (LANL 1995, ER ID 57224).

B-2.0 CLIMATE

Identify the general climate of the area, including prevailing wind direction(s); effects of summer rains, snow melt, etc.; rate of evapotranspiration; range of temperatures; average precipitation; and other pertinent information.

B-3.0 GEOLOGY

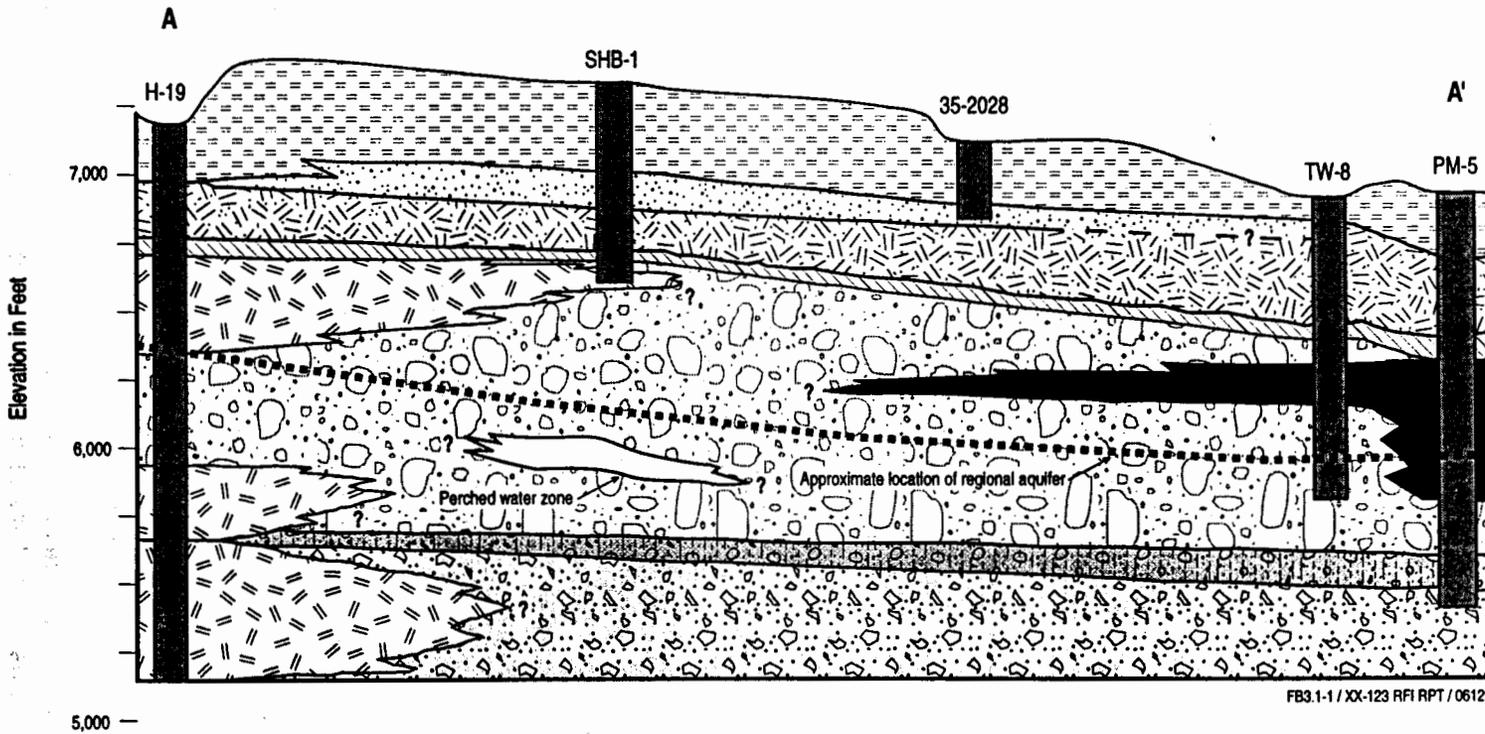
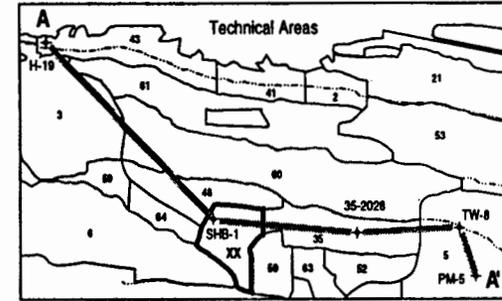
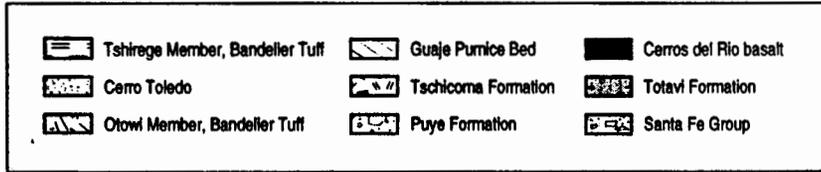
In Appendixes B-3.1 and B-3.2, describe what is currently known about the geology for the facility, TA, or other general area encompassing the PRSs. PRS-specific information should be presented in the body of the report.

