RAAP 050506\05006

ON THE LINE

Delivery Order No. 0013
Environmental Services
Program Support
DACA31-94-D-0064

RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Work Plan Addendum 012: Site Characterization Plan for

SWMU 39
SWMU 48
SWMU 49
SWMU 50
SWMU 58
SWMU 59
AOC-FLFA
AOC-Building 4343
New River Unit

Prepared for:

USACE Baltimore District
10 S. Howard St.
Baltimore, MD 21201

BALTIMORE DISTRICT

Prepared by:

IT Corporation
2113 Emmorton Park Rd.
Edgewood, MD 21040

IT CORPORATION

Final Document

September 2002

4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Date: November 14, 2002

In reply
Refer to 3HS13

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Commander,
Radford Army Ammunition Plant
Attn: SIORF-SE-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

C.A. Jake
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant
SWMUs 39, 48, 49, 50, 58, and 59
Former Lead Furnace AOC and Building 4343 AOC
New River Units
Work Plan Addendum 12
Document submittal and review

Dear Mr. McKenna and Ms. Jake:

The U.S. Environmental Protection Agency (EPA) has reviewed the Army's September, 2002 *Work Plan Addendum 12* for the investigation of SWMUs 39, 48, 49, 50, 58, and 59, along with the Former Lead Furnace AOC and Building 4343 AOC, located at the Radford Army Ammunition Plant (RFAAP), together with the New River Units, located at the New River Ammunition Storage Depot. Based upon our review, *Work Plan Addendum 12* is approved. In accordance with Part II. (E)(5)of RFAAP's Corrective Action Permit, *Work Plan Addendum 12* is now considered final.

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

October 9, 2002

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Master Work Plan, Final September 2002,
Work Plan Addendum 9, Final September 2002, and
✓ Work Plan Addendum 12, Final September 2002
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

This letter is to provide certification for:

Master Work Plan, Final September 2002,
Work Plan Addendum 9, Final September 2002 and
Work Plan Addendum 12, Final September 2002.

This letter is also to confirm your September 6, 2002 conversation with Messrs. John Tesner, Jerry Redder and Jim McKenna that the draft final version of these documents in your possession are acceptable as final provided revised document covers are sent. Enclosed is one copy of the revised document covers. Additional covers will be provided by separate letter. One copy of the Master Work Plan will be sent under separate cover to the Virginia Department of Environmental Quality per their request.

Briefly, the draft Master Work Plan was submitted on February 8, 2002 and the draft final Work Plan Addenda 9 and 12 were submitted February 15, 2002. EPA commented on these three documents on May 22, 2002. On July 10, 2002 Radford AAP responded to these comments. We submitted a draft final Master Work Plan (June 2002 edition). The issues raised by EPA in their comments on Work Plan Addenda 9 and 12 were addressed in the attachments to our July 10, 2002 letter so revised documents were not submitted. The Virginia Department of Environmental Quality approved Work Plan Addenda 9and 12 on May 29, 2002 and the Master Work Plan on September 22, 2002.

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

C. A. Jake

C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company, LLC

Enclosure

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009

02-815-139
JMcKenna/JJRedder

1

Richmond, VA 23240-0009

Mark Leeper
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Kenneth G. Barnes
U.S. Army Operations Support Command
Environmental Restoration Division
1 Rock Island Arsenal, Attn: AMSOS-ISR
Rock Island, IL 61299-5500

Peter J. Rissell
U.S. Army Environmental Center
5179 Hoadley Road, Attn: SFIM-AEC-ERP
Aberdeen Proving Ground, MD 21010-5401

Dennis Druck
U.S. Army Center for Health Promotion and Preventive Medicine
5158 Blackhawk Road, Attn: MCHB-TS-HER
Aberdeen Proving Ground, MD 21010-5403

w/o enclosure
Russell Fish, P.E., EPA Region III

John Tesner
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

bc: Administrative File
J. McKenna-ACO Staff
S. J. Barker-ACO Staff
Rob Davie-ACO Staff
C. A. Jake
J. J. Redder
Env. File

Coordination: ______
J. McKenna

02-815-139
JMcKenna/JJRedder

Concerning: ***Master Work Plan, Final September 2002,***
Work Plan Addendum 9, Final September 2002, and
Work Plan Addendum 12, Final September 2002

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE: (CEA)
PRINTED NAME: FOR Brian A. Butler
TITLE: LTC, CM, Commanding
Radford AAP

SIGNATURE:
PRINTED NAME: Anthony Miano
TITLE: Vice President Operations
Alliant Ammunition and Powder Company, LLC

02-815-139
JMcKenna/JJRedder

11.

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

July 10, 2002

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: EPA comments dated May 22, 2002 on Master Work Plan, February 2002, Work Plan Addendum 9, February 2002 and Work Plan Addendum 12, February 2002, Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is our response to the above subject.

The Master Work Plan has been revised as noted in our response and a certified copy is enclosed. Your additional five copies and the Virginia Department of Environmental Quality copies will be sent under separate cover. As we believe the issues raised by EPA have been addressed in this latest draft, we request the enclosed document be accepted as final..

Regarding Work Plan Addenda 9 and 12 we believe our enclosed response should satisfy the issues raised by EPA without further revisions to either of these documents. Therefore we request that they be approved in their current form.

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

C. A. Jake

C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company, LLC

Enclosure

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Mark Leeper
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

02-815-100
JMcKenna/JJRedder

WPA 12

Kenneth G. Barnes
U.S. Army Operations Support Command
Environmental Restoration Division
1 Rock Island Arsenal, Attn: AMSOS-ISR
Rock Island, IL 61299-5500

Peter J. Rissell
U.S. Army Environmental Center
5179 Hoadley Road, Attn: SFIM-AEC-ERP
Aberdeen Proving Ground, MD 21010-5401

Dennis Druck
U.S. Army Center for Health Promotion and Preventive Medicine
5158 Blackhawk Road, Attn: MCHB-TS-HER
Aberdeen Proving Ground, MD 21010-5403

w/o enclosure
Russell Fish, P.E., EPA Region III

John Tesner
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

Coordination: J. McKenna
J. McKenna

bc: Administrative File
~~J. McKenna, ACO Staff~~
Rob Davie-ACO Staff
C. A. Jake
J. J. Redder
Env. File

02-815-100
JMcKenna/JJRedder

[illegible]ncerning the following document:

Master Work Plan, June 2002, Radford Army Ammunition Plant

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: Brian A. Butler
TITLE: LTC, CM, Commanding
Radford AAP

SIGNATURE:
PRINTED NAME: Anthony Miano
TITLE: Vice President Operations
Alliant Ammunition and Powder Company, LLC

Response to EPA Comments on Master Work Plan (MWP) dated February 2002;
Work Plan Addendum (WPA) 009, dated February 2002;
And Work Plan Addendum (WPA) 012, dated February 2002
Comments dated 22 May 2002
From Rob Thomson

GENERAL COMMENTS

Comment 1: The "Preface" to this draft Master Work Plan, Master Quality Assurance Plan and Master Health & Safety Plan (MWP) states that the "MWP provides comprehensive discussions of standard procedures, protocols, and methodologies that are to be followed during execution of field investigations at RCRA sites within the RFAAP." Figure 2-2 of the MWP shows the locations of Solid Waste Management Units (SWMUs) in the Main Manufacturing Area (MMA) and Figure 2-3 shows the "area locations" in the New River Unit (NRU). However, Figure 2-2 provides numerical designation of the SWMUs, and Figure 2-3 provides names of the areas. In addition, Section 3.0 (Environmental Setting) of the MWP provides extensive environmental setting information for certain SWMUs and Hazardous Waste Management Units (HWMUs). However, these SWMUs and HWMUs are only referenced by their designated numbers, except for the Horseshoe Area (HSA). Since the site-specific Work Plan Addenda (WPA) will be referencing this MWP for the installation description and environmental setting, it is important to identify each SWMU, HWMU and Area of Concern (AOC) by its designated name and number combination, and to provide a map that clearly delineates such information. This will aid the reviewer in understanding and cross-referencing the detailed information provided in Section 3.0. Please revise the MWP to address this issue.

Response

The Master Work Plan will be revised to include both the designated name and number combination and maps will be provided that will aid the reviewers with cross-referencing the detailed information in the report.

Comment 2: The MWP contains numerous inconsistencies in its cross reference of the various information provided. As this MWP will be a comprehensive document that will be referenced by the multiple site-specific WPA, all references and cross-references should be accurate and current. Examples of discrepancies and incompleteness include:

a) In Section 5.2.2 of the MWP, the first bullet references Standard Operating Procedure (SOP) 10.3 of Appendix A regarding the qualifications of drilling contractors and personnel responsible for the supervision of the contractor. However, this information is not provided in the referenced SOP.

Response

The SOP referenced in Section 5.2.2 of the MWP should be SOP 20.11, *Drilling Methods and Procedures*, not 10.3, *Boring Logs*. SOP 20.11 specifies the particular drilling procedures. Section 5.2.2 will be augmented to include a statement regarding the qualifications of drilling contractors and the site geologist.

b) The 7th bullet references Section 5.2.7 for information regarding soil sampling methods during drilling. However, this information is not provided in Section 5.2.7.

<u>Response</u>

The 7th bullet should reference Section 5.2.8 not 5.2.7. The MWP will be revised to refer to the correct section.

c) The last bullet references Section 5.2.5 for soil boring abandonment. However, this information is not provided in Section 5.2.5, it is rather provided in Section 5.2.7.

<u>Response</u>

The MWP will be revised to correct the section reference.

d) In Section 5.2.3.1 of the MWP, the first paragraph on page 5-5 references Section 3.6 for site subsurface conditions. Section 3.6 discusses Regional geology. The referenced information is provided in Section 3.7.

<u>Response</u>

The MWP will be revised to correct the section reference.

e) In SOP 20.11, Sections 2.1 and 2.2, the first bullets refer to Sections 2 and 3 for drilling equipment outline. It is not clear where these sections are located, as Sections 2 and 3 of this SOP do not provide the referenced information.

<u>Response</u>

These references to Sections 2 and 3 will be struck from the MWP.

f) In SOP 20.1, Section 3.3.10 references Figure 20.1a for well construction diagram. However, the referenced figure does not exist. Also, Section 5.6 of the Master Quality Assurance Plan references back to this section for the location of a well construction diagram.

<u>Response</u>

The well construction diagram will be included in the revised MWP.

g) In Section 9.5.1 of the Master Quality Assurance Plan, the 5th bullet states that "This assessment will be provided in the form of data validation reports as defined in Section 9.6.2." However, no such definition is provided in Section 9.6.2.

Response

Section 9.5.1 of the MQAP refers to Section 9.6.2 for a definition of the Data Validation Reports but should refer to Section 9.5.2, *Validation and Verification Methods*. The MQAP will be revised to correct the reference.

Please revise the MWP to address these and other discrepancies, and ensure the document can easily be cross-referenced and is complete.

Response

The Master Work Plan will be revised to address inconsistencies and to ensure the document can easily be cross-referenced and is complete.

Comment 3: Decontamination needs to be addressed. Regional guidelines for organic and inorganic sampling decontamination procedures follow:

- wash with non-phosphate detergent,
- tap water rinse,
- 0.1N nitric acid rinse when cross contamination from metals is a concern,
- deionized/distilled water rinse,
- pesticide-grade solvent, methanol rinse when semivolatile and non-volatile organic contamination may be present,
- double rinse with deionized/distilled water, and
- organic-free water rinse (high performance liquid chromatography [HPLC] grade).

The final water rinse is collected for confirmation analyses, to insure there is no carry over of contaminants to other samples. This procedure is recommended for the geo-punch equipment, and any other re-usable equipment.

Response

The MWP will be revised to incorporate the recommended decontamination procedures.

Comment 4: A provision should be included in the subject document(s) for validating 100% of data generated according to procedures consistent with those specified in the documents "Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis," April 1993, and "Region III Modifications to National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration"(OLMO1.0-OLMO1.9) September 1994 by an independent third party. That third party should be named prior to sampling. The laboratory deliverable requirements should be modified to include the submission of a complete raw data package, as appropriate, for this review. That data packet and all electronic tapes should be accessible to the EPA upon request.

Response

Non-CLP methods are proposed for analytical work for these WPA. These WPA will be using SW 846 methods. For non-CLP methods, 100% of the data is planned to be independently validated in accordance with the USEPA (SW846) method criteria, performed using the USEPA Region III Modifications to the NFG as guidance. The USEPA Region III Modifications to the NFG criteria is specific to USEPA CLP method criteria. The data qualifiers from the USEPA Region III Modification to the NFG will be used. Discussion as to the laboratory deliverables may be found in Section 9.8.3 of the MWP and is adequate (CLP-like) for data validation. Discussion of data validation may be found in MWP Section 9.5. Data will be made available to USEPA upon request and presented in RFI/RI reports.

Comment 5: Whenever a mass spectral analysis is requested using SW-846 methods, such as 8270 and 8260, the laboratory should submit a Tentatively Identified Compound (TIC) list with each analysis. The TIC list can identify unknown and unexpected compounds at all stages of investigation.

Response

In accordance with Section 5.3 of USEPA Region III's Site Screening Process (SSP) developed for Radford (dated 26 October 2001) and approved by EPA Region III on 11 February 2002, TIC's are to be addressed as follows:

5.3 Tentatively Identified Compounds

Chemical analysis to identify and quantify organic compounds is performed with gas chromatography-mass spectrometry (GC-MS) methods. The GC-MS instrument is calibrated for a series of target analytes using chemical standards of known concentration and purity. Quantification of these target analytes is performed against specific internal standards as identified in the respective method. Identification of these target analytes is based on a comparison of the unknown analyte to the chemical standards used during calibration based on the analyte's retention time and mass spectra.

Chromatographic peaks in volatile/semivolatile fractions analyses that are not target analytes, surrogates, or internal standards are potential Tentatively Identified Compounds (TICs). TICs must be qualitatively identified by a National Institute of Standards and Technology (NIST) mass spectral library search and the identification assessed by the data reviewer. For each sample, the laboratory conducts a mass spectral search of the NIST library and report the possible identity for the 10 VOC and/or 20 SVOC largest fraction peaks that are not surrogates, internal standards, or target compounds, but that have an area or height greater than 10 percent of the area or height of the nearest internal standard. TIC results are reported for each sample on the Organic Analyses Data Sheet (Form I - VOC-TIC or SVOC -TIC)

TICs will be reported and included in the COPC identification based upon the degree of match, evidence of similar pattern, analyst professional judgment, availability of toxicity data (e.g., IRIS, HEAST, or NCEA reference doses and/or slope factors), and consultation with EPA Region III (see Section 6.1.1.1). The top 20 TICs will be reported by name and CAS Registry number and may be quantified. Quantification of TICs will be based on input from EPA staff. Positive identification and quantification of TICs will be accomplished by acquiring the appropriate standards and calibrating the GC-MS for the tentatively identified compounds. TICs that lack toxicity data will be discussed in the uncertainty section of the screening risk assessment results.

Where TICs do not provide a quantified value, they do indicate the presence of samples where extensive organic contamination may exist. The top 10 TICs are to be reported for all GC/MS analysis for such analysis.

SPECIFIC COMMENTS

Volume I - Master Work Plan

Comment 6: Figure 2-2 Site Layout and SWMU Location Map: The legend of this map uses an acronym (VI) which is not defined or included in the List of Acronyms. Please either define this acronym in the text where the figure is referenced or include it in the List of Acronyms for Volume I.

Response

The acronym VI (Verification Inspection) in the legend of Figure 2-2 of the MWP will be revised to specify the meaning of the acronym and the acronym will be included within the Acronym list.

Comment 7: Page 6-3, Selection of COPCs, second paragraph: The report recommends using the 95% UCL for screening if the data display the required statistical properties. EPA recommends the use of the maximum detected concentration unless site specific circumstances indicate otherwise. The reason is that stats alone cannot determine if the 95% UCL would give an appropriate screening value. Other important considerations include the characterization of nature and extent and an appropriate exposure unit.

Response

The Army agrees that it is common practice to compare the maximum detected concentration (MDC) for each constituent during the screening process. However, it is stated in the SSP as approved by EPA Region III that the MDC would be used for screening unless the data display the statistical properties required to calculate a valid 95% upper confidence limit (UCL). In those cases, the 95% UCL would be used.

Comment 8: Page 6-3, Soil and Sediment: EPA recommends the use of an alternate screening value for sediment. One would expect much less exposure to sediment compared to soil. The difference is typically about 10 fold less exposure. Therefore, I recommend that the sediment screening value be ten times higher than the soil screening concentration. The result is still screening sediment at approximately a HI = 0.1 and a ICR = 10-6 using a ten fold exposure factor. For example, the screening concentration of aluminum and arsenic in residential soil would be 7800 and 0.43 mg/kg. The screening concentration in sediment for Al and As would be 78000 and 4.3.

Response

The MWP will be revised to incorporate the recommended screening value for sediment. The following paragraph will be added to Section 6.2.2 of the MWP:

In recognition of the special nature of sediment, a ten fold exposure factor will be applied to the screening values for both cancer and non-cancer compounds as identified in the Region III RBC Tables. The result is still screening sediment at approximately a HQ = 0.1 and an increased cancer risk = 1 x 10^{-6} *using this ten fold multiplier. For example, the screening concentration of aluminum and arsenic in residential soil would be 7,800 mg/kg and 0.43 mg/kg, respectively. The screening concentration in sediment for aluminum and arsenic would be 78,000 mg/kg and 4.3 mg/kg, respectively.*

Comment 9: Page 6-3, Soil and Sediment: EPA recommends including an industrial soil lead screening value as a point of reference. US EPA Region III typically uses 1000 mg/kg as the industrial lead screening concentration.

Response

The MWP will be revised to incorporate the recommended screening value for lead. The following bold/italicized text will be added to this paragraph in Section 6.2.2 of the MWP:

If lead concentrations in soil are greater than 400 milligrams per kilogram (mg/kg) (USEPA 1994a), then potential risk associated with lead will be evaluated using the Integrated Exposure Uptake Biokinetic model (USEPA 1994b). As a screening value point of reference, ***USEPA Region III recommends an industrial soil lead screening value of 1,000 mg/kg.*** The model will be run using site-specific input parameters based on Site Screening Process (SSP) findings and consultation with USEPA Region III. If the percentage of children expected to have blood lead levels of 10 micrograms per deciliter (µg/dL) or greater exceeds 5%, then lead will be retained as a COPC to be evaluated in the next steps of the HHRA (Exposure Assessment and Risk Characterization).

Comment 10: Page 6-3, Groundwater and Surface Water: EPA recommends using an exposure factor applied to surface water similar to sediment. One would expect about ten fold less exposure to surface water compared to groundwater. For example, the screening concentration for aluminum and arsenic in groundwater would be 3700 and 0.045 ug/l. The screening concentration in surface water for Al and As would be 37000 and 0.45.

Response

The MWP will be revised to incorporate the recommended screening value for surface water. The following paragraph will be added to Section 6.2.2 of the MWP:

In recognition of the special nature of surface water, a ten fold exposure factor will be applied to the screening values for both cancer and non-cancer compounds as identified in the Region III RBC Tables. The result is still screening surface water at approximately a HQ = 0.1 and an increased cancer risk = 1 x 10^{-6} *using this ten fold multiplier. For example, the screening concentration of aluminum and arsenic in groundwater would be 3,700 µg/L and 0.045 µg/L, respectively. The screening concentration in surface water for aluminum and arsenic would be 37,000 µg/L and 0.45 µg/L, respectively.*

Comment 11: Page 6-5, Exposure Quantification: EPA requires clarification on the calculation of the exposure point concentration (EPC). US EPA Region III interprets the Calculating Concentration Term, 1992 guidance to mean that first the distribution of the data will be determined (normal, lognormal or undetermined). If the data are normally distributed, then use the Student's t statistic to calculate the UCL. If the data are lognormally distributed, then use Land's H-statistic to calculate the UCL. Additionally, US EPA is working on updating this guidance. We have found that the H-statistic is very sensitive to the assumption of lognormality. If the data are not truly lognormal, then the resulting UCL is very high. EPA suggests that if a sample distribution is neither normal nor lognormal, then try a non-parametric approach. The resulting EPC could be much lower.

Response

The Army agrees that the approach that USEPA has described is consistent with what is planned in this WPA. Note the WPA approach is based on the SSP as approved by EPA, Region III. We first test the distribution, then calculate the 95% UCL based on the appropriate distribution. In the case where the distribution is neither normal nor lognormal, the nonparametric distribution will be used. As the reviewer notes, the nonparametric 95% UCLs are often lower. The Army is aware that USEPA have considered updating guidance regarding the use of the H-statistic and using different techniques instead (e.g., bootstrap, jack-knife), but cannot comment as this information is not available for review.

Comment 12: Section 8.7 Laboratories, page 8-8: This section states that "laboratories will meet the requirements established in the EPA document *RCRA Corrective Action Plan."* Please provide the appropriate and complete citation for this document. Irregardless, the laboratory QA/QC must comply with the Region 3 Functional Guidelines, which must be cited in the final document.

It is further stated in this section that "data will be validated in accordance with current EPA guidance." Revise the MWP to add a statement that the appropriate citation for the guidance in effect at the time of the investigations will be provided in the site-specific WPA, including but not limited to the Region III Functional Guidelines.

Response

Section 8.7 will be revised to read as follows:

Laboratories activities will be conducted in accordance with the established guidelines in the USEPA Directive, RCRA Corrective Action Plan (USEPA 1994a). Data will be validated in accordance with current USEPA guidance including Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis (USEPA 1993b) and Region III Modifications to National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration (OLM01.0-OLM01.9) September 1994 (USEPA 1994c), or the appropriate guidance in effect at the time of investigation. Preliminary specifications for sampling and analysis will be included in the site-specific WP/QAP/HSP, to be submitted prior to the performance of fieldwork. Specifications will include, as a minimum, proposed SW-846 methods or Standard Methods to be employed, detection limits, practical quantitation limits (PQLs), and the identification of the laboratory. Methods and detections will be, as a minimum, those established by guidance from USEPA Region III or as established by Virginia Department of Environmental Quality (VDEQ) approved plans, if applicable.

Volume II - Master Quality Assurance Plan

Comment 13: Section 3.0 Quality Assurance Objectives, page 3-1: The second paragraph of this section states that "the DQO [data quality objective] process used for developing RFAAP data quality criteria and performance specifications for data operations is consistent with the *Guidance for the Data Quality Objectives Process*, U.S. Environmental Protection Agency (USEPA) QA/G-4, September, 1994." Please note that the most current Guidance is dated August 2000 and revise this citation accordingly. In general, ensure that the latest methods (e.g., sampling and analysis) and guidance documents are cited in the site-specific WPA, including the EPA Region III Functional Guidelines.

Response

Section 3.0 of the MQAP will be revised to specify the most current guidance for the Data Quality Objective Process. The latest methods and guidance documents will be cited, as appropriate, throughout the MWP, MQAP, and MHSP.

Comment 14: Section 2.3.1, More detail is needed in the section detailing data quality objectives. Particular emphasis needs to be placed on the following:

a) State the Problem, historical uses of the site and possible components of concern should be identified. The approach needs to be more consistent in this application; in some areas the treatment is very strong, in others it is weak.

b) The Decision Threshold, which is used to determine the applicability of the proposed analytical methods and their ability to achieve the necessary sensitivity for this sampling event. Maximum containment levels and RBCs are referenced, however these two tables do not incorporate all the compounds identified as possible analytes in this plan. It is recommended that all decision threshold criteria, i.e. including MCLs, RBCs, SSLs, eco screening values, etc., be added to the list of threshold levels to be used. As part of the DQO process the sampling event should have its sampling goals enumerated. This will lead to decision thresholds and resulting actions clearly described in "If...Then" statements. For example: If the concentrations are below the named health risk levels then no further action will be taken. If the concentrations are at or above those levels, then an evaluation of further action will occur, at a minimum, a written report for that evaluation will be submitted. Decision rules need to be stated in this document, or, alternatively the method that will be used to determine the decision rule needs to be established, before sampling begins.

c) The WPA states, "The consequence of decision errors and acceptable probability will be assessed." This document is where that procedure for determining the acceptance probability is to be described.

Response

This comment appears to be directed at WPA 9 and 12. The response is crafted under that assumption. The data quality objectives are specified in Section 2.3 of both WPA 9 and 12. The problem statement, decision inputs, and optimal data design identify the approach to be taken during the site investigation. Previous investigations, conceptual site-model, data gap analysis, and planned field activities and technical approach are further discussed for each SWMU in Section 1.0 of WPA 9 and 12. Decision rules are to be developed based upon the action levels and data found for the parameters of interest.

The analyte list covering this investigation with associated levels of concern (LOCs) may be found in Table 2-6 of the QAPP in WPA 12 and Table 2-7 in WPA 9. Comparison of the data to these LOCs will be discussed in RFI reports after the sampling, analysis, and validation are completed. Analytes without chemical-specific comparison criteria (*i.e.* MCL or RBC values) will be evaluated on an individual basis and will not be removed from the list of constituents of potential concern (COPCs). Several naturally occurring, abundant metals, for example, do not have comparison criteria and are considered essential nutrients (calcium, potassium).

The *Guidance For The Data Quality Objectives Process*, EPA QA/G-4, September 1994 and *USACE Shell for Analytical Chemistry Requirements*, December 1998 provide the basis for the DQO process and are referenced in the QAPP Addenda.

Comment 15: Section 2.4.3 Sample Identification Duplicate samples should be submitted to the laboratory blind. Labeling them in a manner that identifies them as a duplicate reduces their value.

Response

Agreed. Duplicate samples will be submitted to the laboratory blind.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

May 29, 2002

Mr. James McKenna
Radford Army Ammunition Plant
SIORF-SE-EQ
P.O. Box 2
Radford, VA 24141-0099

RE: Draft Work Plan Addendum 012 (WPA 12)

Dear Mr. McKenna:

This office has reviewed the referenced draft document and concurs with WPA 12. No revisions to the document are required. Please provide this office a copy of the final document when it is completed.

If you have any questions, please call me at 804.698.4308.

Sincerely,

Mark S. Leeper
Remedial Project Manager

cc: Norman L. Auldridge - WCRO, DEQ
Durwood Willis - DEQ
Robert Thompson, Region III, U.S.EPA, 3HS13

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

May 22, 2002

In reply
Refer to 3HS13

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Commander,
Radford Army Ammunition Plant
Attn: SIORF-SE-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

C.A. Jake
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant
Master Work Plans
Work Plans Addendums 9 & 12
Document submittal and review

Dear Mr. McKenna and Ms. Jake:

The U.S. Environmental Protection Agency (EPA) has reviewed the Army's draft *Master Work Plans, Work Plan Addendum 9, and Work Plan Addendum 12* for the Radford Army Ammunition Plant (RFAAP) and New River Ammunition Storage Depot (NRASD). The reviews were based on guidance provided in "Guidance for Data Quality Objectives (DQO) Process" September 2000 (EPA QA/G-4), "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" March 2001(EPA QA/R-5), "Guidance for Quality Assurance Project Plans" March 2001 (EPA QA/G-5), and Regional guidance documents, "Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis," April 1993, and "Region III Modifications

However, this information is not provided in Section 5.2.7.

The last bullet references Section 5.2.5 for soil boring abandonment. However, this information is not provided in Section 5.2.5, it is rather provided in Section 5.2.7.

☐ In Section 5.2.3.1 of the MWP, the first paragraph on page 5-5 references Section 3.6 for site subsurface conditions. Section 3.6 discusses Regional geology. The referenced information is provided in Section 3.7.

☐ In SOP 20.11, Sections 2.1 and 2.2, the first bullets refer to Sections 2 and 3 for drilling equipment outline. It is not clear where these sections are located, as Sections 2 and 3 of this SOP do not provide the referenced information.

☐ In SOP 20.1, Section 3.3.10 references Figure 20.1a for well construction diagram. However, the referenced figure does not exist. Also, Section 5.6 of the Master Quality Assurance Plan references back to this section for the location of a well construction diagram.

☐ In Section 9.5.1 of the Master Quality Assurance Plan, the 5th bullet states that "This assessment will be provided in the form of data validation reports as defined in Section 9.6.2." However, no such definition is provided in Section 9.6.2.

Please revise the MWP to address these and other discrepancies, and ensure the document can easily be cross-referenced and is complete.

3. Decontamination needs to be addressed. Regional guidelines for organic and inorganic sampling decontamination procedures follow:

- wash with non-phosphate detergent,
- tap water rinse,
- 0.1N nitric acid rinse when cross contamination from metals is a concern,
- deionized/distilled water rinse,
- pesticide-grade solvent, methanol rinse when semivolatile and non-volatile organic contamination may be present,
- double rinse with deionized/distilled water, and
- organic-free water rinse (high performance liquid chromatography [HPLC] grade).

difference is typically about 10 fold less exposure. Therefore, I recommend that the sediment screening value be ten times higher than the soil screening concentration. The result is still screening sediment at approximately a HI = 0.1 and a ICR = 10-6 using a ten fold exposure factor. For example, the screening concentration of aluminum and arsenic in residential soil would be 7800 and 0.43 mg/kg. The screening concentration in sediment for Al and As would be 78000 and 4.3.

9. **Page 6-3, Soil and Sediment:** EPA recommends including an industrial soil lead screening value as a point of reference. US EPA Region III typically uses 1000 mg/kg as the industrial lead screening concentration.

10. **Page 6-3, Groundwater and Surface Water:** EPA recommends using an exposure factor applied to surface water similar to sediment. One would expect about ten fold less exposure to surface water compared to groundwater. For example, the screening concentration for aluminum and arsenic in groundwater would be 3700 and 0.045 ug/l. The screening concentration in surface water for Al and As would be 37000 and 0.45.

11. **Page 6-5, Exposure Quantification:** EPA requires clarification on the calculation of the exposure point concentration (EPC). US EPA Region III interprets the Calculating Concentration Term, 1992 guidance to mean that first the distribution of the data will be determined (normal, lognormal or undetermined). If the data are normally distributed, then use the Student's t statistic to calculate the UCL. If the data are lognormally distributed, then use Land's H-statistic to calculate the UCL. Additionally, US EPA is working on updating this guidance. We have found that the H-statistic is very sensitive to the assumption of lognormality. If the data are not truly lognormal, then the resulting UCL is very high. EPA suggests that if a sample distribution is neither normal nor lognormal, then try a non-parametric approach. The resulting EPC could be much lower.

12. **Section 8.7 Laboratories, page 8-8:** This section states that "laboratories will meet the requirements established in the EPA document *RCRA Corrective Action Plan.*" Please provide the appropriate and complete citation for this document. Irregardless, the laboratory QA/QC must comply with the Region 3 Functional Guidelines, which must be cited in the final document.

then no further action will be taken. If the concentrations are at or above those levels, then an evaluation of further action will occur, at a minimum, a written report for that evaluation will be submitted. Decision rules need to be stated in this document, or, alternatively the method that will be used to determine the decision rule needs to be established, before sampling begins.

c) The WPA states, "The consequence of decision errors and acceptable probability will be assessed." This document is where that procedure for determining the acceptance probability is to be described.

15. **Section 2.4.3 Sample Identification** Duplicate samples should be submitted to the laboratory blind. Labeling them in a manner that identifies them as a duplicate, reduces their value.

This concludes EPA's review of the Army's draft revised *Master Work Plans, Work Plan Addendum 9 and Work Plan Addendum 12 for* the RFAAP and NRASD. The referenced draft *Master Work Plans, Work Plan Addendum 9 and Work Plan Addendum 12* are disapproved by EPA in their current form, and they must be revised to reflect the comments above. However, based upon the content of the above comments, EPA is agreeable with approving the initiation of field sampling activities associated with *Work Plan Addendum 9* and *Work Plan Addendum 12*, provided that comment resolution occurs within the proscribed timeframes outlined in the EPA RCRA Corrective Action permit. Per Part II, Section E.4.e. of the EPA RCRA Corrective Action Permit, the Army is required to revise the above documents and submit a revised copy to EPA for review within 60 days of the receipt of EPA comments. Part II, Section E.4.f. of the Permit allows for an additional 20 days for issuing the revised document to EPA, provided that timely notice is given, i.e. within 10 days. Additional time extensions can be requested under Part II, Section F. of the permit.

If you have any questions, please call me at 215-814-3357.

Sincerely,

Robert Thomson, PE
Federal Facilities Branch

cc: Russell Fish, EPA
Mark Leeper, VDEQ

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

April 5, 2002

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Revised Sections for Work Plan Addendum 12 Site Characterization Plan SWMUs 38, 48, 49, 50, 58, 59, AOC FLFA, AOC Building 4343, New River Unit, Draft Final, February 2002
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is a new Section 1.15 Bag Loading Area (BLA) for Work Plan Addendum 12 that was submitted [illegible]bruary 15, 2002. Please replace Section 1.15 entirely. This section was revised to increase sampling per a [illegible]rch 12, 2002 conference call with Mr. Mark Leeper and Ms. Sharon Wilcox , VDEQ. There was further discussion and subsequent agreement of the BLA sampling strategy with Mr. Durwood Willis, VDEQ during his March 21, 2002 site visit to the Bag Loading Area.

Note the added sampling has resulted in changes to other parts of WPA 12. Below is an outline of these changes.

Section/Table	Comment/Action
Table of Contents	Revised for pagination, replace entire table
Table 1.1-3	Revised to show the additional BLA sampling, replace the table
Section 1.15 Bag Loading Area	Revised to show additional BLA sampling, replace entire section
Section 1.16 New River Unit Surface Water Drainage Sampling	Revised for pagination, replace entire section
Section 1.17 New River Unit Transformer Sampling	Revised for pagination, replace entire section
Table 2-4	Revised to show the additional BLA sampling, replace table

Your six additional copies and copies to Virginia Department of Environmental Quality (VDEQ), U.S. Army [illegible]erations Support Command, U.S. Army Environmental Center, U.S. Army Center for Health Promotion and [illegible]ventive Medicine will be sent under separate cover.

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

C. A. Jake

C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company, LLC

Enclosure

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Mark Leeper
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Kenneth G. Barnes
U.S. Army Operations Support Command
Environmental Restoration Division
1 Rock Island Arsenal, Attn: AMSOS-ISR
Rock Island, IL 61299-5500

Peter J. Rissell
U.S. Army Environmental Center
5179 Hoadley Road, Attn: SFIM-AEC-ERP
Aberdeen Proving Ground, MD 21010-5401

Dennis Druck
U.S. Army Center for Health Promotion and Preventive Medicine
5158 Blackhawk Road, Attn: MCHB-TS-HER
Aberdeen Proving Ground, MD 21010-5403

00-815-53
JJRedder

w/o Enclosure

Russell Fish, P.E., EPA Region III

John Tesner
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

00-815-53
JJRedder

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

February 15, 2002

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Work Plan Addendum 12
Site Characterization Plan SWMUs 38, 48, 49, 50, 58, 59,
AOC FLFA, AOC Building 4343, New River Unit
Draft Final, February 2002
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is a certified copy of "Work Plan Addendum 12 Site Characterization Plan SWMUs 38, 48, 49, 50, 58, 59, AOC FLFA, AOC Building 4343, New River Unit, Draft Final, February 2002". Your six additional copies and copies to Virginia Department of Environmental Quality, U.S. Army Operations Support Command, U.S. Army Environmental Center, U.S. Army Center for Health Promotion and Preventive Medicine will be sent under separate cover.

Work Plan Addendum 12 has been revised to address your draft comments of August 6, 2001 and Virginia Department of Environmental Quality (VDEQ) comments of September 10, 2001. These comments were discussed with EPA and VDEQ on September 20 and 21, 2001 via teleconference call. Minutes of this call were emailed to the participants on September 28, 2001 and serve as our response to EPA comments. The minutes are enclosed as Attachment A. On October 18, 2001 we responded to the September 10, 2001 VDEQ comments.

VDEQ further commented in two separate letters both dated November 7, 2001, one for the Main Manufacturing Area and one for the New River Unit. Work Plan Addendum 12 has revised to address these comments also. Responses to these comments are enclosed as Attachments B and C respectively.

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

C. A. Jake

C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company LLC

Enclosure & Attachments

c: Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Mark Leeper
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Kenneth G. Barnes
U.S. Army Operations Support Command
Environmental Restoration Division
1 Rock Island Arsenal, Attn: AMSOS-ISR
Rock Island, IL 61299-5500

Peter J. Rissell
U.S. Army Environmental Center
5179 Hoadley Road, Attn: SFIM-AEC-ERP
Aberdeen Proving Ground, MD 21010-5401

Dennis Druck
U.S. Army Center for Health Promotion and Preventive Medicine
5158 Blackhawk Road, Attn: MCHB-TS-HER
Aberdeen Proving Ground, MD 21010-5403

Russell Fish, P.E., EPA Region III - w/o enclosure

02-815-31
JMcKenna/JJRedder

John Tesner
Corps of Engineers, Baltimore District
ATTN: CENAB-EN-HM
10 South Howard Street
Baltimore, MD 21201

02-815-31
JMcKenna/JJRedder

Concerning the following:

Work Plan Addendum 012:
Site Characterization Work Plan
SWMU 39, SWMU 48, SWMU 49, SWMU 50, SWMU 58, SWMU 59,
AOC-FLFA, AOC-Building 4343, New River Unit
February 2002
Radford Army Ammunition Plant

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: Brian A. Butler
TITLE: LTC, CM, Commanding
Radford AAP

SIGNATURE: H. E. Martin for
PRINTED NAME: Ken Dolph
TITLE: Vice President Operations
Alliant Ammunition and Powder Company LLC

02-815-31
JMcKenna/JJRedder

ATTACHMENT A

W

McKenna, Jim

rom: McKenna, Jim
ent: Friday, September 28, 2001 7:42 AM
To: 'rob thomson'; 'mark leeper'
Cc: 'john e tesner'; 'Andrew Rak'; 'Barnes, Kenneth G'; 'peter rissell'; 'Parks, Jeffrey N'; Redder, Jerome; Davie, Robert
Subject: Sept 20-21 teleconference notes & background study numbers

All:

Please see the attached files for the subject as above (SAB). Note your action items.

Status of Radford AAP/ATK action items: Jerry has located the SWMU 76 UST paperwork and is sending under separate cover to Rob Thomson, Mark Leeper and John Tesner. I have contacted our command and we have relooked at the Radford AAP situation and pesticide screening samples are in. We will propose 1 to 2 samples per site for screening purposes. That does it for Radford AAP/ATK direct action items. Of course I will be working with John Tesner and Jeff Parks on their direct action items as well as scheduling, programming, budgeting, etc, etc.

Thanks,
Jim

PS Rob, Mark: Also please look over the background numbers and provide comments or concurrence so we can get moving on finalizing the Background Study report.

PA12Sept20-21 eeconference ...

inal Combined UTL SUM.xls

Copy in 216 and 439
GWPAs 10 & 12

MEETING MINUTES FOR RADFORD AAP
WORK PLAN ADDENDUM 12
20-21 SEPTEMBER 2001

Day 1:
20 September 2001
Time: 1300-1600

Participants:

USEPA, Region III: Rob Thomson
VDEQ: Mark Leeper, Sharon Wilcox
RFAAP: Jim McKenna
ATK: Jerry Redder
USAEC: Pete Rissell
OSC: Ken Barnes
USACE, Baltimore District: John Tesner, Andrew Rak
IT Group: Jeff Parks, Mark Thomas, Tim Leahy

GENERAL ISSUES

1. Pesticide sampling:
Jim McKenna stated the Army's positions; that pesticides were not manufactured at RFAAP, that there has been no identified location were pesticides were regularly mixed or stored, and the Army's uncertainty regarding the end use of data especially as it relates to BTAG screening values.

Rob Thomson of EPA stated that EPA wants sampling, but in a rational way. There would be no need to collect pesticide samples from former sampling locations nor is 100 percent sampling required for all new sampling. Further, Mr. Thomson stated that EPA needs to be able to document that pesticide releases didn't occur in conjunction with other releases at a site. In addition, if a site were seeking a No Further Action (NFA) status then it would be incumbent upon EPA and VDEQ to be able to show that pesticides were not an issue at the site. Sharon Wilcox of VDEQ concurred with this assessment from EPA adding that she thought that the number of samples per site would vary based on site conditions (e.g., the presence of a single runoff area from a site may require only one sample) and/or site size.

The Army and EPA agreed that pesticides receive analysis in laboratories when PCB's are being analyzed. This could possibly reduce the financial impact of adding pesticide sampling given that some sites will already be performing PCB sampling.

The Army advanced the idea that Tentatively Identified Compound (TIC) analyses that has already been included in the Site Screening Process (SSP) document, would provide indication as to the presence or absence of pesticide compounds. EPA did not agree with this assertion stating that their opinion is that TIC analyses identifies classes of compounds not specific compounds.

The discussion concluded with the Army agreeing to take this issue back to Command, but this may yet be an issue that requires Tier II involvement to resolve. The Army will continue to apprise the team as to the results of these discussions.

2. COPC Residential/Industrial
VDEQ stated that there is room to make risk management decisions on COPC's that fall between residential and industrial RBC's. This represents a clarification to their comments on WPA 12.

In the ensuing conversation relative to the role of BTAG and BTAG screening values, Rob Thomson indicated that a pre-remedial site screening process was now available from BTAG.

3. Groundwater
In order to respond to VDEQ comments regarding the inclusion of groundwater data in WPA 12, Jim McKenna restated its intent for the study of groundwater at RFAAP. The goals of WPA 9 and the Current Conditions report were discussed. Also, the plans for an expanded investigation of groundwater to include the balance of the Main Manufacturing Area were reiterated. VDEQ concurred with this discussion stating that this was "... a good game plan."

It was established that removing the label DNE (Does Not Exceed) from tables in the Current Conditions report will satisfy VDEQ comments.

4. Air Pathway
Both VDEQ and EPA stated that air sampling would not be required at this time. Air sampling would become necessary should a completed air pathway be established. VDEQ clarified their comment regarding the air pathway stating that they took exception with the assertion made in WPA 12 that air was not considered a complete pathway prior to the investigation. It was agreed that presumptive language relative to the completeness of risk pathways would be removed from the WPA.

5. BTAG Issues
The group quickly agreed on the need for another meeting that would include the BTAG in order to clarify their issues. It was also agreed that this meeting needed to occur ASAP. Drew Rak from USACE was tasked with contacting Bruce Pluta from EPA Region III BTAG to set up this meeting.

6. Surface soil sampling depth, end use of data
After some discussion on this issue, the group agreed on the following regarding surface soil sampling at RFAAP:

- Future surface soil sampling, including that proposed in WPA's 9 and 12, would be defined as soil in the first six inches below the root mat.
- Sampling for VOC compounds (where proposed) would occur from the interval between 6 and 12 inches in realization that the volatile nature of VOC compounds makes their detection in the 0-6 inch interval unlikely.

- Previous surface soil sampling, that until now had been 0 to 2 feet at Radford AAP, is considered valid for evaluation of surface soil. Additional sampling from previous sampling locations is not required.

SITE SPECIFIC ISSUES

SWMU 39

Based on review of the additional figures and tables provided to meeting attendee's in preparation for this conference, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites.

It was agreed that the vertical sampling profile would be adjusted to capture subsurface soil in the intervals from 1 to 3 feet and the interval from 3 to 5 feet in order to better capture intervals were COPC's may be present. This did not result in an addition of samples, rather it was an adjustment to proposed sampling depths.

SWMU 48, 49, 50, 59

Upon discussion of VDEQ comments regarding inclusion of dioxin/furan sampling, it was agreed that these analyte suites were not required for SWMU's 48 and 50. The attendee's agreed that dioxin/furan analyte suites would be included at sites where burning activities had taken place; or where ash, burned material, or burn residue was suspected of being deposited. SWMU's 48 and 50 did not appear to meet this criteria. VDEQ requested and the attendee's agreed that they be given time to double check why the comment was made initially to ensure that there was no other rationale for the inclusion of dioxins/furans.

With regards to SWMU 48, the Army agreed that some additional sampling for explosives was justified. Additional characterization samples for explosives will be proposed by the Army. The use of immunoassay test kits for this purpose was discussed and approved by EPA and VDEQ.

Additionally, at the request of VDEQ, proposed boring 49SB02 will be advanced to a depth of 17-19 feet in order to assess the interval where relatively high TPH detection's had previously occurred. This will be an additional sample at this location and will receive the same analytical analyses as other sample intervals proposed at this location.
A discussion ensued as to the final disposition of SWMU 50 in light of the recent delisting of calcium sulfate sludge as a listed hazardous waste for explosive manufacture. Depending on analytical results (i.e., no COPC's), and review of Commonwealth regulations, no further action may be an appropriate remedy.

Based on review of the additional figures and tables related to SWMU 59, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites.

SWMU 58

The Army agreed with VDEQ that given the sites reported history, the inclusion of dioxin/furan analyte suites was appropriate for SWMU 58. Otherwise, based on review of the additional figures and tables provided, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites.

It was agreed that the vertical sampling profile would be adjusted to capture subsurface soil in the intervals from 0-2', 2-4', and 4-6' below ground surface where it begins beneath the rubble pile that is the primary feature of SWMU 58. This will not result in additional samples, rather it is an adjustment to the previously proposed sampling depths.

Day 2:

21 September 2001
Time: 0900-1200

Participants:

USEPA Region III: Rob Thomson
VDEQ: Mark Leeper
RFAAP: Jim McKenna
ATK: Jerry Redder
USAEC: Pete Rissell
USACE, Baltimore District: John Tesner, Andrew Rak
IT Group: Jeff Parks, Mark Thomas, Tim Leahy

GENERAL ISSUES

1. ER, A Program Definitions (i.e., Active vs. Inactive sites)

Jim McKenna provided definition of the program regarding the eligibility of SWMU's at Radford AAP. The Army's policy is that sites that were active beyond 17 October 1986 are considered active, therefore, ineligible for ER, A funding. This includes SWMU 17. The Army understands that it has an obligation to investigate SWMU's as named in the Installation's RCRA permit (October 2000), and will continue to pursue actions at active sites via separate funding mechanisms, programs, and documentation.

2. VDEQ review status

Jim McKenna recommended that VDEQ contact USACE's hydrogeologist, Mr. Drew Clemens (617-480-7732) for Radford AAP as they perform their review of WPA 9. VDEQ stated that WPA 9 comments will be made available the first week of October.

VDEQ agreed in the future to send out "draft" comments initially in order to allow the Army to address the issues more expeditiously and allow for the removal of comments when they become finalized.

USEPA agreed to accept these meeting minutes as the Army's response to draft USEPA comments.

The Army will submit formal responses to VDEQ's comments on WPA 12, since those comments were submitted as final.

3. Project schedule

The Army stated that adjusted project schedules will be provided for WPA 9 and 12 once WPA 9 comments are received/resolved and BTAG issue are resolved. At this time it is estimated that IT could be in the field in the November/December 2001 timeframe.

4. Background Study

Verified with EPA and VDEQ that the intent of the most recent comments from VDEQ was to have a single value for background that represented the 95% UTL calculated from a single combined data set. This was confirmed. IT will calculate these values and have them ready for distribution by COB 28 September.

5. SSP Issues

The group agreed that the remaining issues related to the SSP are to be resolved at the proposed BTAG meeting.

SITE SPECIFIC ISSUES

Former Lead Furnace Area (FLFA)

Jerry Redder from ATK provided a description and status of the non-ER, A funded project currently being executed at SWMU 17. He also discussed the solid waste permit being pursued at SWMU 17 as requested by VDEQ.

Based on review of the additional figures and tables provided for FLFA, and explanation provided by the Army, EPA and VDEQ tentatively approved the proposed sampling locations and analyte suites with the following issues pending resolution:

- The Army/ATK is to look for existing data/information regarding SWMU 76.
- Mark Leeper (VDEQ) will look into the Commonwealth's specific concerns at SWMU 17 that may relate to FLFA.
- The appropriate lead screening level may be an open issue relative to BTAG. This will need to be discussed a the upcoming BTAG meeting.
- The Army needs to screen the site data again versus recalculated background lead levels.

Building 4343

Based on review of the additional figures and tables provided for Building 4343, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites. Also, cyanide will be added to the analyte list for this site based on its general use in metal finishing operations.

The Army agreed to look at ways of moving forward more quickly with this site. The Army noted that the IAP workshop, scheduled for Spring 2002, will provide the best opportunity to discuss moving project phases and funding.

New River

Building Debris Disposal Trench (BDDT)

The Army addressed or received clarification regarding several of VDEQ's comments. EPA believes that BTAG will want to discuss BDDT at the upcoming meeting.

Based on review of the additional figures and tables provided for BDDT, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites. The Army agreed to modify the figure presented to show the extent of rip-rap at BDDT. This rip-rap extends to Avenue A though this is not evident on the figure.

Igniter Assembly Area (IAA)

Based on review of the additional figures and tables provided for IAA, the Army agreed to increase the number of samples collected as follows:

- Three additional subsurface soil samples will be collected and analyzed for TAL metals in the vicinity of IASB05 at a depth interval of 4-6 feet bgs (depth of elevated mercury detection).
- Three surface soil samples will be collected and analyzed in the vicinity of both SS11 and SS-12 (six additional samples).
- One subsurface soil sample from the 2-4 foot interval will be collected in the vicinity of both SS-11 and SS-12 (two additional samples).
- TAL metals analyses will be included at the other proposed sampling locations contained in WPA 12 for IAA.

Northern Burning Ground (NBG)

Based on review of the additional figures and tables provided for NBG, and explanation provided by the Army, EPA and VDEQ approved the proposed sampling locations and analyte suites.

Western Burning Ground (WBG)

Based on review of the additional figures and tables provided for WBG, and explanation provided by the Army, EPA and VDEQ tentatively approved the proposed sampling locations and analyte suites pending the outcome of the forthcoming BTAG meeting. Drew Rak recommended that surface water data be compared to Ambient Water Quality Criteria instead of MCL's in preparation for the BTAG meeting.

Rail Yard

Based on review of the additional figures and tables provided for the Rail Yard, and explanation provided by the Army, EPA and VDEQ tentatively approved the proposed sampling locations and analyte suites pending verification of site drainage and topography in the southeast portion of the site in the area near the unnamed creek.

DRAFT Summary of Total Soil Data at Radford
Upper Tolerance Limits (UTLs)

	MMA/NRU and Surface/Subsurface Soil Data						
Chemical	Frequency of Detection	Range of data, mg/kg	Statistical Distribution [a]	95% UTL mg/kg [b]	Residential Screening RBC [c], mg/kg	Industrial Screening RBC [c], mg/kg	Background Basis
ALUMINUM	79/79(100)	3,620 - 47,900	L	40,041	7,800	200,000	95% UTL
ARSENIC	76/79(96)	1.2 - 35.9	L	15.8	0.43	3.8	95% UTL
BARIUM	63/79(80)	23.4 - 174	L	209	550	14,000	RBC
BERYLLIUM	40/79(51)	0.61 - 5.4	U	1.02	16	410	RBC
CADMIUM	13/79(16)	0.62 - 2.5	NP	0.69	3.9	100	RBC
CHROMIUM	79/79(100)	6.3 - 75.8	L	65.3	23	610	95% UTL
COBALT	57/79(72)	5.9 - 130	L	72.3	160	4,100	RBC
COPPER	77/79(97)	1.6 - 38.7	L	53.5	310	8,200	RBC
IRON	79/79(100)	7,250 - 67,700	N	50,962	2,300	61,000	95% UTL
LEAD	79/79(100)	2.1 - 256	U	26.8	400	1,000	RBC
MANGANESE	79/79(100)	16.7 - 2,040	L	2,543	160	4,100	95% UTL
MERCURY	19/79(24)	0.038 - 1.2	NP	0.130	0.78	20	RBC
NICKEL	63/79(80)	4.6 - 94.2	L	62.8	160	4,100	RBC
THALLIUM	16/79(20)	1.3 - 5.0	NP	2.11	0.55	14	95% UTL
VANADIUM	79/79(100)	12.2 - 114	L	108	55	1,400	95% UTL
ZINC	79/79(100)	4.7 - 598	L	202	2,300	61,000	RBC

[a] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NP = Nonparametric distribution for data sets with greater than 50% nondetects.

[b] 95% Upper Tolerance Limit calculated for the indicated distribution.

[c] RBC = Region III risk-based concentration adjusted for a Hazard Quotient = 0.1 to account for potential cumulative effects (dated May 8, 2001).

Note: Highlighted values are below the residential screening RBC.

ATTACHMENT B
Response to Comments on the Draft Site Characterization Work Plan Addendum 012: SWMUs 39, 48, 49, 50, 58, 59, AOC-FLFA - Radford Army Ammunition Plant, November 7, 2001
From the Department of Environmental Quality, Commonwealth of Virginia
Sharon Skutle Wilcox, Office of Remediation Programs

Cover letter:

1. The Department of Environmental Quality (DEQ) will review the VPDES New River ecological studies in conjunction with the surface water and sediment data presented in the January 1996 and January 1999 RCRA Facility Investigations (RFIs) and prepare a response under separate cover if any issues remain of concern.

   Response: No response required.

2. DEQ is not requesting that investigations of SWMU 17 and the incinerator be conducted under the Environmental Restoration Army (ERA) account. It is requesting that investigation encompass the entire extent of contamination which may/appears to have resulted from activities at the Former Lead Furnace Area (FLFA), (or other ERA eligible units) regardless of whether or not the ERA eligible unit contamination has migrated over "clean " property, or over property that is associated with a non-ERA eligible unit. The relevant issue is whether or not the contamination, or a portion thereof, is a result of activities at the ERA eligible unit or, for investigation purposes, is it possible that contamination from the ERA eligible unit could have migrated to, or otherwise be present, at the proposed sampling location.

   Response: As per the conference call on 14-15 November 2001, the following samples were added to the proposed sampling effort at the FLFA to assess whether unit contaminants migrated beyond the site boundary: LFSB16 and LFSB17. (Table 1.8-2, Page 1-81)

3. Regarding sites being carried forward to the Remedial Investigation (RI) phase, DEQ is simply clarifying that all sites where chemical constituents exceed the screening criteria (in these cases residential RBCs or 95% UTL background) will then progress to the RI phase, where, at a minimum, the nature and extent of the contamination must be determined along with all potential migration pathways and potential receptors. Based upon the data available at that time, (background levels have since been updated) all sites would have eventually proceeded to this phase as every site had chemical constituents exceeding both residential RBCs and the interim background screening levels. Ecological concerns may also cause a site to progress to the RI phase of the investigation.

   Response: Pursuant to the 14-15 November 2001 conference call, additional samples were added sufficient to satisfy RI level data requirements.

General Comment 3:

- Use of "NT" or any other abbreviation is acceptable as long as it is defined at the bottom of each page or in an abbreviations table. The concern was that all data is reported, including data below screening levels, data that is qualified, and data that shows a non-detect.

Response: As per the conference call on 14-15 November 2001, occurrences of the abbreviation "NT" were changed to "NA" and defined in a master table legend (Appendix A). Future data reports will contain investigation data in its entirety.

General Comment 4:

- This work plan does not address the groundwater investigation; furthermore, data exists to suggest that there is some level of groundwater contamination, which may have resulted from activities at some or all of these units. All statements suggesting that groundwater has not been impacted should be removed from this work plan.

Response: As per previous discussions with the VDEQ and USEPA, groundwater will be investigated on a larger, regional scale (i.e., entire Horseshoe Area) under WPA 9 (Executive Summary, Page ES-2). References to groundwater impacts have been removed from WPA 12, as requested.

General Comment 5:

- DEQ was lead to understand that all future data in reports, or otherwise, would be reported in a format that reported the actual data values and not a "does not exceed" format. Notations of exceedances will be made by shading, underlining, boxing, highlighting, or other means explained in the table footnotes.

Response: Data will be reported in its entirety in future investigation reports, as requested.

General Comment 8:

- Please be advised that 1 or 2 pesticide and herbicide samples at each site may or may not be sufficient for the purposes of this investigation. Please be certain to identify the sampling location and horizon where the pesticide /herbicide sample will be collected in the revised work plan.

Response: Additional sampling for pesticides and herbicides has been added to WPA 12 and is presented in each section, summarized Table 1.1-3, and summarized for sediment and surface water in Table 1.16-1

General Comment 11:

- DEQ's intent was not to ask for samples at each six inch horizon. Based upon the various site characteristics, samples will need to be collected at the surface (generally 0-6" or 0-12") and at various subsurface levels depending upon the site. At sites where the contamination originated on the surface, subsurface samples at 2' to 4' may be appropriate. However, for a site where the contaminants were buried, subsurface samples may need to be obtained from within the "waste layer" as well as in one or more horizons (generally 2 to 4 foot intervals) below the waste layer. Surface soil or sediment samples may also need to be collected from areas receiving drainage from the site or discharge from groundwater, which may be associated with the site.

Response: No response required.

- Please make it clear in the work plan which horizons will be sampled at each soil boring location. Please also indicate which analyses (TAL metals, VOCs, SVOCs, TPH, Pesticides/Herbicides, PCBs, PAHs, Dioxins/Furans, Explosives, Perchlorates) will be performed on each sample.

  Response: Refer to Table 1.1-3 beginning on Page 1-13.

- A discussion with Mr. Tesner and Mr. Parks resulted in an agreement that all chemical constituents would be listed along with their method number, method detection limit and medium quantitation limit.

  Response: Agreed. This information will be reported in future investigation reports.

New General Comment 1:

- Please indicate the locations, on the figures, of all sinkholes, fracture traces, springs, bedrock outcroppings, inclines, structures, drainage channels, ditches, ponds, marshes, lakes, roads, dams, culverts, or other features which have the potential to influence the migration of contaminants at a site.

  Response: Features which have the potential to influence the migration of contaminants at a site have been included on site figures (where appropriate), as requested.

SWMU 49 – Red Water Ash Burial Site
SWMU 50 – Calcium Sulfate Treatment Sludge Disposal Area
SWMU 39 – Wastewater Ponds From Propellant Incinerator

- No additional comments or requests for samples are being made at this time for SWMUs 49, 50 and 39; however, this is not meant to imply that DEQ believes that the proposed sampling will be sufficient to identify the nature and extent of contamination at these sites.

Response: Per our conference call of 14-15 November 2001, data gap analysis was thoroughly discussed for each site and as a result, additional sampling and analysis have been proposed in WPA 12. The new data will supplement existing data and should provide a sufficient data set to identify the nature and extent of contamination.

SWMU 48 – Oily Water Burial Area

- The January 1999 RFI, page 3-2, stated that small quantities of fly ash were found throughout the test pit. Therefore dioxins/furans samples should be obtained at this site.

Response: As per the 14-15 November 2001 conference call, dioxin/furan analysis has been added to the analyte list for the proposed samples at SWMU 48. (Table 1.3-2, Page 1-42)

- No additional comments or requests for samples, beyond those noted above, are being made at this time; however, this is not meant to imply that DEQ believes that the proposed sampling will be sufficient to identify the nature and extent of contamination at this site.

Response: Per our conference call of 14-15 November 2001, data gap analysis was thoroughly discussed for this site and as a result additional sampling and analysis has been proposed in WPA 12.

13

The new data will supplement existing data and should provide a sufficient data set to identify the nature and extent of contamination.

SWMU 58 – Rubble Pile

- There are no additional comments at this time.

Response: No response required.

SWMU 59 – Bottom Ash Pile

- There are no additional comments at this time.

Response: No response required.

AOC - Former Lead Furnace Area (FLFA)

- There is concern that lead may be present above 400 mg/kg at 3-5 feet below ground surface based upon the increasing trend observed in soil boring LFSB10.

Response: Samples will be collected on either side of location LFSB10 (LFSS01 and LFSS02) and analyzed for TAL metals. Additionally, two soil borings LFSB16 and LFSB17 will be collected downslope of sample location LFSB10 and the former location of the lead furnace. Samples will be collected at depth (3-5 feet) at these locations to characterize potential vertical migration of lead. Boring locations will be dependent on the ability of the boring rig to safely access the slope (Figure 1.8-2).

- Another soil boring sample set should be obtained in the area at the toe of the slope which would receive surface run-off from the FLFA. Based upon the figure, the best location would appear to be northeast of 17SB3; however this would have to be confirmed in the field.

Response: Refer to response to cover letter Comment 2. (Figure 1.8-2)

- No additional comments or requests for samples, beyond those noted above, are being made at this time; however, this is not meant to imply that DEQ believes that the proposed sampling will be sufficient to identify the nature and extent of contamination at this site.

Response: Per our conference call of 14-15 November 2001, data gap analysis was thoroughly discussed for this site and as a result additional sampling and analysis has been proposed in WPA 12. The new data will supplement existing data and should provide a sufficient data set to identify the nature and extent of contamination.

AOC Former Cadmium Plating Facility (Building 4343)

- It is requested that a second ditch sediment/surface soil sample be obtained between B43SB18 and proposed B43SS02.

Response: As per the 14-15 November 2001 conference call, an additional surface soil sample (B43SS03) will be obtained from the drainage ditch east of proposed surface soil sample B43SS02.

- It is understood that all proposed samples will be analyzed for VOCs, SVOCs, PAHs, and explosives; and several of the samples will be analyzed for PCBs and pesticides/herbicides, specifically, the samples in the "delta area", and the two drainage ditch samples.

Response: Two surface soil (B43SB34A; B43SB35A), and one surface water sample if available (B43SW01) will be analyzed for the parameters listed above in addition to pesticides, PCBs, herbicides. In addition, two surface soil samples (B43SS02 and B43SS03) will be analyzed for TAL metals and PCBs. (Table 1.9-2, Pages 1-93 and 1-94 and Figure 1.9-2) n

ATTACHMENT C
Response to Comments on the
Draft Site Characterization Work Plan Addendum 012: New River Unit – Radford Army Ammunition Plant, November 7, 2001
From the Department of Environmental Quality, Commonwealth of Virginia
Sharon Skutle Wilcox, Office of Remediation Programs

Building Debris Disposal Trench (BDDT)

- Due to the variability of contaminant deposition in sediments, it is requested that a total of three sediment samples (an additional 2 samples) be obtained from the sediments up-stream from the trench "delta". It appears that sufficient samples for the purpose of this Site Investigation (SI) have been obtained from the down stream area. There were two thallium exceedances of the residential RBCs in sediment samples from down stream from the site.

  Response: As per the 14-15 November 2001 conference call, two additional collocated surface water/sediment samples (DTSW/SD08 and DTSW/SD09) were added upstream of upstream sample DTSW/SD07 (for a total of three upstream samples). In addition, collocated surface water/sediment sample DTSW/SD10 was added at former location DTSW/SD4 (for a total of three downstream samples) to address thallium residential soil RBC exceedences in sediment. (Figure 1.10-1)

- Please include a statement in the text to certify that no burning or dumping of burned materials has occurred at this site. If the Army cannot make this statement, then dioxin / furan samples should be obtained form the trench "delta" and from the proposed sediment samples.

  Response: The following statement was added to the text indicating that no burning or dumping of burned materials has occurred at the BDDT, "The BDDT was not used for burning or disposal/storage of burned wastes or combustion byproducts, therefore, samples will not be analyzed for dioxins/furans". (Page 1-103, Section 1.10.4, Dioxins/furans)

Igniter Assembly Area (IAA)

- No samples have been obtained from the vicinity of buildings 8101 and 8106. Are these buildings currently in use? If not, please provide information on what activities took place in those buildings. If the activities could have generated contaminants, or there is the conductive floor coating, please propose additional samples at these locations.

  Response: Building 8101 is no longer present at the site. Building 8106 is used for storage and is shared with Virginia Department of Game and Inland Fisheries. A letter dated August 31, 1998 from VDEQ confirms that acceptable site characterization and abatement measures had been achieved for former UST's that were located at Building 8106. As a result of the 14-15 November 2001 conference call, a surface soil sample (IASS05) will be collected adjacent to former location of Building 8101 and analyzed for TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, and explosives. (Figure 1.11-1 and Page 1-119, Table 1.11-2)

- Please include a certification from the Army that no burning or fires occurred at any of the igniter assembly area buildings. If this cannot be done, then the additional samples should include analyses for dioxins/furans

Response: The following statement was added to the text indicating that no burning or dumping of burned materials has occurred at the IAA, "The IAA was not used for burning or disposal/storage of burned wastes or combustion byproducts, therefore, samples will not be analyzed for dioxins/furans". (Page 1-114, Section 1.11.4, Dioxins/furans)

- All additional samples should include TAL metals as proposed, pesticides (at least surface soil), VOCs, SVOCs, PAHs, and PCBs as all of these constituents, except pesticides which have not been analyzed, have been detected above residential and background screening levels at the site.

  Response: Proposed samples at the IAA will be analyzed for TAL metals, as requested. Three surface soil samples (IASS05, IASB06A and IASB12A) and four subsurface soil samples (IASB06B, IASB06C, IASB12B and IASB12C) will be collected for the analytes listed above (with the exception of SVOCs in borings IASB06 and IASB12). Surface soil sample IASB06A will also be analyzed for pesticides, herbicides, TOC, grain size, and pH. In addition to the proposed soil samples, surface water and sediment samples will be analyzed for the constituents requested above. (Page 1-119, Table 1.11-2)

  SVOC analysis was not proposed in every soil sample because SVOC exceedences in soil at this site were PAHs. Since PAH analysis is a more sensitive analysis than the SVOC analysis, SVOCs were not included in every soil sample. It should be noted that there were no exceedences of the residential RBC for VOC compounds.

Western Burning Ground (WBG)

- It is recommended that two additional sediment samples (total of three) be collected from the stream discharging from the lake at the WBG and up stream of the Rail Yard. One sample is already proposed at the discharge from the lake overflow. These samples would serve as a dual purpose in identifying contaminant migration from the WBG and as comparison samples for the downstream samples to be collected at the rail yard. All sediment samples should be analyzed for TAL metals, VOCs SVOCs, PAHs, PCBs, dioxins/furans, explosives, and pesticides/herbicides. The analyses for dioxins/furans may be omitted provided that they tested for and not detected in samples previously obtained in the burning ground area itself or in the lake.

  Response: As per the 14-15 November 2001 conference call, because of the limited distance between the discharge point from the pond overflow and the downstream portion of the creek, before it flows past the Rail Yard, it was recommended that one additional collocated surface water/sediment sample (WBGSW/SD09) be collected downstream of proposed surface water/sediment sample WBGSW/SD08 (total of two). Surface water/sediment samples will be analyzed for the parameters requested above. In addition, both samples will be analyzed for perchlorate and hardness. (Page 1-146, Table 1.13-2 and Figure 1.13-1)

- It is recommended that three sediment samples be collected from the lake bottom sediments, at least one of which should be located in the area between WBGSD5 and SD-02. These samples should be analyzed for TAL metals, VOCs SVOCs, PAHs, PCBs dioxins/furans, explosives, and pesticides/herbicides. These samples could be postponed to the Remedial Investigation (RI) phase sampling event if necessary; however it would be helpful to have this information at the Site investigation (SI) phase.

Response: As per the 14-15 November 2001 conference call, proposed sediment samples WBGSD10, WBGSD11, and WBGSD12 were added to the sampling plan to evaluate pond sediments in the vicinity of WBGSD5 and SD-02. In addition, a surface water sample (WBGSW10) will be collocated with sediment sample WBGSD10 to assess water quality conditions at this location. Samples will be analyzed for the parameters requested above, with the exception of the surface water sample, which will also be analyzed for perchlorate and hardness. (Page 1-146, Table 1.13-2 and Figure 1.13-1)

- Please sketch in the approximate location of the roadway leading from the burning ground area to the lake on Figure 1.13-3.

Response: The approximate location of the roadway leading from the burning ground area to the unnamed pond has been sketched on Figure 1.13-1 (formerly Figure 1.13-3), as requested.

- Please indicate all marsh/wetland type areas on Figure 1.13-3 and Figure 1.13-2.

Response: Recent field reconnaissance has indicated that what was hypothesized to be a marshy area northwest of the burning area is in fact a low lying area containing an intermittent unlined drainage ditch. The text and Figures 1.13-1, 1.13-2, and 1.13-3 have been revised to reflect this.

Northern Burning Ground (NBG)

- Two additional soil boring sample sets should be obtained in the vicinity of SS-01. The samples should be obtained at the surface and at 2-5 ft. bgs and should be analyzed for TAL metals, VOCs SVOCs, PAHs, PCBs, dioxins/furans, explosives, and at least one surface soil sample for pesticides/herbicides. This sampling may be postponed to the RI phase sampling event; however the data would be useful in the SI phase.

Response: As per the 14-15 November 2001 conference call, three soil borings (NBGSB17, NBGSB18, and NBGSB19) will be advanced to a total depth of 3 ft in a triangular pattern surrounding SS-01. One surface (0-0.5 ft bgs) and one subsurface (1-3 ft bgs) soil sample will be collected from each boring to investigate VOC concentrations reported in SS-01. Samples will be analyzed for TCL VOCs, PCBs, TAL metals, and dioxins/furans. After thorough discussion, it was agreed that the site had been previously characterized for SVOC, PAH's, and explosives. In addition, surface soil sample NBGSB17A will also be analyzed for pesticides and herbicides, as requested. (Page 1-130, Table 1.12-2 and Figure 1.12-1)

Rail Yard

- From the information provided, it appears that a small portion of the northern rail yard drains into the stream that parallels A Avenue. Therefore, it is requested that three sediment samples be obtained from this portion of the stream before it crosses Alger Road. All sediment samples should be analyzed for TAL metals, VOCs SVOCs, PAHs, PCBs, explosives, and pesticides/herbicides. This sampling may be postponed to the RI phase sampling event; however the data would be useful in the SI phase.

Response: Three collocated surface water/sediment samples are proposed to be collected in the northern drainage area of the Rail Yard. Samples will be analyzed for the parameters requested above. In addition, surface water samples will be analyzed for perchlorate and hardness. (Pages 1-155 and 1-156, Section 1.14.5, *Surface water* and *Sediment*, Table 1.14-2, and Figure 1.1-1)

- It is understood that a drainage channel exists in the vicinity of RYSB09; however, concern remains that releases during storm events may have carried contaminants to the stream area. Therefore, it is requested that three sediment samples be obtained downstream of the storm water discharge point from the rail yard and upstream of the confluence of the receiving stream which flows past the BDDT after connecting with the branch draining the northern portion of the rail yard. All sediment samples should be analyzed for TAL metals, VOCs, SVOCs, PAHs, PCBs, explosives, and pesticides/herbicides. This sampling may be postponed to the RI phase sampling event; however the data would be useful in the SI phase.