Do not simply refer to the work plan; rather, present all of the relevant information. If what is known about the PRS has changed dramatically from the description in the work plan, discuss the changes and summarize or quote the work plan discussions as needed. See the General Guidelines for further guidance on using information from the work plan and other archival reference materials.

B-3.1 Geologic Setting

Address the following items:

- Provide a figure that shows a cross section of the detailed stratigraphy of the facility, TA, or other general area. If this is not available, provide a figure of the generalized stratigraphy (e.g., the entire Pajarito Plateau, a general mesa, etc.). Follow Example Figure B-3.1-1.



FB3.1-1 / XX-123 RFI RPT / 061298

Example Figure B-3.1-1. Generalized stratigraphy of TA-XX.

- Describe the stratigraphy of the area, including how that information was obtained (e.g., from logs of nearby wells).
- Provide a geologic map of the area under investigation, including the structural geology if such information is available. Use judgment as to format.
- Describe the structural geology, including both local and regional structural features (e.g., folding, faulting, jointing, strike and dip, etc.).
- If applicable, discuss the paleotopography.

B-3.2 Soils

If the information is available, address the following items:

- Describe the soil types, physical and chemical properties, and major geomorphic features (e.g., large drainages, hills, etc.) at the facility, TA, or other general area.
- If applicable, discuss soil thickness and variability, and provide the depth to the soil/tuff interface.
- Provide a soils map. Use judgment as to format.

B-4.0 HYDROLOGY

B-4.1 Hydrological Conceptual Model

Discuss the hydrological conceptual model, including but not limited to the following: surface water run-on and runoff and sediment transport; erosion and surface exposure; fluid transport via the regional aquifer, alluvial aquifers, perched water, springs, and seeps; infiltration and transport in the vadose zone; and atmospheric dispersion.

B-4.2 Surface Water

Address the following items:

- Briefly discuss watershed locations.
- Discuss man-made or natural drainages, streams, wetlands, outfalls, etc. Provide the available information regarding the location, elevation, flow, velocity, depth, width, seasonal fluctuations, and proximity to the 100-year flood plain for associated streams, ditches, drains, wetlands, and channels. Provide the associated National Pollutant Discharge Elimination System (NPDES), Stormwater Permit/Plan, and/or Discharge Permit/Plan number.

B-4.2.1 LANL-ER-AP-4.5 Assessment(s)

Use the following introduction:

“At the Laboratory, surface water runoff and sediment transport are among the potential migration pathways by which contaminants might be transported to off-site receptors. Surface water may also access subsurface contaminants exposed by soil erosion. Soil erosion is dependent on several factors, including soil

properties, the amount of vegetative cover, the slope of the contaminated area, exposure, the intensity and frequency of precipitation, and seismic activity.

The Laboratory's ER Project has developed Administrative Procedure 4.5 (AP-4.5) to assess sediment transport and erosion concerns at specific PRSs. AP-4.5 provides a basis for prioritizing and scheduling actions to control erosion of potentially contaminated soils at specific PRSs. The procedure is a two-part evaluation. Part A is a compilation of existing PRS analytical data, site maps, and knowledge-of-process information. Part B is an assessment of the erosion/sediment transport potential at the PRS. Erosion potential is numerically rated from 1 to 100 using a matrix system. PRSs that score below 40 have a low erosion potential; those that score from 40 to 60 have a medium erosion potential; and those that score above 60 have a high erosion potential. Part A of this assessment is initiated and completed by the Los Alamos National Laboratory (LANL or the Laboratory) Environmental Restoration (ER) Project; Part B is completed by the Laboratory's Water Quality and Hydrology Group (ESH-18). A Surface Water Assessment Team comprised of representatives from the ER Project, ESH-18, the Laboratory's Facility Management Group (FSS-7), and the Department of Energy (DOE) Oversight Bureau evaluates each completed assessment. If necessary, a best management practice or other action is implemented based on the results of the assessment.

The AP-4.5 assessments for the PRSs addressed in the RFI report are attached following this introduction."

If applicable, add the following statement:

"Note in Part A that if Item 10, Sample Information, is marked yes but no data are provided, it is because all applicable data are nondetected values."

Reproduce and attach Parts A and B of the LANL-ER-AP-4.5 assessments for all of the PRSs included in the document.

B-4.3 Groundwater

This section should introduce the material in the sections under Appendix B-4.3. Address the following:

- State that Appendixes B-4.3.1 through B-4.3.4 discuss the alluvial waters, perched aquifers, regional aquifer, and vadose zone in the vicinity of the facility, TA, or other general area encompassing the PRSs.
- Include a map showing the locations of alluvial wells, perched water wells, regional aquifer wells, and springs resulting from alluvial aquifer discharges, perched aquifer discharges, and regional aquifer discharges in the vicinity of the facility, TA, or other general area.
- State that the stratigraphy, the locations of perched waters, the location of the regional aquifer, the unsaturated geologic units above and between the aquifers (if applicable), and depths of perched water wells and regional aquifer wells in the vicinity of the facility, TA, or other general area are presented in Figure B-3.1-1 (see Example Figure B-3.1-1).

B-4.3.1 Alluvial Waters

For the facility, TA, or other general area, discuss alluvial waters. Address the following items:

- Describe the occurrence of alluvial water and the properties of the alluvial material (e.g., sand, clay, gravel content, or rock type).
- If known, discuss the extent (thickness and area) of any alluvial aquifers, identify the bedrock units in which the alluvial waters are perched, and discuss data concerning flow direction and gradient.
- Discuss features that may lead to channeling or localized flow of water or contaminants in the alluvial material (e.g., high permeability zones).
- Discuss alluvial wells in the area. Provide the depth of the wells, the intervals screened, and the depth to water. Also describe monitoring (chemical or hydrologic) currently being conducted in the wells. Provide available information on recharge and discharge pathways and flow rates if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Discuss springs in the area resulting from alluvial aquifer discharges. Discuss available flow rate and chemical information if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Refer to the figure in Appendix B-4.3, and state that it shows the locations of alluvial wells and springs resulting from alluvial aquifer discharges.

B-4.3.2 Perched Waters

For the facility, TA, or other general area, discuss perched waters. Address the following items:

- Describe perched water occurrences for each aquifer.
- If known, identify the depth, thickness, and area of the aquifer; the geologic unit in which the aquifer is located; and the geologic unit in which the aquifer is perched. Discuss the confining unit, if applicable. Also discuss the known hydraulic properties of the aquifer-bearing and perched units, and data on flow direction and gradient.
- Discuss perched water wells in the area. Provide the depth of the wells, the intervals screened, and the depth to water. Also describe monitoring (chemical or hydrologic) currently being conducted in the wells. Provide available information on recharge and discharge pathways and flow rates if PRS-specific discussions were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Discuss springs in the area resulting from perched aquifer discharges. Discuss available flow rate and chemical information if it has not been discussed earlier (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Refer to the figure in Appendix B-4.3, and state that it shows the locations of perched water wells and springs resulting from perched aquifer discharges. Also refer to Figure B-3.1-1, and state that it shows the general stratigraphy of the site, the locations of

perched waters, and the depths of perched water wells in the vicinity of the facility, TA, or other general area.

B-4.3.3 Regional Aquifer

Describe the regional aquifer. Address the following items:

- Discuss regional aquifer wells in the area. Provide the depth of the wells, the intervals screened, the depth to water, the saturated units the wells penetrate, and the uses of the wells (e.g., water supply monitoring). Use a table if it facilitates the presentation (use judgment as to format).
- If applicable, describe monitoring (chemical or hydrologic) currently being conducted at the regional aquifer wells.
- If known, discuss the relevant hydraulic properties (e.g., hydraulic conductivity, bulk density, etc.) of the regional aquifer. Also discuss data on flow direction and gradient.
- Describe the aquifer material (e.g., clay or sand content, fractured or vesicular basalt, etc.).
- Discuss the confined or unconfined nature of the regional aquifer and, if applicable, the nature of the confining units.
- Discuss applicable information on recharge and discharge pathways and flow rates if PRS-specific discussion were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Discuss any springs in the area resulting from regional aquifer discharges. Discuss available flow rate and chemical information if PRS-specific discussion were not included in the body of the report (e.g., in Section 2.2, Description and Operational History, or Section 2.3.5, Revised Site Conceptual Model).
- Refer to the figure in Appendix B-4.3, and state that it shows the locations of regional aquifer wells and springs resulting from regional aquifer discharges. Also refer to Figure B-3.1-1, and state that it shows the general stratigraphy of the site, the location of the regional aquifer, and the depths of regional aquifer wells in the vicinity of the facility, TA, or other general area.

B-4.3.4 Vadose Zone

Address the following items:

- If applicable and not described elsewhere, identify the unsaturated geologic units above and between the aquifers. If applicable, refer to Figure B-3.1-1.
- Discuss hydraulic parameters (e.g., soil characteristic curves, matrix potentials, hydraulic conductivities, etc.) and moisture content data.
- Discuss hydrogeologic features that may influence vadose zone transport (e.g., fractures, buried soils, surge beds, or other highly permeable or impermeable units).