Response: As per the 14-15 November 2001 conference call, two collocated surface water/sediment samples (RYSW/SD12 and RYSW/SD13) were added downstream of the storm water discharge point from the Rail Yard and upstream of the confluence of the receiving stream which flows past the BDDT after connecting with the branch draining the northern portion of the Rail Yard. Samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, and herbicides. In addition, the surface water samples will be analyzed for perchlorate and hardness. (Page 1-157, Table 1.14-2 and Figure 1.14-1)

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

November 7, 2001

Mr. James McKenna
Radford Army Ammunition Plant
SIORF-SE-EQ
P.O. Box 2
Radford, VA 24141-0099

Held another conference call on 14 & 15 Nov 2001. Outcome was to add more sampling. It was agreed to revise the plan and resubmit with another response to comments as documentation of phone call.

JJM
11/15/2001

RE: WP #12 Response to Comments
Letter dated October 18, 2001
Radford Army Ammunition Plant

Dear Mr. McKenna:

We have reviewed your letter dated October 18, 2001, in response to our comment letter dated September 10, 2001. Information provided during a teleconference on September 20-21 and interim submittals of revised tables and figures have also been taken into consideration. Several areas do not appear to be adequately addressed and concerns remain regarding a few issues. The comments, concerns and requests for information are listed below. Where possible they have been organized by site or general geographic unit. If not, reference is made either to the work plan section (WP), or to the response to comment letter (RTC). Comments addressing sites in the New River Unit will be provided in a separate letter.

Cover letter:

1. The Department of Environmental Quality (DEQ) will review the VPDES New River ecological studies in conjunction with the surface water and sediment data presented in the January 1996 and January 1999 RCRA Facility Investigations (RFIs) and prepare a response under separate cover if any issues remain of concern.

2. DEQ is not requesting that investigations of SWMU 17 and the incinerator be conducted under the Environmental Restoration Army (ERA) account. It is requesting that investigation encompass the entire extent of contamination which may/appears to have resulted from activities at the Former Lead Furnace Area (FLFA), (or other ERA eligible units) regardless of whether or not the ERA eligible unit contamination has migrated over "clean " property, or over property

copy in 21b and WP#12

Surface soil or sediment samples may also need to be collected from areas receiving drainage from the site or discharge from groundwater which may be associated with the site.

- Please make it clear in the work plan which horizons will be sampled at each soil boring location. Please also indicate which analyses (TAL metals, VOCs, SVOCs, TPH, Pesticides/Herbicides, PCBs, PAHs, Dioxins/Furans, Explosives, Perchlorates) will be performed on each sample.

- A discussion with Mr. Tesner and Mr. Parks resulted in an agreement that all chemical constituents would be listed along with their method number, method detection limit and medium quantitation limit.

New General Comment 1:
- Please indicate the locations, on the figures, of all sinkholes, fracture traces, springs, bedrock outcroppings, inclines, structures, drainage channels, ditches, ponds, marshes, lakes, roads, dams, culverts ,or other features which have the potential to influence the migration of contaminants at a site.

<u>SWMU 49 – Red Water Ash Burial Site</u>
<u>SWMU 50 – Calcium Sulfate Treatment Sludge Disposal Area</u>
<u>SWMU 39 – Wastewater Ponds From Propellant Incinerator</u>
- No additional comments or requests for samples are being made at this time for SWMUs 49, 50 and 39; however, this is not meant to imply that DEQ believes that the proposed sampling will be sufficient to identify the nature and extent of contamination at these sites. what does DEQ believe?

<u>SWMU 48 – Oily Water Burial Area</u>
- The January 1999 RFI, page 3-2, stated that small quantities of fly ash were found throughout the test pit. Therefore dioxins/furans samples should be obtained at this site.

- No additional comments or requests for samples, beyond those noted above, are being made at this time; however, this is not meant to imply that DEQ believes that the proposed sampling will be sufficient to identify the nature and extent of contamination at this site. what does DEQ believe?

<u>SWMU 58 – Rubble Pile</u> is previous response ok?
- There are no additional comments at this time.

<u>SWMU 59 – Bottom Ash Pile</u> is previous response ok?
- There are no additional comments at this time.

<u>AOC - Former Lead Furnace Area (FLFA)</u>
- There is concern that lead may be present above 400 mg/kg at 3-5 feet below ground surface based upon the increasing trend observed in soil boring LFSB10.

- Another soil boring sample set should be obtained in the area at the toe of the slope which would receive surface run-off from the FLFA. Based upon the figure, the best location would appear to be

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

November 7, 2001

Mr. James McKenna
Radford Army Ammunition Plant
SIORF-SE-EQ
P.O. Box 2
Radford, VA 24141-0099

RE: WP #12 Response to Comments NRU
Letter dated October 18, 2001
Radford Army Ammunition Plant

Dear Mr. McKenna:

We have reviewed your letter dated October 18, 2001, in response to our comment letter dated September 10, 2001. Information provided during a teleconference on September 21, 2001 and interim submittals of revised tables and figures have also been taken into consideration. Several areas do not appear to be adequately addressed and concerns remain regarding a few issues. The comments, concerns and requests for information are listed below. They have been organized by site or general geographic unit. General comments as well as those applicable to the cover letter, and comments addressing sites in the Main Manufacturing Area (MMA) and the Horseshoe Area (HA) were provided in a separate letter dated November 7, 2001.

<u>Building Debris Disposal Trench (BDDT)</u>

- Due to the variability of contaminant deposition in sediments, it is requested that a total of three sediment samples (an additional 2 samples) be obtained from the sediments up-stream from the trench "delta". It appears that sufficient samples for the purpose of this Site Investigation (SI) have been obtained from the down stream area. There were two thallium exceedances of the residential RBCs in sediment samples from down stream from the site.

- Please include a statement in the text to certify that no burning or dumping of burned materials has occurred at this site. If the Army cannot make this statement, then dioxin / furan samples should be obtained form the trench "delta" and from the proposed sediment samples.

copy in 2lb
and WPA 12

An Agency of the Natural Resources Secretariat

Rail Yard

- From the information provided, it appears that a small portion of the northern rail yard drains into the stream that parallels A Avenue. Therefore, it is requested that three sediment samples be obtained from this portion of the stream before it crosses Alger Road. All sediment samples should be analyzed for TAL metals, VOCs SVOCs, PAHs, PCBs, exlosives, and pesticides/herbicides. This sampling may be postponed to the RI phase sampling event; however the data would be useful in the SI phase.

- It is understood that a drainage channel exists in the vicinity of RYSB09; however, concern remains that releases during storm events may have carried contaminants to the stream area. Therefore, it is requested that three sediment samples be obtained downstream of the storm water discharge point from the rail yard and upstream of the confluence of the receiving stream which flows past the BDDT after connecting with the branch draining the northern portion of the rail yard. All sediment samples should be analyzed for TAL metals, VOCs, SVOCs, PAHs, PCBs, exlosives, and pesticides/herbicides. This sampling may be postponed to the RI phase sampling event; however the data would be useful in the SI phase.

Additional samples, beyond those screening level samples identified above, will be required to fully characterize the nature and extent of contamination during the RI phase at the following sites, Western Burning Ground, Northern Burning Ground, Igniter Assembly Area, Rail Yard, and possibly the stream near the Building Debris Disposal Trench.

If you have any questions regarding this information, I can be reached at (804) 698-4143.

Very truly,

Sharon Wilcox

Sharon Skutle Wilcox
Office Of Remediation Programs

cc: Robert Thompson, Region III, U.S.EPA, 3HS13
Aziz Farahmand, VDEQ WCRO
Garwin Eng, VDEQ, CO
John Godfrey, VDEQ, CO
Norm Auldridge, VDEQ WCRO
Durwood Willis, VDEQ CO
Mark Leeper, VDEQ CO

File: Chronological
Radford AAP, 2001

103.

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

October 18, 2001

Mr. Mark Leeper
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Subject: Work Plan Addendum 012:
Site Characterization Work Plan, SWMUs 39, 48,49,50,58,59;
AOCs Former Lead Furnace Area, Building 4343;
New River Unit
Radford Army Ammunition Plant
Radford VA
EPA ID# VA1 210020730

Dear Mr. Leeper:

Attached are our responses to the general and specific comments from Ms. Sharon Wilcox's September 10, 2001 letter on the subject work plan. These responses reflect our understanding from the September 20-21, 2001 conference call that included yourself; Ms. Sharon Wilcox, VDEQ; Mr. Thomson, EPA Region III; Mr. Redder, ATK; Mr. McKenna, Radford AAP; Mr. Tesner, Corps of Engineers; and Mr. Parks, IT Group. Note that the conference call minutes were emailed to the participants on September 28, 2001. A revised work plan is being prepared and will be forwarded under separate transmittal letter once you concur with these responses.

Please note that when we originally prepared Work Plan Addendum (WPA) 012 and WPA 009, we considered the issues in the Department's March 28, 1996 letter that was included with the September 10, 2001 letter. If the DEQ feels there are still outstanding issues, we request that you specifically enumerate them for us in a letter or email. Regarding contaminants in the New River and ecological studies, data is available from effort conducted in accordance with our Virginia Pollutant Discharge Elimination System (VPDES) discharge permits that would suggest there is no impact to this water body. This information has been submitted to the Department and will be evaluated along with the data to be collected from the WPA 012 and 009 field efforts for screening and assessing human and ecological effects.

Also, comments on SWMU 39 and Former Lead Furnace Area (FLFA) request expansion of the work in WPA 12 to cover the incinerator (adjacent to SWMU 39) and SWMU 17, the Open Burn Area (adjacent to FLFA). Please be advised the funding for WPA 12 comes from the Environmental Restoration Army account and can only be used for inactive sites not active sites such as the incinerator and SWMU 17.

Finally we do not agree with VDEQ's statement that "...it is clear from the data presented in WPA

copy in 216
and WPA 12

12 that all of the sites will need to be carried forward to the Remedial Investigation (RI) phase." Based on review of the data during the 20-21 September teleconference, it would appear as if some sites may not require investigation beyond the screening phase. Regardless, we believe it is premature to make that decision at this time.

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

C. A. Jake

C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company LLC

Enclosure

c: w/enclosure

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Russell Fish, P.E., EPA Region III
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Leslie Romanchik
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Garwin Eng
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

E. A. Lohman
Virginia Department of Environmental Quality
West Central Regional Office
3019 Peters Creek Road

01-815-195
JJRedder

Roanoke, VA 24019

bc: Administrative File
~~J. McKenna, ACO Staff~~
Rob Davie-ACO Staff
C. A. Jake
J. J. Redder
Env. File

Coordination: for
J. McKenna

01-815-195
JJRedder

Response to Comments on the
Draft Site Characterization Work Plan Addendum 012: SWMUs 39, 48, 49, 50, 58, 59, AOC-FLFA, New River Unit - Radford Army Ammunition Plant, April 2001
From the Department of Environmental Quality, Commonwealth of Virginia
Sharon Skutle Wilcox, Office of Remediation Programs

Point of Contact for the following comments – Mark Leeper, 804-698-4308

GENERAL COMMENTS:

General Comment 1:

Comment: In Appendix A, several of the tables are not using the RBC value divided by ten for all non-carcinogenic compounds, Table A-7 for example; whereas, other tables such as Table A-38 is using the screening value appropriately. Please use the most recent RBC values in the tables and apply them according to EPA's Risk Assessment guidance for screening for Chemical of Potential Concern (COPCs).

Response: **All tables in Appendix A have been reviewed and revised as necessary. Chemical concentrations are compared to current residential and industrial RBCs, SSLs, BTAG criteria and background numbers. The RBC values for non-carcinogenic compounds have been multiplied by 0.10.**

General Comment 2:

Comment: In Appendix A, all of the tables should be revised to screen against the most recent revised values of the RBC table, currently Spring of 2001. Depending upon when this document is revised, the Fall 2001 values may be available and should then be used.

Response: **All data in tables in Appendix A are now screened against the most recent RBC tables available.**

General Comment 3:

Comment: It is requested, though not absolutely required, that the data from all of the sampling events, at a given site, be combined into one table (multi-page) with an additional page at the end identifying the report from which the data for each date originates. The tables would include the Residential RBC values, the Soil Screening Levels, and if available at the time, the agreed upon Background Screening Values, or at least the background maximum, minimum and mean values. Inclusion of the Industrial RBC values is not as important but still useful. It would also be helpful to include the ecological screening values for each constituent. Data such as hit frequency, HBNs and PQLs is not as useful at this time and may be omitted due to layout space considerations. Shading, bolding, and boxing of values exceeding various parameters is of great value in facilitating the review as are the data qualifiers. Where a constituent was not analyzed an "NA" or preferably, a blank space is always acceptable. Non-detects can be identified by "ND".

Response: **Tables have been revised to include comparison to residential and industrial RBCs, SSLs, BTAG and background screening values. Shading and bolding have been employed to highlight exceedances. "NT" was previously used for compounds not tested. "NT" will be replaced by "NA" in response to this comment.**

\\\\

General Comment 4:

Comment: The statement at the end of the Executive Summary stating that COCs, which are at this point only Chemicals of Potential Concern (COPCs), have been detected only in the surface soil and therefore no groundwater investigation is indicated should be removed. Contaminants at action levels have been detected in groundwater at sites where subsurface soils present no or negligible levels of contamination. Groundwater should be investigated at all of the sites addressed by this Work Plan on an overall and on a site-specific basis. It is understood that the Main Manufacturing Area (MMA) groundwater study is going to address those sites; however, no study has currently been proposed for the New River Unit (NRU).

Response: **The statement will be revised to read "Surface water and sediment sampling along with other data gap filling proposed in this WPA is expected to bolster this assertion". Groundwater is not a part of this WPA and is addressed in WPA 09 and has been discussed at the IAP Workshop 2001. As site data is evaluated, the need for expansion of groundwater investigations will be addressed.**

General Comment 5:

Comment: Existing groundwater data for the Horseshoe Area and NRU should be provided for reference purposes. The data contained in the Current Conditions Report was of little use and is unacceptable. These documents are for public review and omitting data that falls below a screening value, e.g. using DNE in tables, could and does raise questions. If a constituent was not detected, it was not detected and should be reported accordingly; however, if values exist, even if estimated or qualified, they should be reported along with the requisite qualifier. In particular, there are likely to be instances where a concentration exists below the screening level at the sampling point (well) but exist at a higher concentration upstream (or up gradient) from that well. Observing the detection of the non-naturally occurring pollutant, even at extremely low concentrations, may suggest the need for further investigation of the potential source area.

Response: **The Army does not agree that inclusion of existing groundwater data is necessary, since groundwater is not addressed in this WPA. The Army is willing to discuss revision of the groundwater data presentation in future updates to the Current Conditions Report.**

General Comment 6:

Comment: I was unable to locate SWMU-58 - Rubble Pile, AOC - Former Lead Furnace Area (FLFA) and AOC Building 4343 on Figure 1.1-1. Please provide a Site Plan, which more clearly identifies the locations of these units.

Response: **Figure 1.1-1 will be revised to identify the locations of all sites in WPA 12.**

General Comment 7:

Comment: Section 1.1.4 - Air is a potential pathway and should be addressed in the Remedial Investigation Report's Risk Assessment for each site. From the data provided, it is clear that none of the sites can be eliminated from further remedial action based upon screening values alone; a risk assessment will need to be performed for each site, or group of sites, the grouping depending upon the geography and geology of the sites. Potential air pathways include groundwater to indoor air, groundwater volatilization (shower model), and particulate inhalation. It is also possible, though unlikely, that surface concentrations of volatile constituents exist after several years; however, volatile constituents in subsurface soils may be present and affect construction workers as soils are disturbed. Both will need to be discussed qualitatively in the risk assessment and may require quantitative analysis as well.

Response: **The Army agrees that air could be a potential pathway. Appropriate potential pathways will be evaluated in the investigation report for each site.**

General Comment 8:

Comment: Pesticides need to be added to the list of analytes for all sites.

Response: **The Army has agreed to collect and analyze 1-2 samples per site for pesticides and herbicides.**

General Comment 9:

Comment: Please provide a discussion describing perchlorates and why they are only being tested for in surface water and not in other media.

Response: **At this time the Army is not aware of any certified method for the analysis of perchlorate in solid (soil/sediment) matrix. Since groundwater is not being collected as part of this WPA, only surface water will be analyzed for perchlorate.**

General Comment 10:

Comment: In several tables, TCLP metals data is reported. It is not clear from the table whether the results are from the TCLP test or if the results are total metals from the soil sample. If the results are from the TCLP test, and they exceed RCRA hazardous waste thresholds, they should be highlighted. It appears that Barium in Table A-5 is one such example.

Response: **TCLP results have been separated into their own grouping in the data tables and exceedances have been highlighted.**

General Comment 11:

Comment: Samples will need to be obtained from each site that are suitable for ecological screening. Generally, this requires full scan analysis of soils for TAL metals, TCL VOCs, SVOCs, PAHs, explosives, dioxins, furans, PCBs, and pesticides at 0-6" depths, and at multiple depths subsurface. If surface water is present, then surface water and sediment samples will be required in lieu of the surface soil samples (in areas beneath surface water) and perchlorates would be added to the list of analytes. The exact requirements should be discussed with EPA's Biological Technical Assistance Group (BTAG). Sampling locations and horizons should be determined following joint discussions with DEQ, EPA and BTAG.

Response: **The Army does not believe that collection of multiple soil samples in six-inch increments is appropriate at this stage. The Army agrees that a discussion with BTAG to address WPA 12 comments is necessary.**

General Comment 12:

Comment: The figures provided as conceptual site models should have the following information included, as it should be readily available: 1) estimated depth to groundwater, 2) estimated depth of cover material, if any, 3) estimated depth of "buried" waste (e.g. 4-8 ft. bgs).

Response: **The conceptual site models will be revised to include the requested information, where applicable.**

General Comment 13:

Comment: Please re-check all data tables and figures to verify that all sampling locations are indicated on a figure. Several sampling locations have not been identified. If the sampling point location is not available please make a note of it.

Response: **A thorough check will be performed to verify that all sampling locations are included on site figures.**

General Comment 14:

Comment: Please re-check all data tables to verify that there is data for each sampling point indicated on a figure. If, for some reason, no data is available for a given point, please make a note of it.

Response: **A thorough check will be performed to verify that there is data for each sampling point indicated on a figure.**

General Comment 15:

Comment: Please mark the surface drainage flow patterns on all site figures.

Response: **Direction arrows indicating surface drainage flow patterns will be included on all site figures.**

General Comment 16:

Comment: In most of the sections below, a statement has been made identifying primary COPCs. This determination is not exact and does not include many constituents, primarily metals, which were not included if their concentration did not exceed a yet-to-be determined maximum background concentration. The intent was simply to highlight constituents which have been detected, usually at above residential RBC concentrations and appear to require further delineation.

Response: **No response necessary.**

General Comment 17:

Comment: In all of the sections below, which address specific sites, there will occasionally be comments suggesting that proposed samples are not necessary due to existing data. This is based upon the assumption that all of the data presented in this Work Plan has been validated. If this data has not been validated, these comments do not apply.

Response: **The Army is not removing any proposed samples from the workplan. All data except minor data sets from Gannett Fleming and Alliant Tech has been validated.**

SPECIFIC COMMENTS:

SWMU 39 - Wastewater Ponds From Propellant Incinerator

Comment: Sufficient numbers of samples have not been provided to determine the full horizontal or vertical extent of the lead contamination in either the northern or southern settling ponds and surrounding soils.

Response: **Lead does not appear to be an issue in the southern settling pond. In response to comments, the Army has agreed to add four additional surface soil samples around the settling ponds. These samples will be analyzed for TAL metals. The six samples from two borings in the settling ponds will supply the Army with sufficient information to make a risk management decision regarding the settling ponds.**

SWMU 39 - Wastewater Ponds From Propellant Incinerator

Comment: Additional sampling for explosives does not appear to be necessary as those compounds would tend to accumulate in sediments and have not been detected in any of the 3 sediment and 3 surface soil samples already obtained.

Response: **Since no samples for explosives analysis have been collected from subsurface soils and the previous surface soil samples were composite samples, the Army will analyze SWMU 39 samples for explosives to eliminate a potential data gap.**

SWMU 39 - Wastewater Ponds From Propellant Incinerator

Comment: VOC samples do not seem to be necessary in surface water, as they would have evaporated from this media. If they are detected in soils, the surface water would need to be removed and treated in any case. For this site, surface water samples do not appear to be needed except for perchorates. The limited amount of surface water (puddles) and the affinity of most unidentified potential contaminants for sediments suggests that sediment sampling would reveal any COPCs that are present.

Response: **The Army would prefer to leave VOC analysis in the sampling plan for completeness of screening parameters.**

SWMU 39 - Wastewater Ponds From Propellant Incinerator

Comment: Additional surface soil/sediment samples will be needed for PCBs, pesticides, SVOCs, PAHs, dioxins, and furans. If any of these constituents are detected, further subsurface investigations may be required.

Response: **Two surface and 14 subsurface samples have previously been collected and analyzed for SVOCs and PAHs. There were no exceedances in these samples, therefore the Army does not believe that additional sampling for these parameters is necessary. PCBs and dioxin/furan analyses are already in the workplan. As addressed in general comment #8, the Army has agreed to collect two surface soil samples for pesticide/herbicide analysis at this site.**

SWMU 39 - Wastewater Ponds From Propellant Incinerator

Comment: Figure 1.2-2 suggests that the propellant incinerator, skimmer and former spray pond are additional source areas that need to be addressed. It also shows a sludge bed but not the two settling ponds that are described in the text. The figure describes a pathway for runoff to flow to surface water, however Section 1.2.3 states that precipitation infiltrates into the groundwater rather than flowing overland to surface water.

Response: **Figure 1.2-2 will be revised to indicate that surface water runoff is not a pathway and the sludge bed will be relabeled as a settling pond. The former spray pond has been RCRA closed and therefore is not an issue for SWMU 39. The propellant incinerator is an active unit and not a part of the SWMU 39 investigation.**

Comment 6: SWMU 48 - Oily Water Burial Area

Comment: Perhaps this site should be renamed Explosives Contaminated Oily Water Burial Area due to the wide spread low level contamination of the soils with DNT mixtures above the RBC of 0.94mg/kg in soils from 1 through at least 7 feet below ground surface (bgs). Sufficient samples have not been obtained to fully delineate the horizontal and vertical extent of contamination of at least one COPC, DNT, at the site. Samples also need to be obtained from outside of the footprint of the "pit" to confirm that contaminants have not migrated horizontally or vertically beyond the pit boundaries.

Response: **At sites where both 2,4-DNT and 2,6-DNT are present, the "DNT mix" RBC values will be used as comparison criteria. One additional soil boring has been added to delineate the extent of elevated DNT at the site. The two previously proposed soil borings at the site have been re-located to be within the boundaries of the northern and southern trenches. The third additional proposed boring has been located to the west of the elevated explosive concentration at sample location 48SB7 to confirm that elevated concentrations are confined to the locations of the former pits. Samples from the additional soil boring will be collected at three intervals**

and analyzed for explosives. In addition, immuno-assay test kits will be used to screen soils for explosives at the site.

Comment 7: SWMU 48 - Oily Water Burial Area

Comment: Pesticides, PCBs, PAHs, dioxins and furans appear to be the primary data gaps. These samples can be obtained from the same locations and depths used to delineate the explosives contamination.

Response: **The Army agrees that PAHs and PCBs are data gaps, as stated in the work plan. Samples will be analyzed for dioxin/furans at sites where there is a history of burning or the disposal of burned debris/byproducts. This site was not used for burning or the disposal of burned materials; therefore, the Army does not feel that dioxin/furans represent a data gap at the Oily Water Burial Area. A discussion of the inclusion of pesticides as an analyte class is provided in the Response to General Comment 8 above.**

Comment 8: SWMU 48 - Oily Water Burial Area

Comment: The results in Table A-5 suggest that barium and lead are also COPCs at this site due to levels of TCLP lead and barium exceeding the RCRA threshold for a hazardous waste

Response: **A review of the results in Table A-5 indicates that the TCLP levels for lead and barium (149 ug/L and 292 ug/L, respectively) are below RCRA threshold levels (5000 ug/L and 100000 ug/L, respectively) for hazardous waste. Therefore, these metals would not be considered COPCs at SWMU 48.**

Comment 9: SWMU 49 - Red Water Ash Burial Site

Comment: Detection of explosive compounds at concentrations within 1 order of magnitude of the RBC at 8 to 10 ft. bgs suggests that the compounds are likely to exist at greater concentrations closer to the surface. Surface soil and 0.5 to 10-ft. bgs subsurface soil samples need to be obtained at multiple intervals and at several locations within the footprint of the site. These samples should be analyzed for PAHs, pesticides, SVOCs, PCBs, dioxins, furans, VOCs and TAL metals. Depending upon concentrations detected, additional sampling to determine the horizontal extent of contamination could be required. It is unclear why samples at these depths were not previously obtained.

Response: **Two surface soil samples and two subsurface soil samples were proposed in the Workplan. The surface soil samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxin/furans. One surface soil sample will also be analyzed for TOC. The subsurface soil samples will be analyzed for TCL PCBs, PAHs, TAL metals and dioxin/furans. The Army has agreed to add one additional subsurface soil sample to be analyzed for TCL PCBs, PAHs, TAL metals, dioxin/furans and TPH in order to provide additional characterization of the subsurface soil conditions. A discussion of pesticides as an analyte class is provided in the Response to General Comment 8 above.**

Comment 10: SWMU 49 - Red Water Ash Burial Site

Comment: The text on Page 1-35 states that 2,4,6 TNT was detected above the industrial RBC. This data was omitted from the SWMU tables in Appendix A. Please include all data in the appendix tables for this site and others.

Response: **A review of the historical data and the WPA shows that this exceedance was actually at SWMU 48. This section of the text will be corrected to remove the discussion of the 2,4,6-TNT exceedance at SWMU 49. Previous sampling decisions were made that labeled samples collected at SWMU 49 as SWMU 48 samples, leading to some confusion with sample results. This issue will be clarified in the revised text.**

Comment 11: **SWMU 50 - Calcium Sulfate Treatment Sludge Disposal Area**

Comment: The five sampling locations proposed appear to be adequate to determine if significant contamination is present at this site; however, pesticides will need to be added to the analyte list and the sampling horizons will need to be adjusted, see Comment #11 under "General Comments" above.

Response: **Two samples for pesticide/herbicide analysis will be collected at this site.**

Comment 12: **SWMU 50 - Calcium Sulfate Treatment Sludge Disposal Area**

Comment: If COPCs are detected, then additional sampling to determine the extent of the contamination will be required. This second stage of sampling will most likely use an abbreviated analyte list.

Response: **The Army agrees that the presence of COPCs at concentrations greater than industrial RBC values would necessitate an additional investigative phase. A targeted analyte list would most likely be used if this additional investigation were required.**

Comment 13: **SWMU 50 - Calcium Sulfate Treatment Sludge Disposal Area**

Comment: If the calcium sulfate sludges came from a wastewater treatment process, then dioxins and furans should be included in the analyte list, as several fires have occurred at the plant over the years and the wash down and storm waters could have contained these contaminants.

Response: **The Army agrees that samples will be analyzed for dioxins/furans at sites where burning occurred or where burned materials were disposed. The calcium sulfate was generated as part of an operational process and was not associated with wastewater/stormwater management at Radford. Therefore, the Army does not believe that samples at SWMU 50 should be analyzed for dioxin/furans.**

Comment 14: **SWMU 58 - Rubble Pile**

Comment: Once again, data is referred to in the text that does not appear on the Appendix A SWMU 58 data tables. The VOC surface soil results have not been reported.

Response: **VOC surface soil results were not reported in Appendix A, Table A-16 because there were no VOCs detected. The intent of the table was to present detected results. The title of the table will be revised to indicate that only detected results are presented.**

Comment 15: **SWMU 58 - Rubble Pile**

Comment: Several sampling locations at multiple horizons within the footprint of the site will need to be sampled for surface soil and subsurface soils down to 15 ft bgs. Depths below this have already been partially sampled. The samples will need to be analyzed for PAHs, pesticides, SVOCs, VOCs, PCBs, TAL metals, explosives, dioxins and furans. Since bottom ash is one of the wastes allegedly disposed in the pile, dioxins and furans may be present. The sampling horizons should be discussed with BTAG.

Response: **Two surface soil and four subsurface soil samples will be collected at SWMU 58. As stated in the workplan, these samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, and TAL metals. The Army agrees to add dioxin/furan analysis for all samples based on the disposal of bottom ash at the site. Subsurface sample intervals in the soil boring will be adjusted to 0-2, 2-4, 4-6 and 6-8 ft below the contact with native soil in order to characterize the soil immediately beneath the Rubble Pile.**

Comment 16: SWMU 59 - Bottom Ash Pile

Comment: It appears that the only analytes that need to be added to the list are pesticides. The three sampling locations appear adequate for SI level sampling; however, additional samples will be required to define the horizontal and vertical extent of the contamination if the results of the first three sets of samples indicate contamination is present. The sampling horizons should be discussed with BTAG.

Response: **Two samples for pesticide/herbicide analysis will be collected at this site. The Army agrees that the presence of COPCs at concentrations greater than industrial RBC values would necessitate an additional investigative phase. A targeted analyte list would most likely be used if this additional investigation were required.**

Comment 17: AOC - Former Lead Furnace Area

Comment: The statement that environmental receptors are unlikely to frequent the area is not supported by the fact that the area is accessible and is only occupied by humans on a weekly basis.

Response: **The statement that environmental receptors are unlikely to frequent the area is one of the conclusions of the Baseline Risk Assessment conducted by Dames and Moore as part of the Verification Investigation in 1992. This information is presented in the summary of the VI results. The presence or absence of ecological receptors will be addressed in the investigation report for this site.**

Comment 18: AOC - Former Lead Furnace Area

Comment: The conceptual site model fails to reflect surface runoff into the sinkhole area.

Response: **Arrows indicating the direction of surface runoff into the sinkhole area will be included on the conceptual site model.**

Comment 19: AOC - Former Lead Furnace Area

Comment: The text states that sample LFTP8 is located outside of the FLFA boundary but fails to show the location of any of the LFTP samples. Furthermore, if the sample location is anywhere within the general vicinity of the FLFA, it is NOT outside the boundaries. Contaminant impact areas may overlap with those from SWMU 17A and there may be reason to combine the two areas for investigation purposes.

Response: **Text indicating that sample LFTP8 is located outside of the FLFA boundary will be removed. Additionally, the locations of the LFTP confirmation samples will be included on the revised site figure. SWMU 17A is an active site and therefore not eligible for investigation under the Army's ER,A program. The Installation and Command will continue to explore funding for projects at SWMU 17.**

Comment 20: AOC - Former Lead Furnace Area

Comment: The data from Table A-26 is not applicable to this site. Sampling locations referred to in the third paragraph on page 1-58 must be provided, preferably on a figure with the associated analytical results. Furthermore, as long as lead contamination is present, it really makes no difference since associated hazards and contaminants may be present, if the source of the lead contamination is, in fact, the FLFA. Investigation and remediation will need to occur in any case and the source will need to be identified.

Response: **A review of the data tables and the text of WPA 12 indicates that the reference to Table A-26 is in error. The text should instead refer to Table A-22A. The text and tables will be updated to reflect this fact. New figures have been created for each of the sites presenting analyte exceedances at each sample location. The figure**

for the FLFA will be updated to include sample locations that were not shown on the original figure.

Comment 21: AOC - Former Lead Furnace Area

Comment: Two samples indicate that there are high levels, approximately 900 ug/g, of lead in the 4 to 6 ft bgs soil horizon at the site. The vertical and horizontal extent of lead contamination needs to be further delineated across the site and its boundaries. Barium also appears to be a COPC, exceeding the TCLP threshold for hazardous waste at a depth of 8-10 feet. The boundaries of the contamination need to be more clearly defined. Is it possible that the "rim" around the sinkhole may be part of a disposal or fill area?

Response: **The collection of an additional fifteen soil samples has been proposed to further delineate the horizontal and vertical extent of lead concentrations and characterize those parameters that have not been sampled for at the FLFA. Lead contamination appears to be centered in the footprint of the former lead furnace building. Sampling and visual inspection of rim material during site restoration activities do not indicate that the rim was a disposal area.**

The barium concentration of 1,240 ug/L in sample 17SB2 was shaded in Table A-20 to indicate that the value exceeded the HBN criterion. After comparing the concentration to the applicable TCLP criterion of 100,000 ug/L, barium does not appear to be a COPC at this site.

Comment 22: AOC - Former Lead Furnace Area

Comment: It is unclear why sample locations at the bottom of the hill have not been selected as these are expected to receive much of the runoff from the site.

Response: **The area at the bottom of the hill in the sinkhole near the FLFA is SWMU 17A, Stage and Burn Area. This SMWU encompasses the area immediately downslope from the FLFA and samples collected in this area were evaluated as part of the Stage and Burn Area Investigation. SWMU 17A is an active area.**

Comment 23: AOC - Former Lead Furnace Area

Comment: Surface and subsurface soil samples down to at least 8 ft bgs need to be obtained and analyzed for VOCs, SVOCs, TAL metals, pesticides, dioxins, furans, PCBs, PAHs, and explosives.

Response: **In addition to the four surface and four subsurface soil samples proposed in the Workplan, the Army has agreed to collect two additional surface soil samples and four additional subsurface soil samples. These samples will be analyzed for VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, and dioxin/furans. Two samples for pesticide/herbicide analysis will be collected at this site.**

Comment 24: AOC - Former Cadmium Plating Facility (Building 4343)

Comment: The sampling locations for all of the samples in Table A-23 are not shown on a figure. Please provide the figure with the sampling results, including 4343-02-SVR. The 1996 sampling locations should be identified on the key for Figure 1.9-1.

Response: **The sampling locations in Table A-23, including 4343-02-SVR, will be included on the site figure. In addition, the 1996 sampling locations will be more clearly identified on the legend for Figure 1.9-1**

Comment 25: **AOC - Former Cadmium Plating Facility (Building 4343)**

Comment: I was unable to locate sample B43SSB33 on either Figure 1.9-1 or Figure 1.9-2. It would be helpful if both figures had the results for each sample site by horizon. This would result in an additional two figures.

Response: **Site figures will be revised to include all sampling locations. Additionally, sample depths have been included on the figures to identify sampling horizons.**

Comment 26: **AOC - Former Cadmium Plating Facility (Building 4343)**

Comment: The lateral and vertical extent of contamination has not been delineated for the site. It appears that barium, cadmium and chromium, and possibly zinc will be the primary heavy metal COPCs. Additional sampling for TAL metals, cyanides, SVOCs, VOCs, PAHs, explosives, perchorates, and pesticides will need to be performed for surface soils, subsurface soils at various horizons, and surface water where available.

Response: **The Army believes that the vertical and lateral extent of exceedances at the site have been sufficiently delineated to make risk management decisions for the site. The Army believes that cadmium and chromium are the primary COPCs at the site.**

Comment 27: **Building Debris Disposal Trench - New River Unit**

Comment: Additional PCB analysis only appears to be needed for a few surface soils and for sediments. PCBs would not be likely to be present in surface water and not present in the sediments.

Response: **Two subsurface soil, three sediment and three surface water samples have been proposed for PCB analysis. In response to this comment, a surface soil sample will be collected at the proposed boring location and will be analyzed for PCBs.**

Comment 28: **Building Debris Disposal Trench - New River Unit**

Comment: Due to the presence of chlorinated benzenes, analysis for dioxins and furans should also be considered for sediment samples at a minimum.

Response: **Because no burning activities or dumping of combusted material has taken place at this site, the Army does not believe there is reason to sample for dioxin/furans.**

Comment 29: **Building Debris Disposal Trench - New River Unit**

Comment: The vertical extent of PAH concentrations has not been determined; however, sufficient data exists for a Human Health Risk Assessment (HHRA) and, if the results indicate that remedial action is warranted, the vertical extent of contamination can be determined during the feasibility study or remedial design phases.

Response: **The Army agrees that a risk assessment will be conducted as part of the investigation report.**

Comment 30: **Building Debris Disposal Trench - New River Unit**

Comment: Surface water samples need to be collected for perchlorates and VOCs.

Response: **Three surface water samples have been proposed for this site. Analysis would be for TCL VOCs, PCBs, PAHs, and perchlorates (Table 1.10-2, page 1-81).**

Comment 31: **Building Debris Disposal Trench - New River Unit**

Comment: Additional sediment samples need to be collected for PCB, dioxins, furans, PAH, VOC and SVOC analyses.

Response: **Three sediment samples have been proposed for this site. Proposed analysis is for PCBs. TCL VOCs, SVOCs, and PAHs have been previously investigated in surface soils, surface water, and sediment. There were no RBC exceedances in previous sediment samples, therefore the Army does not believe that these parameters need to be characterized further. As stated in response #28, the Army does not believe there is reason to sample for dioxin/furans at the site.**

Comment 32: Building Debris Disposal Trench - New River Unit

Comment: Upstream surface water and sediment samples are also recommended. Typically, three samples are obtained up-gradient of the site.

Response: **Three surface water/sediment sample sets have been proposed for this site. One surface water/sediment sample set will be collected upstream, one set will be collected directly downgradient from the trench, and one set will be collected downstream from the BDDT.**

Comment 33: Igniter Assembly Area - New River Unit

Comment: It appears that barium, arsenic, PAHs and SVOCs are likely COPCs at this site. Cadmium and selenium should also be included due to the TCLP results. Determination of the vertical and horizontal extent of contamination has not been made and will require additional sampling at the 2 to 4 foot depths bgs as well as surface soil samples radiating outward from the building at specified intervals. The statement in the second paragraph of page 1-85 is not supported. Visual notations of "red leachate" do not necessarily indicate that the contaminants have not migrated beyond the stained areas (i.e. three feet from the edges of the building). Elevated levels of barium were detected at depths of 2 feet bgs; therefore the extent of contamination may reach as low as 4 feet bgs. This needs to be determined. However, this determination may be made at a later stage or possibly at the time of remediation, provided confirmatory samples are obtained prior to backfilling of the site.

Response: **The Army would agree that arsenic might be a COPC at the site. The PAH exceedances were from a sample collected away from the site to characterize a creosoted wooden pole that, at the time, was thought to be the location of a transformer. In response to comments, eleven surface soil and seven borings have been added to the investigation to delineate metals exceedances at the site.**

Comment 34: Igniter Assembly Area - New River Unit

Comment: Surface soil samples need to be obtained for explosives, VOCs, dioxins, furans and PAHs.

Response: **Samples for explosives and PAH analyses have been collected in previous investigations with no exceedances of industrial RBCs (with the exception of the sample noted in response #33). There has been no burning activity or dumping of burned material at the site, therefore the Army does not believe that sampling for dioxin/furans at the site is necessary. Six soil samples will be collected and analyzed for VOCs and PCBs.**

Comment 35: Igniter Assembly Area - New River Unit

Comment: Subsurface samples need to be analyzed for VOCs, as well as the constituents identified in Comment # 34 above.

Response: **Four subsurface samples from two borings will be collected and analyzed for VOCs and PCBs. As stated in response #34, the Army does not believe that other analyses are necessary.**

Comment 36: Igniter Assembly Area - New River Unit

Comment: A limited number of surface and shallow horizon subsurface soil samples should also be collected for PCB analysis.

Response: **Two surface soil and four subsurface soil samples have been proposed for PCB analysis (Table 1.11-2).**

Comment 37: Igniter Assembly Area - New River Unit

Comment: Any surface drainage channels, if present, will also need to be sampled.

Response: **The area is relatively flat and is drained by engineered storm drains. One proposed boring will be located near a site drainage area.**

Comment 38: Northern Burning Ground - New River Unit

Comment: Data for soil samples at location NGSB9 are not included in the Appendix. The sampling point is presented on Figure 1.12-1. Please make the requisite corrections.

Response: **Data for soil samples at location NBGSB9 was included in the first data column of Table A-51 on page A-84 in the Appendix.**

Comment 39: Northern Burning Ground - New River Unit

Comment: Zinc was detected at 3,760 ug/g in sample NBGSB2A. Lead, chromium, zinc and VOCs appear to be the primary COPCs at the site, though additional samples may reveal more constituents of concern.

Response: **Lead and chromium are the only constituents that exceeded industrial RBCs at the site, therefore the Army believes that these metals are the most likely COPCs.**

Comment 40: Northern Burning Ground - New River Unit

Comment: The dimensions of the site are reported to be 350x250 feet; however, the majority of the samples, to date, have been obtained within a small 40x60-foot area. Sufficient numbers of samples have not been obtained across the site to fully characterize the nature and extent of contamination. Additional surface and subsurface soil samples need to be collected across the site (including any drainage pathways) and analyzed for explosives, VOCs, SVOCs, TAL metals, PCBs, dioxins, furans and pesticides.

Response: **The majority of samples to date have been collected within an observed burn area to delineate the horizontal and vertical extent of elevated lead concentrations detected in soil samples collected from borings NBGSB1 and NBGDW1. Additional samples collected from across the site were collected from anomalous areas identified during the geophysical survey and analyzed for TAL metals, explosives, VOCs, SVOCs, and PAHs. Analysis of the results did not indicate the need to further delineate detected compounds outside the area where known burning activities occurred.**

Refer to Response to General Comment #8 regarding the analysis of pesticides.

Comment 41: Northern Burning Ground - New River Unit

Comment: There does not appear to be sufficient data on the site to limit the area of lead contamination to the small areas identified in Figure 1.12-3.

Response: **The approximate area with lead greater than 200 mg/kg will be removed from the figure and will be re-evaluated following the collection and analysis of the proposed soil samples.**

Comment 42: **Northern Burning Ground - New River Unit**

Comment: Section 1.12.4 states that VOCs were not detected in soils. They were detected above the RBC in surface soil during the 1997-sampling event. Please make this correction.

Response: **The statement in Section 1.12.4 indicating that VOCs were not detected in soils will be removed.**

Comment 43: **Western Burning Ground - New River Unit**

Comment: It is unclear what the data from the test pits represent. In the text of the Work Plan it would appear that the entire area within the berm had been excavated and possibly backfilled. Were these samples obtained at various depths prior to the excavation? If so, they no longer represent conditions at the site. The text suggests that there is an ash layer throughout the site that is the source of the high lead detects. Has that layer been removed? Does the TP data reflect samples taken below the ash layer after it had been excavated? Was the entire ash layer excavated or were just small test pit spots excavated? The text suggests that the ash layer beneath the road remains in place.

Response: **Data from the test pits represents confirmatory sampling results that followed the test pitting activities and field test kit screening of soils for lead. Confirmatory samples were collected at various depths below an ash layer that averaged approximately 6 inches in thickness throughout the test pit area. The ash layer and debris that was encountered during test pit advancement was removed. A cinder layer remains beneath the dirt road leading to the unnamed pond. It is the Army's position, that this layer is different from the ash layer encountered in the test pits, and is believed to be roadbed material. As shown on revised Figure 1.13-3, 15 borings were advanced along the dirt road to assess potential impacts to soils from the cinder layer. Analysis of chemical results indicated that there were no impacts to soil from the cinder layer present.**

Comment 44: **Western Burning Ground - New River Unit**

Comment: Why were no soil samples obtained in the soil staging area or the marsh?

Response: **The collection and analysis of surface and subsurface soil samples in the former soil staging area and marsh is currently proposed in this WPA.**

Comment 45: **Western Burning Ground - New River Unit**

Comment: Not being familiar with the site, I am having difficulty locating the features on Figure 1.13-2 onto Figure 1.13-1 or vice-versa. Please identify reference points on both figures so that they make sense.

Response: **These figures will be revised in order to clarify the spatial relationship between the figures. A rectangle will be placed around the test pit area on the figures with a note labeling and referencing the other figures. In addition, the figure showing the close up view of the test pit area will be made into two figures. One figure will display the results from the boring samples, while the second figure will show the confirmation results from the test pit samples.**

Comment 46: **Western Burning Ground - New River Unit**

Comment: The text states that there was only one sample in the test pit area that showed high lead; and that this sample was obtained at bedrock. In fact, there was a second elevated lead sample at TP16A showing 681 ug/g lead.

Response: **Test pit confirmation sample WBGTP16A did, in fact, exhibit elevated lead concentrations in test pit 16; however, an additional sample (WBGTP16A2) was collected from the same location to verify the accuracy of the reported sample**

results. Sample results from WBGTP16A2 indicated a lead concentration of 34.2 ug/g. The text will be revised to make note of this.

Comment 47: **Western Burning Ground - New River Unit**

Comment: Please identify which eight sampling locations were the confirmatory samples referenced in the fourth full paragraph on page 1-101.

Response: **The eight sampling locations where test pit confirmation samples were analyzed for dioxins/furans will be identified in the text.**

Comment 48: **Western Burning Ground - New River Unit**

Comment: Please locate the former burn cage and sampling locations on one of the figures. This burn cage is referred to in the first full paragraph on page 1-101.

Response: **The former burn cage and the associated soil sampling location will be included on a new site figure displaying the results from the soil boring samples.**

Comment 49: **Western Burning Ground - New River Unit**

Comment: The nature and extent of contamination has not been determined in the sediments at the site. Additional sampling for all constituents is needed. Locations will need to be determined once the locations of the existing sediment data have been clearly identified and a site visit to locate sampling sites has occurred. Sediments in the marsh and lake may need to be evaluated, depending upon drainage patterns, which are not clearly identified on the figures. Additional soil, sediment and surface water sampling appear to be indicated. The exact constituents and sample locations can be determined once more information about the existing data is made available.

Response: **The Army believes that six previously collected sediment samples (analyzed for TAL metals, TCL VOCs, SVOCs, explosives, and TOC) coupled with the two additional proposed sediment samples in the unnamed pond is sufficient to screen the unnamed pond for the presence or absence of constituents which were not historically used, stored, or disposed at the site. In addition, soil samples have been proposed in the marsh that has not been previously investigated. These samples will be analyzed for the full suite to include: TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, and dioxins/furans.**

Comment 50: **Western Burning Ground - New River Unit**

Comment: Surface water samples need to indicate if the samples were filtered. This may be particularly important when elevated levels of potential soil constituents such as arsenic are detected.

Response: **It has not been standard operating procedure when collecting surface water samples to filter said samples. Surface water samples collected at RFAAP have not been filtered.**

Comment 51: **Western Burning Ground - New River Unit**

Comment: Arsenic in surface water, lead, chromium, explosives, PAHs/SVOCs, dioxins/furans, zinc and possibly explosives appears to be primary COPCs at this site based upon this preliminary data. Additional data to further define the nature and extent of contamination is warranted.

Response: **Re-evaluation of the surface water data to current applicable screening values (AWQCs and Tap Water RBCs) indicates that arsenic (10.4 ug/L) exceeded the Tap Water RBC (0.045) at WBGSW6, copper (20.2 ug/L) exceeded the AWQC (9 ug/L) at WBGSW4, and vanadium (79 and 75 ug/L) exceeded the Tap Water RBC (26 ug/L) at**

locations SW-01 and SW-02, respectively. It is the Army's belief that the two proposed surface water samples to screen for parameters that have not been analyzed for, and the eight previously collected surface water samples are sufficient to adequately define the nature and extent of contamination in the unnamed pond.

Comment 52: Western Burning Ground - New River Unit

Comment: The DNT mix residential RBC is 0.94 mg/kg. Sample WBGSB3A shows a level of 1.06 mg/kg DNT mix. This should be reflected in the text and in the data tables. Explosives are a concem; see "explosives" page 1-104.

Response: **The text and data tables will be revised to compare to the DNT mix screening levels where 2,4- and 2,6-DNT are both detected. It should be noted that DNT mix concentrations do not exceed DNT mix industrial RBCs and therefore, would not be a concern at the WBG.**

Comment 53: Rail Yard - New River Unit

Comment: PCBs, pesticides, barium and explosives appear to be primary COPCs currently noted at this site, though other contaminants will probably need to be included. Additional sampling will need to be done to determine the nature and extent of the contamination in the surface soils, subsurface soils, sediments and surface water.

Response: **It is agreed that additional sampling is necessary to further characterize the nature and extent of contamination in available site media and screen for the presence or absence of constituents, which were not previously investigated at the site. Three soil samples have been proposed in the bermed spurs in the northern portion of the site, which have not previously been investigated. In addition, three soil samples are proposed in the main drainage area of the site, and one surface water sample from under transfer platform 603. It should be noted that PCB, pesticide, barium, and explosive concentrations do not exceed industrial RBCs and therefore would not be COPCs at the Rail Yard. The detection of pentachlorophenol (a wood preservative) was collected at the base of a wooden utility pole. The Army agrees that the concentration exceeds RBCs but does not believe that further characterization is necessary.**

Comment 54: Rail Yard - New River Unit

Comment: Figure 1.14-1 does not indicate the location of the second soil sample taken in 1997 by Gannett Fleming. Please mark the site, as it is the sample showing the most contamination.

Response: **The second soil sample (SS-08) collected in 1997 by Gannett Fleming was present on Figure 1.14-1, but was colored incorrectly on the figure. For consistency purposes, site figures have been color coded to designate samples collected by a specific contractor versus a different color for each investigation. Color coding designations were assigned as follows:**

- **Dames & Moore- red**
- **Parsons Engineering- purple**
- **Alliant Techsystems- black**
- **Gannett Fleming- magenta**
- **ICF Kaiser- cyan**

Proposed sample locations were designated with a green color.

Comment 55: Rail Yard - New River Unit

Comment: Please include the results of the field screening tests or omit them from reference in the document. Though they cannot be relied upon to confirm the presence or absence of a contaminant, they can be used to locate additional points requiring further investigation.

Response: **References to field screening at the Rail Yard will be removed from the document.**

Comment 56: Rail Yard - New River Unit

Comment: There are an insufficient number of surface and upper level subsurface soil sampling locations where VOCs, pesticides, PAHs, PCBs, and explosives were analytes. These analytes were missing from the analyte list for the 1998 Remedial Investigation.

Response: **Refer to the Response to Specific Comment #53 above. It should be noted that explosives were included in the analyte list for the 1998 Remedial Investigation. The data was not included in Appendix A, Table A-71 because explosives were not detected in the 15 soil samples collected at the Rail Yard.**

Comment 57: Rail Yard - New River Unit

Comment: Surface water and sediment samples from the unnamed creek and its tributary appear to be needed. Samples should be analyzed for VOCs, SVOCs, PAHs, pesticides, TAL metals, explosives, perchorates and PCBs.

Response: **A boring has been proposed in the major drainage area of the Rail Yard leading to the unnamed creek. Overland sheet flow migration of constituents from the Rail Yard is not anticipated because of raised roadbeds between the site and the unnamed creek. Therefore, the Army does not believe that sampling of the unnamed creek, in association with the Rail Yard, is necessary at this time.**

Comment 58: Rail Yard - New River Unit

Comment: The report stated that all samples were obtained 1 ft bgs due to a thick gravel layer. Were soils mixed with the gravel layer, which could contain contaminants such as PCBs, which may not migrate, but could pose a future risk (e.g. children playing in the gravel) should site uses change?

Response: **Gravel is part of the road base laid down for track construction and was not mixed with soils. At this time, the Army does not foresee the use of this site as other than industrial.**

END OF COMMENTS

Recv'd ENV 9-19-01
#01-123
C: Jake
Redder
~~McKenna~~
ENV file

141.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

September 10, 2001

[illegible]
[illegible]
[illegible] more [illegible]
[illegible]
[illegible] with [illegible]
[illegible] as documentation of
[illegible]
[illegible]
[illegible]

Mr. James McKenna
Radford Army Ammunition Plant
SIORF-SE-EQ
P.O. Box 2
Radford, VA 24141-0099

RE: Addendum 12, Site Characterization Work Plan
SWMUs 39, 48, 49, 50, 58, 59, AOC-FLFA, New River Unit
Radford Army Ammunition Plant, April, 2001

Dear Mr. McKenna:

Thank you for the opportunity to review the above referenced document. Upon review of previous comment letters submitted by the Department of Environmental Quality (DEQ) it is clear that some of the comments submitted under cover dated March 28, 1996, (copy enclosed) have not been addressed. Please review this prior comment letter with respect to all sites and also to surface water and groundwater issues. There remains concern regarding contaminants in the New River and how they are being studied, a topic associated with this work plan as many of its sites are potential source areas for contamination in the New River. At some point ecological evaluations of the sites and the receptor, the New River, need to be conducted.

Furthermore, it is clear from the data presented in Work Plan, Addendum #12, that all of the sites will need to be carried forward to the Remedial Investigation (RI) phase. Several of the sites may be grouped, e.g. SWMUs 48, 49, 50, and 59 due to their contiguous location and likely shared areas of influence or contamination.

The comments in this letter are organized into two sections. The first section contains comments applicable to the work plan in general and to all, or nearly all of the sites. The second section contains site (or SWMU) specific comments that are applicable only to that particular site.

General Comments

1. In Appendix A several of the tables are not using the RBC value divided by ten for all non-carcinogenic compounds, Table A-7 for example; whereas, other tables such as Table A-38 is using the screening value appropriately. Please use the most recent RBC values in the tables and apply them according to EPAs Risk Assessment guidance for screening for Chemical Of Potential Concern (COPCs).

copy in 216

C26

2. In Appendix A, all of the tables should be revised to screen against the most recent revised values of the RBC table, currently Spring of 2001. Depending upon when this document is revised, the Fall 2001 values may be available and should then be used.

3. It is requested, though not absolutely required , that the data from all of the sampling events, at a given site, be combined into one table (multipage) with an additional page at the end identifying the report from which the data for each date originates. The tables would include the Residential RBC values, the Soil Screening Levels, and, if available at the time, the agreed upon Background Screening Values, or at least the background maximum, minimum and mean values. Inclusion of the Industrial RBC values is not as important but still useful. It would also be helpful to include the ecological screening values for each constituent. Data such as hit frequency, HBNs and PQLs is not as useful at this time and may be omitted due to layout space considerations. Shading, bolding , and boxing of values exceeding various parameters is of great value in facilitating the review as are the data qualifiers. Where a constituent was not analyzed an "NA" or preferably, a blank space is always acceptable. Non-detects can be identified by "ND".

4. The statement at the end of the Executive Summary stating that COCs , which are at this point only Chemicals of Potential Concern (COPCs), have been detected only in the surface soil and therefore no groundwater investigation is indicated should be removed. Contaminants at action levels have been detected in groundwater at sites where subsurface soils present no or negligible levels of contamination. Groundwater should be investigated at all of the sites addressed by this work plan on a overall and on a site specific basis. It is understood that the Main Manufacturing Area (MMA) groundwater study is going to address those sites; however, no study has currently been proposed for the New River Unit (NRU).

5. Existing groundwater data for the Horseshoe Area and the NRU should be provided for reference purposes. The data contained in the Current Conditions Report was of little use and is unacceptable. These documents are for public review and omitting data that falls below a screening value, e.g. using DNE in tables, could and does raise questions. If a constituent was not detected, it was not detected, and should be reported accordingly; however if values exist, even if estimated or qualified, they should be reported along with the requisite qualifier. In particular, there are likely to be instances where a concentration exists below the screening level at the sampling point (well) but exist at a higher concentration upstream (or up gradient) from that well. Observing the detection of the non-naturally occurring pollutant, even at extremely low concentrations, may suggest the need for further investigation of the potential source area.

6. I was unable to locate SWMU 58 – Rubble Pile, AOC – Former Lead Furnace Area (FLFA), and AOC- Building 4343 on Figure 1.1-1. Please provide a site plan which more clearly identifies the locations of these units.

7. Section 1.1.4 – Air is a potential pathway and should be addressed in the Remedial Investigation report's risk assessment for each site. From the data provided, it is clear that none of the sites

can be eliminated from further remedial action based upon screening values alone; a risk assessment will need to be performed for each site, or group of sites, the grouping depending upon the geography and geology of the sites. Potential air pathways include groundwater to indoor air, groundwater volatilization (shower model), and particulate inhalation. It is also possible, though unlikely, that surface concentrations of volatile constituents exist after several years; however, volatile constituents in subsurface soils may be present and affect construction workers as soils are disturbed. Both will need to be discussed qualitatively in the risk assessment and may require quantitative analysis as well.

8. Pesticides need to be added to the list of analytes for all sites.

9. Please provide a discussion describing perchlorates and why they are only being tested for in surface water and not in other media.

10. In several tables, TCLP metals data is reported. It is not clear from the table whether the results are from the TCLP test or if the results are total metals from the soil sample. If the results are from the TCLP test, and they exceed RCRA hazardous waste thresholds, they should be highlighted. It appears that Barium in Table A-5 is one such example.

11. Samples will need to be obtained from each site that are suitable for ecological screening. Generally this requires full scan analysis of soils for TAL metals, TCL VOCs, SVOCs, PAHs, explosives, dioxins, furans, PCBs, and pesticides at 0-6" depths, and at multiple depths subsurface. If surface water is present, then surface water and sediment samples will be required in lieu of the surface soil samples (in areas beneath surface water) and perchlorates would be added to the list of analytes. The exact requirements should be discussed with EPA's Biological Technical Assistance Group (BTAG). Sampling locations and horizons should be determined following joint discussions with DEQ, EPA and BTAG.

12. The figures provided as conceptual site models should have the following information included, as it should be readily available: 1) estimated depth to groundwater, 2) estimated depth of cover material, if any, 3) estimated depth of "buried " waste (e.g.4-8 ft. bgs).

13. Please recheck all data tables and figures to verify that all sampling locations are indicated on a figure. Several sampling locations have not been identified. If the sampling point location is not available please make a note of it.

14. Please recheck all data tables to verify that there is data for each sampling point indicated on a figure. If, for some reason, no data is available for a given point, please make note of it.

15. Please mark the surface drainage flow patterns on all site figures.

16. In most of the sections below, a statement has been made identifying primary COPCs. This determination is not exact and does not include many constituents, primarily metals, which were not included if their concentration did not exceed a yet-to-be-determined maximum background

concentration. The intent was simply to highlight constituents which have been detected , usually at above residential RBC concentrations and appear to require further delineation.

17. In all of the sections below, which address specific sites, there will occasionally be comments suggesting that proposed samples are not necessary due to existing data. This is based upon the assumption that all of the data presented in this work plan has been validated. If this data has not been validated, these comments do not apply.

SWMU 39 - Wastewater Ponds From Propellant Incinerator

1. Sufficient numbers of samples have not been provided to determine the full horizontal or vertical extent of the lead contamination in either the northern or southern settling ponds and surrounding soils.

2. Additional sampling for explosives does not appear to be necessary as those compound would tend to accumulate in sediments and have not been detected in any of the 3 sediment and 3 surface soil samples already obtained.

3. VOC samples do not seem to be necessary in surface water as they would have evaporated from this media. If they are detected in soils, the surface water would need to be removed and treated in any case. For this site, surface water samples do not appear to be needed except for perchlorates. The limited amount of surface water (puddles) and the affinity of most unidentified potential contaminants for sediments suggests that sediment sampling would reveal any COPCs that are present.

4. Additional surface soil / sediment samples will be needed for PCBs, pesticides, SVOCs , PAHs, dioxins, and furans. If any of these constituents are detected, further subsurface investigations may be required.

5. Figure 1.2-2 suggests that the propellant incinerator, skimmer, and former spray pond are additional source areas that need to be addressed. It also shows a sludge bed but not the two settling ponds that are described in the text. The figure describes a pathway for runoff to flow to surface water, however section 1.2.3 states that precipitation infiltrates into the groundwater rather than flowing overland to surface water.

SWMU48 – Oily Water Burial Area

1. Perhaps this site should be renamed explosives Contaminated Oily Water Burial Area due to the wide spread low level contamination of the soils with DNT mixtures above the RBC of 0.94mg/kg in soils from 1 through at least 7 feet below ground surface (bgs). Sufficient samples have not be obtained to fully delineate the horizontal and vertical extent of contamination of at least one COPC, DNT, at the site. Samples also need to be obtained from outside of the footprint of the "pit" to confirm that contaminants have not migrated horizontally or vertically beyond the pit boundaries.

2. Pesticides, PCBs, PAHs, dioxins, and furans appear to be the primary data gaps. These samples can be obtained from the same locations and depths used to delineate the explosives contamination.

3. The results in Table A-5 suggest that barium and lead are also COPCs at this site due to levels of TCLP lead and barium exceeding the RCRA threshold for a hazardous waste.

SWMU 49 - Red Water Ash Burial Site

1. Detection of explosive compounds at concentrations within 1 order of magnitude of the RBC at 8 to10 ft. bgs suggests that the compounds are likely to exist at greater concentrations closer to the surface. Surface soil and 0.5 to 10 ft bgs subsurface soil samples need to be obtained at multiple intervals and at several locations within the footprint of the site. These samples should be analyzed for PAHs, pesticides, SVOCs, PCBs, dioxins, furans, VOCs, and TAL metals. Depending upon concentrations detected, additional sampling to determine the horizontal extent of contamination could be required. It is unclear why samples at these depths were not previously obtained.

2. The text on Page 1-35 states that 2,4,6 TNT was detected above the industrial RBC. This data was omitted from the SWMU tables in Appendix A. Please include all data in the appendix tables for this site and others.

SWMU 50 – Calcium Sulfate Treatment Sludge Disposal Area

1. The five sampling locations proposed appear to be adequate to determine if significant contamination is present at this site; however, pesticides will need to be added to the analyte list and the sampling horizons will need to be adjusted , see Comment #11 under the general comments above.

2. If COPCs are detected, then additional sampling to determine the extent of the contamination will be required. This second stage of sampling will most likely use an abbreviated analyte list.

3. If the calcium sulfate sludges came from a wastewater treatment process, then dioxins and furans should be included in the analyte list, as several fires have occurred at the plan over the years and the wash down and storm waters could have contained these contaminants.

SWMU 58 – Rubble Pile

1. Once again data is referred to in the text that does not appear on the Appendix A SWMU 58 data tables. The VOC surface soil results have not been reported.

2. Several sampling locations at multiple horizons within the footprint of the site will need to be

sampled for surface soil and subsurface soils down to 15 ft bgs. Depths below this have already been partially sampled. The samples will need to be analyzed for PAHs, pesticides, SVOCs, VOCs, PCBs, TAL metals, explosives, dioxins and furans. Since bottom ash is one of the wastes allegedly disposed in the pile, dioxins and furans may be present. The sampling horizons should be discussed with BTAG.

SWMU 59 – Bottom Ash Pile

1. It appears that the only analytes that need to be added to the list are pesticides. The three sampling locations appear adequate for SI level sampling; however, additional samples will be required to define the horizontal and vertical extent of the contamination if the results of the first three sets of samples indicate contamination is present. The sampling horizons should be discussed with BTAG.

AOC - Former Lead Furnace Area

1. The statement that environmental receptors are unlikely to frequent the area is not supported by the fact that the area is accessible and is only occupied by humans on a weekly basis.

2. The conceptual site model fails to reflect surface runoff into the sinkhole area.

3. The text states that sample LFTP8 is located outside of the FLFA boundary but fails to show the location of any of the LFTP samples. Furthermore, if the sample location is anywhere within the general vicinity of the FLFA, it is NOT outside of the boundaries. Contaminant impact areas may overlap with those from SWMU 17A and there may be reason to combine the two areas for investigation purposes.

4. The data from Table A-26 is not applicable to this site. Sampling locations referred to in the third paragraph on page 1-58 must be provided, prefereably on a figure with the associated analytical results. Furthermore, as long as lead contamination is present, it really makes no difference since associated hazards and contaminants may be present, if the source of the lead contamination is, in fact, the FLFA. Investigation and remediation will need to occur in any case and the source will need to be identified.

5. Two samples indicate that there are high levels, approximately 900 ug/g, of lead in the 4 to 6 ft. bgs soil horizon at the site. The vertical and horizontal extent of lead contamination needs to be further delineated across the site and its boundaries. Barium also appears to be a COPC, exceeding the TCLP threshold for hazardous waste at a depth of 8-10 feet. The boundaries of the contamination need to be more clearly defined. Is it possible that the "rim" around the sinkhole may be part of a disposal or fill area?

6. It is unclear why sample locations at the bottom of the hill have not been selected as these are expected to receive much of the runoff from the site.

7. Surface and subsurface soil samples down to at least 8 ft. bgs. need to be obtained and analyzed for VOCs, SVOCs, TAL metals, pesticides, Dionins, furans, PCBs, PAHs, and explosives.

AOC – Former Cadmium Plating Facility (Building 4343)

1. The sampling locations for all of the samples in Table A-23 are not shown on a figure. Please provide the figure with the sampling results, including 4343-02-SVR. The 1996 sampling locations should be identified on the key for Figure 1.9-1.

2. I was unable to locate sample B43SSB33 on either Figure 1.9-1 or Figure 1.9-2. It would be helpful if both figures had the results for each sample site by horizon. This would result in an additional two figures.

3. The lateral and vertical extent of contamination has not been delineated for the site. It appears that barium, cadmium and chromium, and possibly zinc will be the primary heavy metal COPCs. Additional sampling for TAL metals, cyanides, SVOCs, VOCs, PAHs, explosives, perchlorates, and pesticides will need to be performed for surface soils, subsurface soils at various horizons, and surface water where available.

Building Debris Disposal Trench – New River Unit

1. Additional PCB analysis only appears to be needed for a few surface soils and for sediments. PCBs would not be likely to be present in surface water and not present in the sediments.

2. Due to the presence of chlorinated benzenes, analysis for dioxins and furans should also be considered for sediment samples at a minimum.

3. The vertical extent of PAH contamination has not been determined; however, sufficient data exists for a Human Health Risk Assessment (HRA) and, if the results indicate that remedial action is warranted, the vertical extent of contamination can be determined during the feasibility study or remedial design phases.

4. Surface water samples need to be collected for perchlorates and VOCs.

5. Additional sediment samples need to be collected for PCB, dioxins, furans, PAH, VOC and SVOC analyses.

6. Upstream surface water and sediment samples are also recommended. Typically, three samples are obtained up-gradient of the site.

Igniter Assembly Area – New River Unit

1. It appears that barium, arsenic, PAH's, and SVOCs are likely COPCs at this site. Cadmium

and selenium should also be included due to the TCLP results. Determination of the vertical and horizontal extent of contamination has not been made and will require additional sampling at the 2 to 4 foot depths bgs as well as surface soil samples radiating outward from the building at specified intervals. The statement in the second paragraph of page 1-85 is not supported. Visual notations of "red leachate" do not necessarily indicate that the contaminants have not migrated beyond the stained areas (i.e. three feet from the edges of the building). Elevated levels of barium were detected at depths of 2 feet bgs; therefore the extent of contamination may reach as low as 4 feet bgs. This needs to be determined. However, this determination may be made at a later stage or possibly at the time of remediation, provided confirmatory samples are obtained prior to backfilling of the site.

2. Surface soil samples need to be obtained for explosives, VOCs, dioxins, furans, and PAHs.

3. Subsurface samples need to be analyzed for VOCs, as well as the constituents identified in comment #1 above.

4. A limited number of surface and shallow horizon subsurface soil samples should also be collected for PCB analysis.

5. Any surface drainage channels, if present, will also need to be sampled.

<u>Northern Burning Ground (New River Unit)</u>

1. Data for soil samples at location NGSB9 are not included in the appendix. The sampling point is presented on Figure 1.12-1 Please make the requisite corrections.

2. Zinc was detected at 3,760 ug/g in sample NBGSB2A. Lead, chromium, zinc and VOCs appear to be the primary COPCs at the site, though additional samples may reveal more constituents of concern.

3. The dimensions of the site are reported to be 350 X 250 feet; however, the majority of the samples, to date, have been obtained within a small 40 X 60 foot area. Sufficient numbers of samples have not be obtained across the site to fully characterize the nature and extent of contamination. Additional surface and subsurface soil samples need to be collected across the site (including any drainage pathways) and analyzed for explosives, VOCs, SVOCs, TAL metals, PCBs, dioxins, furans, and pesticides.

4. There does not appear to be sufficient data on the site to limit the area of lead contamination to the small areas identified in Figure 1.12-3.

5. Section 1.12.4 states that VOCs were not detected in soils. They were detected above the RBC in surface soil during the 1997 sampling event. Please make this correction.

Western Burning Ground (New River Unit)

1. It is unclear what the data from the test pits represent. In the text of the work plan it would appear that the entire area within the berm had been excavated and possibly backfilled. Were these samples obtained at various depths prior to the excavation? If so, they no longer represent conditions at the site. The text suggests that there is an ash layer throughout the site that is the source of the high lead detects. Has that layer been removed? Does the TP data reflect samples taken below the ash layer after it had been excavated? Was the entire ash layer excavated or were just small test pit spots excavated? The text suggests that the ash layer beneath the road remains in place.

2. Why were no soil samples obtained in the soil staging area or the marsh?

3. Not being familiar with the site, I am having difficulty locating the features on Figure 1.13-2 onto Figure 1.13-1 or vice versa. Please identify reference points on both figures so that they make sense.

4. The text states that there was only one sample in the test pit area that showed high lead; and that this sample was obtained at bedrock. In fact, there was a second elevated lead sample at TP16A showing 681 ug/g lead..

5. Please identify which eight sampling locations were the confirmatory samples referenced in the fourth full paragraph on page 1-101.

6. Please locate the former burn cage and sampling locations on one of the figures. This burn cage is referred to in the first full paragraph on page 1-101.

7. The nature and extent of contamination has not been determined in the sediments at the site. Additional sampling for all constituents is needed. Locations will need to be determined once the locations of the existing sediment data have been clearly identified and a site visit to locate sampling sites has occurred. Sediments in the marsh and lake may need to be evaluated, depending upon drainage patterns which are not clearly identified on the figures. Additional soil, sediment and surface water sampling appear to be indicated. The exact constituents and sample locations can be determined once more information about the existing data is made available.

8. Surface water samples need to indicate if the samples were filtered. This may be particularly important when elevated levels of potential soil constituents such as arsenic are detected.

9. Arsenic in surface water, lead, chromium, explosives, PAHs/SVOCs, dioxins/furans, and zinc and possibly explosives appear to be primary COPCs at this site based upon this preliminary data. Additional data to further define the nature and extent of contamination is warranted.

10. The DNT mix residential RBC is 0.94 mg/kg. Sample WBGSB3A shows a level of 1.06

mg/kg DNT mix. This should be reflected in the text and in the data tables. Explosives are a concern; see "explosives" page 1-104.