B-5.0 ECOLOGICAL RESOURCES

This section should describe the findings of the ecological surveys that include the PRSs discussed in this report. Address the following items:

- Briefly discuss when, by whom (e.g., Biological Resource Evaluations Team), and for which facility, TA, or other general area biological field surveys were conducted. State the reason for conducting the surveys. Cite the reports that document the surveys.
- Discuss the ecological setting, description, current status, previous surveys, current actions and investigations, and the biological survey for the site.
- Discuss the results of the biological field survey(s) conducted prior to the sampling event. Include the following items:
 - Discuss the habitats and species present or expected to be present at the site and adjacent areas.
 - Describe the biota in surface water bodies on, adjacent to, or affected by the site.
 - Indicate areas at and near the PRSs where state and federal threatened or endangered species (both proposed and listed) are located.
 - Discuss other species or habitats of special significance, such as commercially, culturally, or recreationally significant species.
 - Discuss wetlands or flood plains that are contained within the facility, TA, or other general area.
- Describe disturbed and undisturbed habitats.
- Discuss the impacts of the sampling event(s) on ecological receptors, or state that the sampling event(s) did not impact ecological receptors and discuss what steps were taken to avoid impact or to restore disturbed land.

B-6.0 CULTURAL RESOURCES

This section should discuss the results of the cultural surveys that include the PRSs discussed in this report. Address the following items:

- Briefly discuss when, by whom, and for which applicable facility, TA, or other general area cultural/archaeological surveys were conducted. State the reason for conducting the surveys. Cite the reports that document the surveys.
- Discuss the results of the cultural/archaeological surveys conducted prior to the sampling event.
- Discuss disturbed and undisturbed environments.
- Discuss the impacts of the sampling event(s) on cultural/archaeological sites that exist in the area, or state that the sampling event(s) did not impact cultural/archaeological sites and discuss what steps were taken to avoid such impacts.

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APPENDIX C RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

C-1.0 SUMMARY

This section should provide a summary of the quality assurance (QA)/quality control (QC) activities for the potential release sites (PRSs) included in this report. Introductory material to this appendix should include a description of the data set that was evaluated for this report and how the QA/QC evaluation was carried out. Field analyses should be presented first, followed by fixed laboratory analyses. Address the following items in both discussions as appropriate:

- Summarize the number of field or fixed-laboratory samples analyzed, and the number of associated field QC samples (e.g., field duplicates) and/or PRS-specific performance evaluation samples. List the PRSs for which samples were collected and analyzed.
- Summarize the analytical suites for which samples were analyzed, and state that the target analytes for each suite are listed in Appendix D-1.0, Target Analytes and Detection Limits.
- Include a table that shows the analytical suite, analytical method ID, and method description for all analyses performed (e.g., SW-846 Method 6010, inductively-coupled plasma emission spectroscopy [ICPES]). Use judgment as to format. State that detection or quantitation limits are provided in Appendix D-1.0, Target Analytes and Detection Limits.
- Indicate that sample preservation and holding time requirements are provided in Los Alamos National Laboratory (LANL) Environmental Restoration (ER) standard operating procedure (SOP) 1.02 (revision in progress). Indicate whether there were deviations from these requirements and refer to later sections of this appendix for details.
- Summarize the types of laboratories (e.g., fixed, mobile, internal, external) and, if pertinent to the data quality evaluation, and the number of laboratories used (e.g., whether analyses were performed by single or multiple external laboratories).
- State that the requirements of the sampling and analysis plan (SAP), the ER Project Quality Assurance Project Plan (QAPP), the analytical services statement of work, and/or ER SOPs were followed during analytical data collection and evaluation. Summarize deviations from these requirements.
- Briefly describe the types of QA and QC samples (both field and laboratory) or processes that were evaluated in preparing this appendix (e.g., laboratory duplicates, blank samples, etc.). State that the type and frequency of QC analyses required for fixed-laboratory analyses is described in the ER Project Statement of Work for Analytical Services (LANL 1995, ER ID 49738). State that definitions of the QA/QC sample types and processes are included in the glossary in Appendix A-2.0.
- Describe the procedure that was used for routine validation of the analytical data. If the current ER Project validation procedure was used for all data, state that this procedure is described in the Installation Work Plan (IWP). If data were collected before April 1995, describe the validation procedure that was used (e.g., Chemical Science and Technology [CST] 3 validation procedures). Emphasize that the ER data validation procedures are based on Environmental Protection Agency (EPA) National Functional Guidelines for Data Review (EPA 1994, ER ID 48639; EPA 1994, ER ID 48640).

- Briefly describe the focused validation process, stating that a more detailed description is located in the QAPP (LANL 1996, ER ID 53450). If focused validation was performed for the data set being evaluated, briefly describe why. Refer to later sections of this appendix for details.
- State that, generally, data are still usable even though qualifier flags may be applied during the routine and focused validation processes. State that definitions of laboratory qualifiers, LANL qualifiers, and focused validation qualifiers are included in the glossary in Appendix A-2.0.