Rail Yard (New River Unit)

1. PCBs pesticides, barium and explosives appear to be primary COPCs currently noted at this site, though other contaminants will probably need to be included. Additional sampling will need to be done to determine the nature and extent of the contamination in the surface soils, subsurface soils, sediments and surface water.

2. Figure 1.14-1 does not indicate the location of the second soil sample taken in 1997 by Gannett Fleming. Please mark the site, as it is the sample showing the most contamination.

3. Please include the results of the field screening tests or omit them from reference in the document. Though they cannot be relied upon to confirm the presence or absence of a contaminant, they can be used to locate additional points requiring further investigation.

4. There are an insufficient number of surface and upper level subsurface soil sampling locations where VOCs, pesticides, PAHs, PCBs, and explosives were analytes. These analytes were missing from the analyte list for the 1998 Remedial Investigation.

5. Surface water and sediment samples from the unnamed creek and its tributary appear to be needed. Samples should be analyzed for VOCs, SVOCs, PAHs, pesticides. TAL metals, explosives, perchlorates, and PCBs.

6. The report stated that all samples were obtained 1 ft. bgs due to a thick gravel layer. Were soils mixed with the gravel layer which could contain contaminants, such as PCBs, which may not migrate, but could pose a future risk (e.g. children playing in the gravel) should site uses change?

Due to the number of questions and concerns identified in this comment letter, it is strongly suggested that a meeting be held with all involved parties(including DEQ, EPA, and the consultant) present at the site to reach consensus on the proposed sampling scheme. The intent of this sampling plan, it is presumed, is to provide sufficient data to conduct a human health and ecological screening to identify COPCs and, hopefully, for some sites, to complete a full Remedial Investigation Report, (or RFI) including both a human health and an ecological risk assessment. Following this meeting, a revised work plan should be submitted for review and approval prior to initiating any sampling.

In the revised work plan, please provide a table showing the analyte, the method number, its detection limit and PQL, the most recent residential RBC screening values, and the ecological screening value(s). Non carcinogenic RBC values are to be divided by 10. The selection of the ecological screening values should be discussed with BTAG and the EPA Remediation Project Manager. It is also suggested that separate reports be provided for each site unless, like SMWUs 48, 49, 50, and 59, or the former lead furnace area and SWMU 17, the sites are closely associated with each other.

If you have any questions regarding these comments, please contact Mr. Mark Leeper at (804) 698-4308.

Very truly,

Sharon Wilcox

Sharon Skutle Wilcox
Office Of Remediation Programs

Enclosure: Letter dated March 28, 1996

cc: Robert Thompson, Region III, U.S.EPA
J. J. Redder, Alliant Techsystems
Garwin Eng, VDEQ, CO
Durwood Willis, VDEQ, CO
Mark Leeper, VDEQ, CO
Elizabeth Lohman, VDEQ, WCRO

SITE ID	31SB3A	31SB3B	
DEPTH (ft)	10–12	18–20	
TAL Metals			
Aluminum	18,800	7,010	
Arsenic	**3.9**	**2.9**	
Chromium	30	16	
Iron	34,900	20,600	
Manganese	513	431	
Vanadium	56 J	22	J

SITE ID	31MW3	31MW3–2	
FRACTION	TOTAL	TOTAL	
SAMPLING DATE	JUL–95	01–APR–98	
DEPTH (ft)	23–33	20.5–30.5	
TAL Metals			
Aluminum	na	2,680	
Arsenic	nd	9.4	J
Beryllium	5.24	1.1	J
Chromium	89.1	11.4	B
Iron	na	7,080	
Lead	36.2	6.7	
Manganese	na	183	J
PAHs			
Benzo(a)pyrene	na	.061	

SITE ID	31MW2	31MW2–2	
FRACTION	TOTAL	TOTAL	
SAMPLING DATE	JUL–95	01–APR–98	
DEPTH (ft)	18–28	18.5–28.5	
TAL Metals			
Aluminum	na	2,670	
Arsenic	7.44	9.3	J
Beryllium	6	1.1	J
Chromium	97.3	nd	
Iron	na	7,080	
Lead	41.8	6.6	
Manganese	na	182	J
PAHs			
Benzo(a)pyrene	na	.024	J

SITE ID	31MW4A12	31MW4B22
DEPTH (ft)	10–12	20–22
TAL Metals		
Chromium	38.2	29.6

SITE ID	31MW2A12	31MW2B22
DEPTH (ft)	10–12	20–22
TAL Metals		
Arsenic	nd	**3.67**
Chromium	35.5	30.6

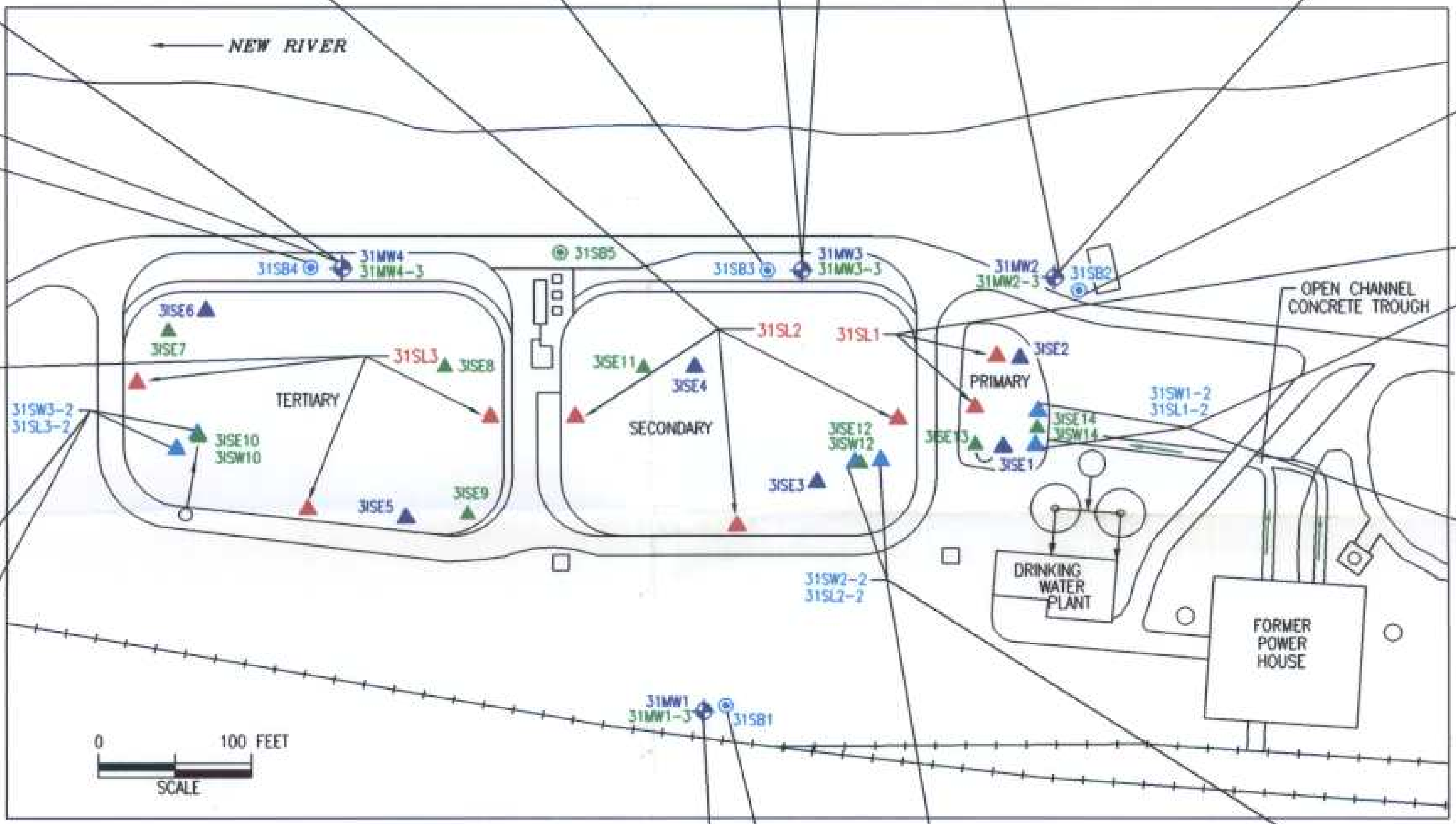
SITE ID	31MW3A10
DEPTH (ft)	5–10
TAL Metals	
Chromium	26.8

SITE ID	31MW4
FRACTION	TOTAL
SAMPLING DATE	JUL–95
DEPTH (ft)	20–30
TAL Metals	
Beryllium	5.26
Chromium	31.6

SITE ID	31SL2
DEPTH (ft)	0–1
SVOCs	
2–Methylnaphthalene	**0.13**

SITE ID	31SB2A	
DEPTH (ft)	12–14	
TAL Metals		
Aluminum	30,500	
Arsenic	**3.7**	
Chromium	34	
Iron	36,400	
Manganese	598	
Vanadium	71	J

SITE ID	31SB4A	31SB4B
DEPTH (ft)	10–12	20–24
TAL Metals		
Aluminum	15,400	12,400
Arsenic	**3.4**	**6.0**
Chromium	27	23
Iron	30,800	37,000
Manganese	502	502



SITE ID	31SL1
DEPTH (ft)	0–1
TAL Metals	
Arsenic	**9.8**
SVOCs	
2–Methylnaphthalene	**1.15**
Fluorene	**0.09**
Naphthalene	**0.56**
Phenanthrene	**0.74**

SITE ID	31SL1–2
DEPTH (ft)	0–0.5
TAL Metals	
Lead	**55**

SITE ID	31SL3
DEPTH (ft)	0–1
SVOCs	
1,2–Dichlorobenzene	**3.46**
2–Methylnaphthalene	**1.53**
Naphthalene	**1.33**
Phenanthrene	**1.18**

SITE ID	31SW1–2	
DEPTH (ft)	NA	
TAL Metals		
Aluminum	**738**	J

SITE ID	31SW3–2	
DEPTH (ft)	NA	
TAL Metals		
Aluminum	**585**	J

SITE ID	31SW2–2	
DEPTH (ft)	NA	
TAL Metals		
Aluminum	**297**	J

SITE ID	31SL2–2	
DEPTH (ft)	0–0.5	
TAL Metals		
Arsenic	**8.6**	J
Lead	**52**	
Nickel	**30.2**	J
Zinc	**180**	J

SITE ID	31SL3–2	
DEPTH (ft)	0–0.5	
TAL Metals		
Arsenic	**8.7**	
Lead	**53**	
Nickel	**32.6**	J
Zinc	**176**	J

SITE ID	31MW1	31MW1	31MW1	31MW1–2	
FRACTION	DISSOLVED	DISSOLVED	TOTAL	TOTAL	
SAMPLING DATE	18–JAN–95	JUL–95	JUL–95	06–APR–98	
DEPTH (ft)	42–52	42–52	42–52	40–50	
TAL Metals					
Aluminum	na	na	na	534	
Antimony	65.2	nd	nd	nd	
Barium	222	264	300	166	J
Beryllium	3.84	3.98	5.16	1.3	J
Iron	na	na	na	860	
SVOCs					
Bis(2–Ethylhexyl)phthalate	na	na	na	4.8	J

SITE ID	31SB1A		31SB1C	
DEPTH (ft)	22–23		10–12	
TAL Metals				
Aluminum	17,900		28,400	
Arsenic	**1.8**		**5.9**	
Chromium	32		**59**	
Iron	25,600		40,200	
Manganese	191		857	
Vanadium	17	J	59	J

<u>LEGEND</u>

- 🔺 1992 VI WASTE COMPOSITE SAMPLE (DAMES & MOORE)
- ▲ 1996 RFI WASTE SAMPLE (PARSONS ENGINEERING)
- ⊕ 1996 RFI MONITORING WELL (PARSONS ENGINEERING)
- ◉ 1998 RFI SOIL BORING (ICF KAISER)
- ▲ 1998 RFI SURFACE WATER/ SEDIMENT COMPOSITE SAMPLE (ICF KAISER)
- ▲ PROPOSED SURFACE WATER/SEDIMENT SAMPLE LOCATION
- ◉ PROPOSED SITE SCREENING SOIL BORING LOCATION
- 31MW1–3 PROPOSED GROUNDWATER SAMPLING LOCATION

NOTE:

SOLID MATRIX UNITS IN UG/G
AQUEOUS UNITS IN UG/L
B = BLANK CONTAMINATION
J = ESTIMATED CONCENTRATION
NA = NOT ANALYZED
ND = NOT DETECTED
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC, TAP WATER RBC, OR AWQC (CHRONIC)
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR MCL
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION OR BTAG CRITERION

Sample Summary

Previous Investigation	Contractor	Total Metals				Dissolved Metals	TCL SVOCs				PAHs				TOC		TOX	TCLP Metals	Total
		SB	SW	SE	GW	GW	SB	SW	SE	GW	SB	SW	SE	GW	SE	GW	GW	SE	
1992 VI	D&M	--	--	3C	--	--	--	--	3C	--	--	--	--	--	--	--	--	--	6
1996 RFI	PES	8	--	--	4	8	--	--	--	--	--	--	--	--	3	--	--	6	29
1998 RFI	ICF Kaiser	8	3	3C	4	4	8	3	3C	4	8	3	3C	4	--	4	4	--	66

RADFORD AAP
PREPARED BY: IT CORP.
CHECKED BY: MT
DATE: OCTOBER 2001
TASK NO: [illegible]
IT DWG NO: 1–8–1–AXLS

FIGURE 1–8
SWMU 31–
PREVIOUS INVESTIGATIONS
SAMPLE RESULTS AND
PROPOSED SAMPLING
LOCATIONS

FILE: 1–8–1AXLS.dwg PLOT: 2–8–02

05003\151 – 1/1

2-3

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Peter W. Schmidt
Director

P. O. Box 10009
Richmond, Virginia 23240-0009
(804) 762-4000

March 28, 1996

Ms. C. A. Jake
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
Route 114
P. O. Box 1
Radford, Virginia 24141-0100

Dear Ms. Jake:

Thank you for providing the Department of Environmental Quality, Office of Federal Facilities Restoration and Superfund, the opportunity to review the draft "RCRA Facility Investigation for Solid Waste Management Units 17, 31, 48, and 54 at Radford Army Ammunition Plant, Virginia" dated January, 1996.

Attached are the staff's comments concerning the Radford document. Please note that this letter represents comments by the Office of Federal Facilities Restoration and Superfund of the Department of Environmental Quality. Other comments may be provided by the Waste Division RCRA Program of the Department of Environmental Quality.

If you have questions concerning these comments please contact me at (804) 698-4192.

Sincerely,

Durwood H. Willis

Durwood H. Willis
Office of Federal Facilities
Restoration and Superfund

cc: Erica S. Dameron, DEQ
Robert Thomson, EPA Region III

629 East Main Street, Richmond, Virginia 23219 ~ Fax (804) 762-4500 ~ TDD (804) 762-4021

Comments on the draft preliminary RCRA Facility Investigation for SWMUs 17/40, 31, 48, and 54. Radford Army Ammunition Plant (RAAP)

General Comments

Future sampling-All future groundwater sampling at RAAP should include testing for TOC, TDS, TKN, ammonia, and nitrate. These parameters are good indicator parameters and/or degradation products of explosives and nitrosamine compounds. In addition, these parameters will be compared to the Commonwealth's groundwater standards and criteria and background data. Testing of the above parameters in samples of subsoils, surface water sediments, and surface waters may be useful in the facility-wide and site evaluations due to the nature of materials and by-products generated at RAAP. (TDS testing applies to water samples only.) Future investigations should also include chemical analyses for volatile organic and semivolatile organic compounds and pesticides and PCBs in the stream samples (water, sediment, and tissue) and at the SWMUs. These parameters are a concern both from a human health and an ecological perspective.

One of the objectives of the RFI was to identify and evaluate potential impacts to human and environmental receptors. There appears to be limited evaluation with respect to impact to the environment. Contaminant levels in the soil can be compared to EPA screening levels for impact on flora and fauna. Levels of contaminants in sediment can be compared to the EPA screening levels or the NOAA screening guidelines. Contaminant levels in the surface water should be compared to the water quality standards. Comparison of environmental data to these guidelines will provide an indication of the likelihood of ecological impact. The impact on receptors such as wildlife could be modeled based on the data in this study however this was not attempted. Examples of modeling are presented as part of the comments on several SWMUs. Future data evaluations at RAAP should include an evaluation of ecological risk.

The data for the SWMUs and the data for the stream samples are presented and discussed separately in the RFI Report. It is difficult to understand the relationship of the SWMUs to the stream surveys when the areas are not presented together. It is suggested that future documentation present the findings for a specific SWMU with the findings for the stream sample(s) most closely associated with that SWMU. For example, SWMU 48 had elevated levels of phthalates in the soil and groundwater. New River station NRSE4, which was selected as potential impact area for SWMU48, contained elevated levels of phthalates in the sediment. New River station NRSE5 contained elevated levels of TNT in the sediment. NRSE5 was selected due to the proximity to SWMU 54. SWMU 54 contained elevated concentrations of TNT in the soil.

6

The RFI Report tables need to more clearly identify the depth of samples with analytical results in both the main report and appendices. It is difficult to determine the depth of subsoil samples and sediment samples correlating with analytical data. This information is needed to fully evaluate the risk assessment conclusions.

Specific Comments

Section 4 Field Investigation Program

Page 4-8 Section 4.5-As a result of the dye study it was determined that the groundwater from SWMU 17 entered the New River at one point. Several monitoring stations had been established in the New River for detection of the injected dye. The investigation for this site does not indicate any attempt to determine the relative dilution of the spring in the New River using the detected dye concentrations. This information would be useful for several reasons. Several references are made to the dilution provided by the New River however there is no indication that the dye study was used to confirm this statement even for the spring. The chemical analyses indicate that contaminants from SWMU 17 are reaching New River and the dye trace could be used to define where these contaminants are transported in the river. Flow data from the closest gaging station on New River should be provided and could be compared with expected flows from Solid Waste Management Units. Future investigations at Radford Army Arsenal Plant involving dye studies could be designed to provide dilution data.

Page 4-14 Section 4.9.0.1-The following comment is presented at this point and during comments on specific SWMUs. The most prevalent gap in data collection appears to be the lack of data for the persistent compounds such as pesticides and PCBS. This class of compounds when used or released even in limited quantities can result in substantial human health and ecological impact. This is a particular concern for sites such as SWMU 48 where the disposal of oily waste potentially containing PCBS has occurred. Future investigations of SWMUs and surface water systems should include pesticides and PCBs.

Section 6 Baseline Risk Assessment

Section 6.2: The EPA Region III guidance document "Selection of Exposure Routes and Contaminants of Concern by Risk-Based Screening" should be consulted for methodology for selecting contaminants of concern. It appears that this guidance has not been followed. Although health-based numbers and industrial RBCs (risk-based concentrations) were compared to previous sample results, it is not clear whether they were used to screen the results of the current investigation. Note that the risk-based screen should be performed before the background comparison. Naturally-occurring contaminants that exceed the screen can then be compared to background. Performing the risk-based screen first can reduce the level of effort for the background comparison considerably.

VDEQ recommends that residential RBCs be used for screening in the baseline risk assessment. (Note that use of residential values in the baseline risk assessments does not necessarily indicate that remedial decisions would be based on that scenario.) Also note that RBCs for noncarcinogens should be adjusted to a target hazard quotient of 0.1 to allow for potential additivity of multiple contaminants. (Divide noncarcinogen RBCs by 10.)

Page 6-3 Section 6.2.0.1-The narrative text of the RFI Report needs to discuss the significance of the Health-based Number (HBN) and its relative importance and relation, if any, to the Risk Based Concentration (RBC) used in the RFI and evaluation.

Page 6-3 Section 6.2.0.1-The statement about chemicals of potential concern should recognize that chemicals may have ecological impact as well as human health impacts and would therefore support those chemicals also being chemicals of concern.

Section 6.2.2.1: This section indicates that a Poisson-based tolerance limit was computed if greater than 50% of the background samples were non-detect. It should be noted that VDEQ guidance (August 10, 1995 memo by Dr. Golam Mustafa and Mr. Howard Freeland) recommends that Poisson-based limits be used only when 100% of the background samples are non-detect. For greater than 50% non-detects, non-parametric methods should be used. However, the non-parametric methods require at least 13 samples and none of the background data subsets will meet this requirement.

It appears that no adjustment was made if the tolerance limit exceeded the maximum background concentration. A value exceeding the maximum background concentration should not be used in the comparison.

Page 6-12 Section 6.2.2.1.7-It is stated that the CERCLA process for risk assessment will be utilized. Mr. Rob Thomson's letter of August 9, 1994 addresses the use of screening values as part of the CERCLA risk assessment process.

Table 6.11-Sample 54SB6A had 11.75 ug/g cadmium in horizon B. Should Table 6.11 indicate the limit was exceeded for cadmium?

Page 6-24 Section 6.2.3.2-Please explain why pesticides and PCBs were not evaluated as part of the target compound list parameters.

Page 6-25 Section 6.3.1.0.5 and Table 6.13-The Virginia Water Quality Standards for lead toxicity is dependent upon the hardness of the receiving waters. The acute and chronic toxicity standards may be different for Stroubles Creek and New River. Please provide the basis for the lead criteria.

Page 6-26, Section 6.3.1.1.2: This section notes that MCLs are not appropriate as ARARs for this investigation since the groundwater is not a public water supply for more than 25 people. This would indicate that MCLs are not applicable but they are relevant and appropriate since the aquifer is potable. Therefore, MCLs and non-zero MCLGs should be considered as ARARs for this investigation.

Page 6-27 Section 6.3.1.2.1-See comment above concerning Stroubles Creek being primarily storm water. It is stated that Stroubles Creek consists of effluent from Blacksburg POTW. Page 11-1 states the POTW discharges to the New River, upstream of Stroubles Creek. Please clarify.

Page 6-27 Section 6.3.1.2.2-It should be noted that acute and chronic Water Quality Criteria are protective for toxic effects but may not be protective for bioaccumulative effects either within the organism or within the food chain.

Page 6-27, Section 6.3.1.3: Region III RBCs, dated October 4, 1995, should be noted as TBC values (to be considered).

Page 6-29 Section 6.4.1.2-A pathway is provided for contaminants to eventually enter the food chain and potentially impact wildlife. The risk to wildlife should be evaluated.

Page 6-31, Table 6.14: Please see the attached guidance for dermal absorption values. (Most of the table values appear to agree with the guidance but there may be a few discrepancies.)

Page 6-32 Section 6.4.3.1-As noted earlier, pesticides and PCBs are not included in the characterization of these sites. Due to the toxicity and persistence of this class of compounds and the potential for impact in the New River and Stroubles Creek, these compounds should be evaluated.

Page 6-35, Section 6.5.1.1.1: VDEQ recommends that a residential scenario be assessed in the baseline risk assessment. Note that assessing a residential scenario does not necessarily indicate that a remedial decision would be based on this scenario. However, it can provide a point of reference to indicate whether the site would be acceptable for unrestricted use.

Page 6-35 Section 6.5.1.1.4-Would it be appropriate to reference Appendix B which contains information concerning private wells and water users within one mile of Radford Army Ammunition Plant?

Page 6-36 Section 6.5.1.1.6-The risk to consumers of fish and aquatic life and waterfowl from this section of the New River should be addressed as well as the risk to consumers in potentially impacted sections of the River downstream. Recreational users could also be fishermen.

Page 6-36 Section 6.5.1.1.7-Are there exposure pathways for hunters other than traveling across contaminated soils?

Page 6-37 Section 6.5.1.2.3-Please explain the comment on Section 6.5.1.1.7 concerning exposure pathways for hunters. Fishermen may be exposed through fish caught and consumed.

Page 6-38, Section 6.5.1.2.3: Current recreational users and fishermen should also be evaluated for incidental ingestion and dermal contact with sediments. Fishermen should also be evaluated for ingestion of potentially contaminated fish. The potential for hunters to ingest contaminated wildlife should be evaluated at least qualitatively.

Page 6-40, Table 6.15 (and subsequent tables): Footnote (a) indicates that the lower of the 95% upper confidence limit of the mean or the maximum value was used as the exposure point concentration for the central tendency exposure estimate. The average value may be more appropriate for the central tendency. The lower of the 95% upper confidence limit of the mean or the maximum value should be used for the RME estimate.

Page 6-43, Table 6.18: Footnotes (d) and (e) indicate an assumption of once per week and twice per week for the central tendency (CT) and reasonable maximum exposure (RME) estimate respectively. However the values given are actually once per week for the RME and once every other week for the CT.

Page 6-44, Table 6.19: The values given for exposure time appear to be a little low. Are these based on actual knowledge of worker activity patterns? Consider adjusting the RME value.

Page 6-45, Table 6.20: Note that the fraction ingested could be adjusted based on the amount of time the worker would be expected to be in contact with sediments. This should be consistent with the surface water scenario.

Page 6-47, Table 6.22 (and subsequent tables): The derivation of the values for exposure time are unclear. The values given in hours per day would work out to less than a minute for the CT and approximately 7 minutes for the RME. These values seem much too low for recreational activity. The national average for swimming is 2.6 hours/day.

Page 6-61, Section 6.5.1.4.2: How were non-detects treated in the calculation of the 95% UCL (upper confidence limit)? Some of the UCLs could not be verified. Were the 1992 data also included in the UCL calculations?

Page 6-62, Section 6.5.2.0.2: Please define DTSC. It could not be located in the list of acronyms and abbreviations.

Page 6-63 Section 6.5.2.1.1.-Additional explanation is needed concerning the range and the conclusion that no toxic effects will occur.

Page 6-64, Table 6-36: A value of .95 should be used for the oral absorption factor for arsenic according to the ATSDR Toxicological Profile.

Page 6-66, Table 6.37: Note that the slope factor for trichloroethene does not require adjustment for oral absorption when used for dermal assessment since it is based on an absorbed dose. The tumor type listed for beryllium (leukemia) may be incorrect. IRIS indicates that leukemia was not statistically significant. Please check and correct if necessary. If a source other than IRIS was used, it should be cited. Also please verify the oral slope factor value for chromium III. Usually only chromium VI is considered carcinogenic and only by the inhalation route. Also to be conservative, chromium should be evaluated as hexavalent. If chromium VI indicates an unacceptable risk, samples should be speciated to verify the proportion of two states.

Section 7 SWMU 17 and SWMU 40

Page 7-1 Section 7.1.0.1-The RFI Report does not describe the volume of wastes handled and burned at SWMU 17 on a yearly basis. This information is needed in the final RFI Report.

Page 7-2 Figure 7.1-This figure does not show a sinkhole on the western portion of SWMU 40 which is indicated on the topographic map. This issue needs to be addressed in the investigation and the RFI Report.

Page 7-6 Table 7.1-A review of the soils data from the 1992 RFI at SWMU 17 indicates that most of the target analyte list parameters exceed the screening levels put forth by the EPA BTAG . The contaminant levels in the sediment samples in Table 7.3 exceed the BTAG screening levels. Table 7.2-The levels of metals in the surface water samples can be compared to the Virginia Water Quality Standards. Several TAL parameters (chromium, copper, lead, mercury, and zinc) appear to exceed the water quality standards.

The data from the 1992 RFI indicate the need for an evaluation from an ecological perspective.

Waste oils were used as fuel to enhance the burning process at SWMU 17. The data does not indicate that PCBS were investigated at SWMU 17. If waste oils were burned at this location then PCBS should be investigated.

Page 7-11, Section 7.3.0.1: This section states that SWMU 17E was not investigated further since it has been adequately characterized. Was a risk assessment performed for SWMU 17E?

Page 7-23, Section 7.5.1.1.1: This section indicates that arsenic and beryllium were found at levels considered to pose a potential threat to human health. What is this statement based on? It is not clear whether this is referring to screening or the risk calculations. Based on the concentrations given in the following section, lead should also have been included in this statement.

Page 7-27, Table 7.7: Since this table only presents detected contaminants, it is not clear which contaminants have been analyzed for. However, it appears from the data summary tables in Appendix G that only a limited number of metals were analyzed. It is not clear how the list of analytes was determined. Copper, which was detected at a maximum of 4000 mg/kg in the 1992 sampling was not included in the current sampling and apparently has not been included in the risk assessment. Therefore it is possible that some potential contaminants of concern have not been assessed for risk.

Page 7-36 Section 7.6 Contaminant Fate and Transport-Future activities at SWMU 17 should address the presence of VOCs, SVOCs, and pesticides and PCBS in the spring and downstream in New River. Section 7.6.0.3 should be expanded to mention that the spring has approximately 550 ug/g lead in the sediment and approximately 25 ug/l lead in the water. In addition this section should include the fact that the closest station in New River downstream of the spring had approximately 9.8 ug/l lead in the water column and approximately 4400 ug/g lead in the sediment.

Page 7-39 Section 7.7.2.1.1-This section is completed with the statement that "The current groundwater pathway is not complete as groundwater in not used for drinking purposes." This is incorrect. This section should indicate that the dye study showed that groundwater is connected to surface water, the New River, which is a public water supply.
While SWMUs 17A, B, C, D, are contained within RAAP property, there are receptors other than workers due to groundwater and surface water movement.

Section 8 SWMU 31

Page 8-3 Section 8.1.0.4-Currently the primary lagoon receives water treatment plant (WTP) wastewater (filter backwash water and underdrainage from the WTP flocculating basins). The volume of WTP wastewater discharged to the lagoon system is specified as 20,000 gpd on page 8-3 and 38,670 gpd on page 8-18. Please address this discrepancy.

Page 8-14 Section 8.4.3.0.4-The volume of ash remaining within the lagoon system has not been provided. According to the figures in the report, the lagoons contain standing water; however, the text does not specify the estimated volume of water in each lagoon nor the level of the standing water. This information should be provided.

Page 8-18 Section 8.4.3.1.5-The estimated groundwater flow velocity of 2.31 ft/yr may actually be higher due to the standing water in the lagoons. The groundwater flow velocity needs to account for the gradient between the water level of the settling basins and the downgradient monitoring wells.

SWMU 48 Oily Wastewater Disposal Area

Page 9-20 Table 9.5-A review of the VI data and RFI data for SWMUs 17/40, 31, 48, and 54 indicates a very limited number of detections of phthalate compounds with the exception of SWMU 48. Many of the well boring soil samples and surface soil samples at SWMU 48 contained either bis 2-ethylhexyl phthalate or di-n-butyl phthalate. Phthalates were detected in two groundwater samples at SWMU 48, collected from 48MW2 and 48MW3. The detected concentrations exceed the RBC for tap water. Results from station NRSE4 contained four phthalates. This was the only sediment station in New River with phthalates. Page 4-25 indicates that NRSE4/NRSW4 was selected due to the proximity to discharge points from SWMU 48. One other compound unique to SWMU 48 and NRSE4 is N-nitrosodiphenylamine, was found in 48SB4B21 at 2.06 ug/g and 48SB4A11 at 1.79 ug/g. The New River sediment contained 2.6 ug/g.

Page 9-28 Section 9.5.2.3.3-Carbon tetrachloride has been used as an industrial solvent to remove grease and clean equipment and parts. It should be expected in oily wastewater from this period. Chloroform is formed when drinking water and wastewater is chlorinated. Both compounds could emanate from SWMU 48.

Page 9-29 Section 9.6.0.4-This paragraph indicates that SWMU 13 has similar contaminants as SWMU 48 which makes it difficult to differentiate a source for contaminants in the New River. The data does indicate that SWMU 48 is contaminated with compounds which are unique to one SWMU in this RFI and the same contaminants are also found only at the River station designated to assess SWMU 48. For this reason it is suggested that Section 9.6, Contaminant Fate and Transport, be expanded to provide additional discussion concerning the relationship between the contaminants found in the soil and groundwater at SWMU 48 and the same contaminants found in the sediment of New River.

Page 9-23 Table 9.6-Another class of compounds, volatile organics, (specificly dense nonaqueous phase liquids) are present in the groundwater at SWMU 48. Seven DNAPLs were identified in the groundwater at this SWMU, with individual compound concentrations as high as 100 ug/l and total compound concentrations as high as 167 ug/l in 48MW3. Several of the DNAPLs exceeded the EPA Region III RBC for tap water. The Fate and Transport section should discuss these DNAPL compounds and how they may influence the movement of other organic compounds in the subsurface at this SWMU and in the vicinity of the New River.

Page 9-30 Section 9.7.0.1-Since this SWMU was used to dispose of oily waste from oil water separators, (approximately 200,000 gallons) what was the rationale for not addressing PCBS as a potential contaminant at this site. PCBS were frequently managed through the disposal of waste oils and SWMU 48 would be an appropriate site for PCB evaluation. In addition the presence of DNAPLs at this site could enhance the transport of PCBS. Any additional work at this site should include a study of PCBS.

Section 10 SWMU 54

Page 10-4 Table 10.1-Carbon disulfide was detected during the 1992 investigation at SWMU 54 but VOCs and SVOCs were not indicated as target parameters in Table 4.3. Based on the constituents used in explosives manufacturing, it appears that SVOCs and VOCs should be tested in any future sampling programs or rationale should be provided for exclusion of these analytical parameters.

Page 10-12 Table 10.3-The temperature of the groundwater during the July, 1995 investigation was 81 degrees F in Sample 54MW3. Why was the groundwater temperature this high? Elevated temperatures may indicate a delay in sample preservation which may impact other analytical parameters.

Page 10-23 Section 10.7.2.1.1-This section states that dense vegetation between the River and SWMU 54 would prohibit contaminant exposure by recreational River users. This may be accurate however the text indicates that this area is outside the fenced RAAP boundary.

It would seem that the recreational user could be exposed to the sediment which contained approximately 29 mg/kg 2,4,6-

trinitrotoluene at NRSE5.

Page 10-24 Section 10.7.2.1.1 It is stated that the current groundwater pathway is not complete as this water is not used for drinking purposes. Page 10-10 and page 10-22 note that groundwater appears to be discharging directly to the river. As the New River is a public water supply in this area, how does the designation as a public water supply impact the risk assessment?

Page 10-24 Section 10.7.2.1-Based on the concentration of TNT in the sediment in New River in the vicinity of this SWMU, it appears that a prediction of potential impact on humans from fish tissue consumption should be made. Table 6.14 provides fate properties which could be used to establish a tissue concentration for TNT.

Page 10-24 Section 10.7.2.1-This section does not address ecological risk.

Page 10-25 Figure 10.5 Based on comments on Section 10.7.2.1, some additions to Figure 10.5 may be appropriate.

Page 10-29-Based on responses to previous comments concerning exposure and comments on Figure 10.5, Table 10.6 may require modifications.

Section 11 Stroubles Creek

Page 11-1 Section 11.1 Environmental Setting-It is stated that Stroubles Creek consists of primarily storm water runoff. It is not clear what is meant by this statement. Does this imply that without runoff Stroubles Creek would be without flow?

Section 11 Table 11.2 and Appendix G Data-Following are comments on the data in this table.

> Are the data provided as wet weight or dry weight? The tables should be labeled to indicate wet or dry weight.
>
> It appears that the explosives data generated in the present study have higher detection limits than the data generated during the "Phase 2 Receiving Water Biological Study 32-24-H15M-94 Sampling and Analysis of Fish, Clams, Sediment and Water in the New River for 2,4- and 2,6-DNT, Radford Army Ammunition Plant Radford Virginia, 11-15 July 1994". Were similar analytical methods used? Please describe differences in methods and options to eliminate data quality qualifiers.
>
> Are the substrates comparable between Station SCSE1 and SCSE2/3? The presence of contaminants is related to sediment particle size. Was particle size determined? How were the sediments characterized to establish that upstream sediment

was comparable to downstream sediment?

The concentrations of several contaminants in the sediment exceed the levels recommended by the US EPA Region III Biological and Technical Assistance Group Screening Levels Guidance. Based on the concentration of arsenic, lead, nickel, and phenanthrene there is the potential for ecological impact.

The following comments address the surface water data for Stroubles Creek.

Toxicity of some metals is dependent on the receiving water hardness. Hardness values are provided in Table 11.3 but are not included in Appendix G at the location of the surface water data for Stroubles Creek. What is the source of the hardness data?

Was the surface water from Stroubles Creek evaluated for copper and zinc?

The semivolatile surface water results for SCSW3 are not legible.

Page 11-10 Section 11.6.2.2-The method for determining the exposure point concentration is unclear. It appears that the Stroubles Creek characterization covered about one mile of stream with two sampling stations. It is suggested that additional stations should be added in future studies if multiple sources may impact Stroubles Creek.

Figure 11.2-Should ingestion be included as an exposure route for hunters, fishermen, and recreational users? Page 11-5 Section 11.6.4.0.4 indicates that tissue consumption was considered but Figure 11.2 does not indicate this.

Page 11-13 Section 11.6.3.1.3 and Section 11.6.3.1.4-As noted earlier there is no allowance for fishermen and recreational individuals consuming fish.

Page 11-15 Section 11.6.4.0.4-This section presented information which raised several points.

It is advisable to collect tissue samples for the determination of risk from fish consumption rather than model tissue levels. Please provide an example of the model for predicting tissue concentrations. The levels of phthalates at the New River sediment station appear elevated and would appear to be good analytes for the model. The potential tissue concentrations of these individual phthalates should be

165

modeled to predict the potential impact on human health.

The uncertainty analysis does not recognize that the most persistent contaminants such as PCBS and pesticides were not evaluated in this assessment.

Metal contaminants are usually bound to the sediment. The extent of metals available to cause toxicity in the sediment is dependent upon the sulfide content of the sediments. In planning future investigations it may be appropriate to consider the analysis of acid volatile sulfides for sediment samples.

Section 12 New River

Page 12-3 Section 12.2-The Virginia Water Quality Standards for water supplies for 2,4-Dinitrotoluene is 1.1 ug/l. Concentrations exceeding 1.1 ug/l may not be protective of the water supply.

Table 12.1-It appears that the concentrations of contaminants in the sediment increases with distance down stream. Is the extent of sediment contamination fully characterized? It appears that future sediment sampling should be extended downstream until the contaminant levels stabilize or diminish. Refer to Mr. Thomson's letter of August 9, 1994.

Table 12.1-Is the data presented in Table 12.1 expressed as wet weight or dry weight?

Table 12.1-The concentrations of several contaminants in the sediment may exceed ecological risk levels. The following metals were present in some samples at levels which exceeded risk screening levels; arsenic, chromium, lead, and zinc. Based on the concentrations detected, future investigation should address the potential for ecological risks from the sediment.

Table 12.2-The concentrations of several contaminants in the water exceed Virginia Water Quality Standards. The concentrations of aluminum, copper, lead, manganese, zinc, TNT, 2,4-DNT, 2,6-DNT, 1,3,5-TNB, and 1,1,2,2-trichloroethane, and 1,1,2-trichloroethane may exceed the water quality standards at some sampling locations in New River.

Page 12-3 Section 12.2.0.4-This section should summarize the levels of contaminants in sediment due to the potential for aquatic life to be impacted by the detected concentrations.

Page 12-7 Section 12.2.0.5-This section should summarize the potential impact on aquatic life by the contaminants detected in the New River.

Section 12.3 Summary of RFI Field Activities-Future investigations should consider utilizing a greater number of samples for evaluation of the impact area because the number of samples taken are not adequate to characterize the full extent of contamination. In the present study three of the six samples collected in the New River addressed background. More sample stations downstream, in the potential impact area, to completely characterize the water, sediment, and tissue should be considered.

Page 12-16 Section 12.4.0.5-The concentrations found in New River sediments of arsenic and lead as well as the concentrations of pyrene, phenanthrene, chrysene, benzo(a)anthracene, and n-nitrosodiphenylamine as presented in Table 12.4 exceed screening levels for potential ecological impact. The levels of several phthalates at station NRSE4 are elevated and may be above the BTAG screening levels for these compounds. Due to the levels of phthalates in the sediment at NRSE4 would these contaminants be expected to accumulate in tissue? It is suggested that the information from Table 6.14 be used with data from NRSE4 to develop a potential tissue concentration which can be compared to the values in the most recent EPA Region III RBC table. This approach would likely represent a worst case for accumulation from the water column.

Page 12-13 Table 12.4-The level of TNT at NRSE5 is approximately 29 ppm. The proximity of this station to SWMU 54 would indicate possible contamination by this source. Phase II of the New River study conducted in July 1994 did not evaluate TNT in sediment. TNT was not detected in September 1993 study however the data was qualified. Based on the level found in the sediment, and the proximity to SWMU 54 it appears additional evaluation of this contaminant is needed. Due to the concentration of 2, 4, 6-TNT in the sediment it is suggested that information from Table 6.14 and the TOC for this station be used to project tissue concentrations.

The IRIS data base contains bioconcentration factor data for this compound and the risk based concentration is provided in the EPA Region III RBC Tables.

Page 12-14 Table 12.5-The level of lead at NRSW4 in Table 12.5 is 9.8 ug/l. The level of lead at this station in Appendix G is 8.79 ug/l. Please indicate the correct value. Either value exceeds the Virginia Water Quality Standards.

Page 12-20 Section 12.4.2.1.2-It would be helpful if Figure 12.1 indicated the location of SPG3SE1.

Page 12-21 Section 12.5.0.1-The last sentence of this paragraph notes that dilution of compounds by the New River is significant when considering distant downstream receptors. First, although a flora and fauna inventory was not provided, it is believed that the New River and Stroubles Creek contain numerous receptors in the immediate vicinity of the Plant. Second, dilution may have limited impact on some of the compounds identified so far at Radford Army Arsenal Plant. The Army's guidance "Procedural Guidelines for Ecological Risk Assessments at U.S. Army Sites" indicates that chemicals with K_{ow} values greater than 3.5 significantly bioaccumulate. Approximately one third of the chemicals listed in Table 6.14 have log K_{ow} values greater than 3.5. Furthermore, New River, Stroubles Creek, and the SWMUs have not been characterized for those analytes, such as PCBS and pesticides, which are least influenced by dilution.

Page 12-25 Section 12.6.3.1 and Section 12.6.3.2-It is unclear how the tissue consumption by fishermen and hunters is factored into the risk assessment. For instance the New River at one station, NRSW4, had 9.8 ug/l lead. Table 6.14 indicates a log BCF of 1.69. How are the water concentrations and potential tissue concentrations factored into a risk assessment?

Page 12-26 Section 12.6.4.0.2-Please provide an explanation of the statement that exposure pathways for fishermen have not been established as part of Risk assessment. Previous comments concerning potential concentrations of lead, TNT, and phthalates in tissue in New River and beryllium in tissue in Stroubles Creek should provide some information for projecting tissue concentrations and incorporating tissue consumption into the Risk Assessment.

Page 12-26 Section 12.6.4.0.5-The application of bioaccumulation factors to project a tissue concentration is an approach that can be used and previous comments have indicated methods which should be considered. In this case it is suggested that future investigations at the Radford Army Ammunition Plant include collection of tissue samples from Stroubles Creek and New River to characterize potential human health and environmental impacts.

Page 12-28 Table 12.8-Does this table address fishermen and hunter dermal contact with sediment (potential ingestion) and tissue consumption? Does this table account for recreational dermal contact?

Section 13 Recommendations

Page 13-2 Section 13.1.1 The RFI Report on Page 7-19 recognizes that "the presence of the large sinkholes indicates that SWMU 17 is within a groundwater recharge zone". Based on site information, the continued operation of SWMU 17 in this area would contribute to the contamination of State waters. The dye study indicates the hydrologic connection of the site to State waters. The CMS should discuss, in addition to the measures included on page 13-2, conceptual plans and specification for an alternative site for SWMU 17 which is more geologically suitable. The measures listed on Page 13-2 should anticipate the use of appropriate air pollution control measures and permit requirements.

Page 13-2 Section 13.1.1-The RFI Report needs to clarify the recommendation associated with SWMU 40. Additional RFI sampling would better characterize the site and potential threat to state waters. Surface soil samples, subsoil borings and some test pits would characterize the nature of wastes disposed at the site. Waste pit contents should be sampled if instrumentation or visual screen indicate the need.

Page 13-2 Section 13.1.1-Subsequent to a more complete site characterization, recommendations should be made regarding interim measures and corrective measures for SWMU 40.

Page 13-3 Section 13.3.1-The RFI recommends a dye tracing study for SWMU 48. Based upon the hydrogeologic data (the time of travel of 34 ft/yr), a dye study may prove difficult to complete.

Page 13-4 Section 13.4.1 A Corrective Measures Study is recommended at this site to determine the methods of source remediation. Based on the results of a complete risk assessment for SWMU 54 it may be possible to conduct interim measures due to the nature of the waste and small volume.

16.

McKenna, Jim

From: Thomson.Bob@epamail.epa.gov
Sent: Monday, August 06, 2001 9:57 AM
To: McKenna, Jim; Redder, Jerome
Cc: sswilcox@deq.state.va.us; Tesner, John E NAB02
Subject: Radford Work Plan Addendum

Attached, please find EPA's draft comments on the Army's Work Plan Addendum 12 for Radford. Based upon EPA's review of the draft Work Plan, the Region would like to offer the Army the opportunity to meet and discuss the focus of the draft Work Plan. As it stands now, Addendum 12 attempts to fill in some missing data gaps. However, EPA believes that with a small amount of tweaking the Work Plan can accomplish the task of completing needed investigative work at these sites, of which the draft plan does not do at the moment.

A tentative proposal for the meeting is September 19 in the afternoon, or September 20 before the RAB.

Rob

(See attached file: WPAddendum12review.wpd)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

XXXX XX, 2001

In reply
Refer to 3HS13

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Commander,
Radford Army Ammunition Plant
Attn: SIORF-SE-EQ (Jim McKenna)
P.O. Box 2
Radford, VA 24141-0099

C.A. Jake
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant
SWMU 31 and the Horseshoe Area Groundwater Study
Document submittal and review

Dear Mr. McKenna and Ms. Jake:

The U.S. Environmental Protection Agency (EPA) has reviewed the Army's draft *Work Plan Addendum 012: SWMUs 39, 48, 49, 50, 58, 59, the Former Lead Furnace Area, Building 4343 and the New River Unit*, dated April, 2001 for the RFAAP. Outlined below, please find EPA's comments based upon that review:

GENERAL COMMENTS

1. The Addendum 012 Site Characterization Work Plan (Work Plan) outlines data gaps remaining from previous investigations at the Site. The data gap analysis as described in Table 1.1-2 does not include pesticides or herbicides. Since most government owned facilities have a history of pesticide and herbicide use, the final Work Plan must include

pesticides/herbicides analysis for this proposed sampling event.

2. The Work Plan proposes very limited sampling at each solid waste management unit (SWMU) for the apparent purpose of evaluating analytes at each SWMU that were not included in past sampling investigations. However, the draft Work Plan fails to recognize that significant contamination may have already been detected at these specific SWMUS, and fails to propose logical means to define the extent of contamination at each SWMU through a designed sampling effort. No rationale or explanation is provided for the focus of the Work Plan. The proposed sampling at these SWMUs is not sufficient to fully characterize potential contaminants at the individual units, and clearly does not attempt to capture the spacial distribution and extent of known contamination at each SWMU. The final Work Plan must propose a sampling scheme that defines the nature and extent of contamination at each SWMU. In the course of accomplishing this scope, the purpose of filling data gaps for each SWMU can also be addressed. However, the main focus should be defining the nature and extent of contamination. Individual SWMU concerns are addressed below in the Specific Comments.

3. Instead of providing a data dump of tables in the Appendices of the draft Work Plan, it would be beneficial to add a site map for each SWMU to the final Work Plan which displays both the previous sampling locations along with the contaminants associated with each sampling location that failed the residential RBC comparision, i.e. as in the Site Screening Process. The inclusion of such figures not only aids in presenting the rationale for proposed sampling at the individual sites, but gives the reader confidence that the Work Plan author(s) have a clear understanding of the contamination present at each SWMU.

4. The draft Work Plan has separated groundwater from this investigation, and proposes that a facility wide groundwater investigation be conducted at a future date. In addition, the draft Work Plan indicates that groundwater investigations will not be required at specific SWMUs, which appears to be very premature, based upon the limited sampling completed to date. The characterization of individual SWMUs (and thus, the potential selection of site remedies) is not complete until it has been determined whether or not the contamination found at any one specific SWMU has impacted groundwater. Thus, a facility wide groundwater investigation must be comprehensive enough to characterize the groundwater at each individual SWMU, so that all potential contaminate release pathways have been investigated. EPA recognizes the complex nature (karst) of the groundwater at the facility and will consider the groundwater concerns at individual SWMUs during review of any proposed facility-wide groundwater study.

5. Surface soil sampling at most of these sites is proposed for collection from 0 to 2 feet in depth. For evaluation of exposure to ecological receptors in the ERA, the EPA BTAG generally recommends that surface soil samples be collected from 0 to 6 inches, since this represents the primary area of exposure to soil organisms. Subsurface soil samples representative of the biologically active zone (typically 6 to 12, 12 to 18, and 18 to 24 inches) should also be collected. Compositing of samples from 0 to 2 feet could underestimate ecological risk from soil because of dilution with subsurface soil. More importantly, compositing of samples is not a generally accepted method of sampling under the RCRA program for site characterization. This is of concern particularly when activities of receptor species are more likely to result in exposure to near surface contamination. In contrast, the behavior of certain fossorial species and invertebrates will significantly increase exposure to subsurface soil. Therefore, EPA BTAG recommends that both surface (0 to 6 inches) and subsurface (6 to 24 inches at appropriate intervals) soil be collected for evaluation.

6. When summarizing previous investigations, comparisons to health-based numbers are often used to describe the contamination at the site. It is unclear if these comparisons are part of an overall site screening process. The purpose of this evaluation should be discussed. In should be noted that ecological risk based numbers do not appear to have been used in the comparison, and must also be considered.

SPECIFIC COMMENTS

7. **Section 1.1.4 (Data Gap Analysis) on page 1-7** states that a data gap analysis was performed to identify areas that have not been completely characterized and to identify parameters for which no samples have been collected and analyzed at each site. The list of analytes to consider does not include pesticides. It is unclear why pesticides would not be considered as a chemical data gap if not previously determined. Analysis for grain size, total organic carbon, and pH should also be added to the list of analytes for soil and sediment, as these parameters will be important for assessing bioavailability to ecological receptors in the ecological risk assessment (ERA). Water hardness should also be analyzed for surface water samples, as this is needed to calculate a site-specific water quality criteria to estimate ecological risk.

8. **Section 1.2.5, Planned Field activities and Technical Approach, page 1-19:** This section indicates that one sample location will be selected in each lagoon and sampled at multiple depths to fill existing data gaps. Please clarify how a single sampling location in each settling pond (each approximately 100 feet by 300 feet) is sufficient to characterize the individual settling pond for the target compound list (TCL) volatile organic compounds (VOCs),

m

polychlorinated biphenyls (PCBs), and dioxins/furans which were not previously investigated. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

Please note that lead appears to be a significant contaminant at this site, as there was a noted lead detection of 7,070 ppm in soil. The draft Work Plan does not propose a sampling scheme designed to delineate the nature and extent of the lead contamination. Also, Table A-4 in the appendices utilized incorrect RBC values for risk screening. For noncarcinogens, a H value of 0.10 is used for calculating the corresponding RBC screening number.

9. **<u>SWMU 39 (Wastewater Ponds from Propellant Incinerator)</u>** **Section 1.2.5** (Planned Field Activities and Technical Approach) on page 1-19 states that sludge in the settling ponds was collected as soil in 1998 because surface water was not present at that time, and that any additional sampling collected during the proposed investigation will be classified as soil to maintain consistency. The type of evaluation should depend on the potential exposure pathways present at the site. In other words, if surface water is present over the sludge in the settling ponds during sampling, they should be evaluated as sediment, since exposure to aquatic organisms can occur.

10. **Section 1.3.5, Planned Field activities and Technical Approach, page 1-29:** This section indicates a single sampling location (48SB08) south of the southern trench and no locations are noted for the northern trench. Please clarify how a single sampling location in the southern trench (approximately 330 feet by 30 feet) and no sampling location in the northern trench (approximately 330 feet x 75 feet) are sufficient to characterize the trenches for PCBs and polynuclear aromatic hydrocarbons (PAHs) which were not previously investigated. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

Additionally, SWMU 48 had a detect of 2,4,6-TNT at 690 ppm, which indicates that TNT is a contaminant of concern for SWMU 48. The draft Work Plan does not propose a sampling scheme designed to delineate the nature and extent of the TNT contamination. Also, it is important to note that for Table A-10 in the appendices, if both 2,4 and 2,6 DNT are detected in soil, the correct RBC value to utilize in risk screening is the ``Dinitrotoluene Mix'' carcinogenic value of 0.94 ppm. EPA also noted that the appendices utilized incorrect RBC values for risk screening. For noncarcinogens, a H value of 0.10 is used for calculating the corresponding RBC screening number.

11. SWMU 48 (Oily Water Burial Area)
Section 1.3.5 (Planned Field Activities and Technical Approach) on page 1-29 states that two surface soil samples will be collected during the advancement of two soil borings, one within the boundaries of the southern trench, and one immediately outside the southern trench, opposite previous sample location 48SB7. The rationale for placing this second sample outside both the northern and southern trenches is unclear. Additional justification for this sample should be provided.

12. **Section 1.4.5, Planned Field activities and Technical Approach, page 1-35:** This section indicates that one sample location will be selected at SWMU 49 and sampled at multiple depths to fill existing data gaps. Please clarify how a single sampling location at SWMU 49 is sufficient to characterize the surface and subsurface soils for the TCL PCBs, PAHs and dioxins/furans which were not previously investigated. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

13. **Page 1-35:** The text of the draft Work Plan mentions that 2,4,6-TNT was detected above the industrial RBC in soil at SWMU 49, yet the Appendices to the draft Work Plan do not report this sample. Please include ALL sampling data in the Appendices, especially if the sample concentration is discussed in the text of the Work Plan

14. **Section 1.5.5, Planned Field activities and Technical Approach, page 1-41:** This section indicates that two subsurface sample locations will be selected in SWMU 50 to fill existing data gaps. Please clarify how a two subsurface sampling locations are sufficient to characterize an area approximately 300 feet by 300 feet which has not had any previous subsurface investigations. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

15. **Section 1.6.5, Planned Field activities and Technical Approach, page 1-47:** This section indicates that one surface soil sample will be collected at the southern toe of the rubble pile. Figure 1.6-3 shows the sample location (58SS05) located at the northern toe of the rubble pile. Please clarify which is correct and revise the text or figure accordingly. In addition, clarify how a single sampling location at SWMU 49 is sufficient to characterize SWMU 58 for the explosives, TCL PCBs, and dioxins/furans, considering that no previous subsurface samples with these analysis were obtained at this unit. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

16. **Section 1.7.5, Planned Field activities and Technical Approach, page 1-54:** This section indicates that one subsurface soil sample will be collected at SWMU 59. Please clarify how a single subsurface sampling location is sufficient to characterize the subsurface contamination at the site, considering that no previous subsurface samples were obtained at this unit. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

    Please note that Table A-19 reports a maximum concentration of arsenic in soil at SWMU 59 at 40 ppm, which appears to be above background given the sampling data to date. Arsenic may be a site contaminant.

17. **AOC - Former Lead Furnace Area**
    Section 1.8.4 (Data Gap Analysis) on page 1-61 discusses the analysis of metals in surface soil near the site. The section states that the area of lead contamination greater than the EPA lead screening level of 400 micrograms per gram (μg/g) has not been fully delineated. Please include an ecological evaluation of the metal concentrations detected in soil as well. In addition, as stated in the general comment above, the collection of surface soil samples in the 0 to 2 foot range at this site could underestimate potential risk, since contamination would be expected to be near surface because of incineration activities.

    The data contained in the Appendices to the draft Work Plan indicate that lead (TAL maximum of 100,000 ppm/TCLP maximum of 500,000ppm), Antimony (249 ppm) and Mercury (64 ppm) are contaminants of concern at this site.

18. **Section 1.9.5, Planned Field activities and Technical Approach, page 1-70:** This section indicates that two subsurface soil samples will be collected in area of concern (AOC) Former Cadmium Plating Facility. Please clarify how two subsurface sampling locations are sufficient to characterize the subsurface soil at the site (approximately 110 feet by 220 feet) for TCL VOCs, TCL SVOCs, PAHs, PCBs, and explosives, considering that no previous subsurface samples with these analysis were obtained at this unit. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

    The data contained in the Appendices to the draft Work Plan indicate that Cadmium (24,300 ppm max.), Chromium (1,820 ppm max.), Lead (1,410 ppm), and Vanadium (205 ppm max.) are soil contaminants of concern at Building 4343. Sludge sample contaminants of concern include Antimony (181 ppm max.), Arsenic (31.5 ppm max.), Cadmium (8,890 ppm max.), Chromium (8,430 ppm max.), and Lead (3,320 ppm max.)

8

19. Building Debris Disposal Trench (New River Unit)
Section 1.10.5 (Planned Field Activities and Technical Approach) on page 1-79 states that three sediment samples will be collected from the unnamed creek downstream of the site, and that only PCBs are proposed for analysis. It is unclear why these sediment samples are only being analyzed for PCBs, since no samples have been collected from the unnamed creek, and upgradient samples have elevated concentrations of PAHs and metals. These samples should be sampled for the full suite of analytes to adequately characterize migration from the disposal trench. It is extremely important to note that the data set presented in the Appendices for the BDDT for the metals analysis is incomplete, as it does not contain results for cadmium, mercury, or selenium. Therefore, the complete TAL analysis needs to be performed on samples taken at the BDDT area.

The data contained in the Appendices for the BDDT area of the NRU indicate that Chromium (73 ppm max.), Lead (336 ppm), Cobalt (446 ppm) and PAHs (multiple) are soil contaminants of concern at the site.

20. Section 1.11.5, Planned Field activities and Technical Approach, page 1-70: This section indicates that two subsurface soil samples will be collected at AOC Igniter Assembly Area. Please clarify how two subsurface sampling locations are sufficient to characterize the subsurface soil at the site (approximately 1000 feet by 250 feet.) for TCL VOCs, and PCBs, considering that no previous subsurface samples with these analysis were obtained there. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

The data contained in the Appendices for the Igniter area of the NRU indicate that Arsenic (164 ppm max.), Barium (11,800ppm max.), Cadmium (6.8 ppm max.), Chromium (99.2 ppm max.), Copper (56,500 ppm max.), Lead (1,040 ppm max.), Silver (22.5 ppm max) and PAHs (multiple) are soil contaminants of concern at the site. In reviewing Table A-46, which depicts the RCRA TCLP results for the conductive flooring, it appears (if the units are correct) that the conductive flooring failed the TCLP analysis for barium, cadmium, and selenium, making the conductive flooring a characteristic hazardous waste.

21. Northern Burning Ground (New River Unit)
Section 1.12.5 (Planned Field Activities and Technical Approach) on page 1-95 states that two soil borings will be advanced in the vicinity of previous sample locations (NBGSB1 and NBGSB2) where known burning activities occurred and analyzed for PCBs and dioxins/furans. Figure 1.12-3 shows the proposed locations relative to the approximate area with lead

greater than 200 milligrams per kilogram. It is unclear why this additional analysis, particularly for dioxins/furans, would not be focused in areas where high lead was detected (as shown on Figure 1.12-3), since the metal contamination is also likely a result of burning activities. This issue should be discussed.

The data contained in the Appendices for the NBG area of the NRU indicate that Chromium (1,620 ppm max.) and Lead (23,400 ppm max.)are soil contaminants of concern at the site.

22. **Section 1.13, Western Burning Ground (New River Unit), pages 1-97 tol-108:** This section references Figures 1.13-1 and 1.13-2 for previous sampling locations and Figures 1.13-4 and 1.13-5 for proposed sampling locations. It is difficult from the Figures presented to determine the spatial relationship between Figures 1.13-1 and 1.13-2 and between Figures 1.13-4 and 1.13-5. Please revise the figures to include a joining line or additional reference which describes the spatial relationship between Figures 1.13-1 and 1.13-2 and between Figures 1.13-4 and 1.13-5.

23. Western Burning Ground (New River Unit)
    Figures 1.13-2 and 1.13-5 show earlier and proposed sampling locations, respectively. A note on the figure states that the unnamed lake constructed in the early 1990s is not shown in the figure. The lake should be shown on the figures. It is important to evaluate the sampling locations relative to the size and shape of the lake to determine if sampling locations are adequate to characterize the contamination.

24. **Section 1.13.2, Previous Investigations, page 1-97:** The first paragraph references Figure 1.13-1 for the 1997 surface soil and surface water/sediment samples collected by Gannett Fleming (GF). These locations are not shown on Figure 1.13-1 or depicted in the Figure Legend. The surface soil locations appear to be shown on Figure 1.13-2. Please Revise Figure 1.13-1 or 1.13-2 to include all of the referenced sampling locations and revise the text accordingly.

25. Section 1.13.2, Previous Investigations, page 1-99: The second paragraph in the section describing the ICF KE remedial investigation indicates that surface water/sediment samples are depicted on Figure 1.13-1 and that soil sampling locations are depicted on Figure 1.13-2. Except for the 1997 GF soil samples, the reverse is true. Please revise the text to reflect the correct figures for the referenced sampling locations.

26. Section 1.13.4 (Data Gap Analysis) on page 1-104 states that lead-containing soil was identified, excavated, and properly disposed of during the 1999 Remedial Investigation sampling effort, and that excavation and disposal of soil has mitigated exposure pathways associated with soil. Since no review of

removal action clean-up criteria or review of post-removal sampling data has been accomplished by EPA or the Commonwealth for this site, it is premature to assume that the WBG has been completely remediated. It is unclear what cleanup level was used to direct this removal action, and if potential risk to ecological receptors was considered. If the 400 µg/g EPA Lead Screening Level was used, then ecological risks may have been overlooked at this site. This issue needs further discussion.

The data contained in the Appendices for the WBG area of the NRU indicate that Chromium (249 ppm max.), Dioxins (1.22 ppm max. TEQ) and Lead (3,990 ppm max.) are soil contaminants of concern at the site.

27. **Section 1.14.5, Planned Field Activities and Technical Approach, page** 1-114: The second paragraph states that one subsurface sample will be collected in the main yard area. Please clarify how one subsurface sampling location is sufficient to characterize the subsurface soil at the site (approximately 3,200 feet by 250 feet) for TCL VOCs, and PCBs, considering that no previous subsurface samples with these analysis were obtained there. Revise the Work Plan to provide the rationale and justification for the number and locations of samples, and propose an adequate number of sample locations for the characterization.

The data contained in the Appendices for the rail yard area of the NRU indicate that Chromium (103 ppm max.), PAHs (multiple), PCBs (1.7 ppm max. TEQ) and Pentachlorophenol (826 ppm max.) are contaminants of concern at the site.

This concludes EPA's review of the Army's draft Work Plan Addendum 012: SWMUs 39, 48, 49, 50, 58, 59, the Former Lead Furnace Area, Building 4343 and the New River Unit, dated April, 2001 for the RFAAP. The referenced draft Work Plan is disapproved by EPA in its current form, and must be revised to reflect the comments above. Per Part II, Section E.4.e. of the EPA RCRA Corrective Action Permit, the Army is required to revise the draft document and submit a revised draft copy to EPA for review within 60 days of the receipt of EPA comments on the draft document. Part II, Section E.4.f. of the Permit allows for an additional 20 days for issuing the revised draft document to EPA, provided that timely notice is given, i.e. within 10 days. Additional time extensions can be requested under Part II, Section F. of the permit.

If you have any questions, please call me at 215-814-3357.

Sincerely,

Robert Thomson, PE
Federal Facilities Branch

cc: Russell Fish, EPA
Leslie Romanchik, VDEQ-RCRA
Sharon Wilcox, VDEQ-CERCLA

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24141
USA

April 30, 2001

Mr. Robert Thomson
U. S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Work Plan Addendum 012
Site Characterization Work Plan,
SWMUs 39, 48,49,50,58,59
AOCs Former Lead Furnace Area, Building 4343; New River Unit
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is a certified copy of the "Work Plan Addendum 012: Site Characterization Work Plan, SWMUs 39, 48,49,50,58,59; AOCs Former Lead Furnace Area, Building 4343; New River Unit". Your six additional copies and Ms. Wilcox's copy will be sent under separate cover

Please coordinate with and provide any questions or comments to myself at (540) 639-8266, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

JJ Redder
for C. A. Jake, Environmental Manager
Alliant Ammunition and Powder Company LLC

Enclosure

c: w/o enclosure
Russell Fish, P.E., EPA Region III

copy in 216

01-815-84
JMcKenna/JJRedder

Durwood Willis
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

Sharon Wilcox
Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

bc: Administrative File
J. McKenna, ACO Staff
S. J. Barker-ACO Staff
Rob Davie-ACO Staff
C. A. Jake
J. J. Redder
Env. File

Coordination: J McKenna
J. McKenna

01-815-84
JMcKenna/JJRedder

131

Concerning Work Plan Addendum 012: Site Characterization Work Plan, SWMUs 39, 48,49,50,58,59; AOCs Former Lead Furnace Area, Building 4343; New River Unit:

Addendum 012
Site Characterization Work Plan
SWMU 39
SWMU 48
SWMU 49
SWMU 50
SWMU 58
SWMU 59
AOC-FLFA
AOC-Building 4343
New River Unit
April 2001

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:
PRINTED NAME: Rodney K. Alston
TITLE: LTC, CM, Commanding
Radford AAP

SIGNATURE:
PRINTED NAME: Ken Dolph
TITLE: Vice President Operations
Alliant Ammunition and Powder Company, LLC

01-815-84
JMcKenna/JJRedder

Kenna, Jim

From: Jenkins, Joanne
Sent: Wednesday, April 04, 2001 9:02 AM
To: McKenna, Jim
Cc: Robert Davie
Subject: RE: NHPA, Work Plan Addenda 009 and 012

Jim,

Reference our meeting this date.

In accordance with 36 CFR Part 800 all RFAAP actions meet the definition of an undertaking ad are therefore subject to 106 review. However, this in itself doesn't warrant full initiation of the process. RFAAP can determine that a proposed action has "no potential to cause effect" on historic properties. If we determine that an action has "no potential to cause effect", then we have no further obligations under 106. Ground disturbing activities in areas where there are no archeological sites and the activity would not compromise the setting or feel of any other historic site in the are examples of activities that would be determined to have "no potential to cause effect".

The locations of the work identified in your request contain no archeological sites and will not compromise any other historic site. Therefore, a determination of "no potential to cause effect" is appropriate and work may proceed.

Joanne Jenkins
Industrial Specialist
Operations Division
DSN 931-7480

-----Original Message-----
From: McKenna, Jim
Sent: Wednesday, April 04, 2001 8:40 AM
To: Jenkins, Joanne
Subject: NHPA, Work Plan Addenda 009 and 012

Joanne,

1. There is sampling work identified in Work Plan Addendum 009 that will occur in the Horshoe Area near the water treatment plant and former power house as well as at 3 spring locations. The WPA has maps that show the locations.

2. There is sampling work identified in Work Plan Addendum 012 that will occur at various sites in the Horseshoe Area and the New River Unit. The WPA has maps that show the locations.

Need you/us to review for possible interference with historic sites.

Thanks,
Jim

98-137

Park
Olsen
ENV file

187

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

West Central Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
Telephone (540) 562-6700, Fax (540) 526-6725
http://www.deq.state.va.us

Dennis H. Treacy
Director

Thomas L. Henderson
Regional Director

August 31, 1998

Ms. Carolyn A. Jake, Supervisor
Environmental Affairs
Alliant Techsystems Inc.
Radford Army Ammunition Plant
P.O. Box 1
[illegible]rd, VA 24141

RE: Abatement Measures / Site Check Close-Out, Building Account 8106-1 and 8106-2, Radford Army Ammunition Plant - New River Facility, Dublin, Pulaski County, Virginia, PC-98-1156, FAC. I.D. No. 2-000051

Dear Ms. Jake:

The Department of Environmental Quality, West Central Regional Office staff has completed a review of the Initial Abatement Measures/ UST Closure Report prepared by Environmental Directions, Inc..

Based on the information provided, it appears that acceptable site characterization and abatement measures have been achieved. Specifically:

1. Soil analytical results indicate low concentrations of Total Petroleum Hydrocarbons are present in the soils adjacent to the former 2,000 gallon and 1,000 gallon UST systems: TPH-DRO of 14 mg/kg, TPH-GRO of 170 mg/kg, TPH 418.1 of 88 mg/kg. The BTEX analysis identified benzene at 1.4 mg/kg, toluene at 1.2 mg/kg, ethylbenzene at 1.2 mg/kg, and a total xylene concentration of 7.3 mg/kg.

2. During a recent site visit, on August 25, 1998, no surface waters or groundwater users were identified within 1,000 feet of the former UST basin. Based on this information, this release does not pose a risk to human health or the environment.

At this time, no further action with respect to this site's petroleum release characterization is required. If significant contamination associated with this facility is detected that presents environmental and/or human health/safety risk, then further investigation and corrective action may be required at that time.

Should you have questions our office will be glad to assist.

Sincerely,

Kenneth R. Chapman

Ken Chapman
Senior Geologist
Site Coordinator

CLOSURE.BL

cc: C. Bruce Davidson, DEQ-WCRO
File

Delivery Order No. 0013
Environmental Services
Program Support
DACA31-94-D-0064

RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Work Plan Addendum 012: Site Characterization Plan for

SWMU 39
SWMU 48
SWMU 49
SWMU 50
SWMU 58
SWMU 59
AOC-FLFA
AOC-Building 4343
New River Unit

Prepared for:

USACE Baltimore District
10 S. Howard St.
Baltimore, MD 21201

Prepared by:

IT Corporation
2113 Emmorton Park Rd.
Edgewood, MD 21040

Draft Final Document

February 2002

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704–0188

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
February 2002

3. REPORT TYPE AND DATES COVERED
Work Plan Addendum, 2002

4. TITLE AND SUBTITLE
Work Plan Addendum 012: Site Characterization Plan - Draft Final

5. FUNDING NUMBERS
USACE, Baltimore District
Contract No. DACA31-94-0064
Delivery Order 0013

6. AUTHOR(S)
T. Leahy, E. Malarek, J. Parks, J. Schrader, M. Thomas, G. Zynda

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
IT Corporation
2113 Emmorton Park Road
Edgewood, MD 21040

8. PERFORMING ORGANIZATION REPORT NUMBER
ESPS 13-29

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
USACE, Baltimore District
10 South Howard Street
Baltimore, MD 21201

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Report is contained in one volume.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The IT Group has been tasked to perform site characterization activities at eight sites in the Main Manufacturing Area (MMA) and six sites at the New River Unit (NRU) of Radford Army Ammunition Plant (RFAAP). Scope of work activities include the collection of additional data at select Solid Waste Management Units and Areas of Concern at the MMA and NRU to complete the characterization of these sites. This Work Plan is an addendum to the RFAAP Master Work Plan (MWP), and is to be used in conjunction with the MWP to perform investigation activities at the MMA and NRU. Definable features of work associated with this investigation includes: surface and subsurface soil, surface water, and sludge/sediment sampling. Corresponding Quality Assurance and Health and Safety requirements are discussed for the associated activities, as appropriate.