Conclude this section by summarizing the results of the evaluation of QA/QC activities in general terms. The following items should be emphasized:

- Indicate whether, as a result of the evaluation of QA/QC activities, the analytical data are of sufficient quality for the intended use in this report. If qualifier flags have been applied to data, generally state the impact on data usability.
- If data were rejected for use in this report, describe those data here and the reasons for rejection. Refer to later sections of this appendix for details.
- State that the detailed results of data validation are presented in Section C-5.0, Results of Data Validation.
- State that discussions of data usability on a PRS-specific basis are also presented in the body of the report in Section 2.3.4.3, Data Review.

C-2.0 INORGANIC ANALYSES

This section should provide a detailed discussion of the QA/QC findings for inorganic analytes. Address the items under each of the following sections.

C-2.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples analyzed for inorganic chemicals using field methods (e.g., x-ray fluorescence [XRF], mobile laboratories, spot tests, etc.). Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.
- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.
- Discuss the detection limits for the field methods employed with respect to background values (BVs) and screening action levels (SALs), and indicate whether detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- If the required detection limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil

contamination), and what actions were taken to try to meet the detection limit requirements.

- Discuss the results of QC activities for field methods, including the acceptance criteria.
- Describe focused validation that was performed for the field inorganic analytical results, and present the outcome.
- Discuss the usability of the field inorganic data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-2.2 Fixed Laboratory Analyses

This section can be presented either as a single discussion, or as separate discussions under separate bolded, unnumbered headings for routine and special analytical services. The following general guidance applies to both routine and special analytical services. If separate headings are used for routine and special analytical services, address these items under both headings.

- State the numbers of samples that underwent inorganic analysis at a fixed laboratory, and the analytical methods used by the fixed laboratories (e.g. SW-6010B, etc.), including sample preparation methods.
- Discuss the detection limits for the methods employed with respect to BVs and SALs, and indicate whether detection limits were greater than these values. If routine analytical services were used, state that a listing of the contractually required detection limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0.
- If the analytical laboratory did not meet the required detection limits, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection limit requirements.
- Discuss the results for laboratory control samples, laboratory duplicates, matrix spikes, and blank samples. Discuss the results for other pertinent QC samples or processes (e.g., performance evaluation samples). Include the acceptance criteria or acceptable recovery ranges for the QC samples being discussed.
- Discuss the results of fixed laboratory inorganic analyses of field QC samples, and how interpretation of regular field sample results may be affected.
- Describe focused validation that was performed for the fixed analytical laboratory inorganic analytical results, and present the outcome.
- When holding times have been exceeded, provide the number of days over the required holding time and the potential impact on the analytical results.
- Discuss the usability of the fixed analytical laboratory inorganic data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-3.0 RADIOCHEMICAL ANALYSES

This section should provide a detailed discussion of the QA/QC findings for radionuclides. Address the items under each of the following sections.

C-3.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples that underwent field radiochemical analysis. Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.
- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.
- Discuss the detection limits for the methods used with respect to BVs and SALs, and indicate whether the detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- Describe how the detection status for radiochemical analytes analyzed by field methods was determined (e.g., comparison to minimum detectable activity, decision level concentration [DLC], 2-sigma total propagated uncertainty [TPU], etc.)
- If the required detection limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., gamma spectrum interference due to high levels of uranium), and what corrective actions were taken to try to meet the detection limit requirements.
- If gamma/beta spectrometry measurements were performed in the field, describe how the results were evaluated (e.g., naturally-occurring isotopes, short-lived isotopes, etc.). Refer to the appropriate SOP (currently in preparation) for identifying specific gamma spectrometry results.
- Discuss the results of QC activities for field methods, including the acceptance criteria.
- Describe focused validation that was performed for the radiochemical analytical results from field samples, and present the outcome.
- Discuss the usability of the field radiochemical data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-3.2 Fixed Laboratory Analyses

This section can be presented either as a single discussion, or as separate discussions under separate bolded, unnumbered headings for routine and special analytical services. The following general guidance applies to both routine and special analytical services. If separate headings are used for routine and special analytical services, address these items under both headings.

- State the numbers of samples that underwent radiochemical analysis at a fixed laboratory. Provide the target analytes and the analytical methods or instrumental techniques used

by the analytical laboratories (e.g., tritium by liquid scintillation counting), including sample preparation methods.