14. SUBJECT TERMS
RFAAP, Work Plan Addendum, Verification Investigation, RCRA Facilty Investigation, Remedial Investigation, Independent Sampling

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. SECURITY CLASSIFICATION OF ABSTRACT
Unclassified

20. LIMITATION OF ABSTRACT
None

NSN 7540–01–280–5500

Standard Form 298 (Rev. 2–89)
Prescribed by ANSI Std 239–18
298–102

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix	
A	Previous Investigation Analytical Results Tables
B	Statement of Qualifications

LIST OF FIGURES

Figure

LIST OF TABLES

Table

ᵛ°\

LIST OF ACRONYMS AND ABBREVIATIONS

μg/g	micrograms per gram
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
246TNT	2,4,6-trinitrotoluene
24DNT	2,4-dinitrotoluene
26DNT	2,6-dinitrotoluene
ACM	asbestos-containing material
AOC	Area of Concern
ATK	Alliant Techsystems, Inc.
BDDT	Building Debris Disposal Trench
bgs	below ground surface
BLA	Bag Loading Area
BRA	Baseline Risk Assessment
BTAG	Biological Technical Assistance Group
CFR	Code of Federal Regulations
COC	constituent of concern
COD	chemical oxygen demand
CSM	conceptual site model
CT	carbon tetrachloride
CVAA	cold vapor atomic absorption
DQO	data quality objective
EQL	estimated quantitation limit
FAL	Fly Ash Landfill
FLFA	Former Lead Furnace Area
ft	feet
ft/day	feet per day
ft/ft	feet per foot
HBN	Health-Based Number
HCOC	hazardous constituent of concern
HSP	Health and Safety Plan
HSPA	Health and Safety Plan Addendum
IAA	Igniter Assembly Area
ICF KE	ICF Kaiser Engineers, Inc.
ICP	inductively coupled plasma
IDM	investigative-derived material
in.	inch
IRDMIS	Installation Restoration Data Management Information System
ISP	Incinerator Spray Pond
IT	IT Corporation
LOC	Level of Concern
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MHSP	Master Health and Safety Plan
MMA	Main Manufacturing Area
MQAP	Master Quality Assurance Plan
msl	mean sea level
MWP	Master Work Plan
NBG	Northern Burning Ground
NQL	nominal quantification limit
NRU	New River Unit
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

PCE	tetrachloroethylene
ppb	parts per billion
PPE.	personal protective equipment and clothing
ppm	parts per million
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QAP.	Quality Assurance Plan
QAPA..	Quality Assurance Plan Addendum
QC	quality control
RA	risk assessment
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFAAP	Radford Army Ammunition Plant
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RY	Rail Yard
SHSO..	Site Health and Safety Officer
SOP	Standard Operating Procedure
SSL	Soil Screening Level
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TCLPRL	TCLP Regulatory Limit
TIC	tentatively identified compound
TOC	total organic carbon
TOX	total organic halides
TPH	total petroleum hydrocarbons
TSDF.	transporter, storage, and disposal facility
USACE	U.S. Army Corps of Engineers
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	U.S. Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VHWMR	Virginia Hazardous Waste Management Regulations
VI	Verification Investigation
VOC	volatile organic compound
WBG	Western Burning Ground
WPA..	Work Plan Addendum

EXECUTIVE SUMMARY

Work Plan Addendum (WPA) 12 was developed to address data gaps for eight sites in the Main Manufacturing Area (MMA) and six sites at the New River Unit (NRU) of Radford Army Ammunition Plant (RFAAP) in Radford, VA.

The MMA Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) were investigated in accordance with the 1989 RCRA permit and those prior sampling strategies were therefore, targeted towards potential contaminants that were used at these sites. Per the 2000 RCRA Permit, a broader sampling strategy is needed at the following sites:

- SWMU 39–Wastewater Ponds from Propellant Incinerator,
- SWMU 48–Oily Water Burial Area,
- SWMU 49–Redwater Ash Burial No. 2,
- SWMU 50–Calcium Sulfate Treatment/Disposal Area,
- SWMU 58–Rubble Pile,
- SWMU 59–Bottom Ash Pile,
- AOC–Former Lead Furnace Area, and
- AOC–Former Cadmium Plating Facility (Building 4343).

The NRU sites were investigated under CERCLA guidance, and previous investigations took a broader approach in sampling strategies but generally followed the 1989 RCRA permit. While samples were collected for most analyte classes, data gaps exist in delineating the extent of identified contamination at these sites. These sites are as follows:

- Building Debris Disposal Trench,
- Igniter Assembly Area,
- Northern Burning Ground,
- Western Burning Ground,
- Rail Yard, and
- Bag Loading Area.

Previous investigations have been conducted at the 14 sites discussed in this Work Plan. The objective of this Work Plan is to identify which sites need additional sampling to complete the delineation of the site and which sites need sampling to characterize the site for chemical parameters not previously investigated. A desktop audit, including the development of a conceptual site model and conducting a data gap analysis, was performed for each site. Once the data needs were identified, sampling strategies were developed to complete characterization and delineation for each of the 14 sites. Site-specific sampling location maps and tables indicating sampling locations, depths, and chemical parameters for each sample are presented in each site-specific section. These sections were designed to provide a rationale for the sample collection strategy and act as field sampling plans for use while conducting fieldwork activities.

The geologic and hydrogeologic conditions at RFAAP are very complex due to the intense structural deformation that is observed throughout the area, with examples of faulting, complex folded and fractured bedrock, and the development of karst within the carbonate rocks that underlie the Installation. Groundwater movement through these rocks can be preferentially channeled through the numerous fractures, along bedding planes, and through solution-enhanced variations of each. Karst features that have been observed at the MMA include sinkholes (bowl-shaped depressions in the land surface), springs that discharge near the margin of the Horseshoe Area and the New River, and enlarged fractures. This type of terrain challenges the sampling methodology and rationale that is typically used in non-karst terrains.

Given these hydrogeologic complexities, it is proposed that groundwater be evaluated on a larger scale at the MMA (entire Horseshoe Area per Work Plan Addendum No. 009) instead of at individual SWMUs. Therefore, groundwater has not been evaluated as a data gap in this Work Plan. Traditional investigation procedures typically are not valid in karst regions. For the NRU, previous soil sampling at the six areas of interest has indicated that constituents of concern, where present, are very near the ground surface. In at least one instance (Western Burning Ground), sampling activities appear to have removed the source area. The notion that COCs, where present, have been shown to occur near the surface makes the probability of contaminant migration through the soil column to groundwater unlikely. Surface water and sediment sampling along with other data gap filling proposed in this WPA is expected to bolster this assertion.

1.0 Work Plan Addendum

IT Corporation (IT) has been tasked by the U.S. Army Corps of Engineers (USACE), Baltimore District, to perform additional characterization activities at eight sites in the Main Manufacturing Area (MMA) and six sites at the New River Unit (NRU), in accordance with Contract No. DACA31-94-D-0064, Delivery Order 0013. Task objectives are to develop and execute investigations to complete characterization of these sites. Investigative activities will be conducted in accordance with the Master Work Plan (MWP), Master Quality Assurance Plan (MQAP), the Master Health and Safety Plan (MHSP), and this Addendum.

Radford Army Ammunition Plant (RFAAP) is located in the mountains of southwestern Virginia in Pulaski and Montgomery Counties. The MMA is located approximately 10 miles west of Blacksburg and 47 miles southwest of Roanoke. Current MMA activities include the manufacturing of solid propellants. **Figure 1.1-1** shows the location of each applicable site in the MMA. The NRU is located approximately 6 miles west of the MMA, near the town of Dublin, VA. The NRU was constructed in 1940 and operated as a bag manufacturing and loading plant for propellant. The six NRU sites included in this WPA are shown on **Figure 1.1-2.**

1.1 OBJECTIVE AND SCOPE

This work plan is written as an addendum to the RFAAP MWP (URS, 2002) and comprises the following three sections, consistent with the MWP:

- Section 1, Work Plan,
- Section 2, Quality Assurance Plan (QAP), and
- Section 3, Health and Safety Plan (HSP).

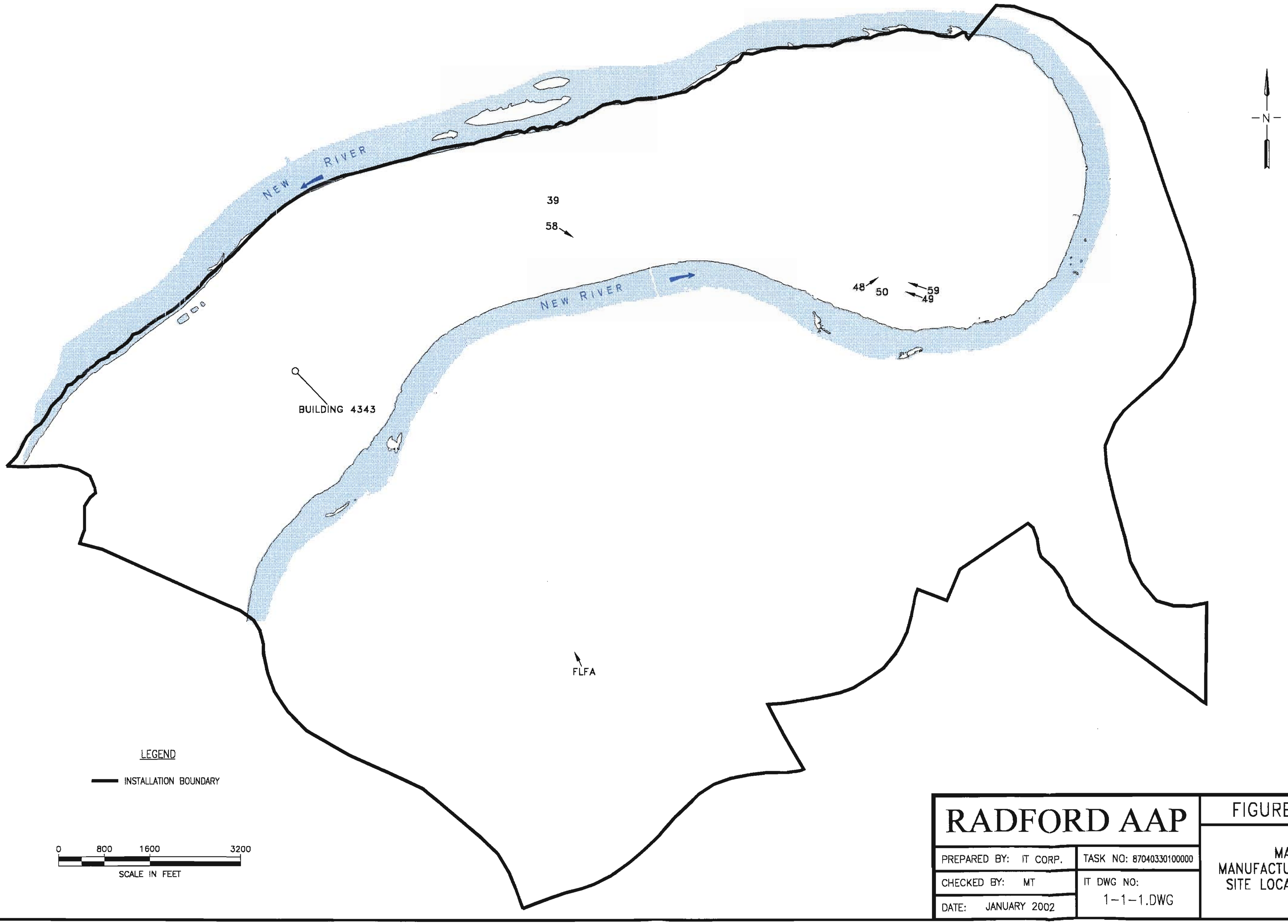
This Work Plan Addendum (WPA) presents site-specific activities for the following eight areas in the MMA:

- Solid Waste Management Unit (SWMU) 39–Wastewater Ponds from Propellant Incinerator,
- SWMU 48–Oily Water Burial Area,
- SWMU 49–Redwater Ash Burial No. 2,
- SWMU 50–$CaSO_4$ Treatment/Disposal Area,
- SWMU 58–Rubble Pile,
- SWMU 59–Bottom Ash Pile,
- Area of Concern (AOC)–Former Lead Furnace Area (FLFA), and
- AOC–Former Cadmium Plating Facility (Building 4343).

And six sites in the NRU:

- Building Debris Disposal Trench (BDDT),
- Igniter Assembly Area (IAA),
- Northern Burning Ground (NBG),
- Western Burning Ground (WBG),
- Rail Yard (RY), and
- Bag Loading Area (BLA).

USACE, Baltimore District, and the Installation have approved the MWP as RFAAP's work plan for performing routine investigative activities. Routine investigative activities that will be performed in accordance with the MWP are listed in **Table 1.1-1.**



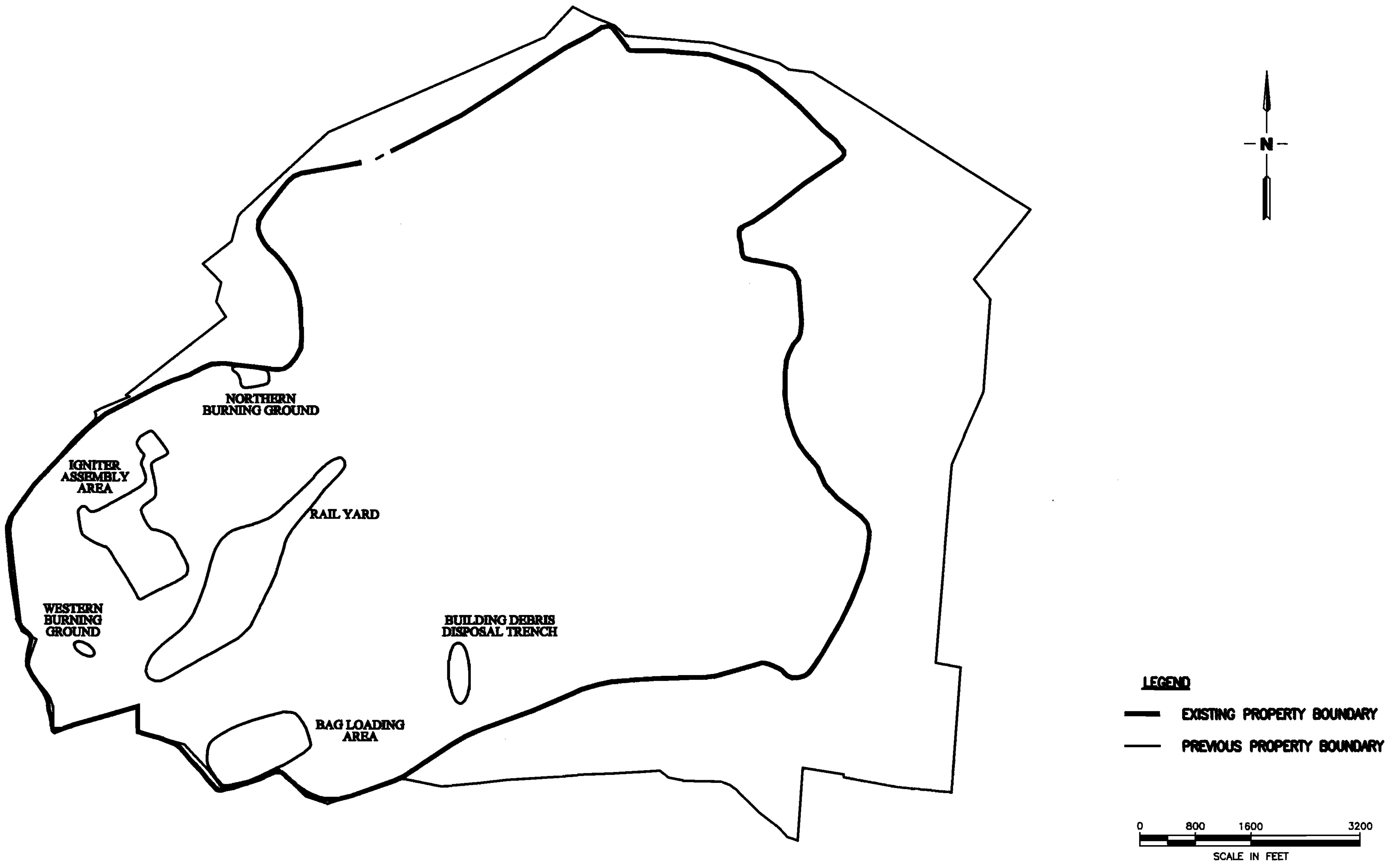
RADFORD AAP

FIGURE 1.1-1

MAIN
MANUFACTURING AREA
SITE LOCATION MAP

PREPARED BY: IT CORP.
CHECKED BY: MT
DATE: JANUARY 2002
TASK NO: 87040330100000
IT DWG NO:
1-1-1.DWG

FILE: ADDENDUM12\1.1\1-1-1.DWG PLOTTED: 2-8-02



PLOTTED: 2-6-02

FILE: 1-1-2.DWG

RADFORD AAP

FIGURE 1.1-2

NEW RIVER UNIT
SITE LOCATION MAP

PREPARED BY: IT CORP.

CHECKED BY: MT

DATE: JANUARY 2002

TASK NO: 87040330100000

IT DWG NO:
1-1-2.DWG

Table 1.1-1
Investigative Activities Discussed in the Master Work Plan

Subject	MWP Section	SOP(s) MWP Appendix A	Applicable Areas	
			MMA UNITS	NRU UNITS
Installation Description	2.0	NA	✓	✓
Environmental Setting	3.0	NA	✓	✓
Sample Management	5.1	50.1, 50.2, 50.3	✓	✓
Documentation	4.3	10.1, 10.2, 10.3, 10.4	✓	✓
Direct Push Methods	5.2.3.3	NA	✓	✓
Boring Logs/Stratigraphic Characterization	5.2.5	10.3	✓	✓
Soil Sampling	5.2.8	30.1	✓	✓
Sediment Sampling	5.4	30.4	✓	✓
Surface Water Sampling	5.3	30.3	✓	✓
Decontamination Requirements	5.12	80.1	✓	✓
IDM	5.14	70.1	✓	✓

Once this WPA has been approved by the reviewing agencies, changes to the WPA will be documented using the Work Plan Revision Form (Form 1-1). Revisions must be reviewed and approved by USACE, Baltimore District, and RFAAP prior to implementation. Project personnel will be required to read this addendum and to sign and date a Worker Acknowledgment Form (Form 1-2). The Site Health and Safety Officer (SHSO) will retain these forms onsite during investigation activities.

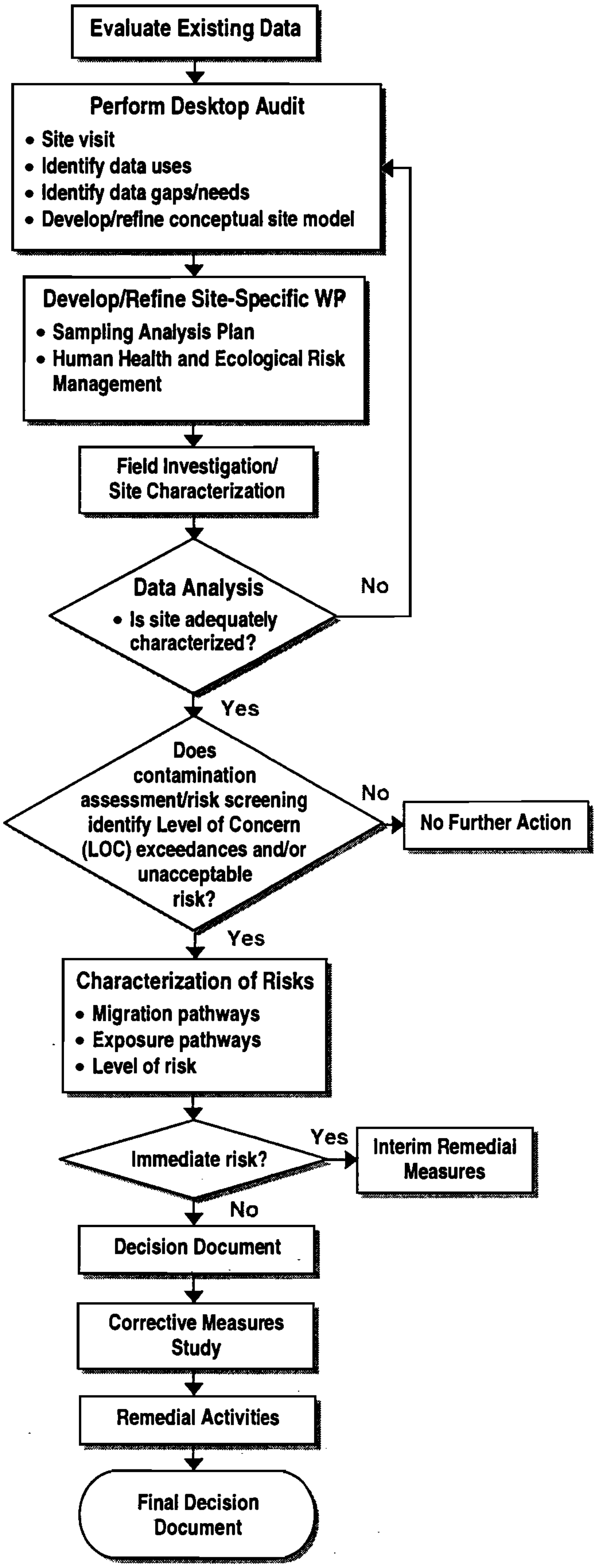
1.1.1 Investigation Overview

Investigation program activities designed to achieve site-specific data quality objectives (DQOs) are presented in the following sections. Each program systematically establishes the rationale for investigative activities through an assessment of site characteristics and associated project objectives. Supplemental chemical and physical data obtained during the sampling and analysis phase will be used to refine site profiles and enhance the accuracy of risk management decisions. A diagram illustrating the investigation process is presented in **Figure 1.1-3**.

Investigation programs focus on data gaps and have been designed to provide a comprehensive framework for establishing consistency in the decision making process. The program clearly articulates project objectives, assumptions, and data use specifications. Program elements include:

- **Site Characteristics:** Brief site descriptions are included in the introductory paragraph for each investigation area to provide an overview of existing site conditions.
- **Preliminary Investigative Results:** Preliminary results will be integrated into conceptual site models. Investigative activities have been conducted in each of the study areas. Baseline Human Health and Ecological Risk Assessments have been conducted in applicable study areas.
- **Sampling Program:** Phased, focused investigations will be performed to effectively utilize resources and achieve project DQOs. The sampling design program presented for each area has been structured to meet site-specific DQOs.
- **Quality Assurance/Quality Control (QA/QC):** Independent quality control (QC) checks are used to demonstrate investigation and laboratory accuracy, precision, and integrity. Section 2.0 of this addendum establishes requirements for documentation, data collection and reporting, management and tracking of electronic and hard copy data, and presentation format. The Quality Assurance Plan Addendum (QAPA) provides assurance that data of known and documented quality is generated to allow the Army to make accurate risk management decisions.

Figure 1.1-3
Investigation Overview



- **Health and Safety:** Site-specific training, personal protective equipment and clothing (PPE), and applicable monitoring requirements are presented in Section 3.0 of this addendum. These procedures were developed to provide the requirements for protection of site personnel including government employees, IT, regulators, subcontractors, and visitors, who are expected to be involved with site activities.

1.1.2 Site Characterization Criteria

IT was tasked to develop and implement a work plan to complete the characterization of each of the 14 sites included in this investigation. Sections 1.2 through 1.15 of this report provide site-by-site summaries that include subsections covering the following investigational activities:

(1) Review of site conditions and existing data;

(2) Completion of a desktop audit, including a conceptual site model and a data gap analysis; and

(3) Proposed sampling plan.

1.1.3 Site Conditions and Previous Investigations

Each site-specific section of this WPA begins with a description of the site and a summary of the current conditions at the site. This section includes physical, natural features that may affect migration pathways as well as structures and former activities that may impact site media.

Following the site description, a summary of previous investigations is provided. These sections primarily focus on sampling activities that have occurred at each site. A re-analysis of existing data, with an emphasis on identifying data gaps, forms the basis for the desktop audit.

1.1.4 Desktop Audit

A desktop audit was performed for each of the 14 sites included in this WPA. The purpose of this audit is to evaluate and document whether operations at specific sites have resulted in the release of hazardous substances/wastes to the environment. The audit consisted of the following activities:

- Evaluation of existing information and analytical data to identify historical uses and potential environmental concerns;
- Site visits to visually inspect each site;
- Development of a site-specific conceptual site model (CSM) to identify potential contaminant sources, exposure pathways, and potential human and ecological receptors; and
- An analysis of data gaps for each chemical class to assess whether sufficient environmental samples have been collected to characterize potentially impacted media.

Existing information and historical data collected during previous investigations was reviewed during the development of this WPA. The methodologies employed during the site visits and used in developing the conceptual models and the data gap analyses are described in the following paragraphs.

Site visits. Multiple site visits have been conducted at each area of concern, to identify the following:

- Potential contamination source areas,
- Potential human and ecological receptors,
- The relationship of each area to other sites,
- Land form analysis to identify migration pathways, and
- Potential sampling locations to fill data needs.

Results of the evaluation of existing data and the site visit were then used to develop CSMs and to identify data needs. Specific items identified were incorporated into the appropriate CSM.

Conceptual site models. A site-specific CSM has been developed for each site to identify potential contaminant sources, exposure pathways and human and ecological receptors. Each media type (i.e., surface soil, subsurface soil, surface water, and sediment) was evaluated to assess whether human (site worker) or biotic (terrestrial, aquatic, and benthic) receptors would be impacted by contamination. For the purposes of this CSM, air is not considered a viable pathway. Should analytical results indicate otherwise, the air pathway will be re-evaluated. Three exposure routes (ingestion, inhalation and dermal absorption) were evaluated for each media type. Historical site use information was employed to identify types of potential contamination and locations of potentially contaminated areas. Site topography and physical land features, such as creeks, sinkholes, or drainage ditches, were used to approximate contaminant migration pathways. A CSM figure was developed for each site.

Data gap analysis. After construction of the CSM, a data gap analysis was performed to identify areas that have not been completely characterized and to identify parameters for which no samples have been collected and analyzed at each site. This information is presented in **Table 1.1-2**. A three-dimensional spatial analysis was used to assess whether previously identified contamination has been sufficiently delineated to its full vertical and horizontal extent. A table was created for each site identifying which media were sampled for each analyte class. The table were constructed based on the understanding that each site should be characterized for the following analyte classes:

- Target Compound List (TCL) volatile organic compounds (VOCs),
- TCL semi-volatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs)
- TCL polychlorinated biphenyls (PCBs),
- Explosives, and
- Target Analyte List (TAL) metals.

Furthermore, selected samples would be tested for the following:

- Dioxins/furans at sites where burning has occurred or burned material/ash was disposed of,
- Perchlorate in surface water samples,
- Pesticides and herbicides to assess the sites for the presence or absence of these compounds, and
- Total organic carbon (TOC) and grain size to assess the bioavailability and migration potential of constituents in soil.

These tables form the basis for deciding which analyses should be performed for each media at each site. At sites where known exceedences have not been completely characterized, additional samples are proposed in order to complete site delineation.

1.1.5 Planned Field Activities and Technical Approach

Based on the results of previous investigations and the desktop audit, a site-specific field program has been developed. The sampling and analysis schemes are designed to complete data needs identified during the Data Gap Analysis. Samples collected as part of this investigation can be divided into two groups, based on whether the samples are for 1) site characterization or 2) delineation, as identified in the CSM. Samples will be collected to characterize each site for analyte classes for which site media have not been previously tested. Samples will also be collected to complete the delineation of sites. The purpose of these samples, then, is to refine the characterization of a previously identified constituent. The rationale for the placement of these samples will differ from the first group of samples in that these samples will be placed at specific locations to target specific analytes. A summary table, detailing the number of samples to be collected from various media, is presented in **Table 1.1-3**.

1.1.6 Material Handling and Disposal

Activities conducted during this investigation will comply with the relevant Occupational Safety and Health Administration (OSHA) and U.S. Environmental Protection Agency (USEPA) regulations regarding the identification, handling, and disposal of nonhazardous investigative-derived material (IDM) and hazardous materials. In addition, activities will be performed in accordance with Installation safety rules, protocols, and MWP Standard Operating Procedure (SOP) 70.1. Material disposal will be documented in the field logbook. Specific compliance issues that may be confronted during investigative activities include:

- Material Characterization—Materials will be sampled prior to disposal to identify waste characteristics, in accordance with 40 Code of Federal Regulations (CFR) 264 and Virginia Hazardous Waste Management Regulations. Material characterization analyses will be performed by a USACE-approved laboratory using USEPA-approved SW-846 Methods (USEPA, 1996). **Table 1.1-4** gives the suspected nature (hazardous vs. nonhazardous) of the materials that are expected to be produced during investigation activities.

Table 1.1-2
Existing Data- Data Gap Analysis

Site	Previous Investigations	Contractor	WPA	Total Metals				Explosives				TCL VOCs				TCL SVOCs				Perch	TCL PCBs				PAHs				Dioxin/Furans				Cyanide				TCLP Metals				Total
				SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	
SWMU 39	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M		3		3C		3		3C						3		3C																							18
	1997 Closure of Spray Pond	ATK		8	16											8	16																								48
	1998 RFI	ICF Kaiser	Add 4	2	14											2	14								2	14												8			56
SWMU 48	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M			4								4				4																					4			16
	1996 RFI	Parsons		3				3	2			3	2			3	2																								18
	1998 RFI	ICF Kaiser	Add 3		9				9				13				9									9															49
SWMU 49	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M			1								1				1																					1C			4
	1996 RFI	Parsons		3												3	8																								14
	1998 RFI	ICF Kaiser	Add 3		6				6				9				6									6															33
SWMU 50	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M											2				2																					2			6
SWMU 58	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M		3								3				3																									9
	1998 RFI	ICF Kaiser	Add 3		5								6				5									5															21
SWMU 59	*1987 RCRA Facility Ass.	USEPA																																							0
	1992 VI	D&M		2												2																									4
FLFA	1992 VI	D&M			6																																	6			12
	1998 RFI (lead)	ICF Kaiser	Add 3	5	20																																1				26
Bldg. 4343	1996 SS Sampling	ATK																																			5				5
	1999 RFI	ICF Kaiser	Add 8	22	33	2 (SL)																											17	12	2 (SL)		26	24			138
BDDT	1997 Prelim. Sampling	ATK														1			1																						2
	1998 Independent Sampling	GF				3	1			3	1			3	1			3	1				3	1																	20
	1998 RI	ICF Kaiser	Add 5	3	34	7	7	3	34	7	7	3	34	7	7	3	34	7	7						3	34	7	7													255
IAA	1997 Soil Sampling	D&M		15	20							15	20			15	20				15	20																			140
	1997 Independent Sampling	GF		2				2				2				2					2												2								12
	1998 Independent Sampling	GF		4				2								2					2												3								13
	1998 RI	ICF Kaiser	Add 5	8	11			4	3							8	7																								41
NBG	1997 Independent Sampling	GF		2				1				2				2					2												2								11
	1998 RI	ICF Kaiser	Add 5	4	7			4	7			4	7			4	7																								44
	1999 RI	ICF Kaiser	Add 8	4	11			4	8			4	10			4	9								4	3												13			74
WBG	1997 Independent Sampling	GF		3		2	2	1		2	1	3		2	2	3		2	2		3		2	2					3				3		2	2					42
	1998 RI	ICF Kaiser	Add 5	1	7	3	3	1	7	3	3	1	7	3	3	1	7	3	3									1													57
	1999 RI	ICF Kaiser	Add 8	6	66	4	3		6				6			5	53	3	3	3						6			1	7								7			179
RY	1997 Independent Sampling	GF		2		1(SL)		2		1(SL)		2		1(SL)		2		1(SL)			2		1(SL)										2		1(SL)						18
	1998 Independent Sampling	GF		1		1(SL), 3 (SE)	1	1		1(SL), 3 (SE)	1	1		1(SL), 3 (SE)	1	3		1(SL), 3 (SE)	1		3		1(SL), 3 (SE)	1									1		1(SL), 3 (SE)	1					40
	1998 RI	ICF Kaiser	Add 5		15				15								15																								45
BLA	1997 Soil Sampling	D&M		3	4							3	4			3	4				3	4																			28
	1997 Independent Sampling	GF		1				1				1				1					1												1								6
	1998 Independent Sampling	GF		1				5				1				2					2												1								12
MMA	2000 Background Study	IT	Add 10	12	22								5			3	5																								47
NRU	1998 RI	ICF Kaiser	Add 5	4	6																																				10
	2000 Background Study	IT	Add 10	16	29								7			4	7																								63
TOTAL				143	346	26	17	37	97	20	13	48	137	17	14	92	235	23	18	3	35	24	7	4	9	77	7	8	4	7	0	0	32	12	6	3	32	65	0	0	1636

(SL) = indicates that the sediment could actually be a sludge sample.

* Indicates that no samples were collected during this assessment.

Abbreviations: C = composite sample; SS = surface soil (0-2 ft); SB = subsurface soil; SE = sediment; SW = surface water;
NRU = New River Unit; BDDT = Building Debris Disposal Trench; IAA = Igniter Assembly Area;
FLFA = Former Lead Furnace Area; MMA = Main Manufacturing Area; WPA = Work Plan Addendum; NBG = Northern Burning Ground;
WBG = Western Burning Ground; RY = Rail Yard; BLA = Bag Loading Area

MEDIA AVAILABLE BY SITE			
SITE	SW	SE	SO
SWMU 39	2 settling ponds	2 settling ponds	AV
SWMU 48	NA	NA	AV
SWMU 49	NA	NA	AV
SWMU 50	NA	NA	AV
SWMU 58	NA	NA	AV
SWMU 59	NA	NA	AV
FLFA	NA	NA	AV
Bldg. 4343	Drainage Ditch	Sumps (SL)	AV
BDDT	SW (creek)	Creek	AV
IAA	Drainage Pathways	Drainage Pathways	AV
NBG	Drainage Pathways	Drainage Pathways	AV
WBG	SW (creek, pond)	Creek, pond	AV
RY	SW (creek)	Creek	AV
BLA	Drainage Pathways	Drainage Pathways	AV
MMA	NA	NA	AV
NRU	NA	NA	AV

Abbreviations: AV = media is available for sampling;
NA = not available; SL = sludge

ns

Table 1.1-3
Summary of Proposed Sampling and Analysis

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SWMU 39	Surface Soil	39SB05A	0–0.5 ft bgs	northern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		39SB06A	0–0.5 ft bgs	southern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
		39SS07	0–0.5 ft bgs	near 39SS2	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
		39SS08	0–0.5 ft bgs	n. of 39SS1	TAL metals
		39SS09	0–0.5 ft bgs	n of ponds	TAL metals
		39SS10	0–0.5 ft bgs	between ponds	TAL metals
		39SS11	0–0.5 ft bgs	s. of ponds	TAL metals
		39SS12	0-0.5 ft bgs	SE end of ponds	TAL metals
	Subsurface Soil	39SB05B	1–3 ft bgs	northern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
		39SB05C	3–5 ft bgs	northern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
		39SB06B	1–3 ft bgs	southern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
		39SB06C	3–5 ft bgs	southern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
	Sediment	39SD01	NA	northern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
		39SD02	NA	southern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	Surface Water	39SW01	NA	northern pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
		39SW02	NA	southern pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
SWMU 48	Surface Soil	48SB08A	0-0.5 ft bgs	southern trench	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		48SB09A	0-0.5 ft bgs	w. of southern trench	Explosives, dioxins/furans
		48SB10A	0-0.5 ft bgs	northern trench	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	Subsurface Soil	48SB08B	4–6 ft bgs	southern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		48SB08C	8–10 ft bgs	southern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		48SB09B	4–6 ft bgs	w. of southern trench	Explosives, dioxins/furans
		48SB09C	8–10 ft bgs	w. of southern trench	Explosives, dioxins/furans
		48SB10B	4-6 ft bgs	northern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		48SB10C	8-10 ft bgs	northern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
SWMU 49	Surface Soil	49SS01	0–0.5 ft bgs	wooded area e. of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		49SB02A	0–0.5 ft bgs	e. of 48SB5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	Subsurface Soil	49SB02B	4–6 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans
		49SB02C	8–10 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans
		49SB02D	17-19 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans, TPH, TOC, grain size, pH
SWMU 50	Surface Soil	50SS01	0–0.5 ft bgs	n. edge of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size, pH
		50SS02	0–0.5 ft bgs	w. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		50SS03	0–0.5 ft bgs	s. edge of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals
		50SB04A	0–0.5 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		50SB05A	0–0.5 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	Subsurface Soil	50SB04B	4–6 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		50SB04C	8–10 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		50SB05B	4–6 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		50SB05C	8–10 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
SWMU 58	Surface Soil	58SS04	0–0.5 ft bgs	n. toe of pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		58SB04A	0–0.5 ft bgs	on top of Rubble pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	Subsurface Soil	58SB04B	Immediately below contact with native soil	at base (through) Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH

Table 1.1-3
Summary of Proposed Sampling and Analysis

SWMU 58 (Cont'd)	**Subsurface Soil (cont'd)**	58SB04C	2 ft below "B" interval	below Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		58SB04D	4 ft below "B" interval	below Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
SWMU 59	**Surface Soil**	59SS03	0–0.5 ft bgs	n. of suspected pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		59SS04	0–0.5 ft bgs	w. of 59SS2	TAL metals
		59SS05	0–0.5 ft bgs	s. of suspected pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		59SB01A	0–0.5 ft bgs	center of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	Subsurface Soil	59SB01B	4–6 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		59SB01C	8–10 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
AOC FLFA	**Surface Soil**	LFSS01	0-0.5 ft bgs	W. of SB10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSS02	0-0.5 ft bgs	E. of SB10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSS03	0-0.5 ft bgs	S of excav.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		LFSB12A	0-0.5 ft bgs	N. of SB11	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		LFSB15A	0-0.5 ft bgs	S. of excav.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		LFSB16A	0-0.5 ft bgs	NW of furnace	TCL SVOCs, TAL metals, dioxins/furans
		LFSB17A	0-0.5 ft bgs	N of furnace	TCL SVOCs, TAL metals, dioxins/furans
	Subsurface Soil	LFSB12B	2-4 ft bgs	N. of SB11	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB12C	4-6 ft bgs	N. of SB11	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		LFSB13A	Immediately below contact with native soil	downgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB13B	5 ft below "A" interval	downgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB14A	Immediately below contact with native soil	upgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB14B	5 ft below "A" interval	upgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB15B	2-4 ft bgs	S. of excav.	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB15C	4-6 ft bgs	S. of excav.	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		LFSB16B	1-3 ft bgs	NW of furnace	TCL SVOCs, TAL metals
		LFSB16C	3-5 ft bgs	NW of furnace	TCL SVOCs, TAL metals
		LFSB17B	1-3 ft bgs	N of furnace	TCL SVOCs, TAL metals
		LFSB17C	3-5 ft bgs	N of furnace	TCL SVOCs, TAL metals
AOC -B4343	**Surface Soil**	B43SS01	0–0.5 ft bgs	S. of parking lot	TAL metals
		B43SS02	0–0.5 ft bgs	in ditch below fan	TAL metals, PCBs
		B43SS03	0-0.5 ft bgs	east of B43SS02	TAL metals, PCBs
		B43SB34A	0–0.5 ft bgs	alluvial fan	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TOC, grain size, pH
		B43SB35A	0–0.5 ft bgs	N. corner of bldg.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives
	Subsurface Soil	B43SB34B	4–6 ft bgs	alluvial fan	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		B43SB35B	4–6 ft bgs	N. corner of bldg.	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	Surface Water	B43SW01	NA	in ditch below fan	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
BDDT	**Surface Soil**	DTSB46A	0-0.5 ft bgs	in trench delta	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, TOC, grain size, pH
		DTSB47A	0-0.5 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals
	Subsurface Soil	DTSB46B	1-3 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals, TOC, grain size, pH
		DTSB47B	1-3 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals

Table 1.1-3
Summary of Proposed Sampling and Analysis

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BDDT (cont'd)	**Surface Water**	DTSW05	NA	downstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
		DTSW06	NA	downstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
		DTSW07	NA	upstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
		DTSW08	NA	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
		DTSW09	NA	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
		DTSW10	NA	downstream at base boundary	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
	Sediment	DTSD05	0–0.5 ft bgs	downstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals
		DTSD06	0–0.5 ft bgs	downstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
		DTSD07	0–0.5 ft bgs	upstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals
		DTSD08	0–0.5 ft bgs	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
		DTSD09	0–0.5 ft bgs	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
		DTSD10	0–0.5 ft bgs	downstream at base boundary	TCL VOCs, PCBs, PAHs, TAL metals
IAA	**Surface Soil**	IASS01	0-0.5 ft bgs	around SS-12	TAL metals
		IASS02	0-0.5 ft bgs	around SS-12	TAL metals
		IASS03	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
		IASS04	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
		IASS05	0-0.5 ft bgs	near Bldg 8101	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		IASB06A	0-0.5 ft bgs	east of 8102-8	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, TOC, grain size, pH
		IASB07A	0-0.5 ft bgs	around IASB5B	TAL metals
		IASB08A	0-0.5 ft bgs	around IASB5B	TAL metals
		IASB09A	0-0.5 ft bgs	around IASB5B	TAL metals
		IASB10A	0-0.5 ft bgs	around SS-12	TAL metals
		IASB11A	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
		IASB12A	0-0.5 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
		IASB13A	0-0.5 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB14A	0-0.5 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB15A	0-0.5 ft bgs	east of 504	TCL PCBs, TAL metals
		IATR01	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR02	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR03	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR04	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR05	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR06	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR07	0-0.5 ft bgs	former transformer location	TCL PCBs
		IATR08	0-0.5 ft bgs	former transformer location	TCL PCBs
	Subsurface Soil	IASB06B	4–6 ft bgs	east of 8102-8	TCL VOCs, PCBs, PAHs, TAL metals
		IASB06C	8–10 ft bgs	east of 8102-8	TCL VOCs, PCBs, PAHs, TAL metals
		IASB07B	4-6 ft bgs	around IASB5B	TAL metals
		IASB08B	4-6 ft bgs	around IASB5B	TAL metals
		IASB09B	4-6 ft bgs	around IASB5B	TAL metals
		IASB10B	2-4 ft bgs	around SS-12	TAL metals
		IASB11B	2-4 ft bgs	around SS-11	TAL metals, PAHs
		IASB012B	4–6 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
		IASB012C	8–10 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
		IASB013B	1-2 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB013C	2-4 ft bgs	east of 504	TCL PCBs, TAL metals

Table 1.1-3
Summary of Proposed Sampling and Analysis

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IAA (cont'd)	**Subsurface Soil (cont'd)**	IASB014B	1-2 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB014C	2-4 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB015B	1-2 ft bgs	east of 504	TCL PCBs, TAL metals
		IASB015C	2-4 ft bgs	east of 504	TCL PCBs, TAL metals
	Surface Water	IASW01	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
		IASW02	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
		IASW03	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
		IASW04	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW05	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW06	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		IASW11	NA	drainage sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
		IASW12	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorates, hardness
	Sediment	IASD01	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		IASD02	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		IASD03	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		IASD04	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD05	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD06	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		IASD11	NA	drainage sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
		IASD12	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, TOC, grain size, pH
	Building Material	IAASB1	NA	building	asbestos
		IAASB2	NA	building	asbestos
NBG	**Surface Soil**	NBGSB11A	0–0.5 ft bgs	near NBGSB1	TCL pesticides/PCBs, herbicides, TAL metals, dioxins/furans
		NBGSB12A	0–0.5 ft bgs	SE corner	TCL pesticides/PCBs, herbicides, TAL metals, dioxins/furans, TOC, grain size, pH
		NBGSB13A	0–0.5 ft bgs	former NBGSS03	TCL PCBs, TAL metals, dioxins/furans
		NBGSB14A	0–0.5 ft bgs	former NBGSS04	TCL PCBs, TAL metals, dioxins/furans
		NBGSB15A	0–0.5 ft bgs	NW corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB16A	0–0.5 ft bgs	SW corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB17A	0–0.5 ft bgs	around SS01	TCL VOCs, pesticides/PCBs, herbicides, TAL metals dioxins/furans
		NBGSB18A	0–0.5 ft bgs	around SS01	TCL VOCs, PCBs, TAL metals, dioxins/furans
		NBGSB19A	0–0.5 ft bgs	around SS01	TCL VOCs, PCBs, TAL metals, dioxins/furans
	Subsurface Soil	NBGSB11B	1–3 ft bgs	near NBGSB1	TCL PCBs, TAL metals, dioxins/furans
		NBGSB11C	6–8 ft bgs	near NBGSB1	TCL PCBs, TAL metals, dioxins/furans
		NBGSB12B	1–3 ft bgs	SE corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB12C	6–8 ft bgs	SE corner	TCL PCBs, TAL metals, dioxins/furans, TOC, grain size, pH
		NBGSB13B	1-3 ft bgs	former NBGSS03	TCL PCBs, TAL metals,dioxins/furans
		NBGSB14B	1-3 ft bgs	former NBGSS04	TCL PCBs, TAL metals, dioxins/furans
		NBGSB15B	1-3 ft bgs	NW corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB16B	1-3 ft bgs	SW corner	TCL PCBs, TAL metals, dioxins/furans

ml

Table 1.1-3
Summary of Proposed Sampling and Analysis

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NBG (Cont'd)	**Subsurface Soil (cont'd)**	NBGSB16C	6-8 ft bgs	SW corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB16D	10-12 ft bgs	SW corner	TCL PCBs, TAL metals, dioxins/furans
		NBGSB17B	1-3 ft bgs	around SS01	TCL VOCs, PCBs, TAL metals, dioxins/furans
		NBGSB18B	1-3 ft bgs	around SS01	TCL VOCs, PCBs, TAL metals, dioxins/furans
		NBGSB19B	1-3 ft bgs	around SS01	TCL VOCs, PCBs, TAL metals, dioxins/furans
	Surface Water	NBGSW01	NA	drainage sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, dioxin/furans, perchlorate, hardness
	Sediment	NBGSD01	NA	drainage sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, dioxin/furans
WBG	**Surface Soil**	WBGSB22A	0–0.5 ft bgs	w. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB23A	0–0.5 ft bgs	w. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
		WBGSB24A	0–0.5 ft bgs	nw. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB25A	0–0.5 ft bgs	nw. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		WBGTR01	0–0.5 ft bgs	former transformer location	TCL PCBs
	Subsurface Soil	WBGSB22B	2–4 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB22C	6–8 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB23B	2–4 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB23C	6–8 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB24B	2–4 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB24C	6–8 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB25B	2–4 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSB25C	6–8 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	Surface Water	WBGSW07	NA	near spring	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
		WBGSW08	NA	creek below pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
		WBGSW09	NA	creek below pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
		WBGSW10	NA	nearshore pond sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
		WBGSW13	NA	secondary drainage from pond	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
		WBGSW14	NA	drainage entering NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
		WBGSW15	NA	drainage at western end of NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
	Sediment	WBGSD07	0–0.5 ft bgs	near spring	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD08	0–0.5 ft bgs	creek below pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD09	0–0.5 ft bgs	creek below pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD10	0–0.5 ft bgs	nearshore pond sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD11	0–0.5 ft bgs	unnamed pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD12	0–0.5 ft bgs	unnamed pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
		WBGSD13	0–0.5 ft bgs	secondary drainage from pond	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
		WBGSD14	0–0.5 ft bgs	drainage entering NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides

Table 1.1-3
Summary of Proposed Sampling and Analysis

WBG (cont'd)	**Sediment (cont'd)**	WBGSD15	0–0.5 ft bgs	drainage at western end of NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
RY	**Surface Soil**	RYSS01	0–0.5 ft bgs	bermed spur	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		RYSS02	0–0.5 ft bgs	at SS-07	TCL PCBs, TAL metals
		RYSS03	0–0.5 ft bgs	at SS-08	TCL PCBs, explosives
		RYSB08A	0–0.5 ft bgs	bermed spur	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size, pH
		RYSB09A	0–0.5 ft bgs	near culvert	TCL VOCs, pesticides/PCBs, herbicides
		RYTR01	0–0.5 ft bgs	former transformer location	TCL PCBs
		RYTR02	0–0.5 ft bgs	former transformer location	TCL PCBs
		RYTR03	0–0.5 ft bgs	former transformer location	TCL PCBs
	Subsurface Soil	RYSB08B	4–6 ft bgs	bermed spur	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
		RYSB09B	4–6 ft bgs	near culvert	TCL VOCs, PCBs
		RYSB09C	8–10 ft bgs	near culvert	TCL VOCs, PCBs
	Surface Water	RYSW01	NA	northern trib.	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, herbicides, explosives, perchlorate, hardness
		RYSW02	NA	spring sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
		RYSW03	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
		RYSW04	NA	center of pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
		RYSW05	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
		RYSW06	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
		RYSW07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW11	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
		RYSW12	NA	southern trib.	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW13	NA	southern trib.	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
		RYSW14	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
		RYSW15	NA	transfer platform	Perchlorate, hardness
	Sediment	RYSD01	NA	northern trib.	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, herbicides, explosives,
		RYSD03	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
		RYSD04	NA	center of pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
		RYSD05	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
		RYSD06	NA	northern trib.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
		RYSD07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		RYSD08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		RYSD09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		RYSD10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
		RYSD11	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
		RYSD12	NA	southern trib.	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, explosives

Table 1.1-3
Summary of Proposed Sampling and Analysis

[illegible]	[illegible]	Sample ID	Depth	[illegible]	[illegible]
RY (cont'd)	**Sediment (cont'd)**	RYSD13	NA	southern trib.	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, explosives
		RYSD14	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
BLA	**Surface Soil**	BLASS01	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
		BLASS02	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
		BLASS03	0-0.5 ft bgs	B-405, inside "L"	TCL VOCs, SVOCs, TAL metals, explosives
		BLASS04	0-0.5 ft bgs	Building 407	Explosives (other parameters were previously tested)
		BLASS05	0-0.5 ft bgs	Building 413	TCL VOCs, SVOCs, TAL metals, explosives
		BLASS06	0-0.5 ft bgs	Building 412	TCL VOCs, SVOCs, TAL metals, explosives
		BLASS07	0-0.5 ft bgs	Building 411	TCL VOCs, SVOCs, TAL metals, explosives
		BLASS08	0-0.5 ft bgs	Building 406	TAL metals, explosives
		BLASS09	0-0.5 ft bgs	B-404, inside "L"	TCL VOCs, SVOCs, TAL metals, explosives
		BLASS10	0-0.5 ft bgs	B-404, near walkway to 405	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
		BLASS11	0-0.5 ft bgs	B-405, near walkway to 404	TCL VOCs, SVOCs, TAL metals, explosives
		BLASB01A	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives TOC, grain size, pH
		BLASB02A	0-0.5 ft bgs	at "Y" in walkway	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
		BLASB03A	0-0.5 ft bgs	B-404, outside "L"	TCL VOCs, SVOCs, TAL metals, explosives
		BLATR01	0-0.5 ft bgs	Former transformer location	TCL PCBs
		BLATR02	0-0.5 ft bgs	Former transformer location	TCL PCBs
		BLATR03	0-0.5 ft bgs	Former transformer location	TCL PCBs
	Subsurface Soil	BLASB01B	2-4 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
		BLASB02B	2-4 ft bgs	at "Y" in walkway	TCL VOCs, SVOCs, TAL metals, explosives
		BLASB03B	2-4 ft bgs	B-404, outside "L"	TCL VOCs, SVOCs, TAL metals, explosives
	Surface Water	BLASW01	NA	Near culvert	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
		BLASW02	NA	Near culvert	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
		BLASW03	NA	Sewer sample	TAL metals, TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, perchlorate, hardness
		BLASW04	NA	Unnamed creek	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
		BLASW05	NA	Unnamed creek	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
	Sediment	BLASD01	NA	Near culvert	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides
		BLASD02	NA	Near culvert	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides
		BLASD03	NA	Sewer sample	TAL metals, TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides
		BLASD04	NA	Unnamed creek	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides
		BLASD05	NA	Unnamed creek	TAL metals, TCL VOCs, SVOCs, PAHs, explosives, pesticides/PCBs, herbicides

Environmental Samples Only. QA/QC samples will be collected in addition to the above samples in the following ratios:

Trip Blanks	daily
Equipment Blanks	10%
Duplicates	10%
MS/MSD	5%

Table 1.1-4
Handling and Disposal of Non-Hazardous Materials

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SWMU 39	Soil cuttings	From 8 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM sample for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
SWMU 48	Soil cuttings	From 3 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM sample for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
SWMU 49	Soil cuttings	From 2 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
SWMU 50	Soil cuttings	From 5 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
SWMU 58	Soil cuttings	From 2 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
SWMU 59	Soil cuttings	From 4 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
AOC-FLFA	Soil cuttings	From 9 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
AOC-FCPF	Soil cuttings	From 4 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
BDDT	Soil cuttings	From 2 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM sample for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
IAA	Soil cuttings	From 12 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
NBG	Soil cuttings	From 9 borings	Approx. 1/8 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
WBG	Soil cuttings	From 4 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM sample for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
RY	Soil cuttings	From 5 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
BLA	Soil cuttings	From 3 borings	Approx. 1/4 55-gal. drum	COCs	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in soil are not expected to exceed TCLP limits.
Misc.	Water/sludge	Decon. water/ sludge	Approx. 1 55-gal. drum	IDM	Collect IDM samples for TCLP metals	Nonhazardous. Concentrations in water are not expected to exceed TCLP limits.
Misc.	PPE	Miscellaneous IDM	Approx. 1 55-gal. drum	IDM	None	Nonhazardous material. Will be disposed of as IDM.

𝄀

- Handling and disposal of nonhazardous materials—Following analysis, solid nonhazardous materials will be segregated by material and disposed of offsite. Aqueous nonhazardous material will be disposed of at the RFAAP wastewater treatment facility.
- Handling and disposal of hazardous materials—Hazardous materials are not expected to be encountered during this investigation.
- Handling and disposal of hazardous waste—Hazardous waste is not expected to be encountered during investigation activities.

Miscellaneous IDM—Miscellaneous IDM will include decontamination water/sludge and used PPE. IDM will be disposed of offsite in accordance with federal, state, and Installation requirements.

- Accumulation and storage—IDM will not be stored at RFAAP for greater than 90 days. Containerized material will be stored in an Alliant Techsystems, Inc. (ATK) approved area.
- General disposal—Analytical results, including analytical methods and detection limits, will generally be submitted to ATK seven (7) working days prior to submitting a material profile for approval unless directed otherwise. The material profile will be submitted to ATK ten (10) working days prior to material disposal. ATK will be contacted again seven (7) working days prior to material disposal.
- Transporter, storage, and disposal facility (TSDF)—A list of TSDFs previously used for RFAAP disposal activities will be obtained from ATK at the beginning of the project. Previously used TSDFs will have priority over TSDFs that have no work history with the Installation. A copy of the proposed TSDF's most recent state or federal inspection will be provided to ATK upon selection for Installation approval. In the event ATK decides that the proposed TSDF is unsuitable, a new TSDF will be selected for approval.
- Manifest—A hazardous waste manifest will be prepared as requested. In the event that the IDM is a hazardous waste, 9VAC20-60-370 will be complied with. ATK will provide an authorized signature before shipment.

1.1.6.1 Nonhazardous Material

Specific information on nonhazardous materials that are expected to be encountered at the site, including description, estimated quantity, and final disposition, are presented in **Table 1.1-4**. Handling and disposal of nonhazardous materials associated with investigation activities include the following:

- Soil cuttings from soil borings at the following locations: SWMUs 39, 48, 49, 50, 58, and 59, AOC–FLFA, AOC–Former Cadmium Plating Facility, BDDT, IAA, NBG, WBG, RY, and the BLA.
- Sediment cuttings from borings at SWMU 39 and the applicable NRU.
- Decontamination water and sludge produced at each site.
- Miscellaneous PPE items (e.g., Tyvek, nitrile/latex gloves, booties, etc.).

1.1.6.2 Hazardous Material

Hazardous materials are not expected to be encountered during this investigation.

Form 1–1

Revision Form

Work Plan—Quality Assurance Plan—Health and Safety Plan Addendum

SITE DESIGNATION/LOCATION:
Radford Army Ammunition Plant
Radford, VA

SUBJECT:

Section:____________________________________
Addendum:__________________________________
Version:____________________________________
Effective Date:_______________________________

Approved By:
Field Operations Leader

____

Date ______________________________________

Concurrence:
Project Manager

____

Date ______________________________________
Sheet ____ of ____

Form 1–2

Worker Acknowledgment Form

Document:	Master Work Plan/QAP/HSP and Addendum 012
Version:	Draft
Project:	Radford Army Ammunition Plant
Location:	MMA and NRU

Prior to the initiation of field activities, I have been given an opportunity to read and question the contents of this Master Work Plan/QAP/HSP, this Site-Specific Addendum, and approved revisions through the number listed above. With my signature I certify that I have read, understood, and agree to comply with the information and directions set forth in these plans. I further certify that I am in full compliance with 29 CFR 1910.120 in regard to training and medical monitoring requirements.

Site Personnel:

Name (please print)	Signature	Date

1.2 SWMU 39–WASTEWATER PONDS FROM PROPELLANT INCINERATOR

1.2.1 Site Description

SWMU 39 consists of two unlined earthen ponds and is located in the north-central section of the Horseshoe Area, adjacent to and associated with the Hazardous Waste Incinerator. The earthen settling ponds received washdown drainage piped from the incinerators. The SWMU is adjacent to a RCRA closed concrete-lined spray pond [Hazardous Waste Management Unit (HWMU) 39]. A site map depicting the locations of the settling ponds and the former location of the incinerator spray pond (ISP) is presented in **Figure 1.2-1**.

The subsurface geology consists of alluvium and residual deposits consisting of clay and silt with some sand and gravel. Depth to bedrock below the SWMU is approximately 14–20 ft below ground surface (bgs). Bedrock consists of highly fractured and folded limestone and dolostone of the Elbrook Formation. There are several large sinkholes near the SWMU and several mapped photolineaments. Outcrops of the Elbrook Formation along the riverbank to the north exhibit a series of folds (anticlines and synclines).

1.2.2 Previous Investigations

1992 Verification Investigation, Phase I (Dames & Moore). The 1992 Verification Investigation (VI) conducted by Dames & Moore identified two potential environmental concerns at SWMU 39 and the ISP:

- Contamination of surface soils adjacent to the spray pond from windblown spray, and
- Leaching of constituents accumulating in the sediments of the spray pond and two unlined overflow settling ponds.

Note: The ISP consisted of a concrete basin with metal pipes through which air was circulated in order to prevent formation of sludges in the basin. Therefore, the main incinerator spray pond is a misnomer in the fact that there was no actual "spray". This information negates one of the initial concerns of investigating wind blown spray.

To evaluate the potentially affected surface soils, three surface soil samples were collected from a depth of 0–6 inches (in.) below the surface gravel and root zone. These samples were located to the east of the spray pond, in the area most possibly to have received contaminated spray based on the prevailing wind direction. Sample locations and chemical exceedences are shown on **Figure 1.2-1**. Samples were analyzed for TAL metals, SVOCs, and explosives. Detected analytical results are presented in Table A-1. Explosives were not detected in these samples and one TCL SVOC (cyclohexene oxide) was detected at 0.2 and 0.22 milligrams per kilogram (mg/kg). A total of six TAL metals (aluminum, arsenic, chromium, iron, manganese and thallium) were detected, but with the exception of thallium, these metals were reported at concentrations between the residential and industrial RBC values in the three soil samples. Thallium concentrations exceeded the industrial RBC value of 14 mg/kg in two of the three samples. Thallium was not detected in the third sample (39SS3). The highest concentration of thallium (22.7 mg/kg) was reported in sample 39SS1, located at the northeast corner of the spray pond.

Two composite sludge samples were collected from the settling ponds. Composite samples were created from three locations in each settling pond to form a sludge sample that was representative of each pond (**Figure 1.2-1**). At each location, sludge was collected from 0–1 ft below the water/sludge interface. Samples were analyzed for TAL metals, TCL SVOCs and explosives. Analytical results for the sludge samples are presented in Table A-2. Explosives were not detected in the sludge samples. TCL SVOCs were detected, however, none of these constituents exceeded their respective industrial or residential RBCs. Aluminum, arsenic, chromium, copper, iron, lead, manganese and thallium were detected above residential RBC values in the settling pond samples (39SL2 and 39SL3). Thallium exceeded the industrial RBC (14 mg/kg) in both ponds with concentrations of 28 mg/kg (39SL2) and 32.3 mg/kg (39SL3). Lead exceeded the industrial RBC in the northern spray pond with a concentration of 21,000 mg/kg. The lead concentration in the southern settling pond was 33.4 mg/kg, below the residential RBC.

1997 Risk-Based Closure of the Former Incinerator Spray Pond (ATK). The ISP consisted of a concrete basin with metal pipes through which air was circulated in order to prevent formation of sludges in the basin. Accumulated storm water and sludges were removed from the ISP prior to demolition activities. The storm water was pumped to the wastewater treatment plant. Remaining sludges were drummed and sent offsite for treatment as D008 characteristic hazardous waste. The ISP was then demolished and the associated concrete basin and pipes were removed.

A composite sample (39SL1) was collected from two locations in the spray pond in February of 1992 and analyzed for TAL metals, SVOCs, and explosives. Five metals (antimony, arsenic, copper, lead and thallium) exceeded industrial soil RBCs and two metals, aluminum and barium, exceeded the residential RBC in the spray pond samples. Detected analytical results for this sample are presented in Table A-2. Lead concentrations detected in sludges from the ISP exceeded toxicity levels and were classified as a characteristic hazardous waste (Part III, VHWMR). Prior to disposal of the concrete, a representative sample from the basin was collected and analyzed for Toxicity Characteristic Leachate Procedure (TCLP) lead. Results indicated a lead concentration of approximately 0.5 parts per million (ppm). The piping was decontaminated and sold as scrap metal to a recycler.

Random grid soil samples were collected during the removal of soil beneath the former concrete basin. Samples were collected from the surficial soil directly below, 6 in. below, and 12 in. below the former concrete basin. These samples were screened onsite for lead, with a lead detection limit of 12.5 ppm. Results indicated that lead concentrations exceeded the 19-ppm screening threshold in surficial soil and in samples from six inches below the former basin. None of the screening samples from the 12-in. depth exceeded the 19-ppm threshold. Confirmation samples from 12 in. below the former concrete basin were collected and analyzed by an off-site laboratory to certify clean closure. Analytical results indicated that barium, chromium, and lead concentrations exceeded thresholds in the samples from the 12-in. depth. Based on exceedences detected in samples collected at the 12-in. depth, additional samples were collected from 18- and 24-in. depths at the same locations as the 12-in. depth samples. Analytical results indicated that arsenic, barium, and chromium concentrations exceeded threshold values in the 24-in. depth samples.

Based on exceedences detected in the 24-in. samples, clean closure could not be established at the ISP. A risk assessment was conducted to assess if the hazardous constituent of concern (HCOC) concentrations would pose an unacceptable risk to the potentially exposed population. The risk assessment concluded that the maximum concentrations of the detected HCOCs did not pose an unacceptable risk under current use or to a potential future residential population. HCOC concentrations remaining in the ISP met the acceptable risk levels as outlined in the ISP Closure Plan and the Virginia Risk Guidance for risk-based closure.

After completion of the risk assessment for risk-based closure, the ISP was accepted as clean closed by the VDEQ and backfilled with clean soil.

1998 RCRA Facility Investigation (ICF Kaiser Engineers). An RFI was conducted in 1998 by ICF Kaiser Engineers (ICF KE) to further characterize the nature and extent of contamination at the settling ponds through the investigation of surface and subsurface soil.

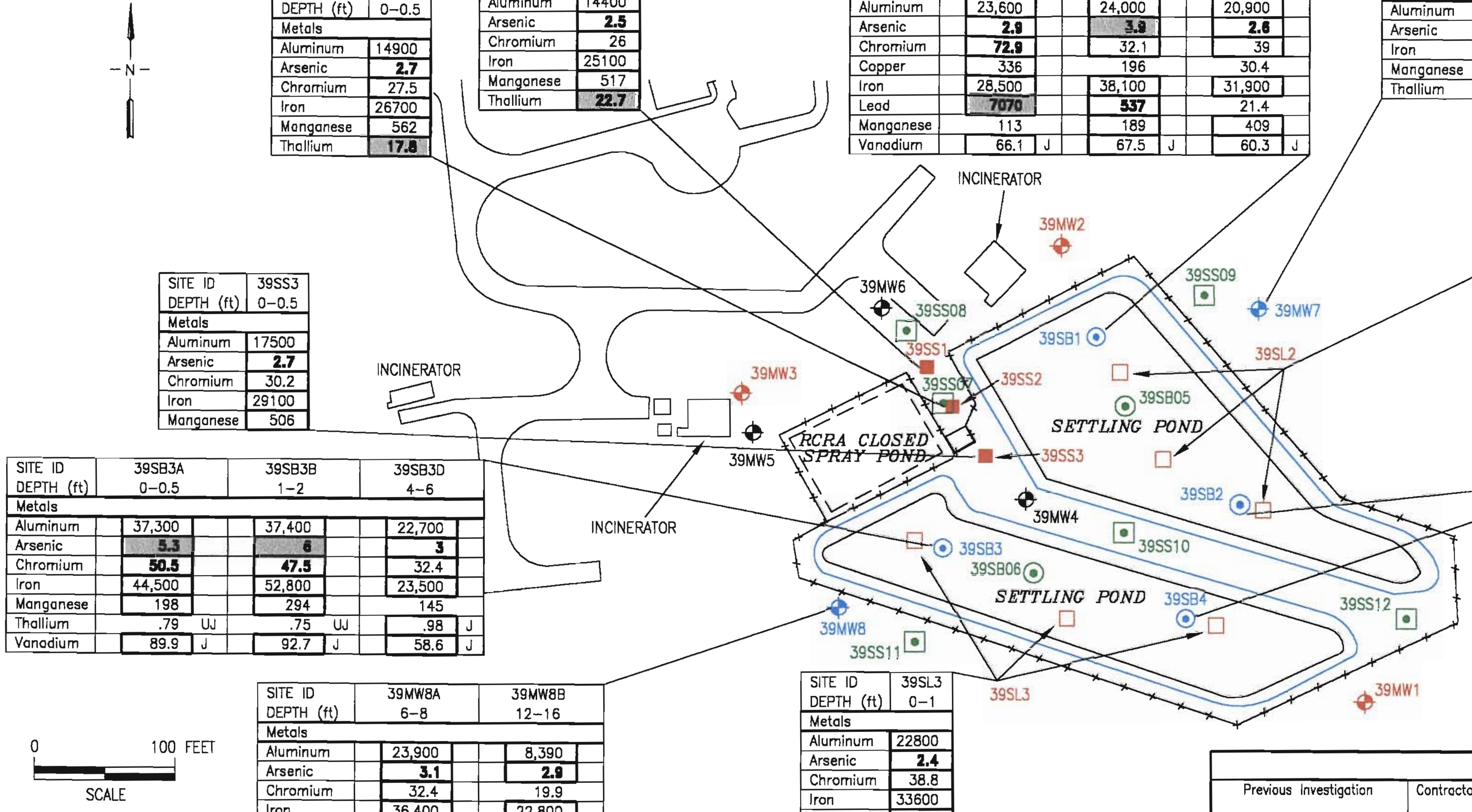
A total of 24 soil samples (2 surface and 22 subsurface) were collected. Surface soil samples 39SB1A and 39SB3A were collected at the west end of the settling ponds during the advancement of soil borings 39SB1 and 39SB3. Surface soil samples were analyzed for TAL metals, TCL SVOCs, and PAHs.

Subsurface soil samples were collected during the advancement of four soil borings (two in each pond) and two monitoring well borings to further characterize SWMU subsurface soil conditions. Subsurface soil samples were analyzed for TAL metals, TCL SVOCs, PAHs, grain size, percent moisture, and bulk density. Eight samples (39SB1C, 39SBIE, 39SB2C, 39SB2E, 39SB3C, 39SB3E, 39SB4C, and 39SB4E) were analyzed for TCLP metals.

TCL SVOCs and PAHs were not detected in either the surface soil or the subsurface soil. The analytical results for detected TAL metals are presented in Table A-3. Aluminum, arsenic, chromium, copper, iron, lead, manganese, thallium and vanadium were detected at concentrations greater than residential RBCs in at least one sample. Arsenic and lead also exceeded the industrial RBC. Lead was detected at a concentration of 7,070 mg/kg in sample 39SB1A (0 – 0.5 ft bgs). This industrial RBC exceedence is located in the northern settling pond at a depth of less than two feet, confirming the 1992 VI sludge sample results from the same settling pond. Arsenic slightly exceeded the industrial RBC of 3.8 mg/kg in four near surface soil samples (less than 2 ft bgs) and one subsurface soil sample, with a maximum concentration of 9.2 mg/kg. TCLP results indicated that arsenic, barium, chromium, and lead were detected at concentrations below the RCRA TCLP regulatory limit. Analytical results for detected TCLP metals are presented in Table A-4.