- Discuss the detection limits for the methods used with respect to BVs and SALs, and indicate whether the detection limits were greater than these values. If routine analytical services were used, state that a listing of the contractually required detection limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- Describe how the detection status for radiochemical analytes analyzed by fixed analytical laboratories was determined (e.g., comparison to minimum detectable activity, DLC, 2-sigma TPU, etc.)
- If the analytical laboratory did not meet the required detection limits, describe which samples were affected, what caused the elevated detection limits (e.g., gamma spectrum interference due to high levels of uranium), and what corrective actions were taken to try to meet the detection limit requirements.
- If gamma spectrometry measurements were performed during fixed-laboratory analysis, describe how the results were evaluated (e.g., naturally-occurring isotopes, short-lived isotopes, etc.). Refer to the appropriate SOP (currently in preparation) for identifying specific gamma spectrometry results.
- If tritium measurements were performed on soil samples, explain that results were expressed in units of pCi per gram of dry soil.
- Discuss the results for laboratory control samples, duplicate samples, and blank samples. Discuss tracer and/or carrier recoveries with respect to acceptance criteria. Discuss the results for other pertinent QC samples or processes (e.g., matrix spike, performance evaluation samples, etc.). Include the acceptance criteria or acceptable recovery ranges for the QC samples being discussed.
- Discuss the results of fixed-laboratory radiochemical analysis of field QC samples, and how interpretation of regular field sample results may be affected.
- Describe focused validation that was performed for the radiochemical analytical results from fixed-laboratory samples, and present the outcome.
- When holding times have been exceeded, include the number of days over the required holding time and the potential impact on the analytical results.
- Discuss the usability of the fixed-laboratory radiochemical data, including potential bias (in direction or relative magnitude), as determined by the data quality evaluation.

C-4.0 ORGANIC ANALYSES

This section should provide a detailed discussion of the QA/QC findings for organic analytes. Address the items under each of the following sections.

C-4.1 Field Analyses

This section should include the QA/QC results from all field analyses. As applicable, include discussions of spot tests, field screening, other field analytical methods, and field (mobile) laboratory analyses.

- State the numbers of samples that underwent field organic analysis, and the analytical methods used. Provide the target analytes and the analytical methods or instrumental techniques used. Do not include screening measurements made for the purposes of health and safety or shipping and handling.
- Cite the ER SOP, LANL SOP, or published method that was used for the field measurements.
- Discuss the detection and/or quantitation limits for the field analytical methods employed with respect to BVs and SALs, and indicate whether quantitation and/or detection limits were greater than these values. Refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.
- If the required detection and/or quantitation limits were not met in the field, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection and/or quantitation limit requirements.
- Discuss the results of QC activities for field methods including acceptance criteria.
- Describe focused validation that was performed for the field organic analytical results, and the outcome.
- Discuss the usability of the field organic data, including potential bias (in direction or relative magnitude for the individual analytical suite), as determined by the data quality evaluation.

C-4.2 Fixed Laboratory Analyses

This section should be presented as separate discussions under separate bolded, unnumbered headings for individual analytical suites (i.e. semivolatile organic compounds [SVOCs], volatile organic compounds [VOCs], polychlorinated biphenyls [PCBs], etc.). Address the following general guidance under all of the subdivisions.

- State the numbers of samples that underwent fixed-laboratory organic analysis, and the analytical methods used by the laboratories (e.g., SW-8270B) including sample preparation methods.
- Discuss the detection and/or quantitation limits for the fixed-laboratory methods employed with respect to BVs and SALs, and indicate whether quantitation and/or detection limits were greater than these values. Provide a statement that quantitation limits are generally five to ten times the method detection limit. If routine analytical services were used, state that a listing of the contractually required detection and/or quantitation limits for routine analytical services is included in Appendix D, Analytical Suites and Results. If nonroutine analytical methods were used, refer to the appropriate table in Appendix D-1.0, Target Analytes and Detection Limits.

- If the analytical laboratory did not meet required detection and/or quantitation limits, describe which samples were affected, what caused the elevated detection limits (e.g., matrix interference due to oil contamination), and what corrective actions were taken to try to meet the detection and/or quantitation limit requirements.
- Discuss the results for blank sample analysis, with particular emphasis on false positive results in regular field samples. Discuss surrogate recoveries with respect to acceptance criteria. Discuss the results for other pertinent QC samples or processes (e.g., matrix spikes/matrix spike duplicates [MS/MSD], performance evaluation samples, etc.). Include the acceptance criteria or acceptable recovery ranges for the QC sample being discussed.
- Discuss the results of fixed-laboratory organic analyses of field QC samples, and how interpretation of regular field sample results may be affected.
- Describe focused validation that was performed for the fixed-laboratory organic analytical results, and present the outcome.
- When holding times have been exceeded, include the number of days over the required holding time and the potential impact on the analytical results.
- Discuss the usability of the fixed-laboratory organic data, including potential bias (in direction or relative magnitude for the individual analytical suite), as determined by the data quality evaluation.

C-5.0 RESULTS OF DATA VALIDATION

For each PRS included in the report, provide a table presenting data qualifiers that were applied as a result of the data validation process. Use judgment as to table format. Provide bolded headings for each PRS in the report. Follow each heading either with a table or a statement that no data qualifiers were applied for the PRS.