1.2.3 Conceptual Site Model

A conceptual site model for SWMU 39 is presented in **Figure 1.2-2**. Potentially affected media include surface soil, subsurface soil and surface water/sediment (if present). The area surrounding the wastewater ponds and



SITE ID DEPTH (ft)	39SS2 0–0.5
Metals	
Aluminum	14900
Arsenic	**2.7**
Chromium	27.5
Iron	26700
Manganese	562
Thallium	**17.8**

SITE ID DEPTH (ft)	39SS1 0–0.5
Metals	
Aluminum	14400
Arsenic	**2.5**
Chromium	26
Iron	25100
Manganese	517
Thallium	**22.7**

SITE ID DEPTH (ft)	39SB1A 0–0.5		39SB1B 1–2		39SB1D 4–6	
Metals						
Aluminum	23,600		24,000		20,900	
Arsenic	**2.9**		**3.9**		**2.6**	
Chromium	**72.9**		32.1		39	
Copper	336		196		30.4	
Iron	28,500		38,100		31,900	
Lead	**7070**		**537**		21.4	
Manganese	113		189		409	
Vanadium	66.1	J	67.5	J	60.3	J

SITE ID DEPTH (ft)	39MW7A 6–9		39MW7B 14–16	
Metals				
Aluminum	13,700			5,510
Arsenic	**2.6**			**2**
Iron	26,000			16,400
Manganese	348			320
Thallium	1.2	J	<	.62

SITE ID DEPTH (ft)	39SL2 0–1
Metals	
Aluminum	17500
Arsenic	**2.95**
Chromium	**206**
Copper	403
Iron	26600
Lead	**21000**
Thallium	**28**

SITE ID DEPTH (ft)	39SS3 0–0.5
Metals	
Aluminum	17500
Arsenic	**2.7**
Chromium	30.2
Iron	29100
Manganese	506

SITE ID DEPTH (ft)	39SB2B 1–2		39SB2D 4–6		39SB2F 12–14	
Metals						
Aluminum	28,300		18,100		18,700	
Arsenic	**3.4**		**3**		**9.2**	
Chromium	35.5		25.9		35.7	
Iron	42,600		31,000		29,400	
Manganese	579		393		342	
Thallium	1	J	.71	UJ	.77	UJ
Vanadium	76.4	J	52.5	J	49.8	J

SITE ID DEPTH (ft)	39SB3A 0–0.5		39SB3B 1–2		39SB3D 4–6	
Metals						
Aluminum	37,300		37,400		22,700	
Arsenic	**5.3**		**6**		**3**	
Chromium	**50.5**		**47.5**		32.4	
Iron	44,500		52,800		23,500	
Manganese	198		294		145	
Thallium	.79	UJ	.75	UJ	.98	J
Vanadium	89.9	J	92.7	J	58.6	J

SITE ID DEPTH (ft)	39SB4B 1–2		39SB4D 4–6		39SB4F 6–10	
Metals						
Aluminum	22,400		34,500		31,100	
Arsenic	**4.1**		**3.5**		**2.9**	
Chromium	31.7		**42.1**		**44.4**	
Iron	27,900		36,900		31,900	
Manganese	**1110**		359		262	
Thallium	.74	UJ	.86	J	.75	J
Vanadium	53.2	J	78.7	J	74.8	J

SITE ID DEPTH (ft)	39MW8A 6–8		39MW8B 12–16	
Metals				
Aluminum	23,900		8,390	
Arsenic	**3.1**		**2.9**	
Chromium	32.4		19.9	
Iron	36,400		22,800	
Manganese	471		392	
Vanadium	65.6	J	29.9	J

SITE ID DEPTH (ft)	39SL3 0–1
Metals	
Aluminum	22800
Arsenic	**2.4**
Chromium	38.8
Iron	33600
Manganese	617
Thallium	**52.3**
Vanadium	68

Sample Summary													
Previous Investigation	Contractor	TAL Metals			Explosives		TCL SVOCs			PAHs		TCLP Metals	Total
		SS	SB	SE	SS	SE	SS	SB	SE	SS	SB	SB	
1992 VI	D&M	3	--	3C	3	3C	3	--	3C	--	--	--	18
1997 Closure of Spray Pond	ATK	8	16	--	--	--	8	16	--	--	--	--	48
1998 RFI	ICF Kaiser	2	14	--	--	--	2	14	--	2	14	8	56

LEGEND:

■	1992 VI SOIL SAMPLE (DAMES & MOORE)
□	1992 VI WASTE COMPOSITE SAMPLE (DAMES & MOORE)
⌖	1994 VI MONITORING WELL (DAMES & MOORE)
⌖	1997 RFI MONITORING WELL (ALLIANT TECHSYSTEMS)
⌖	1998 RFI MONITORING WELL (ICF KAISER)
◉	1998 RFI SOIL BORING (ICF KAISER)
–x–x–	FENCE
◉	PROPOSED SOIL BORING LOCATION
▣	PROPOSED SURFACE SOIL LOCATION

NOTE:

ALL UNITS IN MG/KG

J = ESTIMATED CONCENTRATION

UJ = ESTIMATED NON-DETECT

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC

SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

METALS REFERS TO TAL METALS

FILE: 1-2-1xls.DWG PLOT: 2-6-02

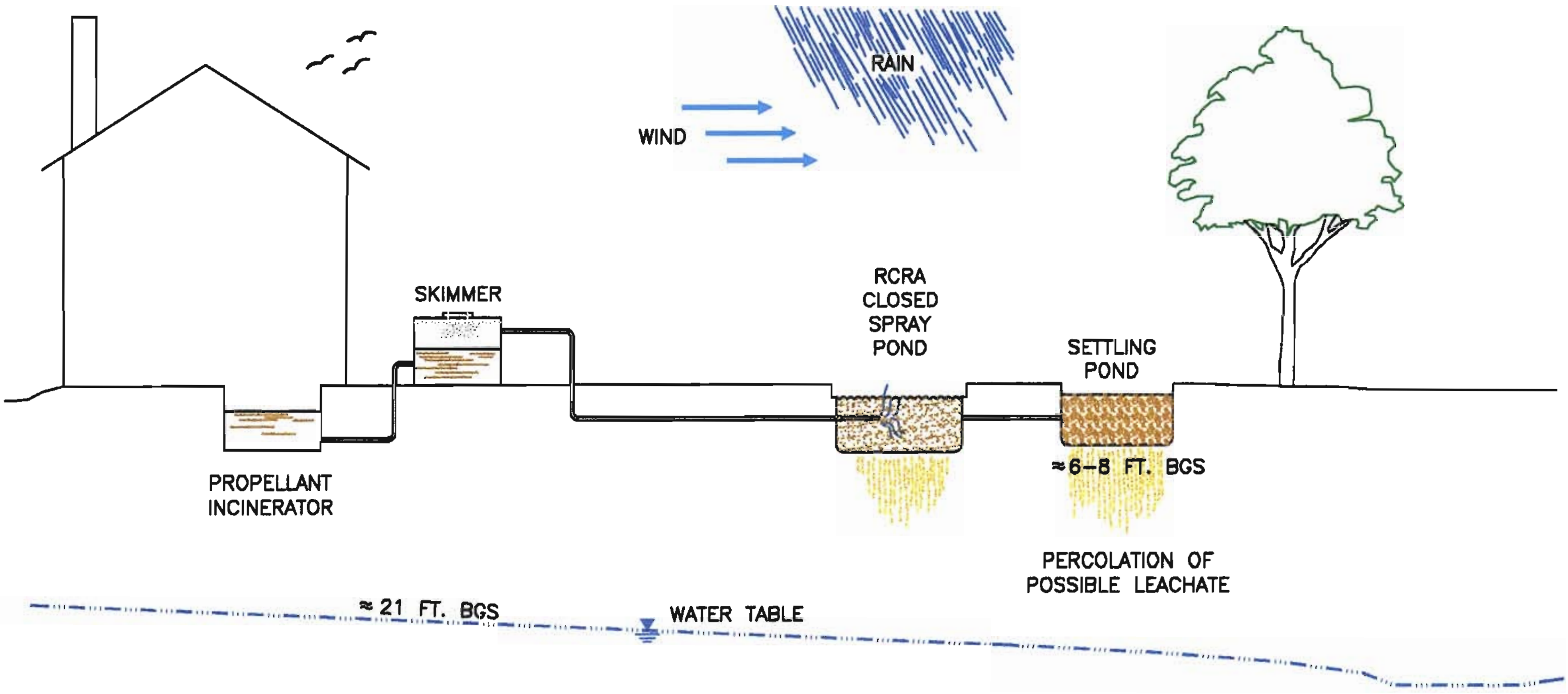
RADFORD AAP

PREPARED BY: IT CORP.
CHECKED BY: MT
DATE: FEBRUARY 2002

TASK NO: 87040330100000
IT DWG NO:
1-2-1Axls.DWG

FIGURE 1.2-1

SWMU 39
PREVIOUS INVESTIGATIONS
SAMPLE RESULTS AND
PROPOSED SAMPLING
LOCATIONS



"NOT TO SCALE"

NOTE:

SEE TABLE 1.2–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-6-02
FILE: 1-2-2.DWG

RADFORD AAP

PREPARED BY: IT CORP.
CHECKED BY: MT
DATE: JANUARY 2002
TASK NO: 870403300100000
IT DWG NO: 1–2–2

FIGURE 1.2–2

CONCEPTUAL MODEL
SWMU 39
WASTEWATER PONDS
FROM PROPELLANT
INCINERATOR

275

the location of the former spray pond is flat, with precipitation infiltrating into the ground rather than flowing overland to a surface water body, other than the settling ponds. The following receptors were considered since each medium is potentially present: site workers, terrestrial, aquatic, and benthic biota. **Table 1.2-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially affected by the discharge from washdown water from the incinerator. Site workers and ecological receptors could be impacted through inhalation of dust, incidental ingestion of soil, and dermal absorption through direct contact.

Subsurface soil is also potentially affected. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Potential receptors and pathways associated with surface water/sediment are incidental ingestion and dermal absorption by benthic and aquatic organisms. Site worker and terrestrial biota exposure pathways include dermal absorption and incidental ingestion of surface water/sediment.

1.2.4 Data Gap Analysis

TCL VOCs. A data gap exists in the characterization of surface soils and subsurface soils since TCL VOC samples were not previously collected. TCL VOCs also represent a data gap in the characterization of surface water (if present) in the settling lagoons. Therefore, samples will be collected for TCL VOC analysis from each medium to fill this data need.

TCL SVOCs/PAHs. Composite samples from the settling ponds (classified as sediment) were analyzed for TCL SVOCs during the 1992 VI, and low levels of SVOCs were detected in these samples. Two surface soil and 14 subsurface samples were collected from the settling ponds (classified as soil) and analyzed for SVOCs and PAHs during the 1998 RFI. Neither TCL SVOCs nor PAHs were detected in these samples. Therefore, these media are considered characterized for TCL SVOCs/PAHs. Surface water in the settling ponds has not been analyzed for SVOCs/PAHs. Therefore, samples will be collected for TCL SVOCs/PAHs analysis from this medium, if present, to fill this data need.

TCL PCBs. Samples were not collected for TCL PCB analysis from media during the previous investigations. Therefore, a data gap exists in the characterization of available media (surface soil, subsurface soil, and surface water/sediment [if present]). Samples will be collected for TCL PCB analysis from each medium to fill this data need.

Pesticides/Herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Three surface soil samples and three composite sludge samples were analyzed for explosives during the 1992 Dames & Moore VI. Explosives were not detected in these samples. However, samples from subsurface soil and surface water were not analyzed for explosives. Additional discrete samples will be needed from the surface soil in order to complete the characterization of this medium for risk assessment purposes. Therefore, explosives represent a data gap.

TAL metals. Samples were analyzed for TAL metals during the 1998 RFI. Two surface soil and 14 subsurface soil samples were collected during this investigation for TAL metals analysis. Arsenic and lead were detected in the soil samples at concentrations greater than the industrial RBC. Thallium was reported in the settling pond beds during the 1992 VI at concentrations above the industrial RBC. None of these exceedences have been fully delineated. Surface water samples have never been collected from the settling ponds. Therefore, TAL metals represent a data gap in surface water, if present. In addition, further surface and subsurface soil sampling is also necessary to complete the characterization of these media.

Dioxins/furans. Samples will be collected for dioxins/furans analysis where previous site activities included burning or the disposal of burning byproducts or debris. SWMU 39 was used to treat incinerator wastewater, therefore, site media will be analyzed for dioxins/furans. Previous investigations have not collected samples for this analysis; therefore, this analyte class is a data gap.

Table 1.2-1
Potential Exposure Pathways and Receptors—SWMU 39

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, DA	IN, DA	IN, DA	IN, DA	Water in settling ponds may be ingested/absorbed.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.2-2 for conceptual model.

* The environmental medium in the settling ponds is potentially affected and will be classified as sediment or soil based on current site conditions.

Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

Perchlorate. Surface water samples were not collected during the previous investigations. Surface water, if present, will be collected and analyzed for perchlorate.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.2.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment (RA). Proposed sampling locations are presented in **Figure 1.2-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Analyses for each media type, presented in **Table 1.2-2**, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Surface soil. Eight surface soil samples will be collected from 0–0.5 ft bgs at SWMU 39. Three of these samples will be analyzed for TCL VOCs, TCL pesticides/PCBs, herbicides, explosives, dioxins/furans, and TAL metals. One sample (39SS07) will be located between the former spray pond and the northern settling pond, and the other two surface soil samples (39SB05A and 39SB06A) will be collected from the 0–0.5 ft interval of soil borings located in each of the settling ponds. Five surface soil samples (39SS08, 39SS09, 39SS10, 39SS11, 39SS12) will be collected from the perimeter of the settling ponds and analyzed for TAL metals to verify that elevated concentrations of metals are confined to the settling ponds. Sample 39SB05A will be analyzed for total organic carbon (TOC), grain size and pH to assess the availability of constituents in soil.

Subsurface soil. Four subsurface soil samples will be collected for characterization. These samples will be analyzed for TCL VOCs, TCL PCBs, explosives, dioxins/furans and TAL metals. Soil borings (39SB05 and 39SB06), located in each of the two settling ponds, will be advanced to 5 ft bgs. Two subsurface soil samples will be collected from each boring, at depths of 1–3 ft bgs and 3–5 ft bgs.

Surface water. If surface water is present in the settling ponds, two surface water samples (39SW01 and 39SW02) will be collected and analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, dioxins/furans, TAL metals, perchlorate and hardness.

Sediment. If surface water is present in the settling ponds, two sediment samples (39SD01 and 39SD02) will be collected and analyzed for TCL VOCs, TCL pesticides/PCBs, herbicides, explosives, dioxins/furans and TAL metals. The sediment samples will be collocated with surface water samples 39SW01 and 39SW02.

SITE ID DEPTH (ft)	48TP1 6-6.5	48TP2 6-6.5	48TP3 6-6.5	48TP4 6-6.5
Metals				
Aluminum	9,230	47,400	50,700	47,900
Arsenic	**8.1**	**4.3**	**4.8**	**4.8**
Chromium	23.2	28.4	33	31.2
Iron	16,700	51,100	55,000	54,800
Manganese	314	188	218	163
Thallium	1.1 UJ	1.9 J	.66 UJ	.65 UJ
Vanadium	12.1 J	94.6 J	100 J	96.4 J
Explosives				
1,3-Dinitrobenzene	**2.7** J	< .2	< .2	< .2
2,4-Dinitrotoluene	**6.7** J	< .2	< .2	< .2
2,6-Dinitrotoluene	**1.3**	< .2	< .2	< .2
4-Amino-2,6-dinitrotoluene	**5.5** J	< .2	< .2	< .2
Nitrobenzene	**1** J	< .2	< .2	< .2

SITE ID DEPTH (ft)	48SB2 10-12	48SB2 20-22
Metals		
Aluminum	15700	14600
Arsenic	**4.7**	**2.8**
Chromium	29.5	31.9
Iron	25800	41600
Manganese	278	547
Semivolatiles		
2,4-Dinitrotoluene	3.2	ND
2,6-Dinitrotoluene	1.2	ND

SITE ID DEPTH (ft)	48SS3 0-1
Metals	
Chromium	24.3

SITE ID DEPTH (ft)	48SS2 0-1
Metals	
Arsenic	**7.97**
Chromium	**47.8**

SITE ID DEPTH (ft)	48SB6A 6-7	48SB6B 14-16	48SB6C 1-3
Metals			
Aluminum	15,700	34,200	11,800
Arsenic	**2.8**	**5.4**	**5**
Chromium	35.5	**42.2**	**65.4**
Iron	18,100	39,700	11,700
Manganese	148	342	123
Volatiles			
Benzene	**.017** J	< .85	< 1.2
Explosives			
2,4-Dinitrotoluene	.25 UJ	.24 UJ	**3.8** J
2,6-Dinitrotoluene	< .25	< .24	**1.1** J

SITE ID DEPTH (ft)	48SB1 7.5-9	48SB1 13-15
Metals		
Aluminum	2940	12200
Arsenic	**8.2**	**3.1**
Chromium	7.8	27.3
Iron	8550	21200
Manganese	222	195
Mercury	2.6	nd

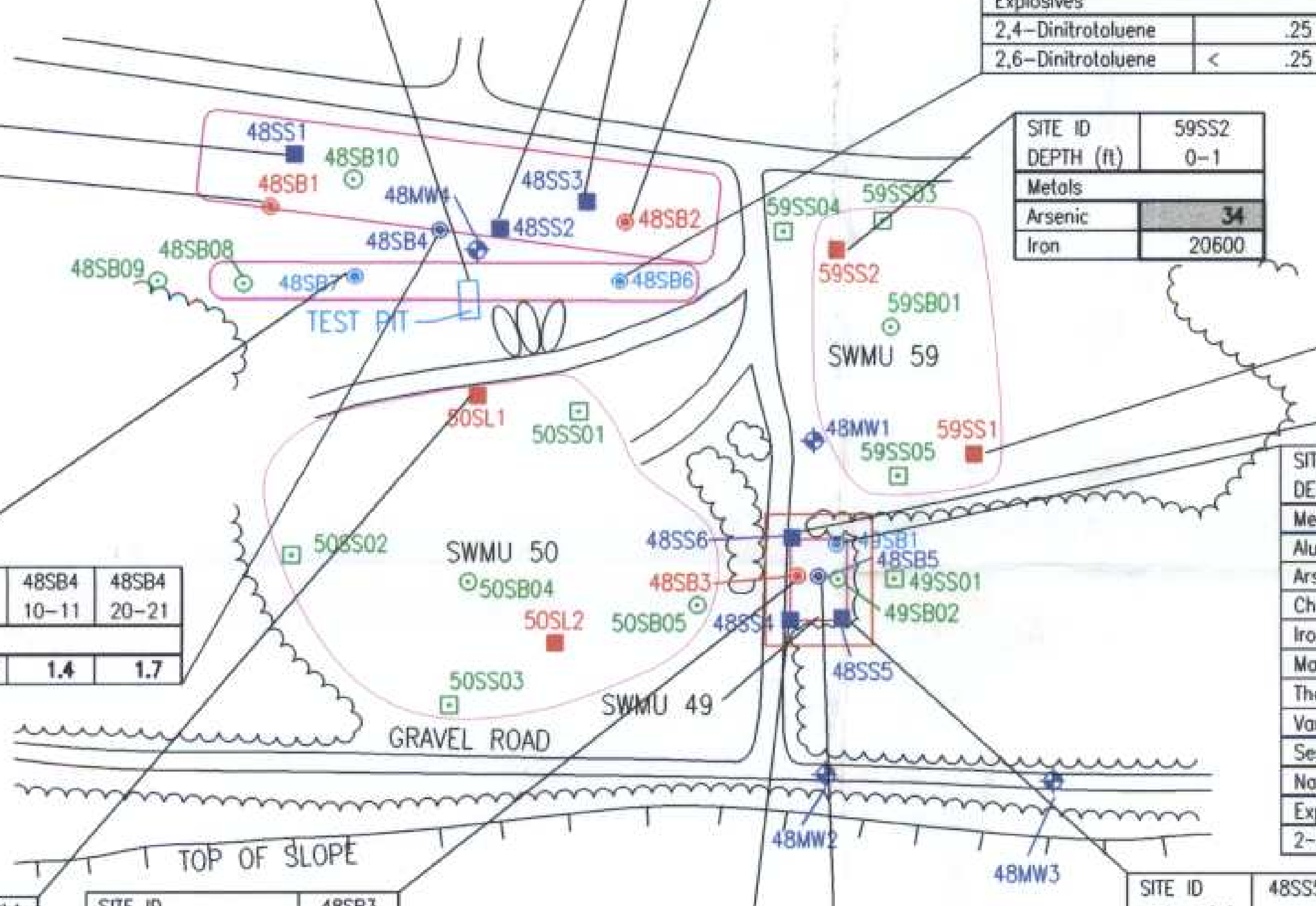
SITE ID DEPTH (ft)	48SS1 0-1
Metals	
Arsenic	**3.42**
Barium	572

SITE ID DEPTH (ft)	59SS2 0-1
Metals	
Arsenic	**34**
Iron	20600

SITE ID DEPTH (ft)	59SS1 0-1
Metals	
Aluminum	11400
Arsenic	**1.85**
Iron	12700
Manganese	**2560**

SITE ID DEPTH (ft)	48SS6 0-1
Metals	
Arsenic	**3.81**

SITE ID DEPTH (ft)	48SB7A 8-9	48SB7B 10-11
Metals		
Aluminum	24,600	16,500
Arsenic	**8.0**	**3.5**
Chromium	33.3	37.4
Iron	45,600	25,300
Manganese	176	613
Vanadium	73.2 J	23.1 J
Explosives		
1,3-Dinitrobenzene	**3.6** J	.25 UJ
2,4,6-Trinitrotoluene	690 J	35.9 J



SITE ID DEPTH (ft)	49SB1A 8-10	49SB1B 18-24	49SB1C 28-32	49SB1D 38-40	49SB1E 48-50	49SB1F 58-60
Metals						
Aluminum	27,300	18,300	22,700	19,900	14,800	13,000
Arsenic	**3.2**	**2.5**	**3.8**	**3.9**	**4.2**	**2.8**
Chromium	29.2	22.3	27.5	35.3	27.3	25.4
Iron	33600	40300	43000	39000	37700	33700
Manganese	74.5	350	449	271	532	421
Thallium	.78 J	< .74	< .72	< .69	.93 J	< .7
Vanadium	63.2 J	23.2 J	21 J	18.8 J	22.3 J	14.3 J
Semivolatiles						
Naphthalene	< 2	**4.1** J	**11**	.4 UJ	.4 UJ	.4 UJ
Explosives						
2-Amino-4,6-dinitrotoluene	.6 J	.25 UJ	.24 UJ	.24 UJ	.24 UJ	.25 UJ

SITE ID DEPTH (ft)	48SB4 10-11	48SB4 20-21
Semivolatiles		
N-Nitrosodiphenylamine	**1.4**	**1.7**

SITE ID DEPTH (ft)	50SL1 0-5
Volatiles	
Chloroform	**2.0**
Semivolatiles	
Naphthalene	**0.4**

SITE ID DEPTH (ft)	48SB3 18-20
Metals	
Aluminum	16400
Iron	23700
Manganese	168
Semivolatiles	
2-Methylnaphthalene	**30**
Naphthalene	**6**

SITE ID DEPTH (ft)	48SS4 0-1
Metals	
Arsenic	**3.66**

SITE ID DEPTH (ft)	48SB5 17-19
Semivolatiles	
Naphthalene	**20**

SITE ID DEPTH (ft)	48SS5 0-1
Metals	
Chromium	30.3

Sample Summary

Site	Previous Investigation	Contractor	TAL Metals		Explosives		TCL VOCs		TCL SVOCs		PAHs	TCLP Metals	Total
			SS	SB	SS	SB	SS	SB	SS	SB	SB	SB	
SWMU 48	1992 VI	D&M	--	4	--	--	--	4	--	4	--	4	16
	1996 RFI	Parsons	3	--	3	2	3	2	3	2	--	--	18
	1998 RFI	ICF Kaiser	--	9	--	9	--	13	--	9	9	--	49
SWMU 49	1992 VI	D&M	--	1	--	--	--	1	--	1	--	1C	4
	1996 RFI	Parsons	3	--	--	--	--	--	3	8	--	--	14
	1998 RFI	ICF Kaiser	--	6	--	6	--	9	--	6	6	--	33
SWMU 50	1992 VI	D&M	--	--	--	--	--	2	--	2	--	2	6
SWMU 59	1992 VI	D&M	2	--	--	--	--	--	2	--	--	--	4

LEGEND

☐	1992 SOIL GAS SURVEY AREA (DAMES & MOORE)
■	1992 VI SURFACE SOIL SAMPLE (DAMES & MOORE)
◆	1996 RFI MONITORING WELL (PARSON ENGINEERING SCIENCE)
■	1996 RFI SURFACE SOIL SAMPLE (PARSON ENGINEERING SCIENCE)
☐	1998 RFI TEST PIT (ICF KAISER)
◉	1992 VI SOIL BORING (DAMES & MOORE)
◉	1996 RFI SOIL BORING (PARSON ENGINEERING SCIENCE)
◉	1998 RFI SOIL BORING (ICF KAISER)
—	SWMU BOUNDARIES
⌒⌒⌒	TREES
⊙	PROPOSED SOIL BORING LOCATION
⊡	PROPOSED SURFACE SOIL LOCATION

NOTE:

ALL UNITS IN MG/KG

J = ESTIMATED CONCENTRATION

UJ = ESTIMATED NON-DETECT

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC

SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

METALS REFERS TO TAL METALS

FILE: 1-7-1XLS.DWG PLOT: 2-8-02

RADFORD AAP

PREPARED BY: IT CORP.	TASK NO: 870403010000
CHECKED BY: MT	IT DWG NO: 1-7-1XLS.DWG
DATE: NOVEMBER 2001	

FIGURE 1.3-1

SWMUS 48, 49, 50 & 59
PREVIOUS INVESTIGATIONS
SAMPLE RESULTS AND
PROPOSED SAMPLING
LOCATIONS

05006 \ 24f - 1/1

Table 1.2-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 39

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	39SB05A	0–0.5 ft bgs	northern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	39SB06A	0–0.5 ft bgs	southern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	39SS07	0–0.5 ft bgs	near 39SS2	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	39SS08	0–0.5 ft bgs	n. of 39SS1	TAL metals
	39SS09	0–0.5 ft bgs	n. of ponds	TAL metals
	39SS10	0–0.5 ft bgs	between ponds	TAL metals
	39SS11	0–0.5 ft bgs	s. of ponds	TAL metals
	39SS12	0-0.5 ft bgs	SE end of ponds	TAL metals
Subsurface Soil	39SB05B	1–3 ft bgs	northern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
	39SB05C	3–5 ft bgs	northern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
	39SB06B	1–3 ft bgs	southern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
	39SB06C	3–5 ft bgs	southern pond	TCL VOCs, PCBs, explosives, TAL metals, dioxins/furans
Sediment	39SD01	NA	northern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
	39SD02	NA	southern pond	TCL VOCs, pesticides/PCBs, herbicides, explosives, TAL metals, dioxins/furans
Surface Water	39SW01	NA	northern pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
	39SW02	NA	southern pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness

metals, TCL VOCs, TCL SVOCs, PAHs, and explosives. The analytical results for detected TAL metals are presented in Table A-11 and for detected organic compounds in Table A-12. Samples were recollected for VOC analysis by the methanol preservation method subsequent to the collection of the original samples. These VOC results are presented in Table A-13.

Detected TAL metal results indicated that arsenic concentrations exceeded the industrial RBC in three of the five subsurface soil samples. Aluminum, chromium, and iron exceeded the residential RBC in the five samples. Manganese exceeded the residential RBC in three of the five samples and vanadium in one of the five samples.

One explosive compound, 246TNT, was detected in sample 48SB7A at a concentration of 690 mg/kg, exceeding the industrial RBC of 190 mg/kg. 13DNB was reported at a concentration greater than the residential RBC in the same sample. 246TNT exceeded the residential RBC in the deeper sample from boring 48SB7; however, the concentration was below the industrial RBC in this sample. 24DNT and 26DNT were detected at concentrations greater than the residential 'dinitrotoluene mix' RBC of 0.94 mg/kg in the shallow sample (1–3 ft bgs) collected from 48SB6. These compounds were not detected in the deeper samples collected from this boring. TCL VOCs (by both methods), TCL SVOCs and PAHs were detected below residential RBCs in both borings.

1.3.3 Conceptual Site Model

A conceptual site model for SWMU 48 is presented in **Figure 1.3-2.** Potentially affected media include surface and subsurface soil. Surface water and sediment are not present. The area surrounding the site is relatively flat. Precipitation is expected to infiltrate into the ground rather than flow overland to a surface water body. Site workers and terrestrial biota are considered receptors. **Table 1.3-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially affected by the discharge of oily wastewater into shallow trenches. Site workers and ecological receptors could be impacted though incidental ingestion and inhalation of soil and dermal absorption through direct contact with impacted soil.

Subsurface soil is also potentially affected by oily wastewater disposal activities. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

1.3.4 Data Gap Analysis

TCL VOCs. 13 subsurface soil samples were collected for TCL VOC analysis during the 1998 RFI (ICF KE, 1999) at this SWMU. TCL VOCs were detected during this investigation at concentrations below the residential soil RBC level in subsurface soil. Surface soil samples are proposed to complete the characterization for TCL VOCs. Therefore, TCL VOCs represent a data gap in the characterization of surface soil. Additional subsurface soil samples will be collected from the trenches to further characterize these areas.

TCL SVOCs/PAHs. Nine subsurface soil samples were collected for TCL SVOC analysis during the 1998 RFI. TCL SVOCs were detected during this investigation at concentrations below the residential soil RBC level in subsurface soil. Surface soil samples are needed to complete the delineation of this site. TCL SVOCs are a data gap in the characterization of surface soil. Samples will be analyzed for PAH analysis where low levels of SVOCs were previously reported in the TCL SVOC analysis. PAHs were detected in surface and subsurface soil at low concentrations. Additional samples will be collected for SVOC/PAH analysis to verify the concentrations detected during previous investigations.

TCL PCBs. TCL PCBs analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap in the characterization of surface soil and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Samples were collected for explosives analysis from nine subsurface soil locations during the 1998 RFI. One sample from a test pit and one soil boring in the southern trench area contained elevated levels of explosive compounds. The area of elevated explosives however, has not been fully delineated. Therefore, explosives represent a data gap in subsurface soil characterization. Samples will also be collected from the surface soil to complete the characterization of this medium.

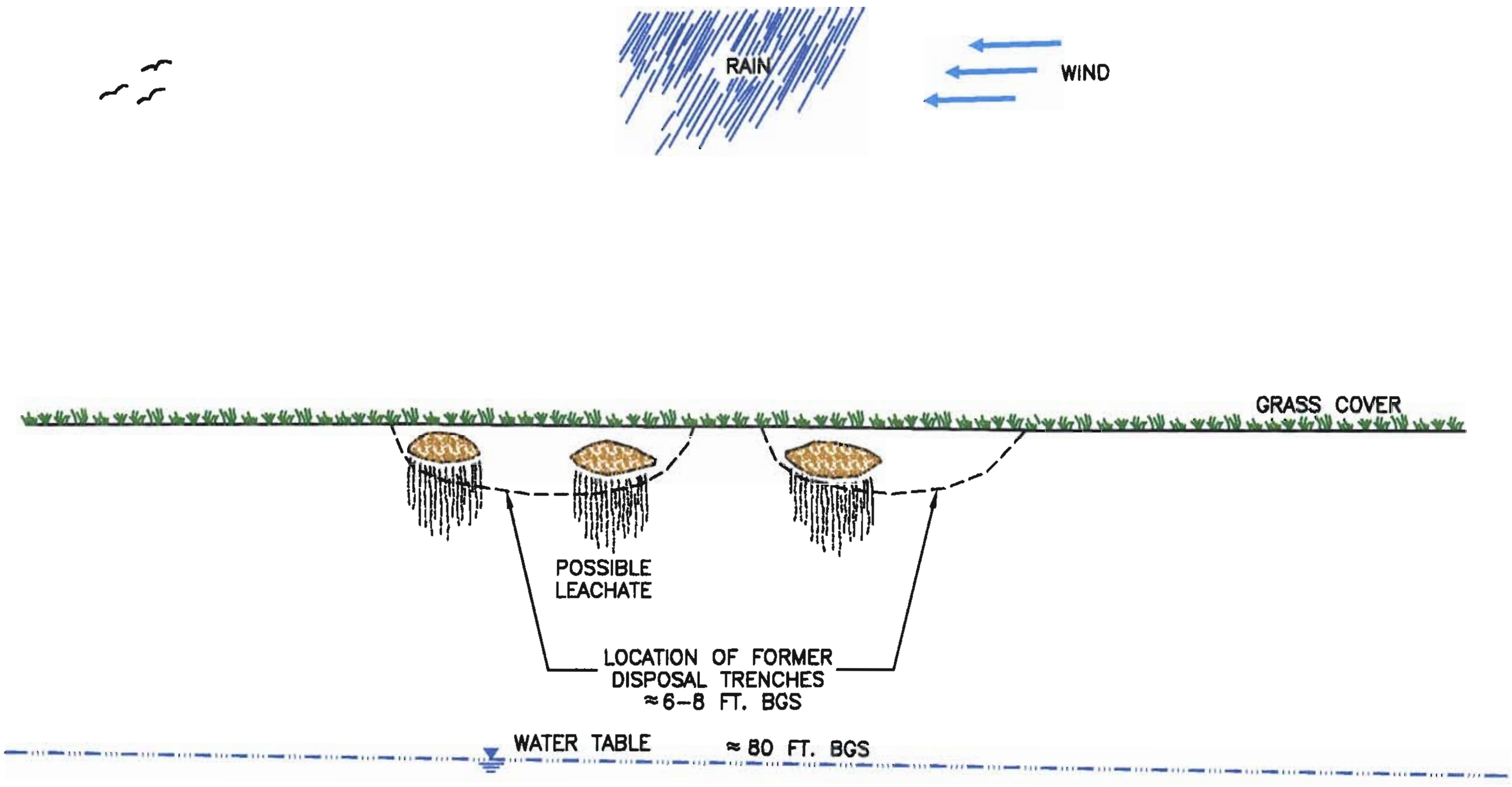
TAL metals. TAL metals analysis was performed on nine subsurface soil locations during the 1998 RFI. Elevated levels of arsenic were detected in the subsurface soil at the site. Additional samples will be collected from the surface soil to fully characterize this medium. Therefore, TAL metals represent a data gap in the characterization of surface soil. Subsurface soil from within the trenches will also be analyzed for TAL metals to assess these areas.

Dioxins/furans. Samples will be analyzed for dioxins/furans because ash was reported as one of the constituents encountered during test pit operations during the 1998 RFI. Since SWMU 48 was potentially used for disposal of burned wastes or combustion byproducts, dioxins/furans are considered a data gap for available site media (surface and subsurface soil).

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. One or two samples per site will be analyzed for these parameters.

1.3.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.3-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.3-2** for different media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:



"NOT TO SCALE"

NOTE:

SEE TABLE 1.3–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-6-02

FILE: 1-3-2.DWG

RADFORD AAP		FIGURE 1.3–2
PREPARED BY: IT CORP.	TASK NO: 67040330100000	CONCEPTUAL MODEL SWMU 48 OILY WATER BURIAL AREA
CHECKED BY: MT	IT DWG NO: 1–3–2	
DATE: JANUARY 2002		

Table 1.3-1
Potential Exposure Pathways and Receptors—SWMU 48

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.3-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

Table 1.3-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 48

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Soil	48SB08A	0-0.5 ft bgs	southern trench	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	48SB09A	0-0.5 ft bgs	w. of southern trench	Explosives, dioxins/furans
	48SB10A	0-0.5 ft bgs	northern trench	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	48SB08B	4–6 ft bgs	southern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	48SB08C	8–10 ft bgs	southern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	48SB09B	4–6 ft bgs	w. of southern trench	Explosives, dioxins/furans
	48SB09C	8–10 ft bgs	w. of southern trench	Explosives, dioxins/furans
	48SB10B	4-6 ft bgs	northern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	48SB10C	8-10 ft bgs	northern trench	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans

Surface soil. Three surface soil samples will be collected from 0–0.5 ft bgs during the advancement of three soil borings. One sample (48SB08A) will be collected from within the boundaries of the southern trench, at the western end of the trench. The second boring (48SB09) will be located immediately outside the western end of the southern trench boundary opposite boring location 48SB08 and analyzed for explosives and dioxins/furans. The third boring (48SB10) will be located in the northern trench to assess this trench. Sample locations will allow for assessment of the extent of explosives in the soil detected during previous investigations. In addition to explosives, surface soil samples 48SB08A and 48SB10A will be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL pesticides/PCBs, herbicides, TAL metals and dioxins/furans. Sample 48SB08A will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in the soil.

Subsurface soil. Six subsurface soil samples will be collected from three soil borings. Samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxins/furans at borings 48SB08 and 48SB10 and samples from 48SB09 will be analyzed for explosives and dioxins/furans. One boring, 48SB08, will be located within the boundaries of the southern trench at the western end of the trench. The deeper sample from this boring (48SB08C) will also be analyzed for TOC, grain size and pH in order to assess subsurface conditions at this SWMU. The second boring (48SB09) will be located immediately outside the southern trench boundary, opposite boring location 48SB08. The third boring, 48SB10, will be advanced in the northern trench to assess this area. Two subsurface soil samples will be collected from each boring, with samples collected immediately below the suspected bottom of the former trench and one sample collected 5 ft below that interval. Boring locations will allow for assessment of the extent of explosives in the soil detected during previous investigations.

1.4 SWMU 49–RED WATER ASH BURIAL NO. 2

1.4.1 Site Description

SWMU 49 is located in the Horseshoe Area, east of the main bridge over the New River (**Figure 1.1-1**). The estimated dimensions of the SWMU are 75 ft by 50 ft. The SWMU is located adjacent to a narrow drive constructed of gravel and bottom ash. SWMU 49 is contiguous to SWMUs 48, 50, and 59, 30 ft south of SWMU 59 and 75 ft east of SWMU 50. During the 1987 RCRA Facility Assessment (RFA), the three SWMUs were classified together because no distinction could be made between the areas by visual observation. During the 1992 VI and the 1996 RFI, a potential location for SWMU 49 was not stated, but SWMU 48 was divided into an upper and a lower disposal area. SWMU 49 was identified to be the area of SWMU 48 called the "lower disposal unit" by previous investigations. Although disposal at SWMUs 48, 49, and 50 reportedly took place in the 1970s, the units are currently inactive. SWMU 49 was identified from aerial photography as disturbed ground during active disposal in the contiguous SWMUs. SWMU 49 reportedly received 10 tons of redwater ash during its active period. There are no known release controls for the unit. No signs of release were noted during the April 1987 Site Inspection performed by the USEPA (USEPA, 1987).

Approximately 100 ft south of SWMU 49, the topography forms a ridge crest and then slopes steeply down to the New River. The elevation of the SWMU is approximately 1,820 ft msl, about 120 ft above the New River. The area is grassy and wooded with young trees. Based on topography, surface water runoff from SWMU 49 is expected to infiltrate into the ground, rather than flow approximately 700 ft southwest to the New River. According to RFAAP utility maps, there are no manholes, catch basins, or storm drains located in the immediate vicinity of SWMU 49.

Subsurface conditions in the vicinity of SWMU 49 were characterized during investigation activities at the unit. The subsurface geology consists of alluvium and residual deposits (physically and chemically weathered bedrock) consisting of clay and silt with some sand and gravel. Depth to bedrock is 63 ft bgs. Bedrock consists of highly deformed and fractured limestone and dolomite of the Elbrook Formation. The Max Meadows Breccia is evident in outcroppings along the slope leading to the river. In the outcrop along the slope immediately south of SWMU 49, the tectonic breccia and the limestone and dolomite is highly weathered with many solution cavities.

Samples were collected during three previous investigations at this unit. Each of these investigations is summarized in the following sections.

1.4.2 Previous Investigations

1992 Verification Investigation (Dames & Moore). The VI was conducted in order to assess the presence of contaminants at this SWMU. To achieve this goal, a subsurface soil sample was collected and a soil gas survey was conducted. The sample locations and chemical exceedence results are depicted in **Figure 1.3-1**.

One subsurface soil sample was collected from 18-20 ft bgs from boring 48SB3 (Note: Sample prefixes were designated "48" during the Dames and Moore VI and the Parsons RFI because the exact locations of SWMUs 48 and 49 had not yet been ascertained) and analyzed for TAL metals, TCL VOCs, TCL SVOCs, and TCLP metals. A summary of detected analytes is presented in Table A-14. None of the analytes were reported at concentrations exceeding the industrial RBCs or TCLP metals criteria. Three metals, aluminum, iron and manganese, were detected at concentrations exceeding their respective residential RBCs. Field notes indicate that the sample exhibited a fuel-like odor.

A subsurface soil gas survey was performed in the vicinity of soil boring 48SB3 to further investigate apparent petroleum fuel contamination of soils. Eight soil gas samples, spaced on a 50-ft grid, were collected at a depth of 4 ft, and were analyzed for pentane/MTBE, benzene, toluene, ethylbenzene, and xylenes. Results of the soil gas survey indicated that concentrations of subsurface vapors for the above analytes were below detectable limits [1.0 parts per billion (ppb)] except for one sample that exhibited a total analyzed volatile concentration of 1.1 ppb, which was slightly above the detection limit.

The absence of detectable concentrations of volatile petroleum compounds during the soil gas survey correlated with the low concentrations of TCL VOCs detected in soil boring 48SB3.

1996 RCRA Facility Investigation (Parsons Engineering Science). A second investigation was conducted in this area by Parsons Engineering Science to further investigate the SWMU. The RFI also addressed the possible presence of explosive contamination. To support these objectives, the following investigation activities were performed:

- Collection of three surface soil samples to assess potential surface exposure routes, and
- Collection and analysis of two subsurface soil samples (deep and shallow) from each of the three well borings and one boring in the center of the SWMU to define the extent and boundaries of the area impacted by the former disposal activities.

Sampling locations and chemical exceedence results are presented in **Figure 1.3-1**.

Three surface soil samples were collected and analyzed for TAL metals, TCL SVOCs, and TPH. The results for detected metals are presented in Table A-15, and for organics in Table A-16. Arsenic was detected slightly above the industrial RBC of 3.8 mg/kg in sample 48SS6, with a reported concentration of 3.81 mg/kg. Arsenic exceeded the residential RBC in sample 48SS4 and chromium exceeded the residential RBC in sample 48SS5. SVOCs were detected at concentrations below the residential RBC. TPH was reported at a concentration of 335 mg/kg in sample 48SS5. No criterion is available for TPH.

Two subsurface samples were collected from each of four borings at the site and analyzed for SVOCs and TPH. In addition, the deep samples were analyzed for TOC. SVOCs were detected sporadically at concentrations below the residential RBC. TPH was detected at a concentration of 3,570 mg/kg in the shallow 48SB5 sample (17-19 ft bgs). TOC concentrations ranged from 1,209 mg/kg to 39,281 mg/kg. The results for detected analytes are presented in Table A-16.

1998 RCRA Facility Investigation (ICF KE). The 1998 RFI was performed to identify the level and extent of contamination and to confirm the analytical results obtained from previous investigations. Sample locations and chemical exceedence results are shown in **Figure 1.3-1**. Investigation activities included the collection of six subsurface soil samples from one soil boring (49SB1). Samples were collected at 10-ft intervals and analyzed for TAL metals, TCL VOCs (three of the samples were recollected for VOC analysis by the methanol preservation method at a later date), TCL SVOCs, PAHs, and explosives. The detected analytical results are presented in Table A-17 (metals), Table A-18 (organics), and Table A-19 (VOC methanol preservation).

Analytical results indicate that arsenic was the sole analyte to exceed the industrial RBC. Arsenic concentrations were greater than the industrial RBC of 3.8 mg/kg in three of the six samples and ranged from 3.8 mg/kg to 4.2 mg/kg. Aluminum, chromium, iron, manganese, thallium and vanadium were detected at concentrations between the residential and industrial RBC. One explosive compound, 2-amino-4,6-dinitrotoluene, was detected in the 8-10 ft bgs sample at a concentration of 0.6 mg/kg, exceeding the residential RBC of 0.47 mg/kg. This concentration is below the industrial RBC of 12 mg/kg. TCL VOCs (both collection methods) and SVOCs (primarily PAHs) were detected at concentrations below the residential RBC.

1.4.3 Conceptual Site Model

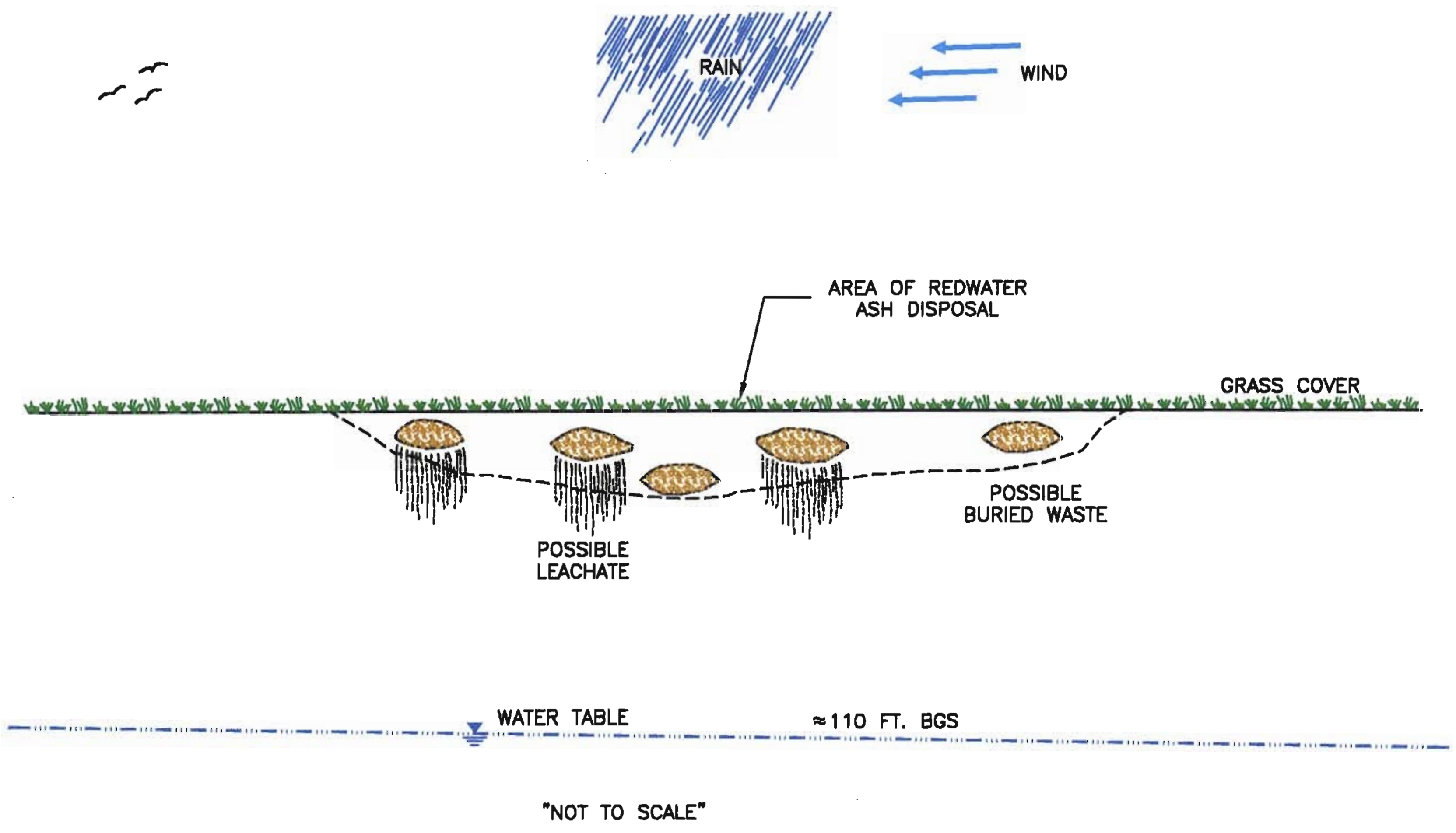
A conceptual site model for SWMU 49 is presented in **Figure 1.4-1**. Potentially affected media include surface and subsurface soil. Surface water and sediment are not present. SWMU 49 and the area surrounding the site are relatively flat. Precipitation is expected to infiltrate into the ground rather than flow overland to a surface water body. Site workers and terrestrial biota are considered receptors. **Table 1.4-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially impacted by the reported disposal of ten tons of redwater ash during the 1970s. Site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust.

Subsurface soil is also potentially contaminated by the disposal of redwater ash. Downward migration of leachate from the ash could result in contamination of the subsurface soil. Site workers would be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

1.4.4 Data Gap Analysis

TCL VOCs. Nine subsurface soil samples (including three re-collected samples by the methanol preservation method) were collected for TCL VOC analysis during the 1998 RFI (ICF KE, 1999). In subsurface



NOTE:

SEE TABLE 1.4-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-6-02

FILE: 1-4-2.DWG

RADFORD AAP

PREPARED BY: IT CORP.

CHECKED BY: MT

DATE: FEBRUARY 2002

TASK NO: 87040330100000

IT DWG NO: 1-4-2

FIGURE 1.4-1

CONCEPTUAL MODEL
SWMU 49
REDWATER ASH
BURIAL #2

Table 1.4-1
Potential Exposure Pathways and Receptors—SWMU 49

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comment
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.4-1 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

soil, TCL VOCs were detected during this investigation at concentrations below residential RBCs. Surface water and sediment are not present. Additional surface soil samples are proposed to complete the characterization for TCL VOCs. Therefore, TCL VOCs represent a data gap in the characterization of surface soil.

TCL SVOCs/PAHs. Six subsurface soil samples were collected for TCL SVOC/PAH analysis during the 1998 RFI (ICF KE, 1999). TCL SVOCs were detected during this investigation at concentrations below residential RBCs in subsurface soil. Additional surface soil samples are needed to complete characterization of this site. TCL SVOCs, including PAHs, are a data gap in the characterization of surface soil. PAHs were detected at low concentrations in the TCL SVOC analysis of subsurface soil during the 1998 RFI. In order to verify these concentrations and fill the surface soil data gap, PAH analysis will be performed on surface and subsurface soil samples. Elevated concentrations of TPH were detected in the sample from 17-19 ft bgs at boring location 48SB5. In order to verify this result, an additional sample is needed at the 17-19 ft depth interval at this SWMU.

TCL PCBs. TCL PCBs analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap in the characterization of surface soil and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment (at sites where present) in locations where these compounds would tend to accumulate.

Explosives. Six subsurface soil samples were collected for explosives analysis during the 1998 RFI (ICF KE, 1999). Explosives and explosive breakdown products were detected during this investigation. One explosive compound, 2-amino-4,6-dinitrotoluene, was detected above the residential RBC, but below the industrial RBC. Surface soil samples are needed to assess the concentrations of explosive compounds near ground surface. Explosives are a data gap in the characterization of surface soil.

TAL metals. TAL metals analysis was performed on six subsurface soil samples during the 1998 RFI. Results indicated that arsenic was present at concentrations greater than the industrial RBC. TAL metals are a data gap in the characterization of subsurface soil because the area of elevated TAL metals was not fully delineated during the previous investigations. Additional surface soil samples are also necessary to fully characterize the surface soil.

Dioxins/furans. Dioxins/furans are potential chemicals of concern because this site is associated with the disposal of ash. No samples for dioxins/furans analysis were collected during the previous investigations from available media (surface and subsurface soil). Therefore, dioxins/furans represent a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.4.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis are proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.3-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.4-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Table 1.4-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 49

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	49SS01	0–0.5 ft bgs	wooded area e. of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	49SB02A	0–0.5 ft bgs	e. of 48SB5	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	49SB02B	4–6 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans
	49SB02C	8–10 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans
	49SB02D	17-19 ft bgs	e. of 48SB5	TCL PCBs, PAHs, TAL metals, dioxins/furans, TPH, TOC, grain size, pH

Surface soil. Two surface soil samples will be collected from 0–0.5 ft bgs and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, and dioxins/furans. One sample (49SS01) will be located in the wooded area to the east of the site to investigate the possible horizontal migration of redwater ash-related contaminants. This sample will also be analyzed for TOC, grain size and pH. The second sample (49SB02A) will be collected from the east-central portion of the SWMU.

Subsurface soil. One soil boring (49SB02) will be advanced to a depth of 19 ft in the east-central portion of the SWMU. Two subsurface soil samples will be collected from this boring and analyzed for TCL PCBs, PAHs, TAL metals, and dioxins/furans. Samples will be collected from 4–6 ft (49SB02B) and 8–10 ft (49SB02C) to investigate possible downward migration of contaminants from the buried redwater ash. A third sample (49SB02D) will be collected from this boring at 17-19 ft bgs and analyzed for TPH, TOC, grain size and pH, in addition to TCL PCBs, PAHs, TAL metals and dioxins/furans. This sample will be collected at the same depth interval as previous sample 48SB5 (17-19), where elevated levels of TPH were previously reported.

1.5 SWMU 50–$CaSO_4$ TREATMENT/DISPOSAL AREA

1.5.1 Site Description

SWMU 50 is an open area south of SWMU 48, approximately 300 ft long by 300 ft wide (**Figure 1.3-1**). Based on a review of historical aerial photographs and an interview with plant personnel, it was concluded that the area was used for sludge disposal. Until 1982, this was the major disposal area at RFAAP for sludge removed from the calcium sulfate drying beds (SWMUs 35, 36, 37, 38, and Area Q). Due to its close proximity to SWMU 48, it is assumed that this unit exhibits similar subsurface and hydrogeologic characteristics.

Environmental sampling was conducted during one previous investigation at this unit. This investigation, the 1992 VI performed by Dames & Moore, is summarized in the following section.

1.5.2 Previous Investigations

1992 Verification Investigation (Dames & Moore). The 1992 VI was conducted to evaluate whether hazardous constituents were present at elevated concentrations at this SWMU. Two soil borings were advanced to a depth of 5 ft. One subsurface soil sample was collected from each boring and analyzed for TCLP metals, TCL VOCs, and TCL SVOCs. Sample locations and chemical exceedence results are presented on **Figure 1.3-1.**

TCL VOCs and SVOCs were detected in the northern sample (50SL1) at concentrations below residential RBCs. TCLP metals analysis indicated that arsenic, barium, chromium, and lead were reported at detectable concentrations, but concentrations were below TCLP Regulatory Limits (TCLPRL). Analytical results for these samples are presented in Table A-20.

1.5.3 Conceptual Site Model

A conceptual site model for SWMU 50 is presented in **Figure 1.5-1**. Potentially affected media include surface and subsurface soil. Surface water and sediment are not present. The area surrounding SWMU 50 is relatively flat, suggesting that precipitation will infiltrate into the ground rather than flow overland to a surface water body. Site workers and terrestrial biota are considered receptors. **Table 1.5-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

The dumping of $CaSO_4$ sludge prior to 1982 potentially contaminated surface soil. Site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust.

Subsurface soil is also potentially contaminated by the treatment and disposal activities. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

1.5.4 Data Gap Analysis

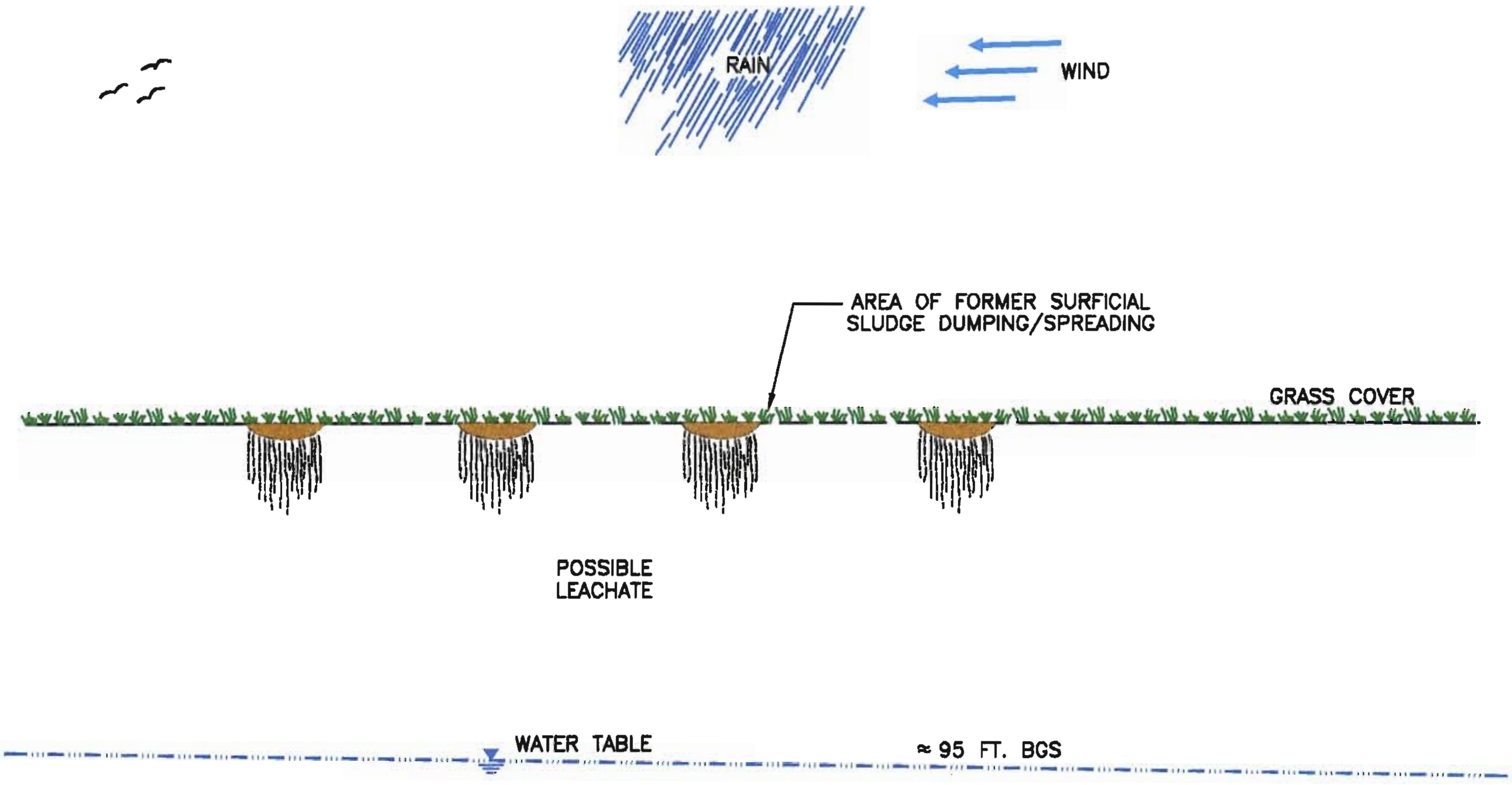
TCL VOCs. Two subsurface soil samples were collected for TCL VOC analysis during the Dames & Moore 1992 VI. Two TCL VOCs (1,1,1-trichloroethane and chloroform) were detected during this investigation at concentrations below the residential RBCs. Surface soil samples were not collected for TCL VOC analysis. Surface soil samples and additional subsurface soil samples will be collected for TCL VOC analysis to verify and supplement these results. TCL VOCs represent a data gap in the characterization of surface soil and subsurface soil.

TCL SVOCs/PAHs. Two subsurface soil samples were collected for TCL SVOC analysis during the Dames & Moore 1992 VI. TCL SVOCs, including PAHs, were detected during this investigation at concentrations below the residential soil RBC level in both samples. Samples were not collected for TCL SVOC analysis from surface soil. Both surface and subsurface soil samples will be collected for TCL SVOC and PAH analysis to complete characterization of this site. TCL SVOCs and PAHs represent a data gap in the characterization of surface soil and subsurface soil.

Table 1.5-1
Potential Exposure Pathways and Receptors—SWMU 50

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.5-1 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.5-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-6-02

FILE: 1-5-2.DWG

RADFORD AAP		FIGURE 1.5-1
PREPARED BY: IT CORP.	TASK NO: 67040330100000	CONCEPTUAL MODEL SWMU 50 CaSO4 TREATMENT/ DISPOSAL AREA
CHECKED BY: MT	IT DWG NO: 1-5-2	
DATE: JANUARY 2002		

TCL PCBs. TCL PCBs analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap in the characterization of surface soil and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Samples were not collected for explosives analysis during the previous investigation. Therefore, explosives represent a data gap.

TAL metals. Two subsurface soil samples were analyzed for TCLP metals during the Dames & Moore VI. Soils have not been tested for TAL metals. Metals are considered a data gap for surface and subsurface soil.

Dioxins/furans. Dioxins/furans are not considered a data gap because SWMU 50 was not used for burning or storage/disposal of burned waste.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.5.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented on **Figure 1.3-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.5-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Table 1.5-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 50

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	50SS01	0–0.5 ft bgs	n. edge of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size, pH
	50SS02	0–0.5 ft bgs	w. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SS03	0–0.5 ft bgs	s. edge of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals
	50SB04A	0–0.5 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05A	0–0.5 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
Subsurface Soil	50SB04B	4–6 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB04C	8–10 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05B	4–6 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	50SB05C	8–10 ft bgs	e. edge of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals

Surface soil. Five surface soil samples will be collected and analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives and TAL metals. Four samples (50SS01, 50SS02, 50SS03, and 50SB05) will be collected from the perimeter of the disposal area to assess the extent of disposal activities. One additional sample (50SB04A) will be collected from the 0–0.5-ft interval of the soil boring located within the disposal area. Two of these samples (50SS01 and 50SS03) will also be analyzed for TCL pesticides and herbicides to assess this site for these compounds. 50SS01 will be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in soil.

Subsurface soil. Two soil borings (50SB04 and 50SB05) will be located in the disposal area to characterize the subsurface soil. Two samples will be collected from each boring (for a total of four samples) at 4–6 and 8–10 ft bgs to define the extent of vertical migration of constituents from disposal activities. These samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives and TAL metals. PAHs will be investigated due to the presence of these compounds at low concentrations during the VI.

1.6 SWMU 58–RUBBLE PILE

1.6.1 Site Description

SWMU 58, the Rubble Pile, is approximately 50 ft high and roughly triangular in shape with each side approximately 300 ft long (**Figure 1.6-1**). According to facility representatives interviewed during the March 1990 facility visit, SWMU 58 was used as a one-time disposal site in 1979. During clearing activities prior to the construction of the Continuous Automated Multi-Base Line (CAMBL), pine trees and surface debris were pushed into a pile and then covered with dirt and fill material. It was believed that no other materials were disposed of at SWMU 58.

SWMU 58 is located in the south-central portion of the Horseshoe Area, east of the main bridge over the New River and directly west of SWMU 32 (Inert Waste Landfill No. 1) (**Figure 1.1-1**). It is located along the lower portion of the plateau at approximately 1,740 ft msl. Topography in the area of SWMU 58 is moderately sloping towards the north. There are several buildings, an overhead steam pipe, and gravel and paved roads in the vicinity. Surface water appears to flow in each direction from the debris pile at SWMU 58. Runoff is expected to flow northward following topography and infiltrate into the ground.

Subsurface soil conditions were characterized during the 1998 RFI. The subsurface consisted of varying quantities of fill material (bottom ash, coal, concrete) and silt, sand, gravel, and clay overlying carbonate bedrock. Depth to bedrock ranged from 22.5 ft to 59 ft bgs. Bedrock consisted of gray limestone and dolostone of the Elbrook Formation.

Two previous investigations that involved the collection of samples have been conducted at the Rubble Pile. These investigations are summarized in the following sections.

1.6.2 Previous Investigations

1992 Verification Investigation (Dames & Moore). The VI field program included the collection and analysis of three surface soil samples for TAL metals, TCL VOCs, and TCL SVOCs. Sampling locations and chemical exceedence results are shown in **Figure 1.6-1**. Samples were collected from beneath the cover material along the edges of the Rubble Pile at a depth of 0–1 ft. Detected analytical results are presented in Table A-21.

A total of 19 TAL metals were detected in the samples. Arsenic, however, was the sole analyte to exceed industrial RBCs. Arsenic concentrations were greater than the industrial RBC of 3.8 mg/kg in the three samples, with reported concentrations ranging from 3.8 mg/kg to 7 mg/kg. Aluminum, chromium, iron, manganese and thallium were detected at concentrations greater than the residential RBC, but below the industrial RBC. TCL VOCs and TCL SVOCs were not detected in the soil samples, with the exception of trace levels of TCL SVOC TICs.

1998 RCRA Facility Investigation (ICF KE). Five subsurface soil samples were collected from three soil borings (58SB1, 58SB2, and 58SB3) to assess the vertical extent of constituents detected during the previous investigation. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, and PAHs. Detected analytical results for metals are presented in Table A-22, and for organics in Table A-23. One sample, 58SB1A, was re-analyzed for VOCs using the methanol preservation collection method. Results were similar for the two methods.

Arsenic was reported at concentrations exceeding its industrial RBC. Arsenic concentrations ranged from 5 to 12.6 mg/kg, exceeding the industrial RBC of 3.8 mg/kg in the five samples. Aluminum, chromium, iron, manganese, thallium and vanadium were detected at concentrations greater than the residential RBC, but below industrial RBCs in the samples. One organic compound, benzo[*a*]pyrene, was also detected above the residential RBC, but below the industrial RBC in sample 58SB1A, at a depth of 15–17 ft bgs. Two TCL VOCs were reported at concentrations below residential RBCs.

1.6.3 Conceptual Site Model

A conceptual site model for SWMU 58 is presented in **Figure 1.6-2**. Potentially affected media include surface soil and subsurface soil. Surface water and sediment are not present. The area surrounding the Rubble Pile slopes gently to the north. Precipitation appears to flow radially outward in each direction from the Rubble Pile. There are no proximate surface water bodies. Consequently, runoff is expected to infiltrate into the ground before arriving at a surface water body. **Table 1.6-1** presents the exposure pathways for each receptor. Site workers and terrestrial biota are considered receptors. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially impacted by disposal activities. Site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of ash or dust. Subsurface soil is also potentially impacted by disposal activities. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

1.6.4 Data Gap Analysis

TCL VOCs. Three surface soil (collected as part of the 1992 VI) and six subsurface soil samples (collected as part of the 1998 RFI) were analyzed for TCL VOCs. Results indicated that two TCL VOCs (*cis*-1,2-dichloroethene and TCE) were present at detectable concentrations in four of the six subsurface soil samples, but were well below the RBC values for residential soils. TCL VOCs are a data gap in the surface and subsurface soil due to the incomplete delineation of these media during previous investigations.

TCL SVOCs/PAHs. TCL SVOC analysis was performed on three surface soil and five subsurface soil samples during previous investigations. Results indicated that one PAH, benzo[*a*]pyrene, was detected at a concentration greater than its residential RBC value in one subsurface soil sample. The soil has not been adequately characterized, therefore, TCL SVOCs are a data gap in the characterization of this site. To further characterize the subsurface, samples will be collected for PAH analysis to refine the understanding of the distribution of PAHs in the soil.

TCL PCBs. TCL PCBs analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap in the characterization of surface soil and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Samples were not analyzed for explosives during the previous investigations. Therefore, explosives represent a data gap in the characterization of available media (surface and subsurface soil).

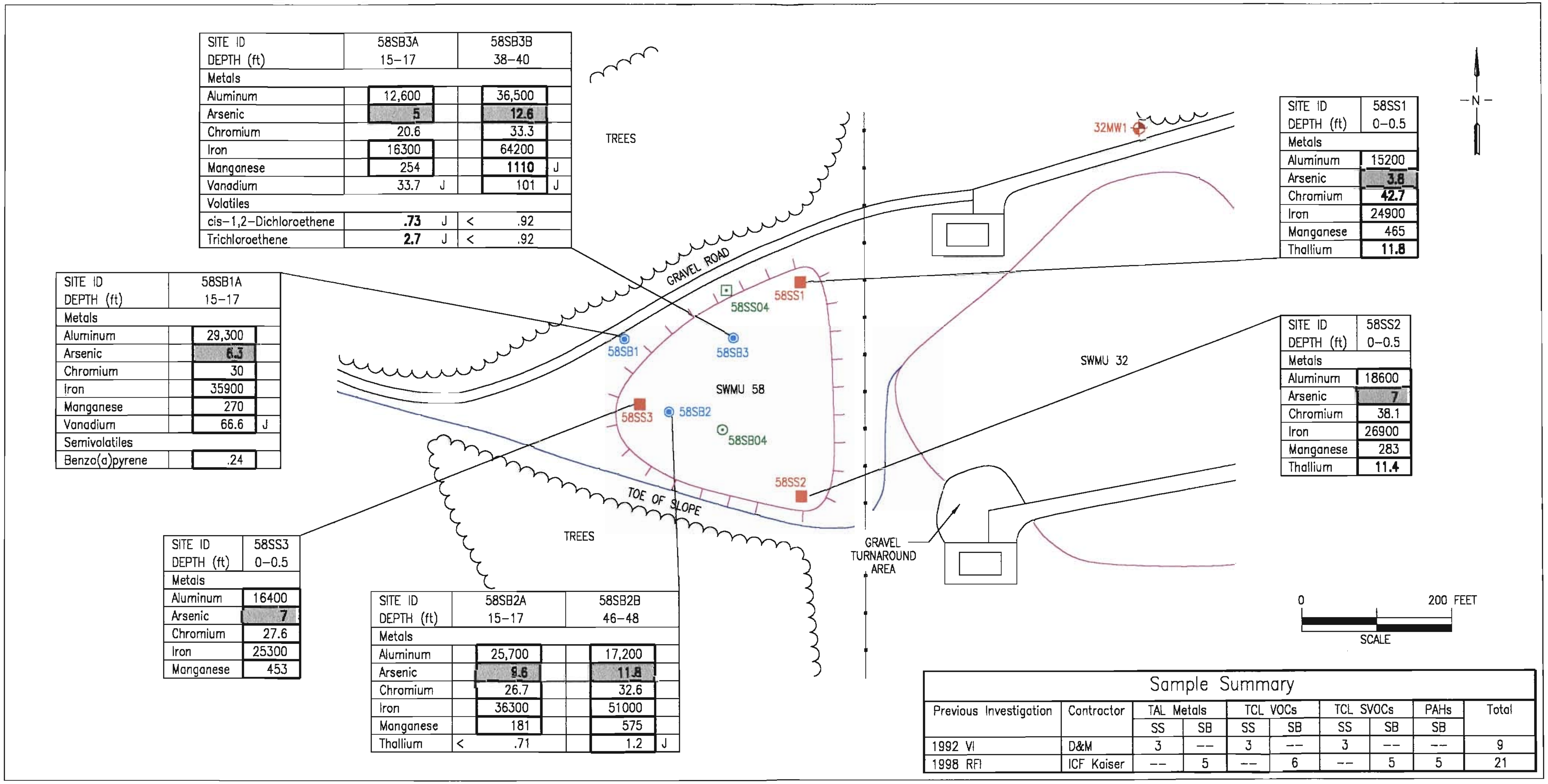
TAL metals. Metals analysis was performed on five subsurface soil samples during the 1998 RFI. Results indicated that arsenic concentrations exceeded the industrial RBC in the five samples. Chromium and iron concentrations were greater than residential RBC values in four of the five samples. Adequate characterization will require the collection of additional samples from surface soil and subsurface soil.