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APPENDIX D ANALYTICAL SUITES AND RESULTS

D-1.0 TARGET ANALYTES AND DETECTION LIMITS

This section should present tables of the target analytes and detection or quantitation limits for all analyses conducted for the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI). Present separate tables for field analyses and fixed-laboratory analyses. Use judgment as to table format. Address the following in the tables:

- Provide information for both routine and nonroutine analytical suites for which samples were analyzed during the RFI.
- Include each target analyte, the matrix analyzed, the method ID, and the detection or quantitation limit for that analysis.

Routine analytical suites are described in the Quality Assurance Project Plan (QAPP) and include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), high explosives (HE), metals, and selected radionuclides. The tables provided in this appendix may need to be modified from those presented in the QAPP because target analytes in several suites have changed with subsequent contract laboratory statements of work. For example, the inorganic suite changed from 11 to 21 analytes in mid-1994. When in doubt, check the target analyte list in one of the data packages associated with this investigation.

D-2.0 RFI ANALYTICAL RESULTS

This section should present the analytical data for the PRSs included in the RFI report. Analytical data must be provided in both electronic and hard-copy formats. A hard copy of the data must be included as an attachment to each copy of the report. In addition, one electronic copy of the data must accompany the hard copy reports submitted to New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB), Department of Energy (DOE), and the Los Alamos National Laboratory (LANL or the Laboratory) Environmental Restoration (ER) Project Records Processing Facility (RPF).

Address the following items in the text of this appendix:

- State that an abridged version of all of the analytical data collected during the RFI are included as an attachment to this report. State that more detailed data have been submitted in electronic format to NMED HRMB, DOE, and the LANL ER Project RPF. State that the copies of the report that include electronic data have the notation "Data disks included with this copy" clearly displayed on the cover.
- State the number of disks on which the electronic data are saved, and the software package and version used to store the data. The data should be formatted in spreadsheets and saved as Excel 4.0.
- Provide the name for each disk, and list the files that each disk contains.
- State that the electronic data are available in the Facility for Information Management, Analysis, and Display (FIMAD). If the data are not available in FIMAD, explain why and provide a method for non-Laboratory readers to obtain the data.
- Be sure that FIMAD personnel have verified all FIMAD data for accuracy (i.e., for data collected after April 1995, ensure that the electronic data have been compared with the hard copy data package from the analytical laboratory) before these data are submitted.

- Be sure that the data reported in this appendix agree with the data presented in the body of this report.
- State that the hard copy data are attached at the end of the report.

The hard copy data should address the following items (use judgment as to table format):

- Present field and fixed-laboratory analytical data in separate tables. Different sample matrixes and analytical suites may also be presented in separate tables.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.
- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all data that are not available in electronic form (e.g., non-FIMAD data).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected during the RFI for the PRSs included in this report and areas down-gradient from these PRSs.
- Include the following fields in the hard copy data:
 - PRS number,
 - Location ID,
 - Sample ID,
 - Depth and units,
 - Sample medium (as defined in FIMAD),
 - Analyte name,
 - Sample results and units (use consistent units for all results), and
 - RFI data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables in the body of this report, which is based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the result of focused data validation).

The electronic copy of the data should include the following items (use judgment as to format):

- Present field and fixed-laboratory analytical data in separate electronic files. Different sample matrixes and analytical suites may also be presented in separate files.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.

- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all quality control (QC) data (e.g., results from matrix spike samples, surrogate compounds, etc.).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected during the RFI for the PRSs included in this report and areas down-gradient from these PRSs.
- Include the following fields in the electronic data:
 - PRS number,
 - Location ID,
 - Sample ID,
 - Collection date for each sample,
 - Depth and units,
 - Sample matrix (as defined in FIMAD),
 - Sample medium (as defined in FIMAD),
 - Request number,
 - Date of submittal to the analytical laboratory for each sample (if available in FIMAD),
 - Date of analysis (if available in FIMAD),
 - Analytical suite,
 - Analytical laboratory name,
 - Analyte name,
 - Sample results and units (use consistent units for all results),
 - Analytical laboratory data qualifiers,
 - LANL data validation qualifiers, and
 - RFI data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables in the body of this report, which is based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the result of focused data validation).

D-3.0 OTHER APPLICABLE RFI RESULTS

This section should include details of RFI results not covered under Appendix D-2.0, including core logs, flow rates, geophysical reconstructions, foot-by-foot neutron logging results or fracture density calculations, daily flow rates, raw geophysical data, etc. Use judgement as to whether to include these items in the appendix or as an attachment.

D-4.0 NON-RFI DATA

Include data that were considered in making the PRS decision but were not collected as part of the RFI or by the ER Project. Submit them as part of the electronic data set described in Appendix D-2.0, or, If data are not available in electronic form, include hard copies. Use judgement as to whether to include these items in the appendix or as part of the attachment described in Appendix D-2.0.

Examples of data that might be included in this section are data from the LANL environmental surveillance reports, non-RFI groundwater analytical data from areas down-gradient from PRSs included in this report, and historical data used directly in the data review, screening, and risk assessments.