Dioxins/furans. The fill material encountered in borings advanced during the 1998 RFI contained bottom ash, indicating that burned materials were disposed at this site. Samples were not analyzed for dioxins/furans during previous investigations. Therefore, dioxins/furans are a data gap for surface and subsurface soil at the Rubble Pile.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.6.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.6-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.6-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:



SITE ID DEPTH (ft)	58SB3A 15–17		58SB3B 38–40	
Metals				
Aluminum	12,600		36,500	
Arsenic	**5**		**12.6**	
Chromium	20.6		33.3	
Iron	16300		64200	
Manganese	254		**1110**	J
Vanadium	33.7	J	101	J
Volatiles				
cis–1,2–Dichloroethene	**.73**	J	< .92	
Trichloroethene	**2.7**	J	< .92	

SITE ID DEPTH (ft)	58SB1A 15–17	
Metals		
Aluminum	29,300	
Arsenic	6.3	
Chromium	30	
Iron	35900	
Manganese	270	
Vanadium	66.6	J
Semivolatiles		
Benzo(a)pyrene	.24	

SITE ID DEPTH (ft)	58SS1 0–0.5
Metals	
Aluminum	15200
Arsenic	**3.8**
Chromium	**42.7**
Iron	24900
Manganese	465
Thallium	**11.8**

SITE ID DEPTH (ft)	58SS2 0–0.5
Metals	
Aluminum	18600
Arsenic	7
Chromium	38.1
Iron	26900
Manganese	283
Thallium	**11.4**

SITE ID DEPTH (ft)	58SS3 0–0.5
Metals	
Aluminum	16400
Arsenic	7
Chromium	27.6
Iron	25300
Manganese	453

SITE ID DEPTH (ft)	58SB2A 15–17		58SB2B 46–48	
Metals				
Aluminum	25,700		17,200	
Arsenic	9.6		11.8	
Chromium	26.7		32.6	
Iron	36300		51000	
Manganese	181		575	
Thallium	< .71		1.2	J

Sample Summary

Previous Investigation	Contractor	TAL Metals		TCL VOCs		TCL SVOCs		PAHs	Total
		SS	SB	SS	SB	SS	SB	SB	
1992 VI	D&M	3	--	3	--	3	--	--	9
1998 RFI	ICF Kaiser	--	5	--	6	--	5	5	21

LEGEND:

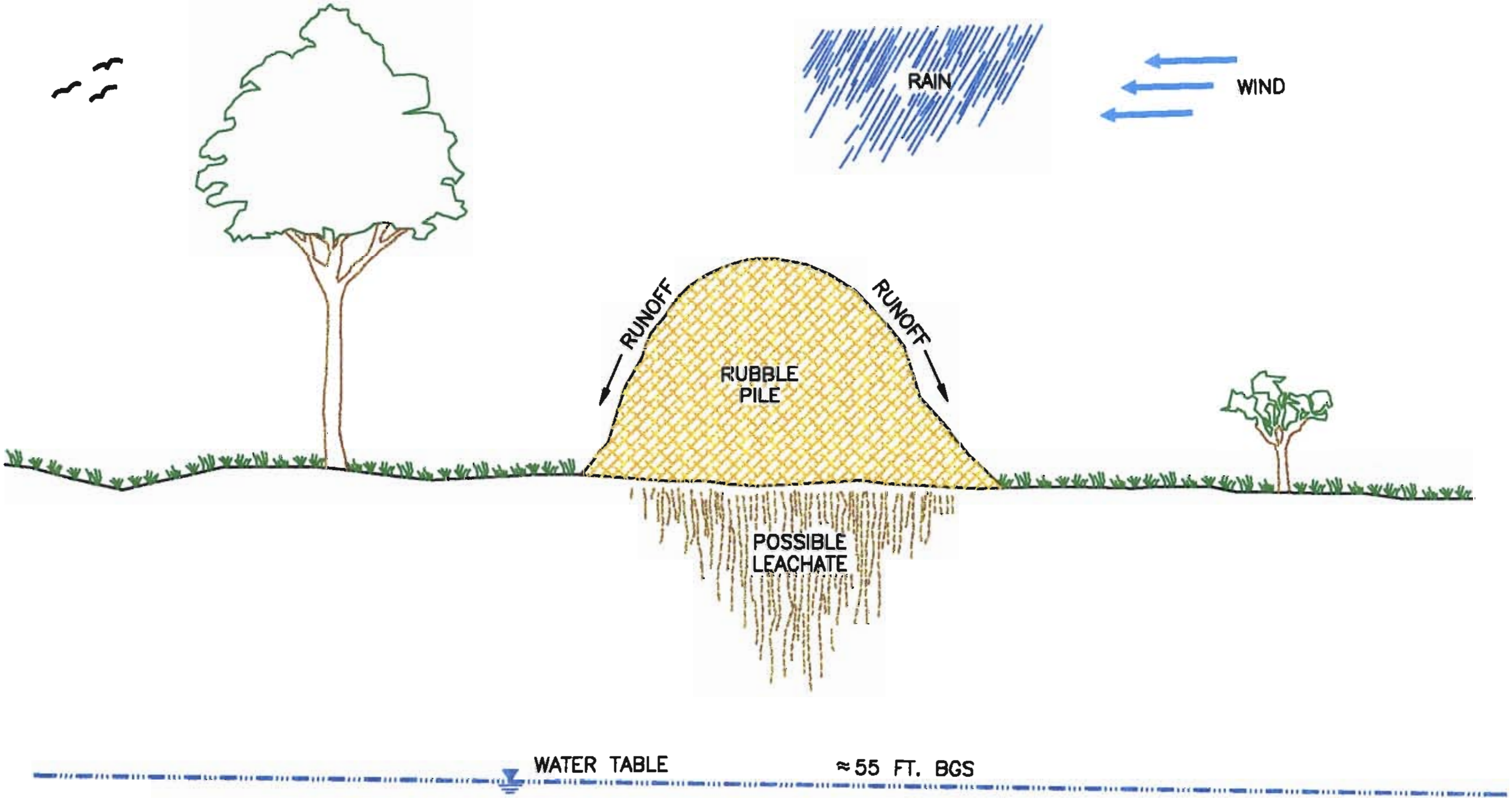
◉	1998 RFI SOIL BORING (ICF KAISER)
⌖	1992 VI MONITORING WELL (DAMES & MOORE)
■	1992 VI SURFACE SOIL SAMPLE (DAMES & MOORE)
–•–•–	OVERHEAD PIPELINE
—	SWMU BOUNDARIES
⊙	PROPOSED SOIL BORING LOCATION
⊡	PROPOSED SURFACE SOIL LOCATION

NOTE:

ALL UNITS IN MG/KG
J = ESTIMATED CONCENTRATION
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION
METALS REFERS TO TAL METALS

FILE: 1–6–1XLS.DWG PLOT: 2–6–02

RADFORD AAP		FIGURE 1.6–1
PREPARED BY: IT CORP.	TASK NO: 87040330100000	SWMU 58 PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS
CHECKED BY: MT	IT DWG NO: 1–6–1XLS.DWG	
DATE: NOVEMBER 2001		



"NOT TO SCALE"

PLOTTED: 2-7-02

FILE: 1-6-2.DWG

NOTE:

SEE TABLE 1.6-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

RADFORD AAP		FIGURE 1.6-2
PREPARED BY: IT CORP.	TASK NO: 87040330100000	CONCEPTUAL MODEL SWMU 58 RUBBLE PILE
CHECKED BY: TL	IT DWG NO: 1-6-2	
DATE: FEBRUARY 2002		

Table 1.6-1
Potential Exposure Pathways and Receptors—SWMU 58

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.6-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

22

Surface soil. Two surface soil samples will be collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, explosives, TAL metals and dioxins/furans. One sample (58SS04) will be collected at the northern toe of the pile in a likely drainage pathway. This sample will be used to identify constituents that may be migrating from the Rubble Pile through overland flow pathways. The second sample (58SB04A) will be collected from the 0–0.5-ft interval of a soil boring, located on top of the Rubble Pile. This sample will characterize the soil deposited in the pile and will also be analyzed for TOC, grain size and pH.

Subsurface soil. Three subsurface soil samples will be collected from a soil boring advanced through the Rubble Pile. The first sample (58SB04B) will be collected immediately below the contact between rubble material and native soil. This sample will be analyzed for TOC, grain size and pH to assess the native material below the rubble pile. Samples will also be collected at 2–4 ft (58SB04C) and 4–6 ft (58SB04D) below the contact to assess the vertical migration of constituents from the Rubble Pile. These three samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, TAL metals and dioxins/furans. These subsurface soil samples should provide adequate vertical delineation of TCL VOCs (TCE, *cis*-1,2-dichloroethene) detected during the 1998 RFI.

Table 1.6-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 58

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Soil	58SS04	0–0.5 ft bgs	n. toe of pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	58SB04A	0–0.5 ft bgs	on top of Rubble pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
Subsurface Soil	58SB04B	Immediately below contact with native soil	at base (through) Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	58SB04C	2 ft below "B" interval	below Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	58SB04D	4 ft below "B" interval	below Rubble Pile	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans

1.7 SWMU 59–BOTTOM ASH PILE

1.7.1 Site Description

SWMU 59, the Bottom Ash Pile, is located near SWMUs 48 and 50 in the Horseshoe Area of RFAAP, east of the main bridge over the New River (**Figure 1.1-1**). SWMU 59 is located on a plateau area of the eastern portion of the Horseshoe Area. The elevation of SWMU 59 is approximately 1,810–1,820 ft msl, gently sloping to the south. Further south, the hillside steeply slopes south towards the New River, which is approximately 500 ft south of the SWMU. SWMU 59 is surrounded by SWMUs 48, 49 and 50. SWMU 49 is approximately 50 ft south of SWMU 59.

Bottom ash is permitted to be buried in landfills on the Installation [in particular, Former Ash Landfill (FAL) No. 2]. Some bottom ash is apparently stored in piles around RFAAP for use on roadbeds and as landfill cover material (USEPA, 1987). It can be assumed that this pile or similar piles have existed at RFAAP since operation of the coal-fueled power plant began. The bottom ash pile is no longer visible at the site.

Although a subsurface investigation has not been performed at SWMU 59, its close proximity to SWMU 48 suggests that geologic conditions are similar. Surface water appears to flow south and southwest and infiltrates into the ground. There are no manholes, catch basins, or storm drains located in the immediate vicinity.

In 1992, Dames & Moore conducted a VI at SWMU 59. This investigation was the sole sampling event to take place at the Bottom Ash Pile. The VI is summarized in the following section.

1.7.2 Previous Investigation

1992 Verification Investigation (Dames & Moore). Sampling was conducted at this unit to evaluate whether soil contamination exists beneath the ash pile area. Two soil samples and one duplicate sample were collected at SWMU 59 at a depth of 0–1 ft bgs. Each sample was analyzed for TAL metals and TCL SVOCs. Analytical results are presented in Table A-24. Arsenic was reported at a concentration greater than the industrial RBC of 3.8 mg/kg at 59SS2 (34 mg/kg; 40 mg/kg in duplicate). Aluminum, iron and manganese were detected at concentrations greater than the residential RBC, but below the industrial RBC. Sampling locations and chemical exceedence results are presented on **Figure 1.3-1**. One SVOC, phenanthrene, was detected at a concentration of 0.4 mg/kg. No RBC values are available for this compound. The source of this compound may be due to runoff from the nearby asphalt road rather than the bottom ash pile. The presence of elevated levels of arsenic was established during this investigation. The vertical and horizontal extent and the source area, however, were not established.

1.7.3 Conceptual Site Model

A conceptual site model for SWMU 59 is presented in **Figure 1.7-1**. Potentially affected media include surface and subsurface soil. Surface water and sediment are not present. The area of the former ash pile slopes gently to the south and is primarily grassy, with a wooded area to the south. Although the area slopes slightly, precipitation is expected to infiltrate into the ground. Site workers and terrestrial biota are considered receptors. **Table 1.7-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially contaminated by the storage of bottom ash generated at the coal-fired power plant. Site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of ash or dust.

Subsurface soil is also potentially contaminated by the disposal of bottom ash. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

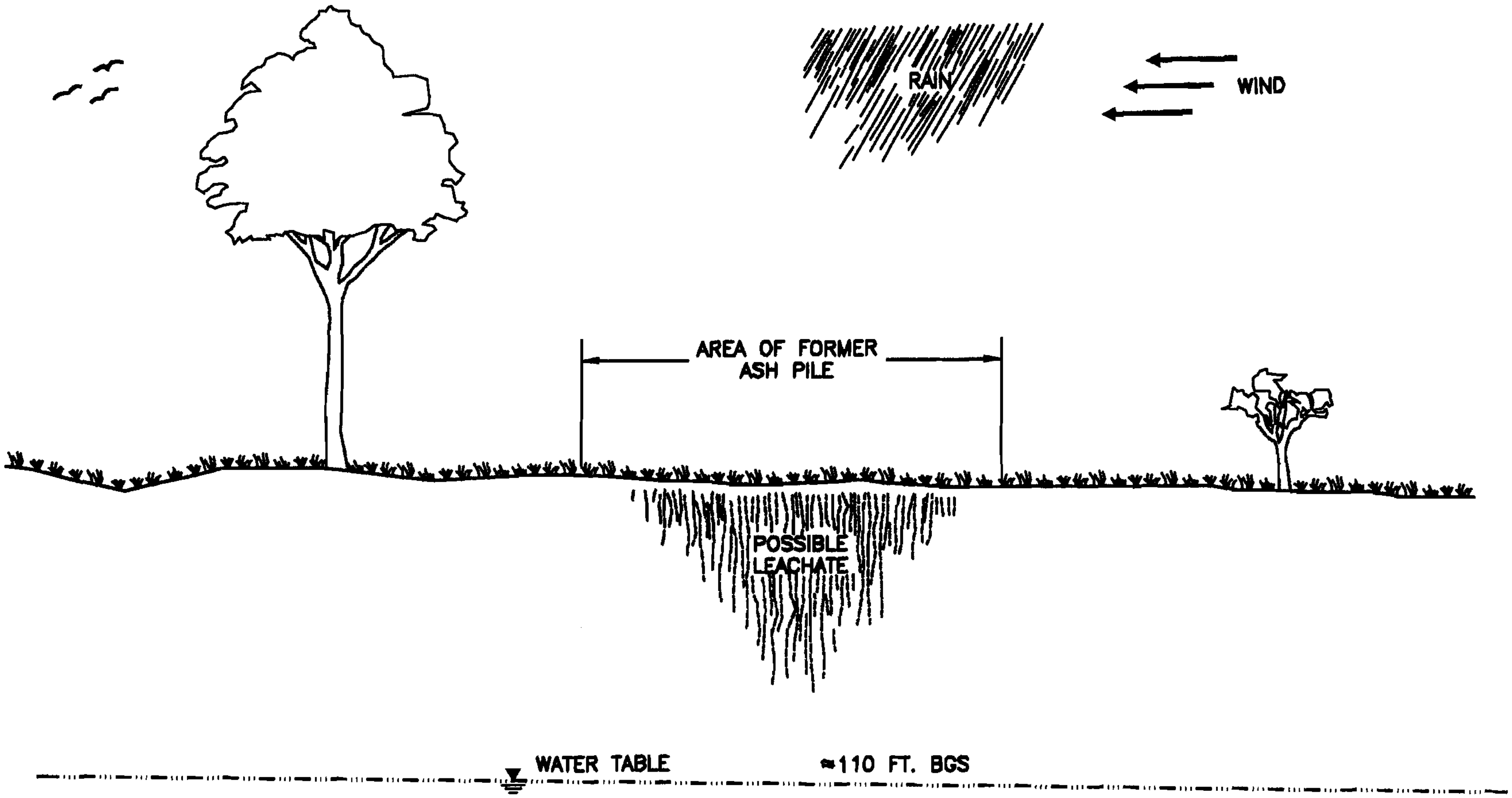
1.7.4 Data Gap Analysis

TCL VOCs. Samples were not collected for TCL VOC analysis during the previous investigation (1992 VI). TCL VOCs, therefore, represent a data gap for surface and subsurface soil.

Table 1.7-1
Potential Exposure Pathways and Receptors—SWMU 59

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.7-1 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.7-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

RADFORD AAP		FIGURE 1.7-1
PREPARED BY: IT CORP.	TASK NO: [illegible]	CONCEPTUAL MODEL SWMU 59 BOTTOM ASH PILE
CHECKED BY: MT	IT DWG NO: 1-7-2	
DATE: JANUARY 2002		

PLOTTED: 2-8-02

FILE: 1-7-2.DWG

TCL SVOCs/PAHs. Two surface soil samples were collected during the 1992 VI for TCL SVOC analysis. Investigation results indicated that low levels of phenanthrene were present in one of the samples. Additional samples were not collected to verify or delineate this surface soil detection. Subsurface soil has not been tested for TCL SVOCs. TCL SVOCs and PAHs represent a data gap in the characterization of subsurface soil and the extent of SVOCs in surface soil has not been delineated. Samples from surface and subsurface soil will, therefore, be analyzed for SVOCs and PAHs.

TCL PCBs. TCL PCB analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap in the characterization of surface and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Samples were not analyzed for explosives during the previous investigation. Therefore, explosives represent a data gap in the characterization of available media.

TAL metals. During the 1992 VI, two surface soil samples were collected and analyzed for TAL metals. Subsurface soil has not been characterized. Results from the VI indicated that arsenic was present at levels greater than the industrial RBC in the samples. TAL metals represent a data gap because there were elevated levels of TAL metals not delineated in the surface soil, and because subsurface soil was not analyzed.

Dioxins/furans. Dioxins/furans are a potential concern because SWMU 59 is associated with the disposal of ash. No samples were collected for dioxins/furans analysis during the previous investigation. Therefore, dioxins/furans represent a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.7.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.3-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.7-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Table 1.7-2
Site-Specific Proposed Sampling and Analysis Plan—SWMU 59

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	59SS03	0–0.5 ft bgs	n. of suspected pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	59SS04	0–0.5 ft bgs	w. of 59SS2	TAL metals
	59SS05	0–0.5 ft bgs	s. of suspected pile	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	59SB01A	0–0.5 ft bgs	center of site	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
Subsurface Soil	59SB01B	4–6 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	59SB01C	8–10 ft bgs	center of site	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans

Surface soil. Three surface soil samples (59SS03, 59SS05 and 59SB01A) will be collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, and dioxins/furans. One of these samples (59SB01A) will be collected from the 0–0.5 ft interval of a soil boring to be advanced near the center of the site. Surface soil samples 59SS03 and 59SS05 will be collected from the north and south end of the suspected pile area to characterize the soil in these areas. A fourth sample (59SS04) will be collected to the west of previous sample location 59SS2 and analyzed for TAL metals to assess the extent of elevated arsenic in surface soil. Sample 59SS03 will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in soil.

Subsurface soil. One soil boring will be advanced to a depth of 10 ft near the center of the site. Two subsurface soil samples (59SB01B and 59SB01C) will be collected from this boring. One sample will be collected from 4–6 ft bgs and the second sample will be collected from 8–10 ft bgs. Samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, TAL metals and dioxins/furans.

1.8 AOC–FORMER LEAD FURNACE AREA

1.8.1 Site Description

During World War II a lead furnace was in operation in the southeastern portion of SWMU 17A (Stage and Burn Area), which is located in the south-central portion of the MMA (**Figure 1-1.1**). Typically, lead recovered during routine operations at RFAAP would be melted in the furnace and cast into ingots for salvage. The former furnace was located at the foot of a steeply sloping hillside in a depression formed by a sinkhole. Based on the occurrence of lead slag, lead was probably off-loaded on the rim of the depression with the lead smelter at the bottom of the slope. The elevation of the area is approximately 1,875 ft msl. The location of removed waste oil tanks (SWMU 76) is upslope to the east of the FLFA at an elevation of 1,895 ft msl. Buildings 7219 and 534 are to the south. There are paved and gravel roads in the vicinity.

Subsurface soil investigations have shown that the bedrock surface is variable and consists of broken and weathered limestone. Unconsolidated soil above bedrock consists of surficial fill material. Based on topography, surface water in the area of the FLFA would flow from the surrounding hillsides and collect in the areas of lower elevations of SWMU 17A. This water runoff would probably percolate into the surface and enter the water table. According to RFAAP utility maps, there are no manholes, catch basins or storm drains in the vicinity of the FLFA.

It is not known precisely how long the lead furnace was in operation, but available maps of RFAAP, dated 1968 to 1988, show the location of the lead furnace. The location has apparently been used for various activities and is listed in the RFAAP 1989 RCRA Permit as a waste oil and transfer location area (SWMU 76). The FLFA was not identified in the RFA and was not included in the RCRA Permit, but was added to the VI by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) in response to conditions uncovered when waste oil tanks at SWMU 76 were removed in 1991. Solid lead slag was observed in the soil around and below the tanks, with soil samples containing high lead concentrations.

In response to the discovery of lead slag at the site, USATHAMA added an exploratory program to the 1992 VI consisting of three borings. Borings were to be advanced to a depth of 10 ft or refusal with the collection of two soil samples from each boring. An RFI was conducted in 1998 in response to the findings of the VI, which indicated high concentrations of lead in soil in the vicinity of the FLFA. Investigative activities during the RFI included: subsurface soil sampling; structure, debris and investigative derived material disposal; and site restoration. Each of these two previous investigations is described in more detail in the following sections.

1.8.2 Previous Investigations

1992 Verification Investigation (Dames & Moore). The VI program included the collection of six soil samples from three soil borings and the performance of a BRA. Samples were obtained at two discrete intervals and at depths no greater than 10 ft bgs. The soil samples were analyzed for TAL metals and TCLP metals. Detected analytical results are presented in Table A-25. Sample results indicated that concentrations of antimony, arsenic, lead, mercury, and thallium exceeded industrial RBCs. Antimony, lead and mercury exceeded their respective industrial RBCs of 82 mg/kg, 750 mg/kg and 61 mg/kg in one sample [17SB2 (7.5-10 ft bgs)], with reported concentrations of 249 mg/kg (antimony) and 100,000 mg/kg (lead) and 64 mg/kg (mercury). The TCLP concentration for lead in this sample also exceeded the TCLPRL (5,000 ug/L) by a factor of 100. The TCLP results demonstrated that lead was mobilized at a high concentration and may have impacted underlying soil or groundwater at the site. Thallium exceeded its industrial RBC in four of the six samples, with a maximum reported concentration of 96.7 mg/kg. Arsenic exceeded the industrial RBC (3.8 mg/kg) in three of the six samples. Aluminum, chromium, copper, iron and manganese were detected at levels between the residential and industrial RBCs. Sampling locations and chemical exceedence results are presented on **Figure 1.8-1**.

Dames and Moore also conducted a BRA at this AOC during the VI. The VI Report stated that workers do not frequently enter the area; however, burn activities occur approximately once per week. Due to the nature of operations conducted in this area, the dust inhalation pathway was considered to be the most viable and significant exposure pathway; exposure via incidental ingestion and dermal absorption was expected to be low. Lead exposure to site workers via inhalation was expected to be moderate to high because of the high lead concentrations assumed to be present in the surface soil.

Conclusions from the BRA indicated that because this site is located in a sinkhole at the bottom of a steep hill, it is unlikely that environmental receptors frequent this area. Therefore, potential exposure to environmental receptors was estimated to be low.

1998 RCRA Facility Investigation (ICF KE). The RFI was conducted to delineate the lead-impacted soil attributable to FLFA historical operations. The investigation consisted of the following elements:

- Collection and field screening of subsurface soil samples,
- Collection, analysis, and confirmatory off-site analysis of subsurface soil samples, and
- Site restoration activities to complement the natural terrain and local flora and fauna of the surrounding area.

Twelve preliminary subsurface soil samples were collected to delineate lead concentrations exceeding 200 mg/kg (the RFAAP lead action level at that time), as directed by USEPA in 1998. Analytical results are presented in Table A-26a. Sample results indicated that lead concentrations exceeded 200 mg/kg in three of the twelve samples. Results also indicated that lead contamination was limited to 0–2 ft bgs, with the exception of LFSB5A (4–6 ft bgs). The structures, debris, and lead soil concentrations in excess of 200 mg/kg attributable to the FLFA were excavated and disposed of in accordance with state and federal regulations.

Eight post-excavation subsurface soil samples were collected and analyzed for lead content by a laboratory to verify that the lower limit of soil with lead concentration in excess of 200 mg/kg had been identified. Analytical results are presented in Table A-26b. Sample results indicated that lead was present at a concentration in excess of 200 mg/kg in one sample (LFTP8; lead concentration = 866 mg/kg), collected from the north wall of the test pit.

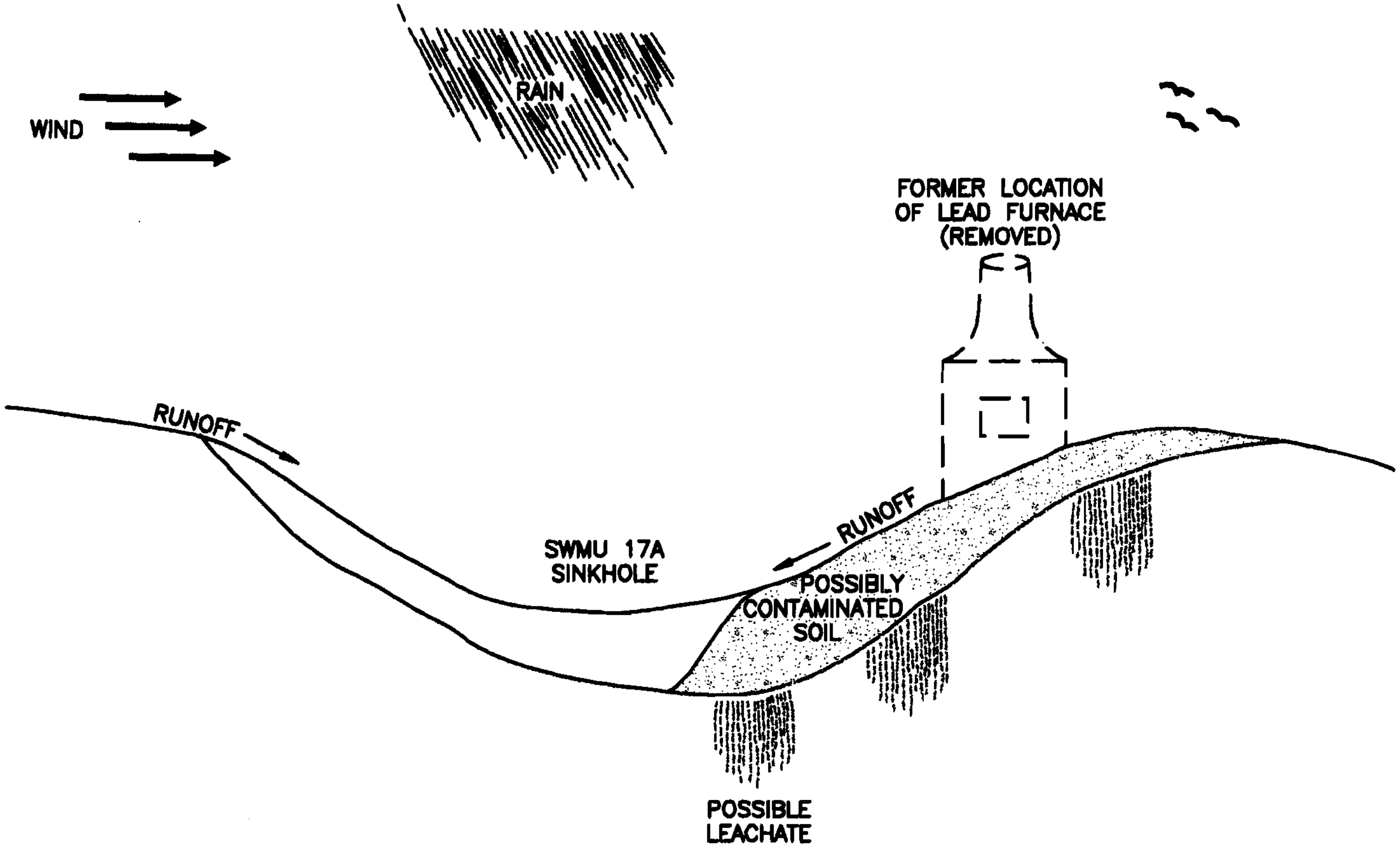
To delineate the extent of elevated lead in soil north of the test pit, five shallow soil samples were collected from four borings (LFSB08 - LFSB11) and analyzed for lead content. Analytical results are presented in Table A-26c. Sample results indicated that lead concentrations were detected in excess of 200 mg/kg in two out of five samples. The sample collected closest to the test pit (LFSB08) had a lead concentration of 86.9 mg/kg. Lead concentration increased northward to LFSB10, indicating that this area of lead is not contiguous with the lead-containing soil in the test pit. Two samples were collected from boring LFSB10. A surface soil sample (0.5-1 ft bgs) had a reported lead concentration of 279 mg/kg. A deeper sample was collected from 2-2.5 ft bgs. This sample had a lead concentration of 326 mg/kg. The lead concentration in these samples, however, was below the residential RBC of 400 mg/kg. Sample locations are presented in **Figures 1.8-1** and **1.8-2**. **Figure 1.8-1** presents the sample locations and results present prior to the excavation of the test pit. **Figure 1.8-2** presents sample locations and results for soil that is still present at the site.

1.8.3 Conceptual Site Model

A conceptual site model for the FLFA is presented in **Figure 1.8-3**. Potentially affected media include surface and subsurface soil. The FLFA is located in a steeply sloping depression formed by a sinkhole. Based on the occurrence of lead slag, lead was most likely off-loaded at the rim of the sinkhole and transported to the furnace located at the bottom of the depression. Precipitation is expected to flow down the hill sides of the depression towards the FLFA and infiltrate into the ground. Site workers and terrestrial biota are considered receptors. **Table 1.8-1** presents the exposure pathways for each receptor. The exposures pathways associated with each media type are described in more detail in the following paragraphs.

Surface soil was impacted by operations at the lead furnace. In 1998, this pathway was mitigated by an expanded sampling effort. Confirmatory sampling indicated that there was at least one remaining area of soil with an elevated lead concentration. The presence of lead in soil beyond the limits of the FLFA indicate that site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with impacted soil, and the inhalation of ash or dust.

Subsurface soil is also potentially impacted by the lead smelting operations. TCLP metals analysis during the 1992 VI indicated that leachable lead concentrations were up to 100 times greater than the TCLP regulatory levels. Leachable TAL metals are mobile in the environment and would negatively impact the subsurface soil. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.



"NOT TO SCALE"

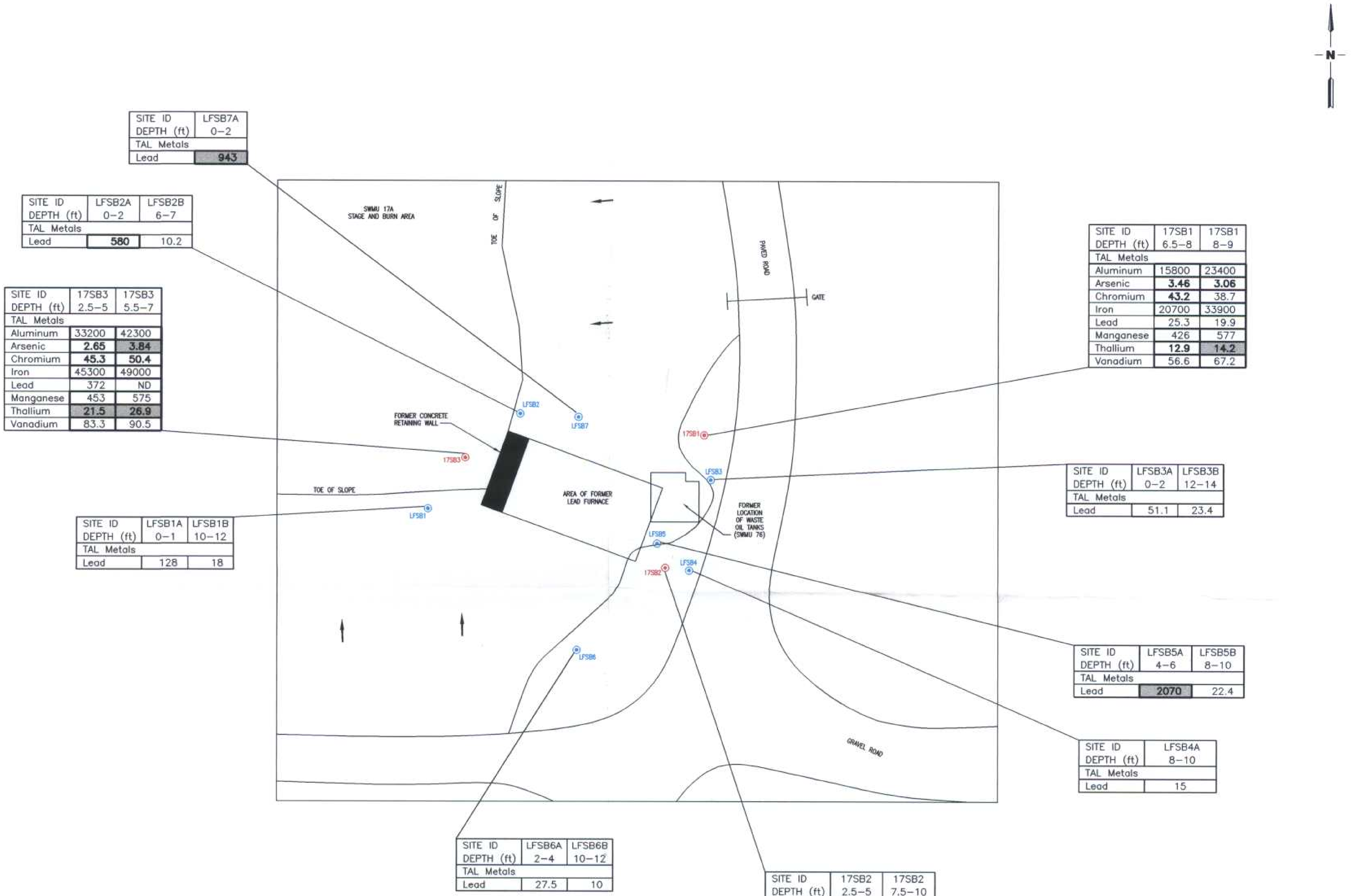
NOTE:

SEE TABLE 1.8-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-7-02

FILE: 1-8-2.DWG

RADFORD AAP		FIGURE 1.8-3
PREPARED BY: IT CORP.	TASK NO: 870463301000000	CONCEPTUAL MODEL FORMER LEAD FURNACE AREA
CHECKED BY: MT	IT DWG NO: 1-8-2	
DATE: JANUARY 2002		



SITE ID	LFSB7A
DEPTH (ft)	0–2
TAL Metals	
Lead	**943**

SITE ID	LFSB2A	LFSB2B
DEPTH (ft)	0–2	6–7
TAL Metals		
Lead	**580**	10.2

SITE ID	17SB3	17SB3
DEPTH (ft)	2.5–5	5.5–7
TAL Metals		
Aluminum	33200	42300
Arsenic	**2.65**	**3.84**
Chromium	**45.3**	**50.4**
Iron	45300	49000
Lead	372	ND
Manganese	453	575
Thallium	**21.5**	**26.9**
Vanadium	83.3	90.5

SITE ID	17SB1	17SB1
DEPTH (ft)	6.5–8	8–9
TAL Metals		
Aluminum	15800	23400
Arsenic	**3.46**	**3.06**
Chromium	**43.2**	38.7
Iron	20700	33900
Lead	25.3	19.9
Manganese	426	577
Thallium	**12.9**	**14.2**
Vanadium	56.6	67.2

SITE ID	LFSB3A	LFSB3B
DEPTH (ft)	0–2	12–14
TAL Metals		
Lead	51.1	23.4

SITE ID	LFSB1A	LFSB1B
DEPTH (ft)	0–1	10–12
TAL Metals		
Lead	128	18

SITE ID	LFSB5A	LFSB5B
DEPTH (ft)	4–6	8–10
TAL Metals		
Lead	**2070**	22.4

SITE ID	LFSB4A
DEPTH (ft)	8–10
TAL Metals	
Lead	15

SITE ID	LFSB6A	LFSB6B
DEPTH (ft)	2–4	10–12
TAL Metals		
Lead	27.5	10

SITE ID	17SB2	17SB2
DEPTH (ft)	2.5–5	7.5–10
TAL Metals		
Aluminum	15500	7460
Antimony	ND	**249**
Arsenic	**5.6**	**5.77**
Chromium	24.1	36.1
Copper	4.95	2260
Iron	22200	22200
Lead	20.9	**100000**
Manganese	130	246
Mercury	.0615	64
Thallium	ND	**96.7**
TCLP Metals		
Lead	ND	500000

LEGEND:

- ● 1992 VI SOIL BORING (DAMES & MOORE)
- ● 1998 RFI SOIL BORING (ICF KAISER)
- → DOWN SLOPE DIRECTION

NOTE:

TCLP UNITS IN UG/L
TAL METAL UNITS IN MG/KG
J = ESTIMATED CONCENTRATION
ND = NOT DETECTED
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR TCLP CRITERIA
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

Sample Summary

Previous Investigation	Contractor	TAL Metals		TCLP Metals		Total
		SS	SB	SS	SB	
1992 VI	D&M	––	6	––	6	12
1998 RFI (lead)	ICF Kaiser	5	20	1	––	26

0 10 20 40
SCALE IN FEET

FILE: 1-8-1_Axls.dwg PLOT: 2-6-02

RADFORD AAP

PREPARED BY: IT CORP.	TASK NO: 870403301000000
CHECKED BY: MT	IT DWG NO: 1-8-1_Axls.dwg
DATE: NOVEMBER 2001	

FIGURE 1.8-1

FORMER LEAD
FURNACE AREA
PRE SITE RESTORATION
SAMPLE RESULTS

05000 \ 284 – 1/2

SITE ID	LFSB11A
DEPTH (ft)	0.5–1
TAL Metals	
Lead	179

SITE ID	LFSB10A	LFSB10B
DEPTH (ft)	0.5–1	2–2.5
TAL Metals		
Lead	279	326

SITE ID	LFTP8
DEPTH (ft)	5–6
TAL Metals	
Lead	**866**

SITE ID	LFSB9A
DEPTH (ft)	0.5–1
TAL Metals	
Lead	189

SITE ID	LFTP4
DEPTH (ft)	5–7
TAL Metals	
Lead	103

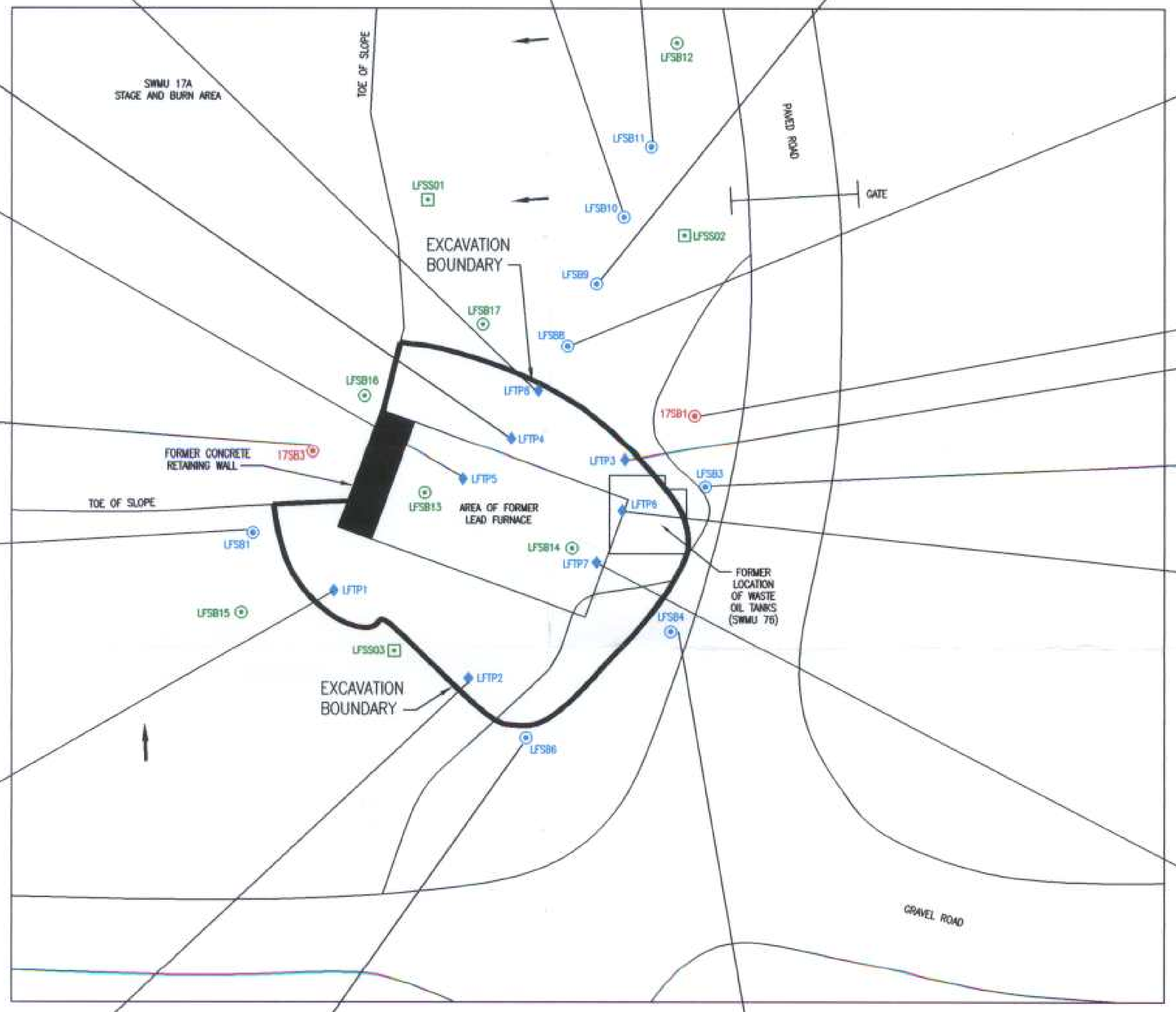
SITE ID	LFSB8A
DEPTH (ft)	0.5–1
TAL Metals	
Lead	86.9
TCLP Metals	
Lead	507

SITE ID	LFTP5
DEPTH (ft)	5–7
TAL Metals	
Lead	12.8

SITE ID	17SB1	17SB1
DEPTH (ft)	6.5–8	8–9
TAL Metals		
Aluminum	15800	23400
Arsenic	**3.46**	**3.06**
Chromium	**43.2**	38.7
Iron	20700	33900
Lead	25.3	19.9
Manganese	426	577
Thallium	**12.9**	**14.2**
Vanadium	56.6	67.2

SITE ID	17SB3	17SB3
DEPTH (ft)	2.5–5	5.5–7
TAL Metals		
Aluminum	33200	42300
Arsenic	**2.65**	**3.84**
Chromium	**45.3**	**50.4**
Iron	45300	49000
Lead	372	ND
Manganese	453	575
Thallium	**21.5**	**26.9**
Vanadium	83.3	90.5

SITE ID	LFTP3
DEPTH (ft)	6–8
TAL Metals	
Lead	10.8



SITE ID	LFSB3A	LFSB3B
DEPTH (ft)	0–2	12–14
TAL Metals		
Lead	51.1	23.4

SITE ID	LFSB1A	LFSB1B
DEPTH (ft)	0–1	10–12
TAL Metals		
Lead	128	18

SITE ID	LFTP6
DEPTH (ft)	8–10
TAL Metals	
Lead	12.5

SITE ID	LFTP1
DEPTH (ft)	5–6
TAL Metals	
Lead	15.3

SITE ID	LFTP7
DEPTH (ft)	8–10
TAL Metals	
Lead	11

SITE ID	LFTP2
DEPTH (ft)	4–5
TAL Metals	
Lead	29.2

SITE ID	LFSB6A	LFSB6B
DEPTH (ft)	2–4	10–12
TAL Metals		
Lead	27.5	10

SITE ID	LFSB4A
DEPTH (ft)	8–10
TAL Metals	
Lead	15

LEGEND:

- ◎ 1992 VI SOIL BORING (DAMES & MOORE)
- ◎ 1998 RFI SOIL BORING (ICF KAISER)
- ◆ 1998 RFI TEST PIT CONFIRMATION SAMPLE (ICF KAISER)
- → DOWN SLOPE DIRECTION
- ⊡ PROPOSED SURFACE SOIL LOCATION
- ◉ PROPOSED SOIL BORING LOCATION

NOTE:

TAL METAL UNITS IN MG/KG
TCLP METAL UNITS IN UG/L
J = ESTIMATED CONCENTRATION
ND = NOT DETECTED
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR TCLP CRITERIA
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

0 10 20 40
SCALE IN FEET

FILE: 1-8-1_Bxls.dwg PLOT: 2-8-02

Sample Summary

Previous Investigation	Contractor	TAL Metals		TCLP Metals		Total
		SS	SB	SS	SB	
1992 VI	D&M	--	6	--	6	12
1998 RFI (lead)	ICF Kaiser	5	20	1	--	26

RADFORD AAP

PREPARED BY: IT CORP.
TASK NO: 87040330100000
CHECKED BY: MT
IT DWG NO: 1-8-1_Bxls.dwg
DATE: NOVEMBER 2001

FIGURE 1.8–2

FORMER LEAD FURNACE AREA POST SITE RESTORATION SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS

05006\2/5- 2/2

Table 1.8-1
Potential Exposure Pathways and Receptors—AOC–Former Lead Furnace Area

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	No	—	—	—	—	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.8-3 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

1.8.4 Data Gap Analysis

TCL VOCs. Samples were not collected for TCL VOC analysis during either of the previous investigations. Therefore, TCL VOCs represent a data gap.

TCL SVOCs/PAHs. Samples were not collected for TCL SVOC analysis during either of the previous investigations. Therefore, TCL SVOCs and PAHs represent a data gap.

TCL PCBs. TCL PCBs analysis has not been performed on previous samples. Therefore, TCL PCBs represent a data gap.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Samples were not collected for explosives analysis during either of the previous investigations. Therefore, explosives represent a data gap.

TAL metals. Previous investigations focused on potential metals contamination from former site operations and the presence of lead slag in the soil. Confirmatory samples collected after the RFI expanded sampling effort indicated that lead was present in the soil throughout the area around the FLFA. TAL metals represent a data gap in soil because the area of elevated lead has not been fully delineated and because RFI sampling solely analyzed samples for lead.

Dioxins/furans. This site is associated with furnace operations; therefore, dioxins/furans are of potential concern. Dioxins/furans represent a data gap because samples have not been collected for dioxins/furans analysis during the previous investigations.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.8.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.8-2**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.8-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Surface soil. Seven surface soil samples will be collected at this AOC to complete the delineation of known contamination and characterize the site for parameters for which the soil has not been tested. Five samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, TAL metals and dioxins/furans. Two surface soil samples (LFSS01 and LFSS02) will be located east and west of previous sample location LFSB10 to delineate the extent of elevated lead reported in the 1998 RFI. Two samples (LFSS03 and LFSB15A) will be collected to the south of the 1998 RFI expanded sampling area to characterize surface soil in this portion of the site. These two samples will also be analyzed for TCL pesticides and herbicides. One surface soil sample (LFSB12A) will be collected to the north of previous location LFSB11 to bound the area of elevated lead and characterize this area. This sample will be analyzed for TCL pesticides, herbicides, TOC, grain size and pH, in addition to the analytes listed above. Two soil samples (LFSB16A and LFSB17A) will be collected outside the northwest corner of the 1998 RFI excavation to confirm that elevated levels of lead do not exist in this area. These two samples will be analyzed for TCL SVOCs, TAL metals and dioxins/furans.

Subsurface soil. Soil borings will be advanced at the downslope and upslope (LFSB13 and LFSB14) ends of the area excavated during the 1998 RFI expanded sampling program. Two samples will be collected from each of the two borings to characterize the subsurface soil. Subsurface soil samples will be collected immediately below the contact with native soil and five feet below this contact. Analysis for these two borings will be TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxins/furans. One boring (LFSB12) will also be advanced north of previous location LFSB11 to bound the area where elevated lead was reported during the 1998 RFI. Subsurface soil

JK

samples will be collected from this boring at 2-4 and 4-6 ft bgs and analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, TAL metals and dioxins/furans. The deeper sample from this boring (LFSB12C) will also be analyzed for TOC, grain size, and pH. One boring (LFSB15) will be advanced southwest of the 1998 expanded sampling area to characterize the subsurface soil in this area. These samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxins/furans. Two soil borings (LFSB16 and LFSB17) will be advanced near the northwest corner of the 1998 RFI excavation to confirm that elevated levels of lead do not exist in this area. Samples at LFSB16 and LFSB17 will be collected from 1-3 ft bgs and 3-5 ft bgs and analyzed for TCL SVOCs and TAL metals.

Table 1.8-2
Site-Specific Proposed Sampling and Analysis Plan—AOC–Former Lead Furnace Area

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	LFSS01	0-0.5 ft bgs	W. of SB10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSS02	0-0.5 ft bgs	E. of SB10	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSS03	0-0.5 ft bgs	S. of excav.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	LFSB12A	0-0.5 ft bgs	N. of SB11	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	LFSB15A	0-0.5 ft bgs	SW. of excav.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	LFSB16A	0-0.5 ft bgs	NW. of furnace	TCL SVOCs, TAL metals, dioxins/furans
	LFSB17A	0-0.5 ft bgs	N. of furnace	TCL SVOCs, TAL metals, dioxins/furans
Subsurface Soil	LFSB12B	2-4 ft bgs	N. of SB11	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB12C	4-6 ft bgs	N. of SB11	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	LFSB13A	Immediately below contact with native soil	downgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB13B	5 ft below "A" interval	downgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB14A	Immediately below contact with native soil	upgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB14B	5 ft below "A" interval	upgradient end of furnace	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB15B	2-4 ft bgs	SW. of excav.	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB15C	4-6 ft bgs	SW. of excav.	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	LFSB16B	1-3 ft bgs	NW. of furnace	TCL SVOCs, TAL metals
	LFSB16C	3-5 ft bgs	NW. of furnace	TCL SVOCs, TAL metals
	LFSB17B	1-3 ft bgs	N. of furnace	TCL SVOCs, TAL metals
	LFSB17C	3-5 ft bgs	N. of furnace	TCL SVOCs, TAL metals

1.9 AOC–FORMER CADMIUM PLATING FACILITY (BUILDING 4343)

1.9.1 Site Description

Building 4343, the Former Cadmium Plating Facility, is situated in the Horseshoe Area (**Figure 1-1.1**). The area surrounding the building is mowed grass at an elevation of approximately 1,830 ft msl. Surface water runoff flows to the north to a drainage ditch that grades to approximately 1,810 ft msl.

Building 4343 was originally designated as the Fire Water Pump House. The building was used to house a 5-in., one-stage, 500-gallon/minute gasoline-powered pump. A 550-gallon underground storage tank, located approximately 40 ft south of Building 4343, was used to store the pump fuel. The tank was removed on June 11, 1998. In 1956, the building was converted to support NIKE igniter grain cadmium plating operations. Conversion activities included the installation of a drying cabinet, cadmium plating baths, an exterior lead catch tank, and an exhaust system. The pump and pump engine have been removed and floor sumps filled to level.

Two investigations have been conducted at this AOC. In 1996, ATK performed surface soil sampling for cadmium to assess whether cadmium was present at elevated levels. ICF KE performed an RFI in 1999 to further delineate the extent of cadmium contamination. These investigations are discussed in more detail in the following sections.

1.9.2 Previous Investigations

TCLP Cadmium Sampling (ATK). Previous investigation activities at Building 4343 include one round of surface soil sampling.[1] Surface soil samples were collected from five locations (4343-01-SVR to 4343-05-SVR) around Building 4343 to assess the extent of cadmium contamination. Sample locations and chemical exceedence results are presented on **Figure 1.9-1**. Samples were analyzed for TCLP cadmium. Concentrations of leachable cadmium exceeded the TCLPRL of 1,000 µg/L in four of the five samples collected, with concentrations ranging from 1,340 to 36,800 µg/L. Analytical results from the cadmium sampling are presented in Table A-27. This investigation was successful in meeting the goal of verifying whether cadmium was present at elevated levels. Based on these results, an additional investigation was recommended to delineate the extent of elevated cadmium concentrations.

1999 RCRA Facility Investigation (ICF KE). In 1999, ICF KE conducted an RFI at Building 4343 to characterize the extent of cadmium concentrations detected during the 1996 investigation. To meet this investigative goal, the following sampling program was performed:

- 39 surface and 36 subsurface soil samples were collected from the vicinity of Building 4343 and along the drainage ditch,
- Sludge samples were collected from two sumps associated with the building, and
- Wipe samples were collected from six locations on the concrete floor inside the building.

Systematic grid and biased sample locations and chemical exceedence results around Building 4343 are shown on **Figure 1.9-1**, and sample locations and chemical exceedence results along the drainage ditch are shown on **Figure 1.9-2**.

Soil. 33 soil samples were collected from 16 locations around Building 4343 to characterize the nature and extent of metals concentrations in soil surrounding the building and to confirm previous investigation results. Sixteen surface (0–1 ft bgs) and 17 subsurface (2–4 ft bgs) soil samples were collected from the following 16 borings: B43SB1 through B43SB12 and B43SB19 through B43SB22. Surface soil samples collected from three locations (B43SSB1, B43SSB2 and B43SSB3) were analyzed for TCLP metals to verify previous investigation results. Subsurface samples were collected to confirm that migration of metals is limited to near surface depths. Samples were analyzed for one or more of the following parameters: TAL metals, TCLP metals, cyanide, TOC, and pH (Tables A-28 to A-31).

Initially, surface and subsurface soil samples were collected from 12 locations (B43SSB1 through B43SSB12) around the building. Sample locations are shown on **Figure 1.9-1**. TCLP cadmium was detected above the TCLPRL of 1,000 µg/L in one surface soil sample (B43SSB2) at a concentration of 3,890 µg/L (Table A-30).

---

[1] Alliant Techsystems; letter report to USEPA, Apr. 4, 1998.

Arsenic (4.1–5.6 mg/kg) was detected at concentrations above the industrial RBC of 3.8 mg/kg. Eight TAL metals were detected above the residential RBCs, but below the industrial in the surface soil samples (Table A-28). Seven TAL metals were detected above the residential RBCs in the subsurface soil samples (Table A-29). Arsenic (5 mg/kg) exceeded the industrial RBC in one subsurface soil sample (B43SB11A).

Based on the results of these samples, additional surface and subsurface soil samples were collected around sample location B43SSB2 from four locations (B43SSB19 through B43SSB22) to further delineate the elevated concentrations of cadmium in soil (**Figure 1.9-1**). The surface soil samples were analyzed for TCLP metals (Table A-30) and the subsurface soil samples were analyzed for TAL metals and TCLP metals (Tables A-29 and A-31). Eight TAL metals exceeded the residential RBC in the subsurface samples. Arsenic (3.9–8.2 mg/kg) exceeded the industrial RBC of 3.8 mg/kg.

Soil samples were collected in the drainage ditch area to characterize the horizontal and vertical extent of potential contamination due to surface water runoff and sump discharge from cadmium plating operations. Forty-two soil samples were collected from 23 locations in the drainage ditch area. The soil borings included B43SSD1 through B43SSD6, B43SB13 through B43SB18, and B43SB23 through B43SB33, as shown on **Figure 1.9-2**. Twenty-three surface (0–1 ft bgs), 17 shallow subsurface (2–4 ft bgs), and two deep subsurface (16–18 and 58–60 ft bgs) soil samples were collected and analyzed for TCLP metals and/or TAL metals (Tables A-28 to A-31).

Surface and shallow subsurface soil samples were initially collected from two locations (B43SSB13 and B43SSB14) leading to the drainage ditch and from six locations directly in the drainage ditch (B43SSD1 to B43SSD6). Arsenic, cadmium, chromium, and lead exceeded industrial RBCs in these samples. Seven TAL metals were detected above the residential RBCs, but below the industrial RBC in these samples (Tables A-28 and A-29). Cadmium was detected above the industrial RBC of 100 mg/kg in the six samples (B43SSD1 to B43SSD6) collected directly from the ditch, and in sample B43SSB14. Concentrations of cadmium greater than the criterion ranged from 124–24,300 mg/kg. Arsenic (3.8–5.3 mg/kg), chromium (1,820 mg/kg), and lead (1,410 mg/kg) were also detected above the industrial RBCs of 3.8 mg/kg, 610 mg/kg, and 750 mg/kg, respectively. TCLP cadmium was detected above the regulatory limit of 1,000 µg/L in three surface soil samples (B43SSD1, B43SSD3, and B43SSD5) at concentrations ranging from 1,520–26,800 µg/L (Table A-30). TCLP cadmium was also detected above the TCLPRL of 1,000 µg/L in sample B43SB14A (1,350 µg/L), collected from 2-4 ft bgs (Table A-31).

Based on the results of the initial samples collected along the ditch, additional surface (0–1 ft bgs) and shallow subsurface (2–4 ft bgs) soil samples were collected from four locations (B43SSB15 through B43SSB18) (**Figure 1.9-2**). Additional deep subsurface soil samples were also collected from 16–18 ft bgs (B43SSB15B) and 58–60 ft bgs (B43SB17B). The samples were analyzed for TAL metals and/or TCLP metals (Tables A-28 to A-31).

Arsenic (4.4–5.1 mg/kg) and cadmium (137 and 339 mg/kg) were detected above their respective industrial RBCs of 3.8 mg/kg and 100 mg/kg (Table A-28) in the surface soil samples. Seven TAL metals were detected above the residential RBCs, but below the industrial RBCs. TCLP cadmium was detected above the TCLPRL of 1,000 µg/L in two samples (B43SSB17 and B43SSB18) at concentrations of 1,040 and 6,750 µg/L (Table A-30).

Additional delineation of surface and subsurface soil was necessary to establish the extent of cadmium soil contamination along the drainage ditch. Soil samples were collected from 11 additional locations (B43SSB23 through B43SSB33), as shown on **Figure 1.9-2**. The samples were collected from depths of 0–1 ft bgs and 2–4 ft bgs and were analyzed for TAL metals and/or TCLP metals (Tables A-28 to A-31).

Arsenic (4 mg/kg) was detected above the industrial RBC of 3.8 mg/kg (Table A-28) in the surface soil. Five TAL metals were detected above the residential RBC, but below the industrial RBC, in surface soil sample B43SSB28. TCLP cadmium (2,140 µg/L) was detected in sample B43SSB33 above the TCLPRL of 1,000 µg/L (Table A-30).

In summary, samples with cadmium and/or TCLP cadmium concentrations above the industrial RBC or TCLPRL were predominantly collected in surface soil (0–1 ft bgs), suggesting that the downward mobility of cadmium in the soil is low. One sample collected below 2 ft bgs had an exceedence of cadmium and TCLP cadmium. Arsenic exceedences were slightly above the industrial RBC. One surface soil sample contained chromium and lead over the industrial RBCs.

Sludge. Two sludge samples (B43SL1 and B43SL2) were collected from the sumps at Building 4343 to characterize the sump contents (**Figure 1.9-2**). The samples were analyzed for TAL metals and cyanide (Table A-

FIELD ID DEPTH (ft)	B43SSB10 0-1	B43SB10A 2-4
TAL Metals		
Aluminum	25100	20900
Cadmium	8.4	< .13
Chromium	**44.4**	28
Iron	51400	45600
Vanadium	108	98.5

FIELD ID DEPTH (ft)	B43SB21A 2-4
TAL Metals	
Aluminum	48200
Arsenic	**8.2**
Cadmium	4.7
Chromium	**72.5**
Iron	7000
Manganese	251
Vanadium	205

FIELD ID DEPTH (ft)	B43SB20A 2-4
TAL Metals	
Aluminum	55300
Chromium	**55.6**
Iron	96500
Manganese	256
Vanadium	194

FIELD ID DEPTH (ft)	B43SB11A 2-4	B43SB11B 54.5-55
TAL Metals		
Aluminum	18300	12700
Chromium	39.7	37.9
Iron	46900	29300
Manganese	183	345
Vanadium	97.4	29.4

FIELD ID DEPTH (ft)	B43SSB2 0-1	4343-05-SVR 0-0.5
TCLP Metals		
Cadmium	3890	36,800

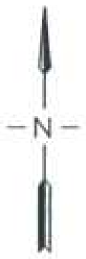
FIELD ID DEPTH (ft)	B43SSB9 0-1	B43SB9A 2-4
TAL Metals		
Aluminum	21400	19500
Chromium	38.6	24.5
Iron	44000	45100
Vanadium	92.8	99.6

FIELD ID DEPTH (ft)	B43SB19A 2-4
TAL Metals	
Aluminum	43000
Chromium	**81.5**
Iron	96600
Manganese	213
Vanadium	203

FIELD ID DEPTH (ft)	B43SSB8 0-1	B43SB8A 2-4
TAL Metals		
Aluminum	23900	18600
Chromium	29.6	28
Iron	44900	46100
Manganese	193	133
Vanadium	96.5	98.2

FIELD ID DEPTH (ft)	B43SB22A 2-4	4343-04-SVR 0-0.5
TAL Metals		
Aluminum	44100	NA
Cadmium	**57.1**	NA
Chromium	**206**	NA
Iron	99100	NA
Manganese	239	NA
Vanadium	196	NA
TCLP Metals		
Cadmium	NA	1340

FIELD ID DEPTH (ft)	B43SSB12 0-1	B43SB12A 2-4
TAL Metals		
Aluminum	10800	15500
Chromium	19.7	23.2
Iron	22400	42300
Manganese	486	111
Thallium	< .83	1.2 J
Vanadium	45.2	94.6



FIELD ID DEPTH (ft)	B43SSB7 0-1	B43SB7A 2-4
TAL Metals		
Aluminum	16900	18000
Iron	40100	39000
Vanadium	90.3	85.6

FIELD ID DEPTH (ft)	B43SSB6 0-1	B43SB6A 2-4
TAL Metals		
Aluminum	15800	19200
Cadmium	9.6	.69
Chromium	34.6	22.1
Iron	40400	42900
Vanadium	87.1	91.8

FIELD ID DEPTH (ft)	B43SSB4 0-1	B43SB4A 2-4
TAL Metals		
Aluminum	15700	17300
Cadmium	16.2	2.9
Chromium	37	18.9
Iron	46400	41100
Vanadium	91.4	89.5

FIELD ID DEPTH (ft)	4343-01-SVR 0-0.5
TCLP Metals	
Cadmium	14050

FIELD ID DEPTH (ft)	4343-02-SVR 0-0.5
TCLP Metals	
Cadmium	2850

FIELD ID DEPTH (ft)	B43SSB5 0-1	B43SB5A 2-4
TAL Metals		
Aluminum	18100	22300
Cadmium	19.3	.76
Chromium	27	22.9
Iron	43200	43300
Manganese	122	182
Vanadium	92.5	94.1

LEGEND

☐	1996 TCLP CADMIUM SOIL SAMPLE LOCATION (ATK)
🟦	1999 RFI SYSTEMATIC GRID SOIL SAMPLE LOCATIONS (ICF KAISER)
🟥	1999 RFI BIASED SOIL SAMPLE LOCATIONS (ICF KAISER)
🟩	1999 RFI SYSTEMATIC GRID WIPE SAMPLE LOCATIONS (ICF KAISER)
🟨	1999 RFI ADDITIONAL WIPE SAMPLE LOCATIONS (ICF KAISER)

NOTE:

TCLP UNITS MEASURED IN UG/L

TAL METAL UNITS MEASURED IN MG/KG

J = ESTIMATED CONCENTRATION

NA = ANALYTE NOT TESTED

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC

SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR TCLP CRITERIA

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

PLOT: 2-7-02

FILE: 1-9-1xls.dwg

Sample Summary

Previous Investigation	Contractor	TAL Metals			Cyanide			TCLP Metals		Total
		SS	SB	SE	SS	SB	SE	SS	SB	
1996 SS Sampling	ATK	--	--	--	--	--	--	5	--	5
1999 RFI	ICF Kaiser	22	33	2 (SL)	17	12	2 (SL)	26	24	138

RADFORD AAP

PREPARED BY: IT CORP.
TASK NO: 870403301000000
CHECKED BY: MT
IT DWG NO: 1-9-1xls.dwg
DATE: NOVEMBER 2001

FIGURE 1.9-1

BUILDING 4343
SYSTEMATIC GRID AND
BIASED SAMPLE
RESULTS

05000 \ 292 - 1/2

FIELD ID	B43SB31A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	7920
Arsenic	**2.1**
Iron	13600
Manganese	703

FIELD ID	B43SB32A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	9550
Arsenic	**2.1**
Iron	6010
Manganese	**1220**

FIELD ID	B43SSB17	B43SB17A	B43SB17B
DEPTH (ft)	0–1	2–4	58–60
TAL Metals			
Aluminum	17100	10800	28800
Arsenic	4.4 B	2 B	**9.4** J
Cadmium	**137** J	15.9 J	< .13
Chromium	**46.2**	27.7	36.1
Iron	27900	8160	44500
Manganese	550	540	212
Vanadium	43.1	24.7	59
TCLP Metals			
Cadmium	1040	NA	1

FIELD ID	B43SSB18	B43SB18A
DEPTH (ft)	0–1	2–4
TAL Metals		
Aluminum	18300	16200
Cadmium	**339** J	3.2 J
Chromium	**160**	30
Iron	32400	7730
Manganese	642	839
TCLP Metals		
Cadmium	6750	NA

FIELD ID	B43SSB33	B43SB33A
DEPTH (ft)	0–1	2–4
TAL Metals		
Arsenic	NA	**2.5**
Cadmium	NA	10.5
Chromium	NA	**61.8**
Iron	NA	10800
Manganese	NA	200 J
TCLP Metals		
Cadmium	2140	NA

FIELD ID	B43SSB16	B43SB16A
DEPTH (ft)	0–1	2–4
TAL Metals		
Aluminum	15100	32300
Chromium	27.9	**54.6**
Iron	23400	46700
Manganese	441	99.4
Vanadium	48.7	96

FIELD ID	B43SB30A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	8650
Arsenic	**3.5**
Chromium	35.6
Iron	17600
Manganese	484

FIELD ID	B43SB29A
DEPTH (ft)	2–4
TAL Metals	
Arsenic	**2.2**
Iron	12400
Manganese	513

FIELD ID	B43SSD6
DEPTH (ft)	0–1
TAL Metals	
Cadmium	**1040**
Chromium	**402**
Iron	21900
Manganese	190

FIELD ID	B43SB27A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	11600
Chromium	35.1
Iron	21000
Manganese	367

FIELD ID	B43SSD3
DEPTH (ft)	0–1
TAL Metals	
Cadmium	**124**
Chromium	**124**
Iron	17800
Manganese	507
TCLP Metals	
Cadmium	1520

FIELD ID	B43SSD5
DEPTH (ft)	0–1
TAL Metals	
Aluminum	9170
Cadmium	**222**
Chromium	**301**
Iron	22800
TCLP Metals	
Cadmium	2540

FIELD ID	B43SSB28	B43SB28A
DEPTH (ft)	0–1	2–4
TAL Metals		
Aluminum	14600	18100
Arsenic	**4**	**4.1**
Chromium	26.7	27.7
Iron	30000	32900
Vanadium	66.1	67.4

FIELD ID	B43SSD2
DEPTH (ft)	0–1
TAL Metals	
Aluminum	9970
Cadmium	**157**
Chromium	**192**
Iron	35300
Manganese	348
Vanadium	73.7

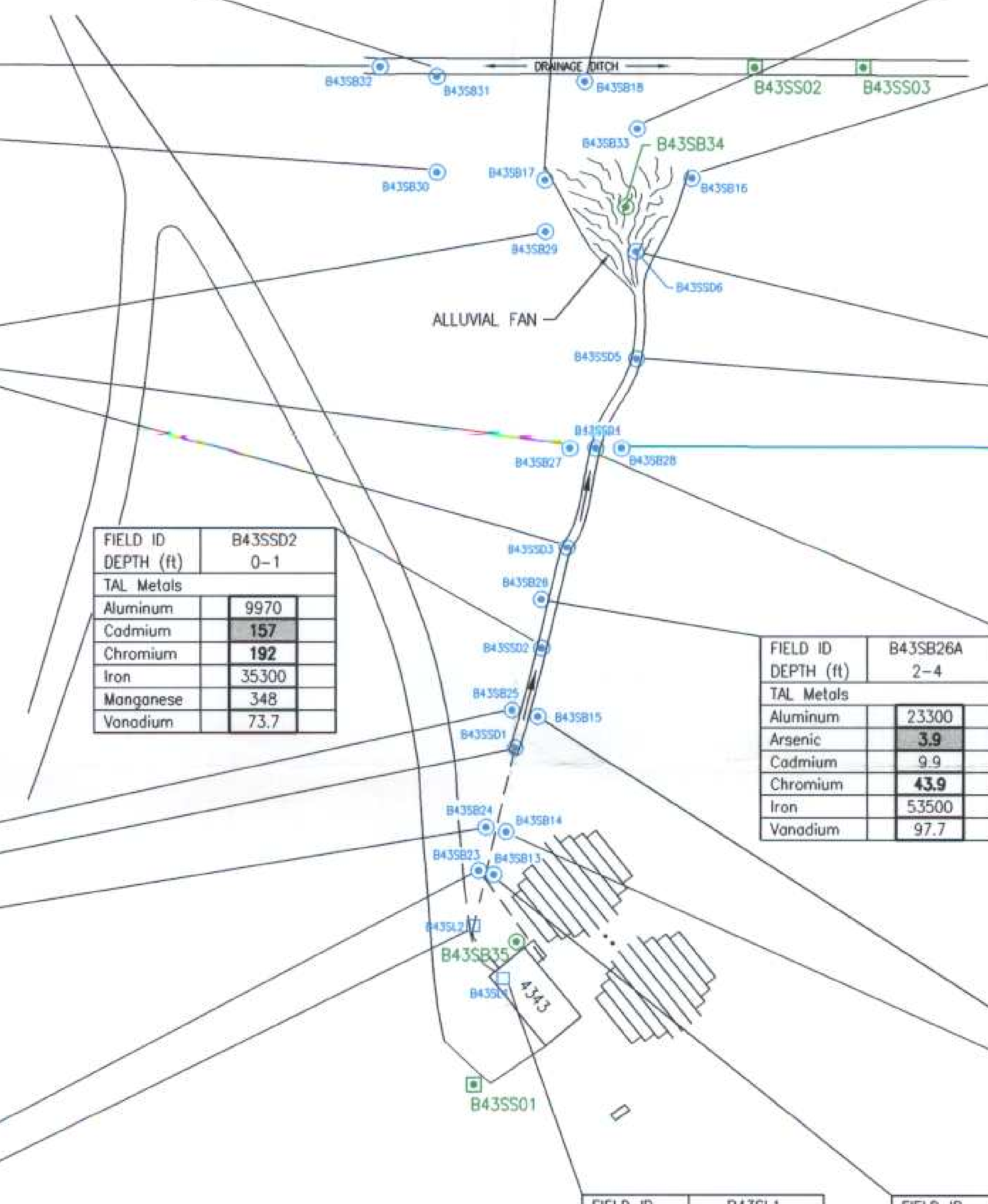
FIELD ID	B43SSD1
DEPTH (ft)	0–1
TAL Metals	
Antimony	**41.2** J
Cadmium	**24300**
Chromium	**1820**
Copper	677
Iron	33000
Lead	**1410**
Manganese	306
Silver	**36**
TCLP Metals	
Cadmium	26800

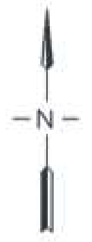
FIELD ID	B43SB25A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	36400
Arsenic	**8.2**
Chromium	**82.2**
Iron	88300
Manganese	196
Vanadium	156

FIELD ID	B43SB26A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	23300
Arsenic	**3.9**
Cadmium	9.9
Chromium	**43.9**
Iron	53500
Vanadium	97.7

FIELD ID	B43SSD4
DEPTH (ft)	0–1
TAL Metals	
Cadmium	**134**
Chromium	**102**
Iron	19100
Manganese	210

FIELD ID	B43SSB15	B43SB15A	B43SB15B
DEPTH (ft)	0–1	2–4	16–18
TAL Metals			
Aluminum	19700	11200	25100
Chromium	27.6	24.6	21.1
Iron	28200	10700	29100
Manganese	534	657	261





FIELD ID	B43SB24A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	47900
Chromium	**69.8**
Manganese	244
Vanadium	202

FIELD ID	B43SB23A
DEPTH (ft)	2–4
TAL Metals	
Aluminum	28900
Chromium	**59.9**
Iron	61000
Manganese	415
Vanadium	124

FIELD ID	B43SL2
DEPTH (ft)	0–0.5
TAL Metals	
Antimony	**20.2** J
Arsenic	**8.4**
Cadmium	**2640**
Chromium	**2130**
Copper	365
Iron	91500
Manganese	584

FIELD ID	B43SL1
DEPTH (ft)	0–0.5
TAL Metals	
Antimony	**181** J
Arsenic	**31.5**
Barium	1770
Cadmium	**8890**
Chromium	**8430**
Copper	2390
Iron	30000
Lead	**3320**
Manganese	583
Vanadium	59.6
Zinc	3390

FIELD ID	B43SSB13	B43SB13A
DEPTH (ft)	0–1	2–4
TAL Metals		
Aluminum	16900	20300
Cadmium	6.3	< .12
Chromium	34.1	28.1
Iron	43300	43200
Vanadium	92.4	96.2

FIELD ID	B43SSB14	B43SB14A
DEPTH (ft)	0–1	2–4
TAL Metals		
Aluminum	20300	17600
Cadmium	9	**191**
Chromium	22.8	**196**
Iron	32100	43400
Vanadium	75.9	94.1
TCLP Metals		
Cadmium	NA	1350

LEGEND:

◉ 1999 RFI SOIL BORING (ICF KAISER)

☐ 1999 RFI SLUDGE SAMPLE LOCATION (ICF KAISER)

◉ PROPOSED SOIL BORING

▣ PROPOSED SURFACE SOIL SAMPLE LOCATION

→ SURFACE RUNOFF

NOTE:

TCLP UNITS MEASURED IN UG/L
TAL METAL UNITS MEASURED IN MG/KG
B = BLANK CONTAMINATION
J = ESTIMATED CONCENTRATION
NA = ANALYTE NOT TESTED
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR TCLP CRITERIA
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

Sample Summary

Previous Investigation	Contractor	TAL Metals			Cyanide			TCLP Metals		Total
		SS	SB	SE	SS	SB	SE	SS	SB	
1996 SS Sampling	ATK	--	--	--	--	--	--	5	--	5
1999 RFI	ICF Kaiser	22	33	2 (SL)	17	12	2 (SL)	26	24	138

PLOT: 2-7-02

FILE: 1-9-2xls.DWG

RADFORD AAP		FIGURE 1.9-2
PREPARED BY: IT CORP.	TASK NO: 870403301000000	BUILDING 4343 PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS
CHECKED BY: MT	IT DWG NO: 1-9-2xls.DWG	
DATE: NOVEMBER 2001		

05006\292-2/2

32). Sample B43SL1 was collected from the interior sump located in the northwest corner of Building 4343. The sump is 18 in. by 18 in. by 7 in. deep and drains to the sump outside the building. The sump contained about a ½-in. layer of dry soil-like material containing shards of metal, glass, rusted bolts, small gravel, small nutshell-like pieces and a few ¼–1-in. dense, spherical structures with a hole through the center. Sample B43SL2 was collected from the exterior sump located on the north side of Building 4343. The sump is 24 in. by 18 in. by 12 in. deep and is constructed of brick. An 8-in.-diameter cast iron pipe and a 6-in.-diameter galvanized pipe discharge to the sump. A 6-in. terra cotta pipe drains the sump and leads to the drainage ditch north of the building. The 4 in. of material sampled at the base of the sump was silty-sand with some clay and a few small pebbles.

Thirteen TAL metals were detected above the residential RBCs and five TAL metals were detected above the industrial RBCs in the sludge samples. Antimony, arsenic, cadmium, chromium, and lead were detected above the industrial RBCs.

Wipe samples. Three wipe samples (B43W1, B43W2, and B43W3) were collected from the concrete floor inside the building to characterize TAL metals contamination associated with cadmium plating operations. Each sample was analyzed for TAL metals, not including mercury (Table A-33). Specific sample locations were selected based on a systematic grid approach (**Figure 1.9-1**). Each wipe sample was collected by wiping a cloth over a 10-cm-by-10-cm area. The results are expressed in mg/100 cm^2.

Twenty-one TAL metals were detected in the wipe samples. These TAL metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, vanadium, and zinc. No comparison criteria, however, are available for wipe samples (Table A-33).

Three additional wipe samples (B43W4, B43W5, and B43W6) were collected from the concrete floor. These samples were analyzed for mercury and one sample (B43W4) was analyzed for TAL metals.

Twenty-one TAL metals were detected in sample B43W4. These TAL metals include antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc. Mercury was not detected in the samples.

1.9.3 Conceptual Site Model

A conceptual site model for Building 4343 is presented in **Figure 1.9-3**. Potentially affected media include surface and subsurface soil, sediment, and surface water. The area surrounding the building is maintained grass, with surface water runoff flowing to a drainage ditch that leads north. Site workers and biota are considered receptors. **Table 1.9-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is impacted from plating operations. Previous investigations have demonstrated that elevated levels of TAL metals, primarily cadmium, exist in the soil around the building and in the drainage ditch near the building. Site workers and ecological receptors could be impacted through incidental ingestion of soil, dermal absorption through direct contact with affected soil, and the inhalation of dust during removal or construction activities.

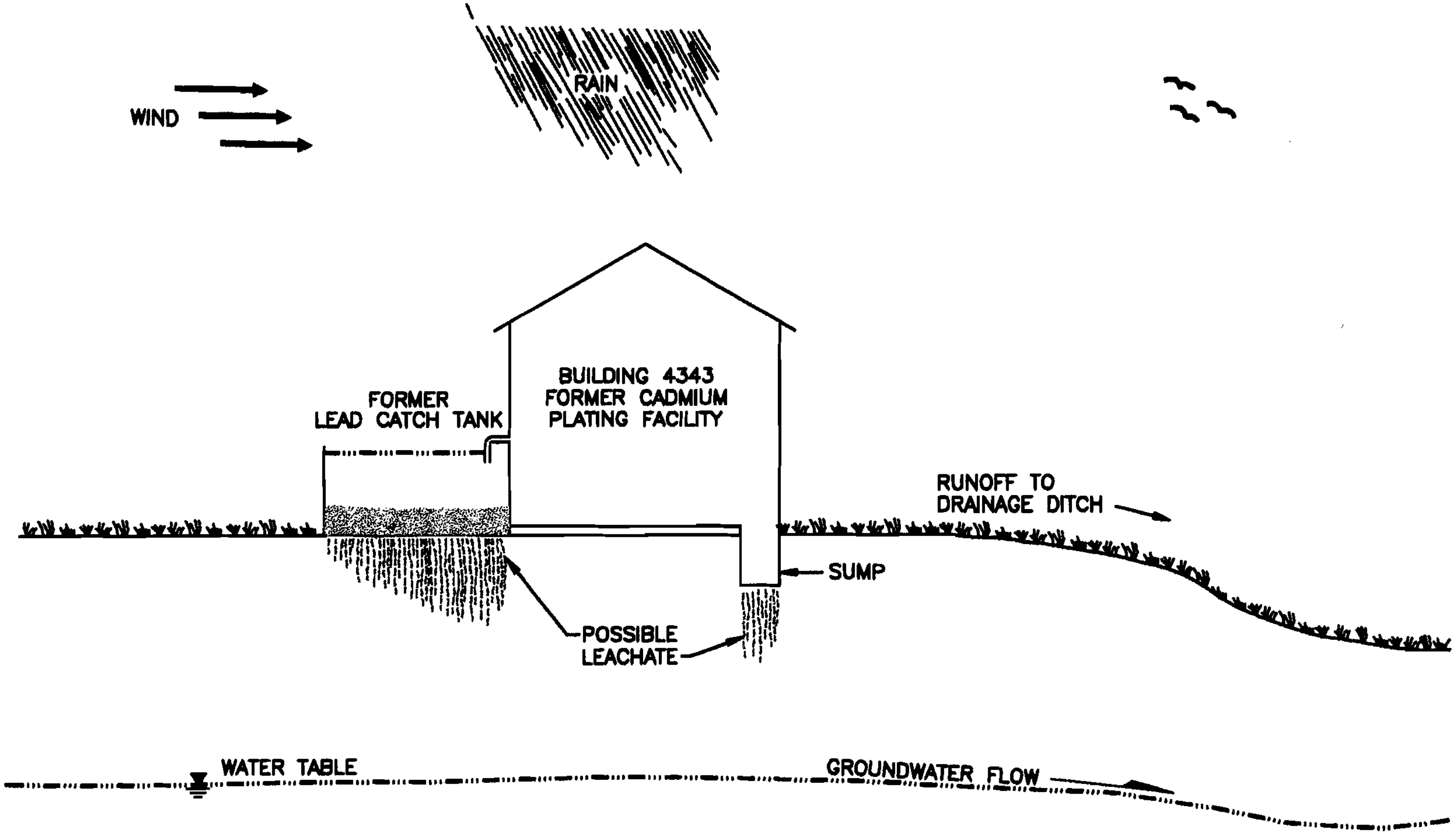
Subsurface soil is also potentially impacted by former operations. Although results from the 1999 RFI indicated that elevated cadmium concentrations were primarily confined to the shallow surface, other constituents (which were not previously tested for) may be present. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water may be present in the system of drainage ditches that control runoff in the area. Previous investigations have collected environmental samples from the floor of ditches as soil. The proposed investigation will preserve this nomenclature. The 1999 RFI demonstrated that soil in the drainage ditch contained elevated levels of total and leachable cadmium. Potential receptors and pathways associated with these media are incidental ingestion and dermal absorption by benthic and aquatic organisms. Site worker and terrestrial biota exposure pathways include dermal absorption and incidental ingestion of surface water and sediment.

Table 1.9-1
Potential Exposure Pathways and Receptors—AOC-Building 4343

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, DA	IN, DA	IN, DA	IN, DA	Direct volatilization from surface water.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.9-3 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.9-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-7-02

FILE: 1-9-3.DWG

RADFORD AAP		FIGURE 1.9-3
PREPARED BY: IT CORP.	TASK NO: [illegible]	CONCEPTUAL MODEL AOC - BUILDING 4343 FORMER CADMIUM PLATING FACILITY
CHECKED BY: TL	IT DWG NO: 1-9-3	
DATE: FEBRUARY 2002		

1.9.4 Data Gap Analysis

TCL VOCs. Samples were not collected for TCL VOC analysis during either of the previous investigations. TCL VOCs, therefore, represent a data gap for surface and subsurface soil and surface water.

TCL SVOCs/PAHs. Samples were not collected for TCL SVOC or PAH analysis during either of the previous investigations. TCL SVOCs and PAHs, therefore, represent a data gap for surface and subsurface soil and surface water.

TCL PCBs. TCL PCBs analysis was not performed on the previous investigation samples. Therefore, TCL PCBs represent a data gap for surface and subsurface soil and surface water.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Explosives analysis was not performed on the previous investigation samples. Therefore, explosives represent a data gap for surface and subsurface soil and surface water.

TAL metals. Thirty-nine surface soil, 33 subsurface soil, and 2 sludge samples were collected during the 1999 RFI to delineate elevated cadmium levels detected during the 1999 RFI. Metals in surface water and sediment have not been characterized. Cadmium was found to be present in shallow soil with concentrations decreasing rapidly with depth. Samples were analyzed for TCLP metals or TAL metals. Although the extent of cadmium was delineated through this sampling program, TAL metals that were not identified in the samples analyzed for TCLP metals may be present at elevated concentrations. Therefore, TAL metals (except cadmium) represent a data gap in the characterization of surface soil, subsurface soil, and surface water.

Dioxins/furans. Building 4343 was not used for burning or disposal/storage of burned wastes or combustion byproducts, therefore, samples will not be analyzed for dioxins/furans.

Perchlorate. Samples were not collected for perchlorate analysis during either of the previous investigations. Perchlorate, therefore, represents a data gap for surface water (if present).

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.9.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.9-2**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses, presented in **Table 1.9-2** for various media types, were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program includes the following media samples and analyses:

Table 1.9-2
Site-Specific Proposed Sampling and Analysis Plan—AOC–Building 4343

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	B43SS01	0–0.5 ft bgs	S. of parking lot	TAL metals
	B43SS02	0–0.5 ft bgs	in ditch below fan	TAL metals, PCBs
	B43SS03	0-0.5 ft bgs	E. of B43SS02	TAL metals, PCBs
	B43SB34A	0–0.5 ft bgs	alluvial fan	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TOC, grain size, pH
	B43SB35A	0–0.5 ft bgs	N. corner of bldg.	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives

Table 1.9-2
Site-Specific Proposed Sampling and Analysis Plan—AOC–Building 4343 (Continued)

Media	Sampling ID	Depth	Location	Analytes
Subsurface Soil	B43SB34B	4–6 ft bgs	alluvial fan	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	B43SB35B	4–6 ft bgs	N. corner of bldg.	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
Surface Water	B43SW01*	NA	in ditch below fan	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness

*Sample will be collected if surface water is available in the drainage ditch below the cadmium-impacted ditch.

Surface soil. Two surface soil samples (B43SB34A and B43SB35A) will be collected from the 0–0.5-ft intervals from two soil borings. One boring (B43SB35) will be located adjacent to the building where high levels of cadmium were detected. The second boring (B43SB34) will be located downslope of the drainage ditch alluvial fan. These samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, and explosives. Sample B43SB34A will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in soil. Three additional samples (B43SS01, B43SS02 and B43SS03) will be collected to complete the delineation of previously identified cadmium contamination. One of these samples (B43SS01) will be collected from the drainage pathway west of Building 4343, across the parking lot from the building. This sample will be analyzed for TAL metals. The second delineation sample (B43SS02) will be located in the drainage ditch northeast of the alluvial fan. The third sample (B43SS03) will be located further east in the drainage ditch. These two samples will be analyzed for TAL metals and PCBs.

Subsurface soil. Two soil borings will be advanced to characterize the subsurface soil for previously untested analyte classes. One subsurface soil sample will be collected from each boring at a depth of 4–6 ft bgs. One boring (B43SB35) will be located adjacent to the building where high levels of cadmium were detected. The second boring (B43SB34) will be located in the center of the alluvial fan. Subsurface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, TAL metals and explosives.

Surface water. If surface water is present in the drainage ditch downgradient of the alluvial fan, a sample will be collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate and hardness. This sample (B43SW01) will be used to characterize this medium for untested analyte classes and to identify the impact that cadmium-impacted soil may be having on the surface water.

Sediment. During previous investigations, the drainage ditches have been dry. Previous samples collected from these ditches were considered soil. If surface water is present in the ditch, then two of the surface soil samples (B43SS02 and B43SS03) will be collected as sediment samples and renamed as B43SD02 and B43SD03. Analytes will be the same regardless of whether the sample is collected as surface soil or sediment.

1.10 BUILDING DEBRIS DISPOSAL TRENCH (NEW RIVER UNIT)

1.10.1 Site Description

The BDDT is located in the southern portion of the NRU (**Figure 1.1-2**). The trench was used as a disposal area for miscellaneous building debris derived from the dismantling of various NRU buildings. The length of the trench runs from north to south and is approximately 950 ft long by 15 ft wide. The head of the trench begins at A Avenue, at an approximate elevation of 2,000 ft above msl, slopes downward to the south and ends at an unnamed creek (approximately 1,960 ft msl), which flows through the NRU.

The area surrounding the BDDT is typically gently to strongly sloping grass-covered hills. The surface layer of soil is generally dark yellowish brown silty clay to approximately 1 ft. The subsoil, to approximately 4 ft bgs, generally ranges from a strong brown silty clay to a brownish yellow silty clay. The substratum (below 4 ft) is brownish yellow silty clay to a depth of approximately 5.5 ft bgs. The bedrock surface is variable and consists of weathered shale interbedded with layers of limestone. Bedrock outcrops are visible along the length of the trench.

Previous investigation activities at the BDDT include Preliminary Sampling conducted by ATK in 1997, independent sampling conducted by Gannett Fleming in 1998, and a Remedial Investigation (RI) conducted by ICF KE in 1998. Each of these previous investigations is summarized in the following sections.

1.10.2 Previous Investigations

Preliminary Sampling, ATK, 1997. An initial investigation was conducted in October 1997 by ATK in the vicinity of the BDDT for characterization purposes. Sampling activities included the following collection and analyses:

- One tar sample for TCLP SVOCs,
- One surface water sample from the unnamed creek for TCL SVOCs, and
- One surface soil sample for TCL SVOCs.

A sample of a solid black substance, suspected to be roofing tar, was collected and analyzed for TCLP SVOCs. Analytical results indicated that concentrations were below detection limits. A surface water sample was collected from the unnamed creek south of the trench and analyzed for TCL SVOCs. Sample results indicated that reported concentrations were below detection limits. Lastly, a soil sample was collected directly downslope of a drum that had leaked its contents onto the soil. The soil sample was analyzed for TCL SVOCs. Soil analytical results indicated that five PAH compounds (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected at concentrations greater than the industrial RBC. Four additional PAHs, including chrysene, fluoranthene, phenanthrene, and pyrene, were reported at levels between the residential and industrial RBCs. These results indicate that the drum had impacted the soils at the BDDT. Detected analytical results for the soil sample are presented in Table A-34.

Independent Sampling, Gannett Fleming, 1998. To further characterize this site and identify constituents that were impacting the unnamed creek, Gannett Fleming conducted independent sampling in 1998 under direction of USEPA. Sampling activities included the following:

- The collection of one surface water sample (SW-07), and
- The collection of three sediment samples (SD-06, SD-07, SD-08).

Sample locations and chemical exceedence results are shown on **Figure 1.10-1**.

One surface water (SW-07) sample was collected from the unnamed creek south of the BDDT and analyzed for TAL metals, TCL VOCs, TCL SVOCs, explosives and PCBs. Surface water analytical results indicated that none of the detected concentrations exceeded Ambient Water Quality Criteria (AWQCs) (chronic) or RBCs for tap water. Detected analytical results are presented in Table A-35. Three sediments samples were also collected during this investigation. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, explosives and PCBs. Sediment sample results indicated that one TAL metal (arsenic) and one TCL SVOC (benzo[*a*]pyrene) were detected above industrial RBCs. Arsenic levels slightly exceeded the industrial RBC of 3.8 mg/kg in two of the three samples, with concentrations of 4.6 mg/kg (sample SD-06) and 5.0 mg/kg (sample SD-07). Three PAHs were reported at concentrations exceeding the residential RBC in sample SD-08. One of these compounds, benzo[*a*]pyrene, also exceeded the industrial RBC. Analytical results are presented in Table A-36. Sample SD-08 was collected downstream from the confluence of the BDDT and the unnamed creek in the floodplain of the unnamed creek. The elevated levels of PAHs in SD-08 and in the soil near the drum suggests that the disposal activities in the BDDT may have negatively impacted sediment in the unnamed creek.

Remedial Investigation Activities, ICF KE, 1998. ICF KE conducted a RI at the BDDT to characterize the nature and extent of subsurface soil contamination and further assess impacts that disposal activities may have had on the unnamed creek. RI activities included surface water/sediment sampling, a geophysical survey, an expanded surface and subsurface soil sampling effort, and site restoration. Modifications to the proposed work plan were necessary due to an unexpected flash flood event that occurred during the expanded sampling effort. The flood event afforded a unique opportunity to observe the impact of a large instantaneous volume of water on the exposed trench and to adjust erosion control methods. Sample locations and chemical exceedence results are presented on **Figure 1.10-1.**

Surface water/sediment. Three collocated surface water/sediment samples were collected upstream and downstream from the confluence of the BDDT and the unnamed creek to assess whether runoff from the site had impacted the creek. Upstream and downstream distances were measured from the approximate center of the southern end of the trench delta and its confluence with the unnamed creek. Sample DTSW/SD3 was collected approximately 70 ft upstream of the confluence. Samples DTSW/SD2 and DTSW/SD1 were collected approximately 114 and 223 ft downstream from the confluence, respectively. These samples were collected at previous investigation sample locations SD-06 and SD-07, respectively, for verification of independent sampling results. Following a flash flood, four additional collocated surface water/sediment samples were collected to characterize constituents that may have been transported to the creek during the flash flood. Samples DTSW/SD1-2, DTSW/SD2-2, and DTSW/SD3-2 were collected from the same locations as the previous surface water/sediment samples. Sample DTSW/SD4 was collected at the property boundary, approximately 545 ft downstream from the confluence of the trench delta and the creek. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, explosives, and PAHs.

Surface water results indicated that copper and lead were detected above AWQCs (chronic). Thallium concentrations exceeded the tap water RBC. The thallium detections, however, were flagged during data validation as either estimated values (J flag), estimated non-detect values (UJ flag), or blank contaminated (B flag – indicating that the analyte was also detected in associated laboratory blanks). Two VOCs, bromodichloromethane and chloroform, were reported in a single surface water sample (DTSW3-2) at concentrations above tap water RBCs. Both of these constituents, however, are common laboratory contaminants and are not likely to be site-related since they were not detected in a previously collected, collocated surface water sample (DTSW3). One SVOC, di-n-butylphthalate, was reported in two samples at concentrations below the tap water RBC. Both of these detections were "B" flagged during data validation, indicating that this compound was also detected in associated laboratory blanks. Explosives and PAHs were not reported in the surface water samples. Detected analytical results for the surface water samples are presented in Table A-37.

Sediment results indicated that seven TAL metals (aluminum, arsenic, chromium, iron, manganese, thallium and vanadium) exceeded the residential RBC screening level. One metal, arsenic, was reported at levels greater than the industrial RBC. Arsenic concentrations ranged from 4.2 to 11.6 mg/kg, slightly exceeding the industrial RBC of 3.8 mg/kg. TCL VOCs, TCL SVOCs, and PAHs were detected in sediments, however, none of these analytes exceed either screening criteria. Explosives were not detected in sediment so they are not presented in the analytical tables. Detected analytical results for sediment are presented in Tables A-38 (metals) and A-39 (organics).

Geophysical survey. A geophysical survey was conducted along both sides of the trench to locate potentially buried drums and other miscellaneous metallic subsurface debris. Results of the survey indicated that metallic subsurface debris was largely limited to the confines of the disposal trench.

Surface soil. Three surface soil samples (DTSS1, DTSS2, and DTSS3) were collected in the trench delta to assess soil that may have been impacted from the transport of constituents in the trench during the flash flood event. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, explosives, and PAHs. Analytical results for detected TAL metals are presented in Table A-40 and for organics in Table A-41.

SITE ID	DTSB9	
DEPTH (ft)	3.0–3.5	
Metals		
Aluminum	11,100	
Arsenic	7.3	
Chromium	33.8	
Iron	29,700	
Manganese	536	
SVOCs		
3,3'-Dichlorobenzidine	**.12**	J
Benz[a]anthracene	0.88	
Benzo[a]pyrene	0.85	
Benzo[b]fluoranthene	1.2	
Carbazole	**.57**	

SITE ID	DTSB7	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	10,700	
Arsenic	7.3	
Chromium	28.3	
Iron	28,600	
Manganese	815	

SITE ID	DTSB5	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	11,000	
Arsenic	6.1	
Chromium	33.9	
Iron	30,800	
Manganese	543	

SITE ID	DTSB3	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	11,200	
Antimony	4.8	J
Arsenic	7.0	
Chromium	27.2	
Iron	29,000	
Manganese	515	

SITE ID	DTSB2	
DEPTH (ft)	2.5–3.0	
Metals		
Aluminum	11,800	
Arsenic	4.5	
Chromium	37.6	
Iron	32,000	
Manganese	812	

SITE ID	DTSB1	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	11,600	
Arsenic	4.8	
Chromium	30.1	
Iron	29,100	
Manganese	408	

SITE ID	DTSB4	
DEPTH (ft)	2.5–3.0	
Metals		
Aluminum	12,900	
Arsenic	6.1	
Chromium	31.4	
Iron	30,500	
Manganese	790	
Vanadium	55.8	J

SITE ID	DTSB6	
DEPTH (ft)	1.0–1.5	
Metals		
Aluminum	16,000	
Arsenic	6.1	
Chromium	32.3	
Iron	32,100	
Manganese	587	
Vanadium	56.3	J

SITE ID	DTSB8	
DEPTH (ft)	1.0–1.5	
Metals		
Aluminum	9,990	
Arsenic	6.3	
Chromium	40.5	
Iron	32,100	
Manganese	**1,660**	
SVOCs		
Benzo[a]pyrene	.83	
Benzo[b]fluoranthene	.94	
Carbazole	**.57**	

SITE ID	DTSB11	
DEPTH (ft)	3.5–4.0	
Metals		
Arsenic	6.4	
Chromium	35.0	
Iron	29,400	
Manganese	612	

SITE ID	DTSB10	
DEPTH (ft)	3.5–4.0	
Metals		
Aluminum	10,100	
Arsenic	6.5	
Chromium	25.1	
Iron	23,500	
Manganese	847	
SVOCs		
Benzo[a]pyrene	**.41**	

SITE ID	DTSB16	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	14,700	
Arsenic	5.8	
Chromium	38.1	
Iron	30,800	
Manganese	553	
SVOCs		
Benz[a]anthracene	19.58	
Benzo[a]pyrene	21.88	
Benzo[b]fluoranthene	27	
Benzo[k]fluoranthene	10.4	
Carbazole	**1.4**	
Dibenz[a,h]anthracene	1.3	J
Indeno[1,2,3-cd]pyrene	11.6	

SITE ID	DTSB12	
DEPTH (ft)	3.5–4.0	
Metals		
Aluminum	11,800	
Arsenic	7.2	
Chromium	37.5	
Iron	32,500	
Manganese	303	

SITE ID	DTSB18	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	15,100	
Arsenic	5.7	
Chromium	32.8	
Iron	31,400	
Manganese	462	
SVOCs		
Benzo[a]pyrene	1.6	
Carbazole	**1.3**	J

SITE ID	DTSB20	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	16,300	
Arsenic	7.1	
Chromium	38.0	
Iron	38,900	
Manganese	564	
Vanadium	70.2	J
SVOCs		
Benzo[a]pyrene	.21	
Carbazole	**.5**	J

SITE ID	DTSB15	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	10,600	
Antimony	4.8	J
Arsenic	4.4	
Chromium	40.0	
Iron	29,100	
Manganese	712	
SVOCs		
1,4-Dichlorobenzene	**.42**	
3,3'-Dichlorobenzidine	**.82**	
4-Nitrophenol	**2.1**	

SITE ID	DTSB13	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	10,100	
Arsenic	7.1	
Chromium	27.8	
Iron	28,600	
Manganese	620	
SVOCs		
Benzo[a]pyrene	.23	

SITE ID	DTSB14	
DEPTH (ft)	3.5–4.0	
Metals		
Aluminum	12,600	
Arsenic	7.0	
Chromium	29.4	
Iron	36,900	
Manganese	**1,040**	

SITE ID	DTSB17	
DEPTH (ft)	3.0–3.5	
Metals		
Aluminum	15,400	
Arsenic	9.6	
Chromium	**53.5**	
Iron	47,800	
Manganese	**1,110**	
Vanadium	85.0	J
SVOCs		
Benz[a]anthracene	**6.6**	
Benzo[a]pyrene	7.4	
Benzo[b]fluoranthene	8.4	
Carbazole	**1.7**	J
Dibenz[a,h]anthracene	.43	J
Indeno[1,2,3-cd]pyrene	4.1	
Naphthalene	**7.8**	

SITE ID	DTSB21	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	8,560	
Arsenic	**2.6**	
Chromium	38.4	
Iron	23,900	
Manganese	541	
SVOCs		
1,4-Dichlorobenzene	**3.2**	
4-Nitrophenol	**5.5**	
Benz[a]anthracene	**1.5**	
Benzo[a]pyrene	1.7	
Benzo[b]fluoranthene	2.1	
Dibenz[a,h]anthracene	.11	
Indeno[1,2,3-cd]pyrene	.97	

SITE ID	DTSB19	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	17,000	
Arsenic	5.7	
Chromium	32.5	
Iron	30,000	
Manganese	470	

SITE ID	DTSB22	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	13,600	
Arsenic	5.4	
Chromium	40.7	
Iron	34,800	
Manganese	437	
Vanadium	59.4	J
SVOCs		
Benz[a]anthracene	**2**	
Benzo[a]pyrene	2.1	
Benzo[b]fluoranthene	2.8	
Dibenz[a,h]anthracene	.15	J
Indeno[1,2,3-cd]pyrene	1.2	

SITE ID	DTSB35	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	14,600	
Arsenic	4.6	
Chromium	**47.2**	
Iron	29,600	
Manganese	746	
SVOCs		
Benz[a]anthracene	**1.7**	
Benzo[a]pyrene	1.8	J
Benzo[b]fluoranthene	2.3	
Carbazole	**3.5**	J
Dibenz[a,h]anthracene	.12	
Indeno[1,2,3-cd]pyrene	1.0	

SITE ID	DTSB23	
DEPTH (ft)	2.0–2.5	
Metals		
Aluminum	12,500	
Arsenic	**3.4**	
Chromium	29.3	
Iron	26,200	
Manganese	918	

SITE ID	DTSB37	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	15,900	
Arsenic	6.7	
Chromium	**58.0**	
Iron	41,600	
Manganese	**1,490**	
Vanadium	71.6	J

SITE ID	DTSB41	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	10,700	
Arsenic	**3.3**	
Iron	23,200	
Manganese	390	

SITE ID	DTSB39	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	19,900	
Arsenic	6.1	
Chromium	38.3	
Iron	37,400	
Manganese	703	
Vanadium	63.4	J

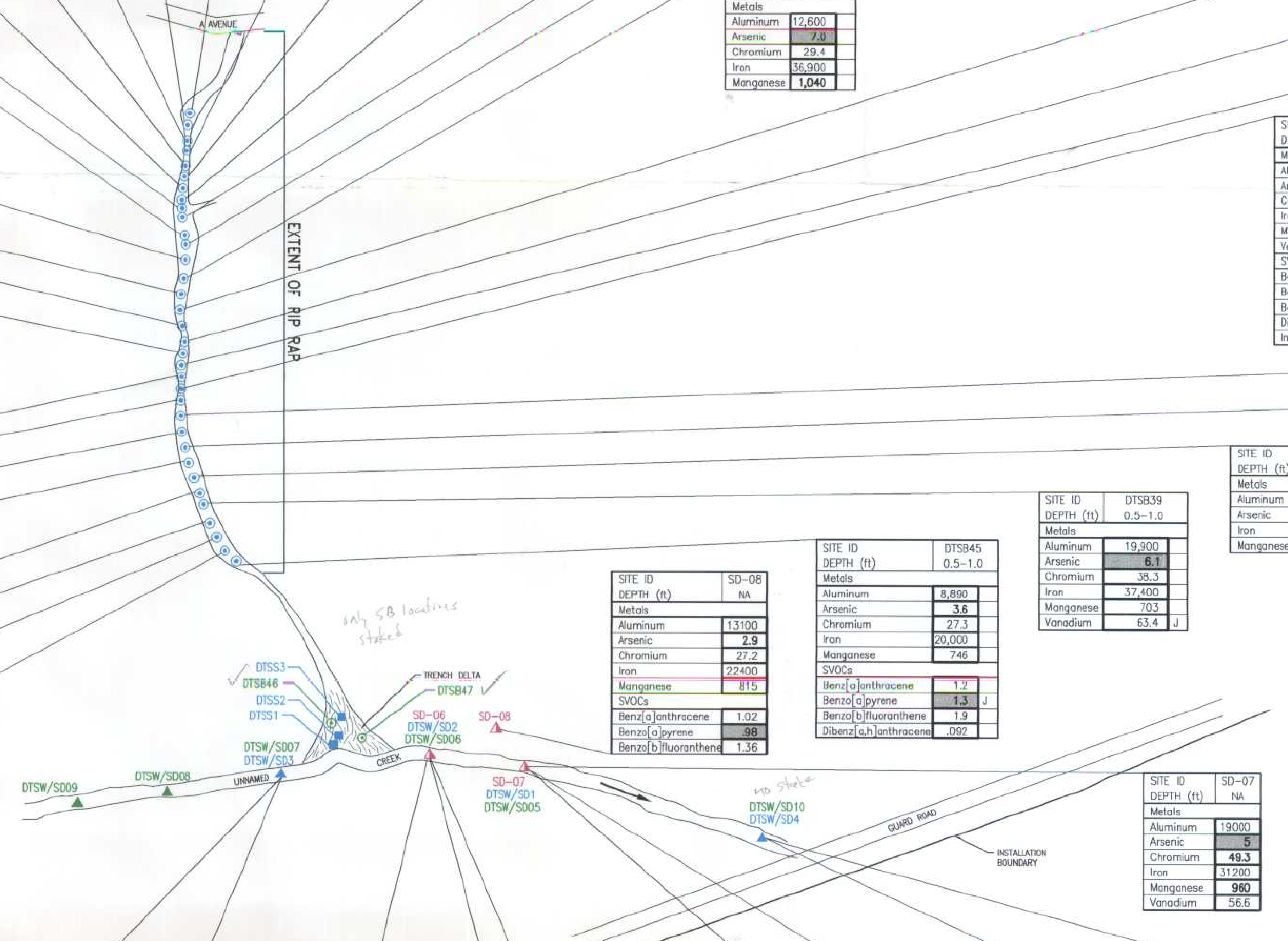
SITE ID	DTSB45	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	8,890	
Arsenic	**3.6**	
Chromium	27.3	
Iron	20,000	
Manganese	746	
SVOCs		
Benz[a]anthracene	1.2	
Benzo[a]pyrene	1.3	J
Benzo[b]fluoranthene	1.9	
Dibenz[a,h]anthracene	.092	

SITE ID	SD-08	
DEPTH (ft)	NA	
Metals		
Aluminum	13100	
Arsenic	**2.9**	
Chromium	27.2	
Iron	22400	
Manganese	815	
SVOCs		
Benz[a]anthracene	1.02	
Benzo[a]pyrene	.98	
Benzo[b]fluoranthene	1.36	

SITE ID	DTSB36	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	15,000	
Arsenic	7.0	
Chromium	**51.9**	
Iron	41,300	
Manganese	815	
Vanadium	69.7	J

SITE ID	DTSB38	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	14,000	
Arsenic	5.2	
Chromium	**43.6**	
Iron	29,500	
Manganese	**1,070**	

SITE ID	DTSB40	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	15,600	
Arsenic	5.2	
Chromium	41.2	
Iron	31,900	
Manganese	**1,060**	
Vanadium	59.5	J
SVOCs		
Benzo[a]pyrene	.15	J
Dibenz[a,h]anthracene	.099	



only SB locations staked

no stake

SITE ID	SD-07	
DEPTH (ft)	NA	
Metals		
Aluminum	19000	
Arsenic	5	
Chromium	**49.3**	
Iron	31200	
Manganese	**960**	
Vanadium	56.6	

SITE ID	DTSB42	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	13,200	
Arsenic	7.6	
Chromium	**63.4**	
Iron	43,500	
Manganese	**1,170**	
Vanadium	77.0	J
SVOCs		
Benz[a]anthracene	1.4	
Benzo[a]pyrene	1.7	J
Benzo[b]fluoranthene	2.3	
Dibenz[a,h]anthracene	.091	
Indeno[1,2,3-cd]pyrene	.9	

SITE ID	DTSB43	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	16,000	
Arsenic	7.4	
Chromium	**50.2**	
Iron	42,600	
Manganese	**1,190**	
Vanadium	75.7	J
SVOCs		
Benz[a]anthracene	**1.9**	
Benzo[a]pyrene	1.9	J
Benzo[b]fluoranthene	2.5	
Dibenz[a,h]anthracene	.097	J
Indeno[1,2,3-cd]pyrene	.93	

SITE ID	DTSB44	
DEPTH (ft)	0.5–1.0	
Metals		
Aluminum	28,500	
Arsenic	5.7	
Chromium	36.0	
Iron	47,500	
Manganese	571	
Vanadium	72.5	J
SVOCs		
Benz[a]anthracene	9.6	
Benzo[a]pyrene	10.4	J
Benzo[b]fluoranthene	12.74	
Dibenz[a,h]anthracene	.7	J
Indeno[1,2,3-cd]pyrene	4.9	

SITE ID	DTSW3-2	
DEPTH (ft)	NA	
Metals		
Copper	12	J
VOCs		
Bromodichloromethane	23	
Chloroform	4	

SITE ID	SD-06
DEPTH (ft)	NA
Metals	
Aluminum	21800
Arsenic	4.6
Chromium	39.2
Iron	31700
Manganese	**1250**
Vanadium	60.5

SITE ID	DTSW4	
DEPTH (ft)	NA	
Metals		
Copper	16.7	J
Thallium	7.2	J

SITE ID	DTSW1-2	
DEPTH (ft)	NA	
Metals		
Copper	34.8	J
Lead	4.6	J

SITE ID	DTSW2-2	
DEPTH (ft)	NA	
Metals		
Copper	27.4	J
Thallium	6.1	J

SITE ID	DTSD4	
DEPTH (ft)	0 – 0.5	
Metals		
Aluminum	8,970	
Arsenic	5.4	J
Chromium	33.6	
Iron	20,200	
Manganese	539	J

SITE ID	DTSD3		DTSD3-2	
DEPTH (ft)	0 – 0.5		0 – 0.5	
Metals				
Aluminum	10,800		9,250	
Arsenic	4.2		13.2	
Chromium	24.9		**73**	
Iron	17,300		56,200	
Manganese	387		**3,340**	
Vanadium	31.6	J	75.7	J

SITE ID	DTSD1		DTSD1-2	
DEPTH (ft)	0 – 0.5		0 – 0.5	
Metals				
Aluminum	17,200		8,690	
Arsenic	6.5		5	J
Chromium	**43.8**		22.3	
Iron	29,900		20,400	
Manganese	468		904	J
Vanadium	56	J	33.5	J

SITE ID	DTSD2		DTSD2-2	
DEPTH (ft)	0 – 0.5		0 – 0.5	
Metals				
Aluminum	15,200		8,980	
Arsenic	8		11.6	J
Chromium	**52.5**		**56.2**	
Iron	32,300		44,900	
Manganese	614		**1,640**	J
Vanadium	55.5	J	69.5	J

LEGEND:
- △ 1998 INDEPENDENT SAMPLING SEDIMENT SAMPLE LOCATION (GANNETT FLEMING)
- ▲ 1998 RI SURFACE WATER/SEDIMENT SAMPLE LOCATION (ICF KAISER)
- ◎ 1998 RI SOIL BORING (ICF KAISER)
- ■ 1998 RI SURFACE SOIL SAMPLE (ICF KAISER)
- ⊙ PROPOSED SOIL BORING LOCATION
- ▲ PROPOSED SURFACE WATER/SEDIMENT LOCATION
- → CREEK FLOW DIRECTION

NOTE:
SOLID MATRIX UNITS IN MG/KG
AQUEOUS UNITS IN UG/L
B = BLANK CONTAMINATION
J = ESTIMATED CONCENTRATION
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC OR AWQC (CHRONIC)
SHADING = VALUE EXCEEDS THE INDUSTRIAL OR TAP WATER RBC
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION
METALS REFERS TO TAL METALS

0 60 120 240
GRAPHIC SCALE IN FEET

SOURCE: NAEVA GEOPHYSICS INC.

Sample Summary

Previous Investigation	Contractor	TAL Metals				Explosives				TCL VOCs				TCL SVOCs				TCL PCBs		PAHs				Total
		SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SE	SW	SS	SB	SE	SW	
1997 Prelim. Sampling	ATK	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	1	--	--	--	--	--	--	2
1998 Independent Sampling	GF	--	--	3	1	--	--	3	1	--	--	3	1	--	--	3	1	3	1	--	--	--	--	20
1998 RI	ICF Kaiser	3	34	7	7	3	34	7	7	3	34	7	7	3	34	7	7	--	--	3	34	7	7	255

RADFORD AAP

PREPARED BY: IT CORP.	TASK NO: 886228300000
CHECKED BY: MT	IT DWG NO: 1-10-1xls.DWG
DATE: NOVEMBER 2001	

FIGURE 1.10-1

BUILDING DEBRIS
DISPOSAL TRENCH
SURFACE WATER/SEDIMENT
AND POST SITE RESTORATION
SAMPLE RESULTS AND
PROPOSED SAMPLING
LOCATIONS

PLOT: 1-14-02 FILE: 1-10-1XLS.DWG

05006 \ 300 - 1/1

Four TCL SVOCs (benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene) were detected at concentrations greater than the residential RBCs. One of these compounds, benzo[a]pyrene, also exceeded the industrial RBC. Benzo[a]pyrene concentrations exceeded the industrial RBC (0.78 mg/kg) in two of the three samples, with concentrations of 2.1 mg/kg (DTSS1) and 2.0 mg/kg (DTSS2) These compounds are PAHs and confirm the previous detections of these compounds. Two TCL VOCs were detected, however, both were reported at trace concentrations below the residential RBCs. Six TAL metals were detected above the residential RBCs. Arsenic also exceeded the industrial RBC. Arsenic concentrations in surface soil ranged from 4.3 mg/kg to 11.6 mg/kg. Sample results indicated that the surface soil in the trench delta had been impacted by the flash flood event. To mitigate impacts to the unnamed creek, the top three to six inches of soil were removed from the delta area.

Subsurface soil sampling. Construction debris and soil were removed from the trench area to allow access to subsurface soil to characterize soil below debris and visibly stained soil. Visible debris and soil removal commenced at the northern end of the trench, approximately 120 ft south of the storm water culvert pipe, and ended approximately 725 ft south of the culvert.

Following the excavation of debris and visibly stained soil, 34 subsurface soil samples (DTSB1 – DTSB23 and DTSB35 – DTSB45) were collected. Samples were collected from the trench floor from 0–0.5 ft below the visibly stained soil layers at an average distance of 17.5 ft apart. A greater number of samples were collected from areas of abundant debris or visibly stained soil and fewer from areas of sparse debris and visibly stained soil. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, explosives, and PAHs. Detected analytical results are presented in Table A-42 for inorganics and in Table A-43 for organics. Metals results indicated that arsenic was present at concentrations greater than the industrial RBC in 30 of the 34 samples. The maximum arsenic concentration was 9.6 mg/kg. Aluminum, antimony, chromium, iron, manganese, thallium, and vanadium were detected at concentrations exceeding residential RBCs but below industrial RBCs. Five TCL SVOCs (benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected above industrial RBCs. These compounds are PAHs and were also detected at elevated levels in the earlier investigations. Trace concentrations of one TCL VOC (methylene chloride) were detected below residential RBCs.

Site restoration activities. After completion of site sampling activities, the BDDT was backfilled with clean fill. A geotextile membrane and riprap was placed over the fill to provide erosion control. Soil and debris that were removed from the trench were sampled and analyzed for TCLP waste characteristics. Waste characterization sample results indicated that the material was non-hazardous, and the debris and soil were segregated and disposed offsite as nonhazardous material.

1.10.3 Conceptual Site Model

A conceptual site model for the BDDT is presented in **Figure 1.10-2**. Potentially affected media include surface and subsurface soil, sediment, and surface water. The area surrounding the disposal trench is grassy and slopes gently downward to the south to an unnamed creek with precipitation infiltrating into the ground or flowing overland to the creek. Site workers and biota are considered receptors. **Table 1.10-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

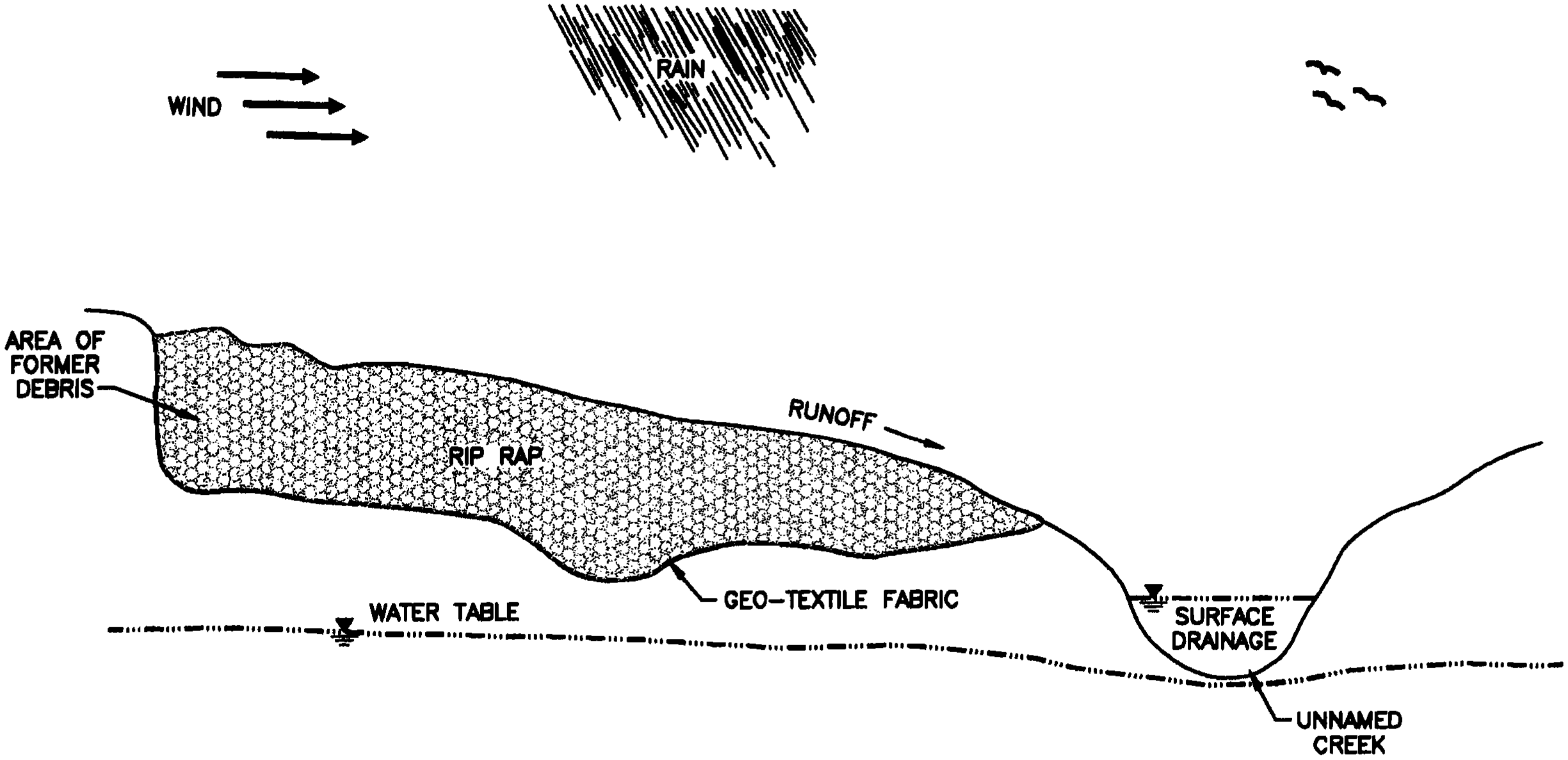
Surface soil was potentially impacted by disposal in the trench. The debris and stained soils removed to expedite sampling were characterized and disposed of as non-hazardous material. Clean backfill and riprap were placed in the trench to prevent erosion and stabilize the site. These activities have mitigated exposure pathways associated with the surface soil. Additional areas downslope from the riprap, however, have not been fully characterized. Therefore, site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities.

Subsurface soil is also potentially impacted by former disposal activities. Although results from the 1999 RI sampling effort indicated that elevated constituent concentrations were confined to the trench, other constituents (which were not previously tested) may be present outside of the disposal trench. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Table 1.10-1
Potential Exposure Pathways and Receptors—Building Debris Disposal Trench

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, INH, DA	IN, INH, DA	IN, DA	IN, DA	In unnamed creek.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.10-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.10-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

RADFORD AAP

PREPARED BY: IT CORP.
TASK NO: [illegible]
CHECKED BY: TL
IT DWG NO: 1-10-2
DATE: FEBRUARY 2002

FIGURE 1.10-2

CONCEPTUAL MODEL
BUILDING DEBRIS
DISPOSAL TRENCH

FILE: 1-10-2.DWG
PLOTTED: 2-7-02

Surface water and sediment are present in the unnamed creek south of the BDDT. Samples were collected during the 1998 RI sampling effort to characterize these media upstream and downstream from the delta at the base of the disposal trench. Not every analyte class was investigated during the 1998 RI. Surface water and sediment exposure pathways still exist in the creek. Potential receptors and pathways associated with these media are incidental ingestion and dermal absorption by benthic and aquatic organisms. Site worker and terrestrial biota exposure pathways include inhalation, dermal absorption and incidental ingestion of surface water, and dermal absorption and incidental ingestion of sediment.

1.10.4 Data Gap Analysis

TCL VOCs. The placement of clean backfill, geotextile membrane, and riprap in the trench has eliminated surface soil pathways in the main portion of the trench. Samples were collected for TCL VOC analysis during the 1998 RI sampling effort from surface soil, subsurface soil, surface water, and sediment. TCL VOCs were not reported in the subsurface soil samples. Two TCL VOCs were reported in surface water (bromodichloromethane and chloroform) at concentrations greater than their tap water RBC. These exceedences were both reported in the same sample (DTSW3-2), collected downstream from the trench. One TCL VOC was also reported in the collocated sediment sample below BTAG and RBC levels. Based on the conceptual model and these previous results, TCL VOCs are a data gap in surface water and in soil downslope from the riprap. Additional samples will also be collected from sediment to supplement previous results for risk characterization.

TCL SVOCs/PAHs. Surface and subsurface soil, surface water, and sediment samples were collected for TCL SVOC and PAH analysis during the 1998 RI sampling effort. TCL SVOCs, which included PAHs, were reported in the surface and subsurface soil samples. Five PAHs (benz[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, dibenz[*a,h*]anthracene, and indeno[1,2,3-*cd*]pyrene) were reported at concentrations greater than the industrial RBC. One TCL SVOC was reported in surface water below the tap water RBC. TCL SVOCs, including PAHs, were also reported in the sediment samples. One PAH, benzo[*a*]pyrene, was reported at concentrations greater than industrial RBC levels during the 1998 independent sampling. Based on the conceptual model and these previous results, PAHs are a data gap.

TCL PCBs. One surface water and three sediment samples were collected during the 1998 independent sampling event and analyzed for PCBs. PCBs were not detected in these samples. However, TCL PCB analysis has not been performed on other site media. Therefore, TCL PCBs are a data gap in the characterization of soil. Additional samples will also be collected from surface water and sediment to supplement the independent sampling results for risk characterization.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Surface soil, subsurface soil, surface water, and sediment samples were collected for explosives analysis during the 1998 RI. No explosive compounds were detected. Therefore, no data gaps exist with regards to this analyte class.

TAL metals. Surface soil, subsurface soil, surface water, and sediment samples were collected for TAL metals analysis during the 1998 RI. Arsenic was detected in samples above industrial RBCs. Other TAL metals were detected at concentrations above the residential soil RBCs. Additional samples will be collected for TAL metals to supplement previous results for risk characterization.

Dioxins/furans. The BDDT was not used for burning or disposal/storage of burned wastes or combustion byproducts, therefore, samples will not be analyzed for dioxins/furans.

Perchlorate. Surface water is present in the unnamed creek south of the BDDT. Previous investigations have not analyzed surface water for perchlorate; therefore, perchlorate represents a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.10.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.10-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.10-2**, includes the following media samples and analyses:

Surface soil. Two surface soil samples (DTSB46A and DTSB47A) will be collected from the 0-0.5 ft bgs interval of soil borings conducted in the trench delta where it meets the unnamed creek. These samples will be analyzed for TCL VOCs, TCL PCBs, PAHs, and TAL metals to characterize the soil in this area. Sample DTSB46A will also be analyzed for TCL pesticides, herbicides, TOC, grain size and pH to assess this site for these compounds and assess the bioavailability and mobility of constituents in soil.

Subsurface soil. Two subsurface soil samples will be collected from soil borings (DTSB46 and DTSB47) advanced in the trench delta where it meets the unnamed creek to complete the characterization of subsurface soil and sample for analytes not previously tested. Subsurface soil samples will be collected at 1–3 ft bgs from each boring and analyzed for TCL VOCs, TCL PCBs, PAHs and TAL metals. Sample DTSB46B will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in the subsurface.

Surface water. Six surface water samples will be collected from the unnamed creek and analyzed for TCL VOCs, TCL PCBs, PAHs, TAL metals, perchlorate and hardness. Three of the samples (DTSW07, DTSW08 and DTSW09) will be collected upstream from the BDDT to assess water quality before being potentially impacted by the BDDT. The remaining three samples (DTSW05, DTSW06, DTSW10) will be collected downstream from the BDDT to characterize water quality after passing the BDDT. One upstream sample (DTSW07) and one downstream sample (DTSW05) will also be analyzed for TCL pesticides and herbicides to assess the surface water for these compounds. Water quality parameters will be measured using a Hydrolab or equivalent and will include temperature, dissolved oxygen, pH, specific conductivity, and turbidity.

Sediment. Six sediment samples (DTSD05, DTSD06, DTSD07, DTSD08, DTSD09, DTSD10) will be collocated with the six proposed surface water samples described in the previous section. Sediment samples will be analyzed for TCL VOCs, TCL PCBs, PAHs and TAL metals. One upstream and one downstream sediment sample (DTSD07 and DTSD05, respectively), will also be analyzed for TCL pesticides and herbicides. Sediment samples will be collected from immediately below the surface water/sediment interface.

Table 1.10-2
Site-Specific Proposed Sampling and Analysis Plan—Building Debris Disposal Trench

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	DTSB46A	0-0.5 ft bgs	in trench delta	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, TOC, grain size, pH
	DTSB47A	0-0.5 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals
Subsurface Soil	DTSB46B	1-3 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals, TOC, grain size, pH
	DTSB47B	1-3 ft bgs	in trench delta	TCL VOCs, PCBs, PAHs, TAL metals
Surface Water	DTSW05	NA	downstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
	DTSW06	NA	downstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
	DTSW07	NA	upstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
	DTSW08	NA	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
	DTSW09	NA	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
	DTSW10	NA	downstream at NRU boundary	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
Sediment	DTSD05	0–0.5 ft bgs	downstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals
	DTSD06	0–0.5 ft bgs	downstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
	DTSD07	0–0.5 ft bgs	upstream from trench	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals
	DTSD08	0–0.5 ft bgs	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
	DTSD09	0–0.5 ft bgs	upstream from trench	TCL VOCs, PCBs, PAHs, TAL metals
	DTSD10	0–0.5 ft bgs	downstream at NRU boundary	TCL VOCs, PCBs, PAHs, TAL metals

1.11 IGNITER ASSEMBLY AREA (NEW RIVER UNIT)

1.11.1 Site Description

The IAA is located in the western portion of the NRU, west of the RY and north of the WBG. The original site was approximately 1,000 ft long by 250 ft wide and consisted of eight assembly buildings and several buildings associated with the igniter assembly process. Each of the igniter assembly buildings is approximately 100 ft long by 20 ft wide with loading rooms along both sides of a central concrete wall. Additional site visits and data analysis indicated that there were additional areas/buildings associated with the IAA. The expanded IAA is presented in **Figure 1.11-1**. The wooden portions of the structures, including the roofing, have been removed and the concrete walls, floors, and foundations remain. The floors in these buildings contain a conductive flooring material that consists of asbestos and heavy metals. The flooring has degraded to varying degrees in each of the buildings and red leachate has migrated into the surrounding soil. The outlying buildings had different functions and are various sizes. The buildings, however, have conductive flooring and are expected to present similar environmental concerns.

The areas between the buildings are generally flat with grassy depressions and are wooded with pine and cedar tree seedlings. Vegetation in the remaining areas is limited to grass. The soils in these areas vary from fill material to native soils. Drainage runs from northwest to southeast towards a drainage ditch between the buildings and Cameron Road. Stratigraphic characterization completed during the 1998 RI indicated that the subsurface at the IAA consists of yellowish-red to dark yellowish-brown to strong brown silt and silty clay. Below this lies a layer of mottled, moderately hard to soft clay with intermixed quartz gravel and weathered bedrock (saprolite). This material grades downward to a tight saprolitic clay at approximately 25 ft bgs.

Previous investigation activities at the IAA include a soil sampling effort conducted by Dames and Moore, Inc., in 1997, two rounds of independent sampling conducted by Gannett Fleming, Inc., in 1997 and 1998, and a Remedial Investigation conducted by ICF KE in 1998. Sample locations and chemical exceedence results from each of these investigations are presented in **Figure 1.11-1**. These investigations are summarized in the following sections.

1.11.2 Previous Investigations

Soil Sampling, Dames and Moore, Inc., 1997. The objective of the 1997 soil sampling effort was to provide an assessment of the lateral and vertical distribution of organic and inorganic constituents around Buildings 8102-2, 8102-7, 502 and 504 at the IAA. At each building, three soil sample locations were positioned in a line perpendicular to the building at distances of 12, 36, and 60 inches out from the sidewalk. Sample locations are shown in red in **Figure 1.11-1**. Three samples were collected from depths of 0-12, 12-24, and 24-36 inches at the location 12 inches away from the sidewalk. For the sampling locations 36 and 60 inches away from the sidewalk, two samples were collected from each location, at depths of 0-12 and 12-24 inches. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals.

Building 8102-2. A total of seven soil samples were collected on the northeast side of Building 8102-2. Arsenic was the single TAL metal detected above the industrial RBC of 3.8 mg/kg in five of the seven samples, with concentrations ranging from 5.0 to 8.2 mg/kg. Aluminum, chromium, iron, thallium (one sample), and vanadium were reported at concentrations between the residential and industrial RBCs. VOCs, SVOCs, and pesticides were not detected in the samples. One PCB (Aroclor-1254) was detected at a concentration below the residential RBC in the 0-12 inch sample, 12 inches away from the sidewalk. Detected analytical results are presented in Table A-44

Building 8102-7. A total of 14 soil samples were collected perpendicular to Building 8102-7. Seven of the samples were collected on the southwest side and seven were collected on the northeast side of the building. Arsenic concentrations (8.2 to 11.4 mg/kg) were detected above the industrial RBC in three of the seven samples collected on the southwest side of the building and in every sample (concentrations ranging from 4.0 to 14.6 mg/kg) on the northeast side of the building. Aluminum, chromium, iron, lead (one sample), manganese, thallium (two samples), and vanadium were reported at concentrations between the residential and industrial RBCs. VOCs were not detected in the samples. One SVOC [bis(2-Ethylhexyl)phthalate] was detected in three samples on the northeast side of the building at concentrations below the residential RBC. Four pesticides (4,4'-DDT, endrin, endosulfan II, methoxychlor) were reported below residential RBCs in one or more samples on both sides of the building. One PCB (Aroclor-1254) was also detected below the residential RBC in one surface soil sample on the northeast side of the building. Detected analytical results are presented in Table A-45 for metals and in Table A-46 for organics

Investigative results from this soil sampling event indicated the presence of elevated levels of metals, primarily arsenic, and trace levels of one SVOC [bis(2-Ethylhexyl)phthalate], four pesticides (4,4'-DDT, endrin, endosulfan II, methoxychlor), and one PCB (Aroclor-1254) in the soil at the IAA. The horizontal and vertical extent of these constituents was assessed; however, the reported results were highly variable and inconclusive.

Building 502. A total of seven soil samples were collected from the northeast side of Building 502, between the building and the access driveway. As with the other buildings, samples were orientated in a line perpendicular to the building. Three samples were collected 12 inches from the building at 0-12 inches bgs, 12-24 inches bgs, and 24-36 inches bgs. Two samples were collected from locations 3 ft and 5 ft from the building at 0-12 inches bgs and 24-36 inches bgs. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs and TAL metals. VOCs, SVOCs and pesticides were not detected in the soil samples from Building 502. One PCB, aroclor-1254, was detected in six of the seven samples. The concentrations, however, were below the residential RBC of 0.32 mg/kg.

21 TAL metals were detected in the samples. Arsenic was the sole constituent to exceed the industrial RBC. Four of the seven soil samples had arsenic concentrations in excess of 3.8 mg/kg (industrial RBC), ranging from 4.8 to 10.6 mg/kg. Arsenic concentrations do not show a trend in either vertical or lateral distribution. Aluminum, chromium, iron, manganese, mercury, thallium and vanadium were present in one or more of the samples at concentrations greater than the residential RBC, but below the industrial RBC. Detected analytical results are presented in Table A-47.

Building 504. Seven samples were also collected from Building 504. Similarly to Building 502, samples were collected from the northeast side of the building between the building and the access driveway. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs and TAL metals. VOCs and pesticides were not detected in the samples. Seven SVOCs were detected in the samples. Concentrations of these compounds were below residential RBCs. Five of the seven SVOCs are PAHs and were detected in the samples collected five ft from the building at 0-12 and 12-24 inches bgs. These samples were collected immediately adjacent to the access driveway and the presence of the PAH compounds is likely related to the asphalt driveway rather than building operations. One PCB, aroclor-1254, was detected at concentrations greater than the residential RBC (0.32 mg/kg) in four of the seven samples. The aroclor-1254 concentration in sample 5043601224, collected at 5 ft from the building at 12-24 inches bgs, was 10 mg/kg, greater than the industrial RBC of 2.9 mg/kg. Site utility maps do not show a transformer at this location.

23 TAL metals were reported in the samples from Building 504. Concentrations of arsenic, chromium and lead were greater than their respective industrial RBCs in the samples. Arsenic concentrations ranged from 4.9 to 11.9 mg/kg, exceeding the industrial RBC of 3.8 mg/kg in the seven samples. Lead concentrations were greater than 750 mg/kg in five of the seven samples. Lead concentrations in the two deeper samples (12-24 in bgs and 24-36 in bgs) from the sample location closest to the building were below the residential RBC. Samples with lead greater than the industrial RBC ranged from 1,280 to 16,200 mg/kg. The lead distribution in soil appears to stay fairly shallow (0-12 in bgs) close to the building, with lead concentrations increasing in the 12-24 in bgs sample at 5 ft from the building. The same pattern is reflected in the chromium concentrations at this site. Two samples from the location 5 ft from the building had chromium concentrations in excess of the industrial RBC of 610 mg/kg. The other five samples had chromium concentrations greater than the residential RBC, but below the industrial RBC. The highest lead (16,200 mg/kg) and chromium (1,920 mg/kg) concentrations were both reported in the 12-24 in bgs sample collected five ft from the building. Aluminum, antimony, barium, copper, iron, manganese and vanadium were reported at concentrations greater than residential RBCs but below industrial RBCs. Detected analytical results are presented in Table A-48 (metals) and in Table A-49 (organics).

Independent Sampling, Gannett Fleming, Inc., 1997. The objective of the 1997 independent sampling was to characterize surface soil at the IAA. Investigative activities included the collection of two surface soil samples from around the IAA buildings. These samples (SS-03 and SS-11) were collected from 0–0.5 ft bgs in the vicinity of Buildings 8102-8 and 8102-5. Sample locations and chemical exceedence results are shown in magenta in **Figure 1.11-1**. Sample SS-03 was collected north of the ditch that parallels the north side of the IAA buildings, approximately 100 ft northwest of Building 8012-8. Sample SS-11 was collected in the center next to Building 8102-5 on the northeast side of the building. The samples were analyzed for TAL metals and cyanide, TCL VOCs, TCL SVOCs, pesticides/PCBs, and explosives.