In both the hard copy and electronic data, address the following items:

- Be sure that the data reported in this appendix agree with the data presented in the body of this report.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank).

APPENDIX E STATISTICAL ANALYSES

This appendix should include the details of all statistical calculations discussed in the body of the report. The details presented here should be clearly and simply written (i.e., the public should not have difficulty understanding what was done and why). Use a technical editor to improve the clarity of this appendix. Definitions for unclear terms should be provided in the glossary in Appendix A-2.0.

If a number of different statistical calculations are necessary, using different subsets of the data and/or different data preparation, break this appendix into the appropriate sections using unnumbered, bold headings. Statistical analyses that might be presented in this section include the following:

- exploratory data analysis, including explanations of graphics that are not self-explanatory (e.g., probability or box plots);
- summary statistics (e.g., estimates of mean contaminant levels or quantiles of the distribution of contaminant levels) and confidence bounds for these estimates;
- statistical comparisons of data sets (e.g., two-sample tests comparing PRS data with background data or comparisons between two subsets of PRS data); and
- statistical data extrapolation, including explanations of algorithms used to generate contour plots or other displays that extrapolate information from the actual samples to unsampled locations and/or times.

Address the following items for each statistical test:

- Completely specify all data sets used (the reviewer should be able to reconstruct each potential release site (PRS) data set from this specification and the information in Appendix D).
- Describe all data preparation steps, including the treatment of below-detection-level, zero, and negative values for various statistical procedures, and the detection and possible elimination of outliers.
- Assess the applicability of a statistical procedure to the given data set, evaluating the assumptions on which that procedure is based and why other more standard procedures are not applicable.
- Describe computational algorithms, either explicitly or by reference, in enough detail to allow the reviewer to reproduce the result (within sampling error, if a randomized procedure is used.)

If no statistical calculations are performed, state that no statistical calculations were performed for the PRSs being reported.

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APPENDIX F RISK ASSESSMENT CALCULATIONS

F-1.0 HUMAN HEALTH

This appendix should include supporting risk assessment calculations and/or spreadsheets for the human health risk assessments discussed in the body of the report. Include all supporting calculations in enough detail for the reviewer to reproduce the risk assessment results. Also present and provide references for all parameters used in the risk calculations.

If no supporting calculations are necessary, state that no quantitative risk assessment was performed for the PRSs being reported.

If more than one risk assessment calculation is necessary, break this appendix into the appropriate sections using unnumbered, bold headings.

F-2.0 ECOLOGICAL

This appendix should include the ecological scoping checklist for each of the PRSs described in the report. It should also include supporting risk assessment calculations and/or spreadsheets for the ecological risk assessments discussed in the body of the report. Include all supporting calculations in enough detail for the reviewer to reproduce the risk assessment results. Also present and provide references for all parameters used in the risk calculations.

If no supporting calculations are necessary, state that no quantitative risk assessment was performed for the PRSs being reported.

If more than one risk assessment calculation is necessary, break this appendix into the appropriate sections using unnumbered, bold headings.

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APPENDIX G RELEVANT DOCUMENTS

G-1.0 DOCUMENTATION OF REGULATORY HISTORY

G-1.1 Corrective Action History

This section should summarize the corrective action history for each potential release site (PRS). Address the following items:

- Provide a chronological list of each Administrative Authority (AA) action (e.g., notices of deficiency [NODs], requests for supplemental information [RSIs], requests for additional work, approvals, etc.) and each Los Alamos National Laboratory (LANL) response.
- Include the date from each action letter and response letter.
- Use a table format if it facilitates the presentation (use judgment as to format).
- Verify the information in this list with the Environmental Restoration (ER) Project deliverable and NOD databases. Note that electronic information is not available for work plans that have already been approved by the AA. For more information, contact the Regulatory Compliance Focus Area leader (Tori George at 5-6953, torig@lanl.gov).
- Cite the AA action letters and LANL responses, and include them (without errata sheets or attachments) in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).

G-1.2 Other Regulatory Documents

This section should summarize the applicable AA documents that are not covered in Appendix G-1.1. This includes but is not limited to approvals of site deferrals, correspondence regarding underground storage tank (UST) remediations, approval of deviations from sampling plans, etc. Address the following items:

- Provide a chronological list of each AA action and each LANL response.
- Include the date from each action letter and response letter.
- Use a table format if it facilitates the presentation (use judgment as to format).
- Cite the AA action letters and LANL responses, and include them (without errata sheets or attachments) in the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).

G-2.0 REFERENCED DOCUMENTS

In this section, attach archival and technical documents referenced in this report that do not belong in the reference set. These documents should be specific only to this RFI report. Archival or technical documents that might apply to other reports should be submitted as part of the appropriate reference set of the LANL ER Project Reference Library (see the General Guidelines for information about this library).