GROUP SAMPLE NUMBER 81022612

SITE ID DEPTH (in)	81022612012 0-12	810226121224 12-24	810226122436 24-36
Metals			
Aluminum	9790	17600	19200
Arsenic	nd	8.2	6.0
Chromium	25.2	**44.3**	**43.9**
Iron	18600	40900	41300
Vanadium	42.5	80.8	84.4

GROUP SAMPLE NUMBER 81027260

SITE ID DEPTH (in)	81027260012 0-12	810272601224 12-24	
Metals			
Aluminum	35400	38600	
Arsenic	11.3	14.6	
Chromium	41.5	**56.7**	
Iron	41100	47000	
Manganese	99.4	178	
Thallium	nd	.55	J
Vanadium	79.9	83.1	

SITE ID DEPTH (ft)	IASB2A 0-2		IASB2B 4-6		IASB2C 26-28	
Metals						
Aluminum	12,900		11,500		9,930	
Arsenic	6.4		7.6		**3.6**	
Chromium	40.5		40.9		24	
Iron	42,700		36,700		25,600	
Vanadium	70	J	56	J	43	J

SITE ID DEPTH (ft)	TR-01A 0 - 0.2	
SVOCs		
Benz[a]anthracene	**3.54**	
Benzo[a]pyrene	5.24	C
Benzo[b]fluoranthene	12.59	C
Dibenz[a,h]anthracene	0.94	
Indeno[1,2,3-cd]pyrene	6.06	C

GROUP SAMPLE NUMBER 81027236

SITE ID DEPTH (in)	81027236012 0-12	810272361224 12-24
Metals		
Aluminum	18000	31500
Arsenic	4.0	8.1
Chromium	26.8	**52.5**
Iron	28900	37300
Manganese	188	442
Vanadium	54.6	67.5

SITE ID DEPTH (ft)	WS-03 NA
Metals	
Arsenic	204
Barium	2080
Chromium	**69.3**
Copper	54200
Iron	30600
Manganese	201
Zinc	3370

SITE ID DEPTH (ft)	SS-11b 0 - 0.2
Metals	
Antimony	ND
Arsenic	56.4
Barium	**4600**
Chromium	**79.1**
Copper	53400
Iron	27500
Manganese	300
Zinc	8280

SITE ID DEPTH (ft)	IATP2A 0.5-1		IATP2B 0.5-1		IATP2C 4-4.5	IATP2D 4-4.5
Metals						
Aluminum	13,900		9,870		13,500	16,700
Arsenic	28.8	J	8.4	J	5.9	10.1
Barium	1,170	J	270	J	38.5	41.7
Chromium	36.8		23.7		**42.2**	36
Copper	7,070		1,440		21.1	23.3
Iron	32,300		24,300		33,200	30,900
Manganese	308		234		270	269

SITE ID DEPTH (ft)	SS-03 0 - 0.5	
Metals		
Aluminum	15,300	
Arsenic	25.2	
Chromium	**54.4**	
Copper	24,600	
Iron	35,800	
Manganese	225	
Thallium	0.8	
VOCs		
Methylene chloride	0.002	B
PEST/PCB		
Aroclor-1260	0.37	

SITE ID DEPTH (ft)	IASB5A 0.5-1		IASB5B 5-6
Metals			
Aluminum	10,000		16,900
Arsenic	**2**		11.9
Chromium	22		**42.1**
Iron	23,100		44,500
Manganese	49.8		254
Mercury	< 0.13		304
Vanadium	40.9	J	64.2

GROUP SAMPLE NUMBER 81022636

SITE ID DEPTH (in)	81022636012 0-12		810226361224 12-24	
Metals				
Aluminum	15900		27200	
Arsenic	**1.4**	J	8.2	
Chromium	33.5		**51.1**	
Iron	31500		44800	
Thallium	nd		.63	J
Vanadium	61.5		95.3	

GROUP SAMPLE NUMBER 81022660

SITE ID DEPTH (in)	81022660012 0-12	810226601224 12-24
Metals		
Aluminum	24300	25600
Arsenic	5.5	5.0
Chromium	**49.8**	**50.8**
Iron	40900	44800
Vanadium	76.6	91.8

SITE ID DEPTH (ft)	IATP1A 0.5-1		IATP1B 0.5-1		IATP1C 4-4.5		IATP1D 4-4.5
Metals							
Aluminum	7,680		5,670		9,160		9,690
Arsenic	4.3	J	**1.8**	J	**3.3**		4
Copper	1,280	J	38.9	J	9.1	B	24.5
Iron	16,700		12,600		17,600		19,300

SITE ID DEPTH (ft)	SS-11 0-0.5	
Metals		
Aluminum	7,920	
Arsenic	85.8	
Barium	**9,360**	J
Cadmium	7.8	
Chromium	**86.8**	
Copper	38,000	
Iron	28,700	
Lead	1,040	
Manganese	498	
Thallium	0.6	
Zinc	**21,800**	
SVOCs		
Benzo[a]pyrene	0.15	J
VOCs		
Acetone	0.009	B
Methylene chloride	0.004	B
Naphthalene	0.0009	B
PEST/PCB		
Aroclor-1260	1.04	

SITE ID DEPTH (ft)	IASB3A 0.5-1		IASB3B 5-6	
Metals				
Aluminum	29,200		17,900	
Arsenic	7.8		3.9	
Chromium	**48.5**		35.2	
Iron	52,600		31,200	
Vanadium	89.8	J	54.5	J

SITE ID DEPTH (ft)	IASB1A 0.5-1		IASB1B 5-6
Metals			
Aluminum	11,100		11,500
Arsenic	6.1		4.3
Chromium	**54.2**		28.6
Iron	40,600		19,600
Vanadium	69	J	63.1

GROUP SAMPLE NUMBER 81027160

SITE ID DEPTH (in)	81027160012 0-12		810271601224 12-24
Metals			
Aluminum	18500		46900
Arsenic	**1.4**	J	11.4
Chromium	24.8		**44.4**
Iron	29300		45300
Vanadium	58.3		84.8

GROUP SAMPLE NUMBER 81027136

SITE ID DEPTH (in)	81027136012 0-12	810271361224 12-24	
Metals			
Aluminum	20000	35100	
Arsenic	**2.6**	8.2	
Chromium	26.5	40	
Iron	32200	41600	
Manganese	47.1	410	
Thallium	nd	.66	J
Vanadium	59.7	77.9	

GROUP SAMPLE NUMBER 81027112

SITE ID DEPTH (in)	81027112012 0-12	810271121224 12-24		810271122436 24-36
Metals				
Aluminum	29300	20800		23800
Arsenic	10.5	**2.1**	J	**2.8**
Chromium	37.2	28.8		31.9
Iron	38500	37400		38600
Manganese	590	69.3		56.5
Vanadium	65.8	nd		nd

GROUP SAMPLE NUMBER 8102727

SITE ID DEPTH (in)	8102727012 0-12	81027271224 12-24	81027272436 24-36
Metals			
Aluminum	16100	37600	33200
Arsenic	8.7	11.3	11.1
Chromium	25.2	**48.5**	**47.1**
Iron	21100	40800	30900
Lead	475	40.0	30.0
Manganese	221	341	408
Vanadium	37.6	76.7	59.2

SITE ID DEPTH (ft)	SS-12 0-0.2
Metals	
Antimony	ND
Arsenic	164
Barium	**3220**
Cadmium	6.8
Chromium	**99.2**
Copper	56500
Iron	35100
Lead	**563**
Manganese	281
Nickel	173
Thallium	.7
Zinc	6460

SITE ID DEPTH (ft)	IASB4A 0.5-1.5		IASB4B 5-6	
Metals				
Aluminum	15,600		15,700	
Arsenic	6.6		7.8	
Chromium	35.5		**59.8**	
Iron	31,200		36,300	
Manganese	144		557	
Vanadium	57.1	J	58	J

GROUP SAMPLE NUMBER 504312

SITE ID DEPTH (in)	504312012 0-12		5043121224 12-24	5043122436 24-36	
Metals					
Aluminum	20200		20300	23500	
Arsenic	7.5		5.4	7.7	
Barium	961		50.2	40.5	
Chromium	**511**		**42.4**	**42.8**	
Copper	1780		19.0	30.4	
Iron	56000		35800	33500	
Lead	4090		15.4	18.5	
Manganese	312		169	51.9	
Vanadium	66.9		74.8	71.4	
Pest/PCB					
Aroclor-1254	0.890	P	nd	0.046	P

SITE ID DEPTH (ft)	SS-11a 0-0.2
Metals	
Aluminum	8060
Antimony	ND
Arsenic	100
Barium	**11800**
Cadmium	5.5
Chromium	**79.4**
Copper	43900
Iron	28600
Lead	918
Manganese	465
Zinc	**18300**

GROUP SAMPLE NUMBER 504360

SITE ID DEPTH (in)	504360012 0-12		5043601224 12-24	
Metals				
Aluminum	10900		7430	
Antimony	3.2	J	7.2	J
Arsenic	5.3		11.9	
Barium	489		906	
Chromium	884		1920	
Copper	397		812	
Iron	41800		88000	
Lead	7370		16200	
Manganese	349		584	
Zinc	1490		3170	
Pest/PCB				
Aroclor-1254	0.560		10	D

GROUP SAMPLE NUMBER 502460

SITE ID DEPTH (in)	502460012 0-12	5024601224 12-24
Metals		
Aluminum	25100	20400
Arsenic	7.9	6.0
Chromium	40.9	36.6
Iron	40600	33900
Mercury	3.3	.63
Vanadium	86.5	70.6

GROUP SAMPLE NUMBER 502436

SITE ID DEPTH (in)	502436012 0-12		5024361224 12-24
Metals			
Aluminum	12800		22200
Arsenic	**1.2**	J	**3.4**
Chromium	25.5		**46.1**
Iron	19100		35200
Manganese	420		88.8
Vanadium	46.0		82.3

GROUP SAMPLE NUMBER 50240

SITE ID DEPTH (in)	50240012 0-12	502401224 12-24		502402436 24-36
Metals				
Aluminum	39000	18100		23000
Arsenic	10.6	**2.4**		4.8
Chromium	**60.3**	31.4		**48.8**
Iron	45500	29000		37400
Thallium	nd	.58	J	nd
Vanadium	98.4	64.6		87.3

GROUP SAMPLE NUMBER 504336

SITE ID DEPTH (in)	504336012 0-12		5043361224 12-24	
Metals				
Aluminum	14200		15700	
Antimony	1.3	J	.41	J
Arsenic	4.9		5.7	
Chromium	**468**		**176**	
Copper	653		123	
Iron	38600		33400	
Lead	3850		1280	
Manganese	281		274	
Pest/PCB				
Aroclor-1254	0.320	P	0.054	P

Sample Summary

Previous Investigation	Contractor	TAL Metals		Cyanide	Explosives		TCL VOCs		TCL SVOCs		TCL PCBs		Total
		SS	SB	SS	SS	SB	SS	SB	SS	SB	SS	SB	
1997 Soil Sampling	D&M	15	20	--	--	--	15	20	15	20	15	20	140
1997 Independent Sampling	GF	2	--	2	2	--	2	--	2	--	2	--	12
1998 Independent Sampling	GF	4	--	3	2	--	--	--	2	--	2	--	13
1998 RI	ICF Kaiser	8	11	--	4	3	--	--	8	7	--	--	41

LEGEND

●	1997 SOIL SAMPLE (DAMES & MOORE)
□	1997 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)
■	1998 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)
◆	1998 INDEPENDENT SAMPLING FLOOR SAMPLE (GANNETT FLEMING)
◉	1998 RI SOIL BORING (ICF KAISER)
▭	1998 RI TEST PIT (ICF KAISER)
◆	1998 RI FLOOR SAMPLE (ICF KAISER)
⊙	PROPOSED SOIL BORING LOCATION
▣	PROPOSED SURFACE SOIL LOCATION
✸	PROPOSED SEWER LOCATION
▲	PROPOSED SURFACE WATER/SEDIMENT LOCATION
▦	IGNITER ASSEMBLY AREA BUILDING
Ⓣ	TRANSFORMER

NOTE:

ALL UNITS IN MG/KG

B = BLANK CONTAMINATION

D = DILUTION FACTOR OF 20 USED TO OBTAIN RESULT

J = ESTIMATED CONCENTRATION

P = THERE IS A >25% DIFFERENCE IN THE DETECTED CONCENTRATION BETWEEN THE TWO COLUMNS

UJ = ESTIMATED NON-DETECT

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC

SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

METALS REFERS TO TAL METALS

RADFORD AAP	FIGURE 1.11-1
PREPARED BY: IT CORP.	TASK NO: 870403301000000
CHECKED BY: MT	IT DWG NO: 1-11-1xls.dwg
DATE: JANUARY 2002	IGNITER ASSEMBLY AREA PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS

05006\310 - 1/1

Three TAL metals, arsenic, copper and lead, were reported at concentrations greater than the industrial RBC. Lead exceeded the industrial RBC of 750 mg/kg in sample SS-11, with a reported concentration of 1,040 mg/kg. Arsenic and copper exceeded the industrial RBCs (arsenic = 3.8 mg/kg; copper = 8,200 mg/kg) in both samples collected. Arsenic concentrations were 25.2 mg/kg (sample SS-03) and 85.8 mg/kg (sample SS-11). Copper concentrations were 24,600 mg/kg and 38,000 mg/kg in samples SS-03 and SS-11, respectively. Aluminum, barium, cadmium, chromium, iron, manganese, thallium, vanadium and zinc were reported at concentrations between the residential and industrial RBCs. VOCs were not reported at concentrations exceeding either the residential or industrial RBCs. One SVOC, benzo[a]pyrene, was reported in sample SS-11 at a concentration greater than the residential RBC; this detection, however, was below the industrial RBC. One PCB compound, Aroclor-1260, was detected in both soil samples at concentrations exceeding the residential RBC. Neither sample exceeded the industrial RBC for this compound. Detected analytical results are presented in Table A-50. This investigation confirmed the presence of elevated levels of constituents, primarily metals, in the soil at the IAA. The extent of these constituents was not, however, assessed.

Independent Sampling, Gannett Fleming, Inc., 1998. The objective of the 1998 independent sampling was to further characterize portions of the IAA considered to be potential areas of concern based on results from the 1997 independent sampling. Investigative activities included the collection of six surface soil samples and one conductive flooring (paint chip) sample for laboratory analysis in the vicinity of the IAA buildings.

Six surface soil samples (SS-11a, SS-11b, SS-12, SS-12c, TR-01a, and TR-01b) were collected from three locations around the buildings of the area. Sample locations and chemical exceedence results are shown in **Figure 1.11-1.** Samples SS-11a and SS-11b were collected, next to Building 8102-5 on the northeast side of the building and analyzed for TAL metals and cyanide. Sample SS-12 and SS-12c were collected, next to Building 8102-6 on the northeast side of the building. Sample SS-12 was analyzed for TAL metals, cyanide, explosives, and asbestos; SS-12c was analyzed for explosives. Samples TR-01a and TR-01b were collected near a utility pole located north of Building 8102-4 and analyzed for TCL SVOCs and pesticides/PCBs. The utility pole was lying on the ground with no evidence of a transformer in the area.

Surface soil results indicate that arsenic, copper and lead exceeded the industrial RBC. Arsenic exceeded the industrial RBC of 3.8 mg/kg in the three samples, with concentrations ranging from 56.4 mg/kg (sample SS-11b) to 164 mg/kg (sample SS-12). Copper was also reported at concentrations exceeding the industrial RBC (8,200 mg/kg) in the three samples. Copper concentrations ranged from 43,900 mg/kg (sample SS-11a) to 56,500 mg/kg (sample SS-12). Lead exceeded the industrial RBC of 750 mg/kg in sample SS-11a, with a concentration of 918 mg/kg. Aluminum, antimony, barium, cadmium, chromium, manganese, nickel, thallium and zinc were detected at concentrations greater than the residential RBC; however, none of these analytes exceeded their respective industrial RBCs. Chrysotile, an asbestiform mineral, was detected in sample SS-12 at a level of 2.1 area %. There is no standard available for comparison. The presence of chrysotile is another indication that the conductive flooring material is impacting the surrounding soils. Three SVOCs (benzo[a]pyrene, benzo[b]fluoranthene, and dibenz[a,h]anthracene) were detected in soil sample TR-01A, collected near a utility pole, at concentrations in excess of the industrial RBC. Benzo[a]pyrene and dibenz[a,h]anthracene were reported at respective concentrations of 5.24 mg/kg and 0.94 mg/kg, exceeding the industrial RBC of 0.78 mg/kg for each compound. Benzo[b]fluoranthene exceeded its industrial RBC of 7.8 mg/kg with a concentration of 12.59 mg/kg. PCBs were not detected in the samples. TR-01A was collected near a utility pole to test for the presence of PCBs at a suspected transformer site. The PAHs detected in sample TR-01A are attributable to the wood preservative used on the utility pole. The absence of PCBs suggests that a transformer was not present at this location, or if present, that it did not leak. Pesticides were detected but did not exceed screening criteria. Explosives were not detected in the samples. Detected analytical results for metals are presented in Table A-51 and for organics in Table A-52.

One sample of conductive flooring (paint chip) (WS-03) was collected from the northeast side of Building 8102-6. This sample was analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, explosives, TAL metals and asbestos. Results indicated that two metals, arsenic and copper, exceeded their respective industrial RBCs. Barium, chromium, iron, manganese and zinc were reported at levels exceeding the residential RBC and below the industrial RBC. VOCs, SVOCs, pesticides/PCBs and explosives were not detected in the sample. Chrysotile, an asbestos mineral, was detected at a level of 2.6 area %. There is no comparison criterion available for this mineral. Detected analytical results for this sample are presented in Table A-53.

The 1998 independent sampling verified the results of the 1997 independent sampling and identified additional areas where IAA activities impacted the soil. The full extent of the area with elevated levels of metals was not bounded during this investigation.

Remedial Investigation, ICF KE, 1998. The purpose of the 1998 RI was to further characterize the nature and extent of contamination at the IAA through the investigation of subsurface soils and conductive flooring.

To accomplish this task, the following activities were performed:

- Eight soil samples were collected from two test pits,
- A total of eleven soil samples were collected from five soil borings using direct push methods in areas identified to be representative of potential environmental concerns, and
- One conductive floor sample was collected from the northeast corner of Building 8102-1 to verify floor material composition and assess transport and mobility.

Corresponding sample locations and chemical exceedence results are presented on **Figure 1.11-1.**

Test pits. Two test pits (IATP1 and IATP2), measuring 6 ft long by 2 ft wide by 4 ft deep, were advanced on the northeast corner of Buildings 8012-1 and 8012-7. These test pits were advanced to characterize the soil profile and assess the nature and extent of contamination due to the runoff of conductive flooring material from the buildings.

A substantial quantity of leachate was encountered in the surface soil immediately surrounding the buildings. Field observations during the advancement of test pit IATP1 indicated that red leachate was visible to a distance of 2.5 ft from the building foundation and to a depth of approximately 1.2 ft bgs. Field observations at test pit IATP2 indicated that the red leachate was found to extend to nearly 3 ft from the building foundation and to a depth of 0.5 ft bgs. The soil physical characteristics and the discovery of fill material, encountered during the advancement of IATP2, indicated that soil directly surrounding Building 8102-7 is not native. However, the soil physical characteristics encountered during the advancement of test pit IATP1 were indicative of native soil.

A total of four soil samples were collected from within each pit. Test pit soil samples IATP1A and IATP1C were collected approximately 1 ft and 5 ft, respectively, out from the building foundation at a depth of 0.5–1.0 ft bgs. Samples IATP1B and IATP1D were collected approximately 1 ft and 5 ft, respectively, out from the building foundation at a depth of 4.0–4.5 ft bgs. The same strategy was utilized for soil samples collected from test pit IATP2. Samples were analyzed for TAL metals. Shallow samples were also analyzed for TCL SVOCs. Additionally, the samples, with the exception of IATP1C and IATP1D, were analyzed for explosives. Detected analytical results are presented in Tables A-54 (metals) and A-55 (organics).

Arsenic exceeded the industrial RBC in every sample except IATP1B and IATP1C. Aluminum, barium, chromium, copper, iron, manganese, and thallium were detected at concentrations exceeding the residential RBC, but were below the industrial RBC in every sample. Additionally, one TCL SVOC (benzo[*a*]pyrene) was reported above the residential, but below the industrial RBC in samples IATP1B and IATP2A.

Subsurface soil borings. A total of 11 soil samples were collected from five borings (IASB1 through IASB5) advanced using direct push sampling methods to characterize the nature and extent of contamination and to assess whether remedial action is warranted. A shallow sample (from within the upper 2 ft of the subsurface) and a medium depth sample (from within 4–6 ft bgs) were collected from each boring. Additionally, one deep sample (IASB2C) was collected from boring IASB2 to characterize the lower subsurface region. Samples were analyzed for TAL metals and TCL SVOCs. Arsenic exceeded the residential RBC in every sample and was above the industrial RBC in every sample but IASB2C and IASB5A. Mercury exceeded its industrial RBC of 61 mg/kg in sample IASB5B with a concentration of 304 mg/kg. Mercury was, however, below the residential RBC of 2.3 mg/kg in the other samples. Aluminum, chromium, iron, manganese, thallium and vanadium concentrations exceeded the residential RBC but were below the industrial RBC. Two TCL SVOCs were detected at concentrations below their respective residential RBCs. Detected analytical results for the subsurface soil samples are presented in Tables A-56 (TAL metals) and A-57 (TCL SVOCs).

Conductive floor. One conductive floor sample was collected from the northeast corner of Building 8102-1 to verify floor material composition and assess transport and mobility. A small chunk of the red conductive flooring material was collected from the surface of the building foundation and was considered representative of the material found in each of the buildings. The flooring was a dry, dull red colored material containing white fibers. The sample was analyzed for TCLP metals, TCL SVOCs and asbestos containing material (ACM). TCLP results indicate that barium, cadmium, chromium, lead, and selenium were present in leachable forms in the conductive floor sample. None of the detected metals exceed their respective TCLP regulatory guidelines. Detected analytical results are presented in Table A-58. ACM and TCL SVOCs were not detected and are consequently not presented on the table.

The 1998 RI was successful in identifying the extent of impacted soil. Vertical and horizontal limits were established for the extent of leachate, and analytical results indicated that, except for arsenic and mercury, detectable constituents were present at levels below industrial RBCs.

1.11.3 Conceptual Site Model

A conceptual site model for the IAA is presented on **Figure 1.11-2**. Potentially affected media include surface soil and subsurface soil. The areas between the eight IAA buildings are flat, lightly wooded and grassy. Most precipitation is expected to infiltrate into the ground rather than flow overland to a surface water body. However, drainage ditches are present onsite. Site workers and terrestrial biota are considered receptors. **Table 1.11-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Surface soil is potentially impacted by the leachate from the conductive flooring. Demolition and removal of the wooden portions (roofs) of the buildings has exposed the conductive flooring material (composed of asbestos and heavy metals) to the elements. During the site visit, leachate was observed in the soil surrounding the buildings. Site workers and ecological receptors could be impacted though incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust.

Subsurface soil is also potentially impacted by leachate from the conductive flooring material. Site workers and terrestrial biota could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water and sediment, if present in the drainage ditches, may also be potentially impacted by leachate from the conductive flooring material. Site workers and ecological receptors could be negatively impacted by dust from dry sediment in the ditches, or from the incidental ingestion or dermal absorption of surface water/sediment in the ditches. Aquatic or benthic organisms are not likely to utilize these media at this site due to the ephemeral nature of water in the ditches.

Conductive flooring appears in numerous buildings throughout the NRU. Sampling of this material and surrounding media suggests that similar results will be obtained from the buildings with conductive flooring. This investigation and future investigations will continue to characterize this material and its impact on surrounding environmental media.

1.11.4 Data Gap Analysis

TCL VOCs. Two surface soil samples were collected for TCL VOC analysis during the 1997 independent sampling investigation. Subsurface soil was characterized for TCL VOCs during the 1997 Dames and Moore Soil Sampling. These investigations were limited in scope and did not assess every area of the site. Additional samples will also be collected from the surface and subsurface soil to provide adequate locations and number of samples for risk assessment. Surface water and sediment in the sewer sytem, drainage ditches, and swales, if present, will be assessed for TCL VOCs.

TCL SVOCs/PAHs. Eight surface soil and seven subsurface soil samples were collected during the 1998 RI to characterize the site for TCL SVOCs. SVOC results indicate that low levels of PAHs were present in the soil. Detection limits for these compounds are very close to the industrial RBC levels for some of these compounds. TCL SVOCs, including PAHs, are a data gap due to residential RBC exceedences of PAH compounds in the SVOC analysis. Previous investigations have not collected surface water or sediment samples for TCL SVOC/PAH analysis. Samples will be collected from these media, if available.

TCL PCBs. Two surface soil samples were collected for TCL PCB analysis during the 1997 independent sampling investigation. Subsurface soil has not been characterized for TCL PCBs, therefore, data gaps exist for this medium. Additional samples will also be collected from the surface soil to provide adequate locations and number of samples for risk assessment. Surface water and sediment samples will be collected for PCB analysis, if present.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Four surface soil and three subsurface soil samples were collected for explosives analysis during the 1998 RI. Results from these samples indicate that explosives were not detected. Explosives represent a data gap in areas of the site which have not been previously tested for this analyte class.

TAL metals. TAL metals analysis was performed on eight surface and 11 subsurface soil samples during the 1998 RI. Results from these samples indicate that arsenic and mercury exceeded the industrial RBC. Based on the chemical results and the locations of the samples relative to the extent of the leachate, TAL metals are not a data gap; however, additional samples will be analyzed for TAL metals in order to complete the delineation of the area of elevated metals concentrations.

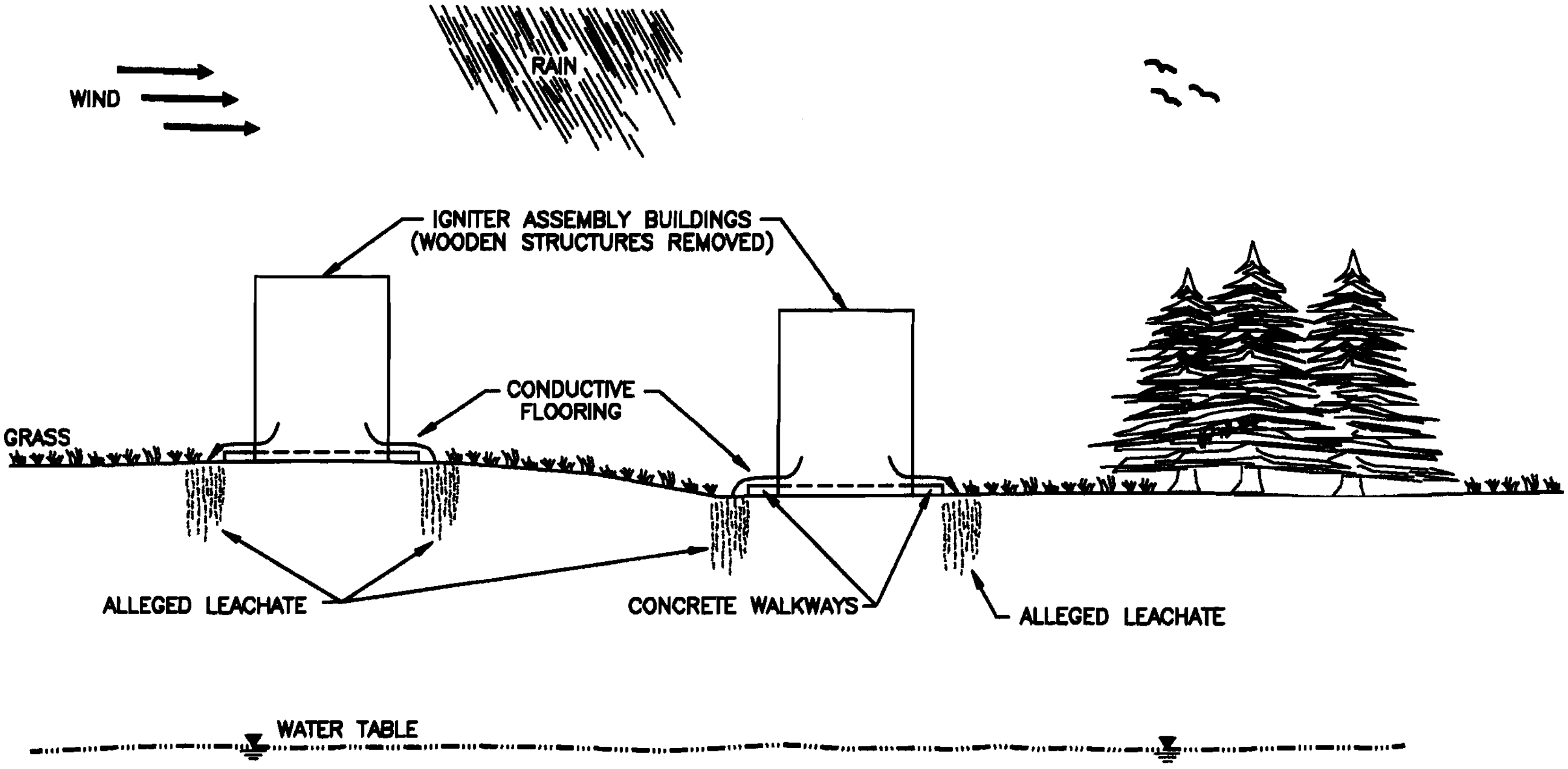
Dioxins/furans. The IAA was not used for burning or disposal/storage of burned wastes or combustion byproducts; therefore, samples will not be analyzed for dioxins/furans. Based on the CSM, dioxins/furans are not considered a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters. Pipe insulation samples will also be collected and analyzed for asbestos at the IAA due to the presence of asbestos-containing material in the soil.

1.11.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.11-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.11-2**, includes the following media samples and analyses:

Surface soil. 23 surface soil samples (0–0.5 ft bgs) will be collected to complete the characterization of the IAA. Boring IASB12 will be positioned in the central portion of the area between Building 8102-1 and 8102-2 to assess whether leachate from the building floors has migrated from the sidewalk areas as previously characterized. In addition, constituents not previously analyzed for in surface soil will be tested. The second sample location (IASB06) will be positioned adjacent to the east sidewalk at Building 8102-8 to test for analytes not previously investigated. Samples will be analyzed for TCL VOCs, TCL PCBs, PAHs and TAL metals. Sample IASB06A will also be analyzed for TCL pesticides, herbicides, TOC, grain size and pH to assess this site for these constituents. To complete the delineation of elevated metals detected during the earlier investigations, nine additional surface soil samples will be collected and analyzed for TAL metals. Six surface soil samples will be collected around previous sample locations SS-11and SS-12 to complete the delineation of elevated levels of metals detected at these locations. Samples collected around SS-11 will be analyzed for TAL metals and PAHs to investigate the benzo[a]pyrene residential RBC exceedence in the SVOC analysis during the 1997 independent sampling. Samples collected around SS-12 will be analyzed solely for TAL metals. Three surface soil samples will be also be collected around previous sample location IASB5B, where elevated mercury concentrations were reported during the RI. These samples will be analysed for TAL metals. Three surface soil samples (IASB13A, IASB14A and IASB15A) will be collected east of Building 504 and analyzed for TCL PCBs and TAL metals to assess the horizontal extent of elevated levels of constituents detected in sample previous sample 504360012. One sample will be collected near Building 8101 and will be analyzed for TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals and explosives. Eight surface soil samples (IATR01 – IATR08) will be collected from eight former locations of pole-mounted transformers at the site. These samples will be analyzed for TCL PCBs.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.11–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

RADFORD AAP		FIGURE 1.11–2
PREPARED BY: IT CORP.	TASK NO: [illegible]	CONCEPTUAL MODEL IGNITER ASSEMBLY AREA
CHECKED BY: TL	IT DWG NO: 1–11–2	
DATE: FEBRUARY 2002		

FILE: 1–11–2.DWG

PLOTTED: 2–7–02

Table 1.11-1
Potential Exposure Pathways and Receptors—Igniter Assembly Area

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, DA	IN, DA	—	—	Drainage ditches.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	IN, INH, DA	—	—	During construction activity.

NOTE: Refer to Figure 1.11-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

Subsurface soil. Two subsurface soil samples will be collected from each of two soil borings (IASB06 and IASB12) advanced to complete the characterization of subsurface soil and sample for analytes not previously tested. Samples will be collected at 4-6 and 8-10 ft bgs depths and analyzed for TCL VOCs, TCL PCBs, PAHs and TAL metals. Additional subsurface soil samples will also be collected at areas where previous investigations detected elevated concentrations of metals. Three subsurface soil samples will be collected from 4–6 ft bgs around sample location IASB5B and analyzed for TAL metals to delineate the elevated mercury level detected during the RI. Subsurface soil samples (IASB11B and IASB10B) will also be collected near previous sample locations SS-11 and SS-12 to define the vertical extent of elevated metals. Sample IASB11B will additionally be analyzed for PAHs to delineate PAH concentrations detected in this area. Six subsurface soil samples will be collected east of Building 504, near previous sample 5043601224. Three of these samples (IASB13B, IASB14B and IASB15B) will be collected from 1-2 ft bgs and analyzed for TCL PCBs and TAL metals to confine the lateral extent of elevated levels of constituents detected in sample 5043601224. Three samples (IASB13C, IASB14C and IASB15C) will be collected from 2-4 ft bgs and analyzed for TCL PCBs and TAL metals to assess the vertical extent of PCBs and metals detected in previous sample 5043601224.

Surface water. 12 surface water samples will be collected from the IAA. Three samples (IASW01, IASW02 and IASW03) will be collected from manholes at the site that lead to the sanitary sewage system. This system is no longer in operation and has been broken/sealed prior to the former discharge point. These samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, and hardness. Seven surface water samples (IASW04 – IASW10) will be collected from drainage pathways or culverts that control surface water runoff in the vicinity of the expanded IAA. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, and hardness. Two surface water samples (IASW11 and IASW12) will be collected from the storm water drainage swale that drains runoff from the IAA, if water is present in the drainage swale. These samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorate and hardness. One of the samples (IASW12) will also be analyzed for TCL pesticides and herbicides.

Sediment. 12 sediment samples will be collected at the IAA. These samples will be collocated with the surface water samples described in the previous section. Three samples (IASD01, IASD02 and IASD03) will be collected from manholes to the sanitary sewer system. These samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, and explosives. Seven sediment samples (IASD04 – IASD10) will be collected from drainage pathways or culverts that control surface water runoff in the vicinity of the expanded IAA. These samples will be collocated with surface water samples IASW04 – IASW10, and will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, and herbicides. Two additional samples (IASD11 and IASD12) will be collected from the drainage swale that controls runoff from the site. The sediment samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, TAL metals and explosives. One of the samples, (IASD12) will also be analyzed for TCL pesticides, herbicides, TOC, grain size and pH.

Asbestos. Two samples of potential asbestos containing material will be collected from pipe-insulation at one of the IAA buildings and analyzed for asbestos.

Table 1.11-2
Site-Specific Proposed Sampling and Analysis Plan—Igniter Assembly Area

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	IASS01	0-0.5 ft bgs	around SS-12	TAL metals
	IASS02	0-0.5 ft bgs	around SS-12	TAL metals
	IASS03	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
	IASS04	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
	IASS05	0-0.5 ft bgs	near Bldg 8101	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	IASB06A	0-0.5 ft bgs	east of 8102-8	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, TOC, grain size, pH
	IASB07A	0-0.5 ft bgs	around IASB5B	TAL metals
	IASB08A	0-0.5 ft bgs	around IASB5B	TAL metals
	IASB09A	0-0.5 ft bgs	around IASB5B	TAL metals
	IASB10A	0-0.5 ft bgs	around SS-12	TAL metals
	IASB11A	0-0.5 ft bgs	around SS-11	TAL metals, PAHs
	IASB12A	0-0.5 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
	IASB13A	0-0.5 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB14A	0-0.5 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB15A	0-0.5 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IATR01	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR02	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR03	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR04	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR05	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR06	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR07	0-0.5 ft bgs	former transformer location	TCL PCBs
	IATR08	0-0.5 ft bgs	former transformer location	TCL PCBs
Subsurface Soil	IASB06B	4–6 ft bgs	east of 8102-8	TCL VOCs, PCBs, PAHs, TAL metals
	IASB06C	8–10 ft bgs	east of 8102-8	TCL VOCs, PCBs, PAHs, TAL metals
	IASB07B	4-6 ft bgs	around IASB5B	TAL metals
	IASB08B	4-6 ft bgs	around IASB5B	TAL metals
	IASB09B	4-6 ft bgs	around IASB5B	TAL metals
	IASB10B	2-4 ft bgs	around SS-12	TAL metals
	IASB11B	2-4 ft bgs	around SS-11	TAL metals, PAHs
	IASB012B	4–6 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
	IASB012C	8–10 ft bgs	center of site	TCL VOCs, PCBs, PAHs, TAL metals
	IASB013B	1-2 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB013C	2–4 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB014B	1–2 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB014C	2–4 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals

Table 1.11-2 (cont'd)
Site-Specific Proposed Sampling and Analysis Plan—Igniter Assembly Area

Media	Sampling ID	Depth	Location	Analytes
Subsurface Soil (Cont'd)	IASB015B	1–2 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
	IASB015C	2–4 ft bgs	east of Bldg. 504	TCL PCBs, TAL metals
Surface Water	IASW01	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
	IASW02	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
	IASW03	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
	IASW04	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW05	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW06	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	IASW11	NA	drainage sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorate, hardness
	IASW12	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
Sediment	IASD01	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	IASD02	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	IASD03	NA	Sewer sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	IASD04	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD05	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD06	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	IASD11	NA	drainage sample	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives
	IASD12	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, TOC, grain size, pH
Asbestos	IAASB01	NA	pipe insulation	asbestos
	IAASB02	NA	pipe insulation	asbestos

1.12 NORTHERN BURNING GROUND (NEW RIVER UNIT)

1.12.1 Site Description

The NBG is located in the northern portion of the NRU, east of Gate 20, along Guard Road (**Figure 1.1-2**). The approximate area of concern at the burning ground is 350 ft long by 250 ft wide. A dirt road follows the outer perimeter of the site, defining the outermost boundary of the AOC. A drainage ditch parallels Guard Road on the north side of the site.

The NBG is a generally level area at an elevation of approximately 2,100 ft msl. The site is wooded with pines and contains sparse undergrowth of mimosa trees and grass. Stratigraphic characterization performed during the 1998 RI sampling effort indicated that the subsurface consists of a layer of yellowish brown to dark brown sandy clayey silt to a depth of 9 ft. Below this layer the soil is predominantly strong brown clay with some silt. Magnesium concretions in the form of black stained veins were observed beginning at a depth of 12 ft bgs and continued to 55 ft bgs.

Previous investigation activities at the NBG consisted of one round of independent sampling conducted by Gannett Fleming, Inc., in June 1997 and two RIs by ICF KE in 1998 and 1999. Sample locations and chemical exceedence results are presented in **Figure 1.12-1**. Each of these investigations is summarized in the following sections.

1.12.2 Previous Investigations

Independent Sampling, Gannett Fleming, 1997. The 1997 independent sampling was conducted to assess the NBG for the presence of elevated levels of constituents associated with former activities. Two surface soil samples (SS-01 and SS-02) were collected from 0.5–0.7 ft bgs in the northeast and southwest portions of the burning area, south of Guard Road. The samples were analyzed for TAL inorganics, TCL SVOCs, TCL VOCs, and pesticides/PCBs. Surface soil sample SS-02 was also analyzed for explosives.

One metal, arsenic, was detected at concentrations that exceed the industrial RBC of 3.8 mg/kg in both samples. Arsenic concentrations were 7.6 mg/kg and 6.3 mg/kg in samples SS-01 and SS-02, respectively. Aluminum, chromium, iron, manganese, and vanadium were present at concentrations above residential RBCs but below industrial RBCs. One VOC, 1,1-dichloroethene, was detected at a concentration below the residential RBC of 1.1 mg/kg. Two SVOCs were detected at concentrations below the residential RBC. Pesticides/PCBs and explosives were not detected in the samples. Analytical results for detected analytes associated with this sampling program are presented in Table A-59.

Limited sampling from a single environmental medium (surface soil) prevented the full characterization of this site during the 1997 independent sampling.

Remedial Investigation, ICF KE, 1998. The purpose of the RI was to characterize additional media and potential exposure pathways at the NBG through the investigation of surface and subsurface soils. In order to fulfill this purpose, the following activities were conducted at the NBG:

- A geophysical survey to aid in selecting locations for soil borings, and
- Collection of 11 soil samples from five soil borings.

Sample locations and chemical exceedence results are shown on **Figure 1.12-1**.

Geophysical survey. Due to a lack of historical information on the exact location of burning ground operations, an EM61 geophysical survey was conducted at the site to assist in the selection of soil boring locations. Aerial photographs were used to guide the geophysical survey within this area.

Five anomalous areas from the EM61 geophysical survey were selected for further investigation through the collection of soil samples. A total of eleven soil samples (four surface and seven subsurface) were collected from five soil borings (NBGSB1 through NBGSB5) using direct push sampling methods. Samples were collected at near surface and intermediate depths at each boring. Additionally, a deep sample was collected at boring NBGSB1 to characterize the lower subsurface region. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, and explosives.

Results show that arsenic concentrations exceeded the industrial RBC value in every sample except NBGSB3A. One sample (NBGSB2A) contained lead at a concentration of 23,400 mg/kg, exceeding the industrial RBC value of 750 mg/kg. Chromium was detected at a concentration of 1,620 mg/kg in the same sample, exceeding the industrial RBC of 610 mg/kg. Aluminum, iron, manganese, thallium and vanadium were detected at concentrations above the residential RBC, but did not exceed the industrial RBCs. Three TCL SVOCs were detected at concentrations below residential RBCs. VOCs and explosives were not detected. Analytical results for detected compounds are presented in Tables A-60 (TAL metals), and A-61 (TCL SVOCs).

Remedial Investigation, ICF KE, 1999. An additional RI sampling effort was conducted in 1999 to augment existing data and evaluate potential remedial alternatives. Investigative activities included the collection of additional subsurface soil samples in the vicinity of 1998 RI sample locations and in a low area adjacent to the burning ground to the west. The low area was investigated to assess whether runoff from the NBG infiltrated this area. A total of 25 soil samples were collected from 18 soil borings. Sample locations and chemical exceedence results are shown on **Figure 1.12-1**.

Seven samples were collected from five borings (NGSB6–NGSB9) in the low area west of the burning ground. The samples were collected at depths ranging from 0–4 ft and were analyzed for TCL VOCs, TCL SVOCs, PAHs, TAL metals, explosives, TOC (one location), and pH.

Arsenic was the sole analyte to exceed industrial RBCs in the low area. Aluminum, iron, manganese, and thallium were reported at concentrations greater than the residential RBC; however, none of these metals exceeded the industrial RBC. Arsenic (5.4–7 mg/kg) was detected slightly above the industrial RBC of 3.8 mg/kg in six samples. The arsenic exceedences were "B" flagged during data validation, indicating that this analyte was also detected in laboratory blanks associated with the sample. There were no detections of TCL VOCs or explosives in the low area. There were no TCL SVOCs or PAHs detected above residential RBCs. TOC concentrations reported in samples NBGSB6A and NBGSB6B were 1,799 mg/kg and 2,376 mg/kg, respectively. pH ranged from 6.05 (NBGSB8A) to 7.55 (NBGSB7B). Detected analytical results are presented in Table A-62 (metals) and A-63 (organics).

Five samples were collected from one boring (NGBSB10) at the burning area to confirm previous metals exceedences. The samples were collected at depths ranging from 0–12 ft and were analyzed for TCL VOCs, TCL SVOCs, TAL metals and explosives.

Arsenic (10.6–16.3 mg/kg) was detected above the industrial RBC (3.8 mg/kg) in the samples. Seven TAL metals (aluminum, chromium, iron, lead, manganese, thallium and vanadium) were detected at concentrations above residential RBCs but below industrial RBCs. TCL VOCs, SVOCs and explosives were not detected in the samples. Detected analytical results are presented in Table A-62 (metals) and A-63 (organics).

Thirteen samples (NBGDW1–NBGDW13) were collected to delineate lead and chromium concentrations detected in surface soil sample NBGSB2A during the 1998 RI sampling effort. Samples were collected by direct push methods from 0–4 ft bgs and were analyzed for TCLP metals. Two samples were analyzed for TAL metals, two samples were analyzed for TCL VOCs, and one sample was analyzed for TCL SVOCs. TCLP analytical results are presented in Table A-64. TCLP lead was detected above the TCLPRL of 5,000 μg/L in three of these samples: NBGDW1 (6,400 μg/L), NBGDW11 (63,300 μg/L), and NBGDW13 (5,100 μg/L). TAL metals results indicate that arsenic exceeded the industrial RBC and aluminum, chromium, lead, manganese, thallium and vanadium were reported at concentrations greater than the residential RBCs, but below industrial RBCs. There were no TCL VOCs or TCL SVOCs detected above residential RBCs.

1.12.3 Conceptual Site Model

A conceptual site model for the NBG is presented in **Figure 1.12-2**. Potentially affected media include surface and subsurface soil. The area surrounding the site is generally flat, with surface water controlled by a drainage ditch parallel to Guard Road. A reanalysis of the topography of the area indicates that surface water flow would be towards the drainage ditch and culvert near Guard Road, and not towards the low area west of the NBG. Site workers and biota are considered receptors. **Table 1.12-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Previous investigations indicate that lead is present at elevated concentrations in surface soil. An area of soil with lead concentrations greater than 200 mg/kg (lead action level at that time) was delineated during the 1998

FIELD ID	NBGDW13	
DEPTH (ft)	0-4	
TAL Metals		
Aluminum	25200	
Arsenic	**8.7**	J
Chromium	**94.5**	
Iron	29100	
Lead	**707**	
Manganese	281	
Vanadium	57.6	
TCLP Metals		
Lead	5100	

FIELD ID	NBGDW10
DEPTH (ft)	0-4
TAL Metals	
Aluminum	37000
Arsenic	**14.5**
Chromium	**54.2**
Iron	51100
Vanadium	97.4

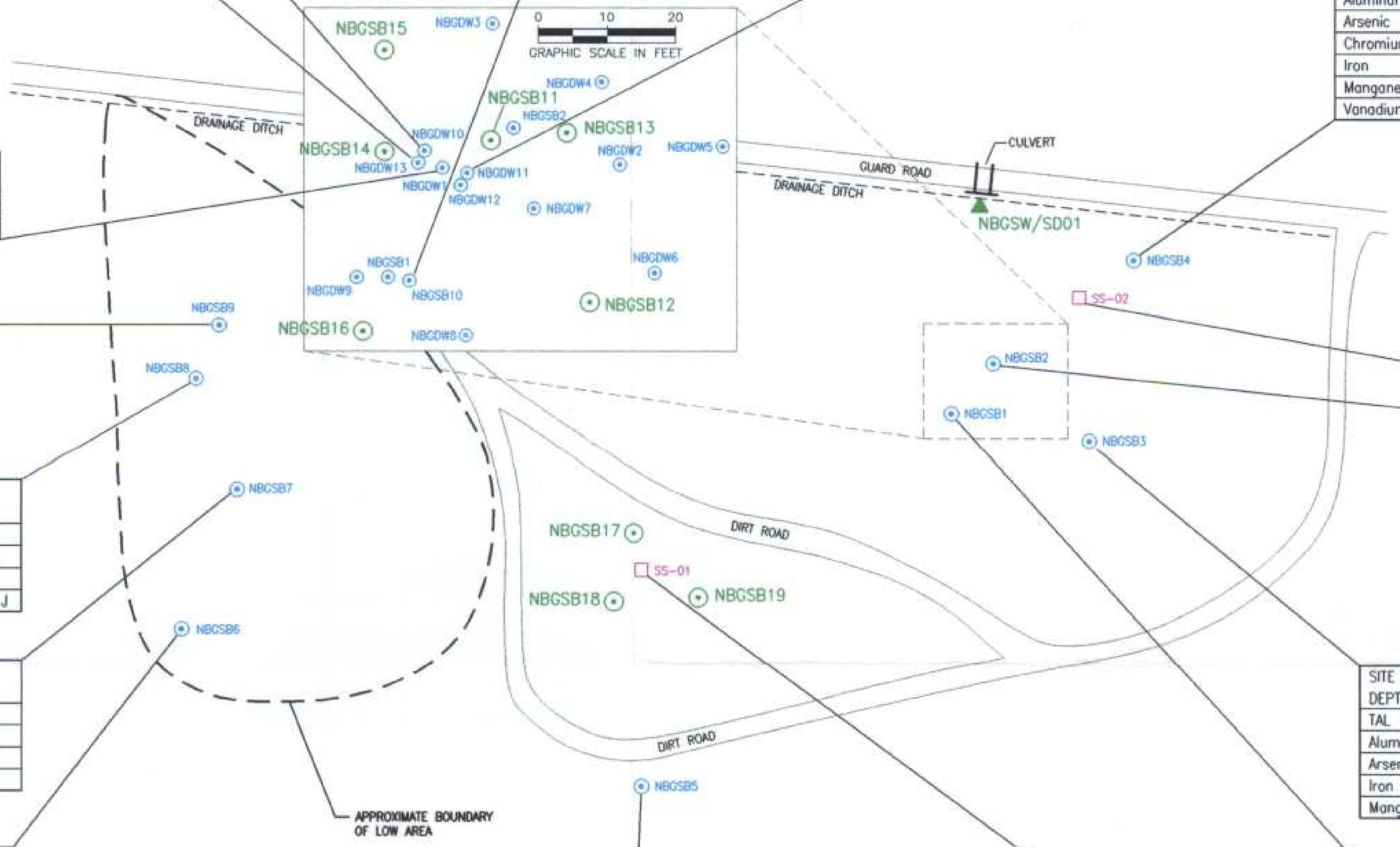
FIELD ID	NBGSB10A	NBGSB10B	NBGSB10C	NBGSB10D	NBGSB10E
DEPTH (ft)	2-4	4-6	6-8	8-10	10-12
TAL Metals					
Aluminum	22200	31200	26700	30600	29800
Arsenic	**10.6**	**15.1**	**16.3**	**14.5**	**17.5**
Chromium	**43.9**	**58.1**	**64.8**	**57.3**	**69.3**
Iron	39500	56500	63100	54500	62300
Vanadium	77.9	112	127	118	125

FIELD ID	NBGDW11
DEPTH (ft)	0-4
TCLP Metals	
Lead	63300

SITE ID	NBGSB4A		NBGSB4B	
DEPTH (ft)	0.5-1.5		5-6	
TAL Metals				
Aluminum	18,400		28,400	
Arsenic	**6**	J	**8.1**	J
Chromium	30		**42.3**	
Iron	23,300		41,900	
Manganese	317		53.3	
Vanadium	39.7	J	76.4	J

FIELD ID	NBGDW1
DEPTH (ft)	0-4
TCLP Metals	
Lead	6400

SITE ID	SS-02	
DEPTH (ft)	0.5-0.7	
TAL Metals		
Aluminum	28,900	
Arsenic	**6.3**	
Chromium	**44.2**	
Iron	26,700	
Vanadium	70.0	
VOCs		
Methylene chloride	0.002	B



FIELD ID	NBGSB9A
DEPTH (ft)	0-0.5
TAL Metals	
Iron	21300
Manganese	926

SITE ID	NBGSB2A		NBGSB2B	
DEPTH (ft)	0-2		5-6	
TAL Metals				
Aluminum	8,270		27,500	
Arsenic	**8.5**	J	**10.5**	J
Chromium	**1,620**		**53.4**	
Iron	12,900		52,000	
Lead	**23,400**		19.5	
Vanadium	23.4	J	79.1	J
Zinc	3,760		22.8	B

FIELD ID	NBGSB8A		NBGSB8B	
DEPTH (ft)	0-0.5		3.5-4	
TAL Metals				
Iron	21200		21800	
Manganese	710		401	
Thallium	.83	UJ	.92	J

FIELD ID	NBGSB7A	NBGSB7B
DEPTH (ft)	0-0.5	3.5-4
TAL Metals		
Aluminum	7800	5930
Iron	30100	29600
Manganese	470	380

SITE ID	NBGSB3A		NBGSB3B	
DEPTH (ft)	0.5-1.5		5-6	
TAL Metals				
Aluminum	9,810		15,800	
Arsenic	**3.2**	J	**4.3**	J
Iron	12,100		19,200	
Manganese	182		21.8	J

FIELD ID	NBGSB6A	NBGSB6B
DEPTH (ft)	0-0.5	3.5-4
TAL Metals		
Aluminum	4670	9420
Iron	8270	28800
Manganese	410	89.9

SITE ID	SS-01	
DEPTH (ft)	0.5-0.7	
TAL Metals		
Aluminum	18,200	
Arsenic	**7.6**	
Chromium	32.2	
Iron	28,000	
Manganese	208	
Vanadium	64.6	
VOCs		
Acetone	0.003	B
Benzene	0.001	J
Chlorobenzene	0.001	J
1,1-Dichloroethene	0.002	J
Methylene chloride	0.002	B
Trichloroethene	0.001	J

SITE ID	NBGSB1A		NBGSB1B		NBGSB1C	
DEPTH (ft)	0.5-1.5		8-10		53-55	
TAL Metals						
Aluminum	10800		27,400		13,100	
Arsenic	**4.2**	J	**7**	J	**9.2**	J
Chromium	31.8		**75.3**		35	
Iron	18,500		45,900		29,700	
Manganese	204		68.1		594	
Vanadium	33.1	J	83.1	J	49.5	J

SITE ID	NBGSB5A		NBGSB5B	
DEPTH (ft)	0.5-1.5		5-6	
TAL Metals				
Aluminum	10,400		30,400	
Arsenic	**4.5**	J	**17**	J
Chromium	16.4		**52.4**	
Iron	16,100		60,600	
Manganese	393		73.5	
Vanadium	27.9	J	91	J

-N-

LEGEND:

⊙ 1998/1999 RI SOIL BORING LOCATION (ICF KAISER)

□ 1997 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)

⊙ PROPOSED SOIL BORING LOCATION

⊡ PROPOSED SURFACE SOIL LOCATION

▲ PROPOSED SURFACE WATER/SEDIMENT LOCATION

NOTE:

TCLP UNITS MEASURED IN UG/L
TAL METAL UNITS MEASURED IN MG/KG
B = BLANK CONTAMINATION
J = ESTIMATED CONCENTRATION
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC OR TCLP CRITERIA
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

0 30 60 120
SCALE IN FEET

PLOT: 2-7-02

FILE: 1-12-1XLS.dwg

Sample Summary

Previous Investigation	Contractor	TAL Metals		Cyanide	Explosives		TCL VOCs		TCL SVOCs		TCL PCBs	PAHs		TCLP Metals	Total
		SS	SB	SS	SS	SB	SS	SB	SS	SB	SS	SS	SB	SB	
1997 Independent Sampling	GF	2	--	2	1	--	2	--	2	--	2	--	--	--	11
1998 RI	ICF Kaiser	4	7	--	4	7	4	7	4	7	--	--	--	--	44
1999 RI	ICF Kaiser	4	11	--	4	8	4	10	4	9	--	4	8	13	74

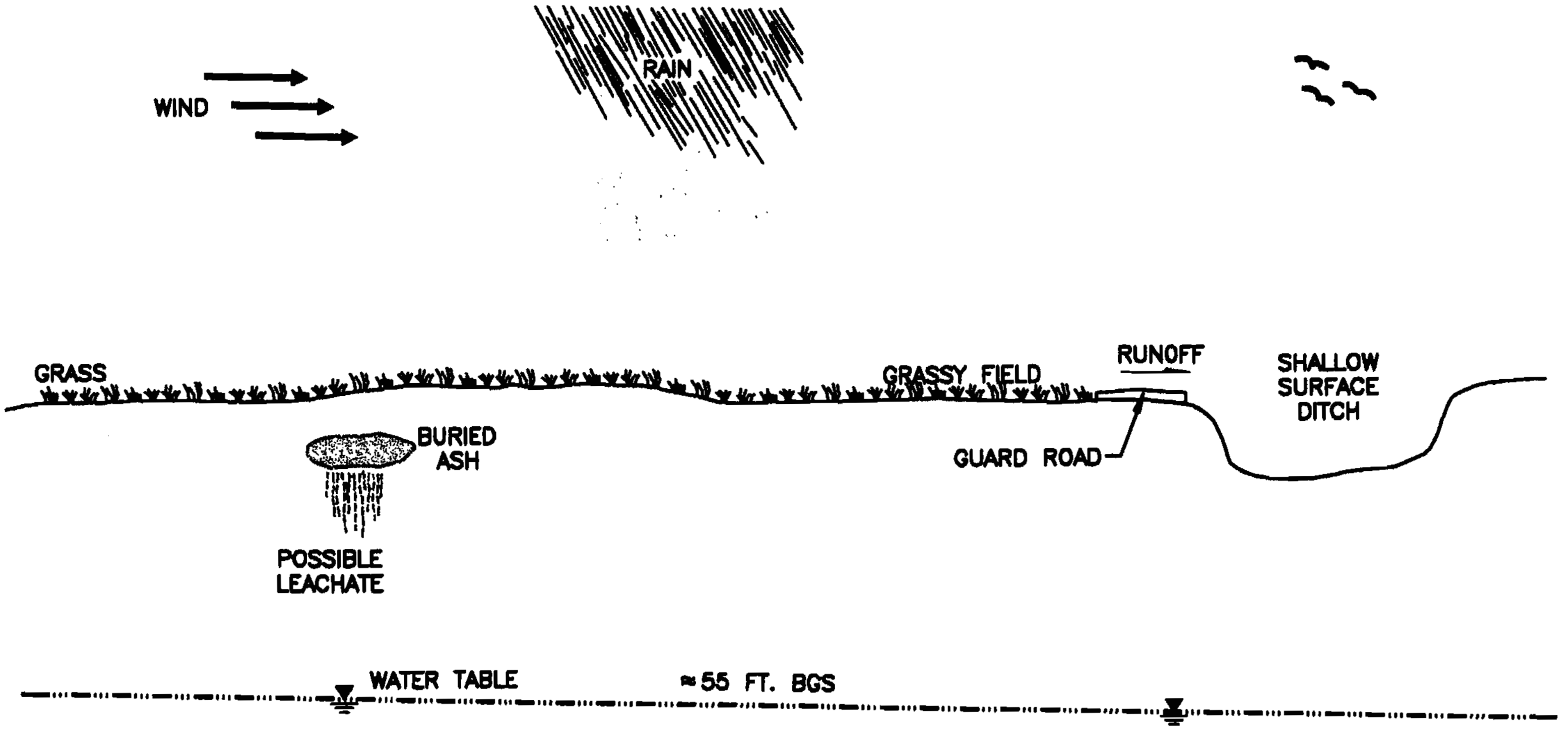
RADFORD AAP

PREPARED BY: IT CORP.	TASK NO: 87040330100000
CHECKED BY: MT	IT DWG NO: 1-12-1XLS.DWG
DATE: NOVEMBER 2001	

FIGURE 1.12-1

NORTHERN BURNING GROUND PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS

05006\332-1/1



"NOT TO SCALE"

NOTE:

SEE TABLE 1.12–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

RADFORD AAP		FIGURE 1.12–2
PREPARED BY: IT CORP.	TASK NO: [illegible]	CONCEPTUAL MODEL NORTHERN BURNING GROUND
CHECKED BY: MT	IT DWG NO: 1–12–2	
DATE: JANUARY 2002		

FILE: 1–12–2.DWG

PLOTTED: 2–7–02

Table 1.12-1
Potential Exposure Pathways and Receptors—Northern Burning Ground

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, INH, DA	IN, INH, DA	IN, DA	IN, DA	Drainage pathway culvert.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.12-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

and 1999 RIs. The soil with elevated lead concentrations has not been removed and represents a potential contaminant source area. Lead in soil may impact site workers and terrestrial biota through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust generated during construction activities.

Subsurface soil is also potentially impacted by past activities. Although results from the 1999 RI indicated that elevated lead concentrations were primarily confined to the shallow soil, high TCLP results indicate that lead may be mobile under certain conditions. In addition, the soil has not been tested for some constituents, primarily dioxins/furans. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water and sediment in the drainage ditch and culvert could be potentially impacted by former activities at the NBG. Site workers and terrestrial biota could be negatively impacted by the inhalation of volatiles from surface water. Site workers and biota (terrestrial, aquatic and benthic) could also be impacted by dermal absorption or ingestion of surface water or sediment.

1.12.4 Data Gap Analysis

TCL VOCs. Surface and subsurface soil samples were collected for TCL VOC analysis during the 1999 RI sampling effort. Additional surface and subsurface soil samples will be collected for VOC analysis to characterize additional portions of the site.

TCL SVOCs/PAHs. Surface and subsurface soil samples were collected for TCL SVOC and separate PAH analysis during the 1999 RI sampling activities. TCL SVOCs, including PAHs, were not detected in the soil. Therefore, this medium is considered characterized for TCL SVOCs and PAHs.

TCL PCBs. Samples were not collected for TCL PCB analysis during the 1998 or 1999 RI sampling activities. Two surface soil samples were collected during the 1997 independent sampling event. TCL PCBs were not detected in these samples. Additional samples will be collected for TCL PCB analysis from surface and subsurface soil.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Surface and subsurface soil samples were collected for explosives analysis during the 1999 RI sampling activities. Explosives were not present in the soil. Therefore, this medium is considered characterized for explosives.

TAL metals. Surface and subsurface soil were characterized for TAL metals during the 1998 and 1999 RI sampling efforts. An area of elevated lead concentration was delineated during these investigations. Results indicated that lead was primarily confined to a small area with most of the lead concentrations remaining in shallow soil. In order to refine the delineation of lead, additional soil samples will be required to fully delineate this analyte class.

Dioxins/furans. The NBG is associated with the burning of explosive/propellant-contaminated material; therefore, dioxins/furans are potential chemicals of concern. No samples for dioxins/furans analysis were collected during the previous investigations from surface or subsurface soil. Therefore, dioxins/furans represent a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.12.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.12-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.12-2**, includes the following media samples and analyses:

Surface soil. Two soil borings (NGBSB11 and NGBSB12) will be advanced in the vicinity of previous boring sample locations NBGSB1 and NBGSB2, where known burning activities occurred. One surface soil sample will be collected from each boring and analyzed for TCL pesticides/PCBs, TAL metals, herbicides and dioxins/furans. Sample NBGSB12A will also be analyzed for TOC, grain size and pH. Two surface soil samples (NBGSB13A and NBGSB14A) will be collected to the east and west of previous sampling location NBGSB2 in order to bound the extent of elevated lead and chromium in these directions. In addition to TAL metals, these samples will be analyzed for TCL PCBs and dioxins/furans because they are close to the area where known burning activities occurred. Samples will be collected from the northwest (NBGSB15A) and southwest (NBGSB16A) corners of the burn area to assess these areas. These samples will be analyzed for TCL PCBs, TAL metals and dioxins/furans. Three surface soil samples (NBGSB17A, NBGSB18A and NGBSB19A) will be collected around previous sample location SS-01 to verify the presence of elevated VOCs detected during the 1997 independent sampling. These samples will be analyzed for TCL PCBs, TAL metals and dioxins/furans, in addition to TCL VOCs. Sample NBGSB17A will also be analyzed for pesticides and herbicides to assess this area for these analyte classes.

Subsurface soil. 13 subsurface soil samples will be collected from nine soil borings advanced at the site. Two soil borings (NGBSB11 and NGBSB12) will be advanced in the vicinity of previous boring sample locations NBGSB1 and NBGSB2, where known burning activities occurred. Two subsurface (1–3 and 3–5 ft bgs) soil samples will be collected from each boring and analyzed for TCL PCBs, TAL metals and dioxins/furans. The 3-5 ft bgs sample from NBGSB12 will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents in the subsurface soil. Samples will collected from 1-3 ft bgs from borings NBGSB13 and NBGSB14 and analyzed for TCL PCBs, TAL metals and dioxins/furans. A subsurface soil sample (NBGSB15B) will be collected from 1-3 ft bgs from the northwest corner of the burn area and analyzed for the same constituents as NBGSB13 and NBGSB14. Three subsurface soil samples will be collected from NBGSB16 (2-4, 6-8, and 8-10 ft bgs) to assess the southwest portion of the burn area. These three samples will also be analyzed for TCL PCBs, TAL metals and dioxins/furans. Finally, three subsurface soil samples (NBGSB17B, NBGSB18B and NBGSB19B) will be collected from 1-3 ft bgs around the location of previous sample SS-01. These samples will be analyzed for TCL VOCs, PCBs, TAL metals and dioxins/furans.

Surface water. If present, one surface water sample (NBGSW01) will be collected at the culvert that provides drainage under the road. The sample will be collected from an area where water is ponded, either upstream or immediately downstream from the culvert. This sample will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, dioxin/furans, perchlorate and hardness.

Sediment. One sediment sample (NBGSD01), collocated with surface water sample NBGSW01 will be collected at the culvert that provides drainage under the road. This sample will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, herbicides, explosives, and dioxin/furans.

Table 1.12-2
Site-Specific Proposed Sampling and Analysis Plan—Northern Burning Ground

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	NBGSB11A	0–0.5 ft bgs	near NBGSB2	TCL pesticides/PCBs, herbicides, TAL metals, dioxins/furans
	NBGSB12A	0–0.5 ft bgs	SE corner of burn area	TCL pesticides/PCBs, herbicides, TAL metals, dioxins/furans, TOC, grain size, pH
	NBGSB13A	0–0.5 ft bgs	former NBGSS03	TCL PCBs, TAL metals, dioxins/furans
	NBGSB14A	0–0.5 ft bgs	former NBGSS04	TCL PCBs, TAL metals, dioxins/furans
	NBGSB15A	0–0.5 ft bgs	NW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB16A	0–0.5 ft bgs	SW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB17A	0–0.5 ft bgs	around SS-01	TCL VOCs, pesticides/PCBs, herbicides, TAL metals dioxins/furans
	NBGSB18A	0–0.5 ft bgs	around SS-01	TCL VOCs, PCBs, TAL metals, dioxins/furans
	NBGSB19A	0–0.5 ft bgs	around SS-01	TCL VOCs, PCBs, TAL metals, dioxins/furans
Subsurface Soil	NBGSB11B	1–3 ft bgs	near NBGSB2	TCL PCBs, TAL metals, dioxins/furans
	NBGSB11C	3–5 ft bgs	near NBGSB2	TCL PCBs, TAL metals, dioxins/furans
	NBGSB12B	1–3 ft bgs	SE corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB12C	3–5 ft bgs	SE corner of burn area	TCL PCBs, TAL metals, dioxins/furans, TOC, grain size, pH
	NBGSB13B	1-3 ft bgs	former NBGSS03	TCL PCBs, TAL metals,dioxins/furans
	NBGSB14B	1-3 ft bgs	former NBGSS04	TCL PCBs, TAL metals, dioxins/furans
	NBGSB15B	1-3 ft bgs	NW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB16B	2-4 ft bgs	SW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB16C	6-8 ft bgs	SW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB16D	10-12 ft bgs	SW corner of burn area	TCL PCBs, TAL metals, dioxins/furans
	NBGSB17B	1-3 ft bgs	around SS-01	TCL VOCs, PCBs, TAL metals, dioxins/furans
	NBGSB18B	1-3 ft bgs	around SS-01	TCL VOCs, PCBs, TAL metals, dioxins/furans
	NBGSB19B	1-3 ft bgs	around SS-01	TCL VOCs, PCBs, TAL metals, dioxins/furans
Surface Water	NBGSW01	na	near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, dioxin/furans, perchlorate, hardness
Sediment	NBGSD01	na	near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, dioxin/furans

1.13 WESTERN BURNING GROUND (NEW RIVER UNIT)

1.13.1 Site Description

The WBG is located in the western portion of the NRU, west of the RY and south of the IAA (**Figure 1.1-2**). The WBG is approximately 170 ft long by 100 ft wide. It is immediately surrounded on three sides by an approximately 4 ft high earthen berm. This area is generally flat at an elevation of approximately 2,050 ft msl. Surface water runoff is expected to flow to the northwest. The site is wooded with a sparse growth of pine trees on the bermed sides of the site.

An unnamed pond was constructed south of the WBG during the early 1990s and is fed by Wiggins Spring, a natural spring located at the head of the pond. The pond drains under an earthen dam into the unnamed creek south of the WBG.

Stratigraphic characterization completed during the 1998 RI indicated that the subsurface consists of a layer of brownish-yellow hard to very hard clay, variably mixed with gray gravel, to a depth of 6 ft. An approximately 3.5-ft-thick brownish-yellow soft clay seam underlies the hard clay. Below this layer, the soil grades to a gray hard clay (weathered bedrock product).

Previous investigation activities at the WBG consisted of one round of independent sampling in 1997, by Gannett Fleming and RIs by ICF KE in 1998 and 1999. Each of these investigations is summarized in the following sections.

1.13.2 Previous Investigations

Independent Sampling, Gannett Fleming, 1997. The objective of the 1997 independent sampling was to characterize surface soil, surface water, and sediment conditions at the WBG. Investigation activities included the collection of three surface soil and two surface water/sediment samples in the vicinity of the burning ground. Sampling locations and chemical exceedence results are presented in **Figure 1.13-1**.

Surface soil. Three surface soil samples (SS-04, SS-04a, and SS-05) were collected from 0–0.5 ft bgs near the central portion of the burning area. Samples were analyzed for TAL metals, cyanide, TCL SVOCs, TCL VOCs, pesticides/PCBs, and dioxins/furans. Surface soil sample SS-05 was also analyzed for explosives. TCL SVOCs, TCL VOCs, and pesticides/PCBs were detected at concentrations below residential RBCs. Dioxins/furans were detected; however, RBCs are not available for the detected compounds. Arsenic concentrations exceeded the industrial RBC of 3.8 mg/kg in the three samples, with concentrations ranging from 6.1 mg/kg to 9.7 mg/kg. Aluminum, chromium, iron, manganese and vanadium were detected at concentrations greater than the residential RBC, but below the industrial RBC. Explosive compounds were not detected. Analytical results for detected compounds are presented in Table A-65.

Surface water. Two surface water samples (SW-01 and SW-02) were collected in the vicinity of Wiggins Spring, at the head of the unnamed pond, located south of the burning ground. Samples were analyzed for TAL metals, cyanide, TCL SVOCs, TCL VOCs, and pesticides/PCBs. Surface water sample SW-02 was also analyzed for explosives. TCL SVOCs, TCL VOCs, pesticides/PCBs, and explosives were not reported in the surface water samples. Eight TAL metals were detected; however, vanadium was the sole analyte reported at concentrations exceeding the tap water RBC. Vanadium concentrations were 79 µg/L (sample SW-01) and 75 µg/L (sample SW-02), both of which exceed the tap water RBC of 0.26 µg/L. Analytical results for detected compounds are presented in Table A-66.

Sediment. Two sediment samples (SD-01 and SD-02) were collected in the vicinity of Wiggins Spring. These samples were collocated with surface water samples SW-01 and SW-02. Samples were analyzed for TAL metals, cyanide, SVOCs, TCL VOCs, and pesticides/PCBs, and explosives. Pesticides, PCBs and explosives were not detected in either of the samples. Several TCL VOCs and TCL SVOCs were reported at concentrations below residential RBCs. One SVOC, benzo[a]pyrene, was reported in sample SD-01 at a concentration of 0.09 mg/kg, exceeding the residential RBC of 0.087 mg/kg. This compound was not detected in SD-02. Arsenic was reported at a concentration greater than the industrial soil RBC in both samples. Aluminum, chromium, iron and manganese were identified at concentrations above residential RBCs, but below industrial RBCs. Results for detected compounds are presented in Table A-67. This investigation provided an initial characterization of the WBG. Limited sample density, however, precluded a complete assessment of available media at the site.

Remedial Investigation, ICF KE, 1998. The purpose of the 1998 RI sampling effort was to characterize the nature and extent of contamination through the investigation of soil, surface water and sediment. A field plan designed to fulfill this purpose was developed and included:

- A geophysical survey,
- The collection of eight soil samples for TAL metals, TCL VOCs, TCL SVOCs and explosives analysis, and
- The collection of three collocated surface water/sediment samples for TAL metals, TCL VOCs, TCL SVOCs, and explosives analysis. One of the surface water samples was also analyzed for PAHs.

Sample locations and chemical exceedence results are shown on **Figure 1.13-1**.

Geophysical survey. Due to a lack of historical information on the exact location of burning ground operations, an EM61 geophysical survey was conducted to assist in the selection of soil sampling locations. Aerial photographs were used to guide in the selection of the geophysical survey boundaries. Highly anomalous areas were marked on the ground after field interpretation of the data.

Soil borings. Five of the anomalous areas identified in the geophysical survey were selected for further investigation through the collection of soil samples. A total of eight soil samples were collected from five soil borings (WBGSB1 through WBGSB5) using direct push sampling methods. A thin ash layer was encountered at approximately 0.5-2 ft bgs during advancement of the soil borings. Samples were not collected from depths greater than 2 ft at WBGSB3, WBGSB4, and WBGSB5 due to refusal at shallow bedrock. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, and explosives.

Arsenic was detected at concentrations greater than the industrial RBC of 3.8 mg/kg in seven of eight samples. Arsenic concentrations above the industrial RBC ranged from 5.3 to 37.9 mg/kg. Lead was detected above the industrial RBC of 750 mg/kg in four near surface soil samples at concentrations between 2,070 mg/kg and 3,990 mg/kg. Ten metals (aluminum, antimony, barium, chromium, copper, iron, manganese, thallium, vanadium and zinc) were reported at concentrations between the residential and industrial RBCs. VOCs were not detected in the samples. Benzo[*a*]pyrene was detected above the residential RBC, but below the industrial RBC in two near surface soil samples. Detected analytical results are presented in Tables A-68 (TAL metals) and A-69 (TCL SVOCs).

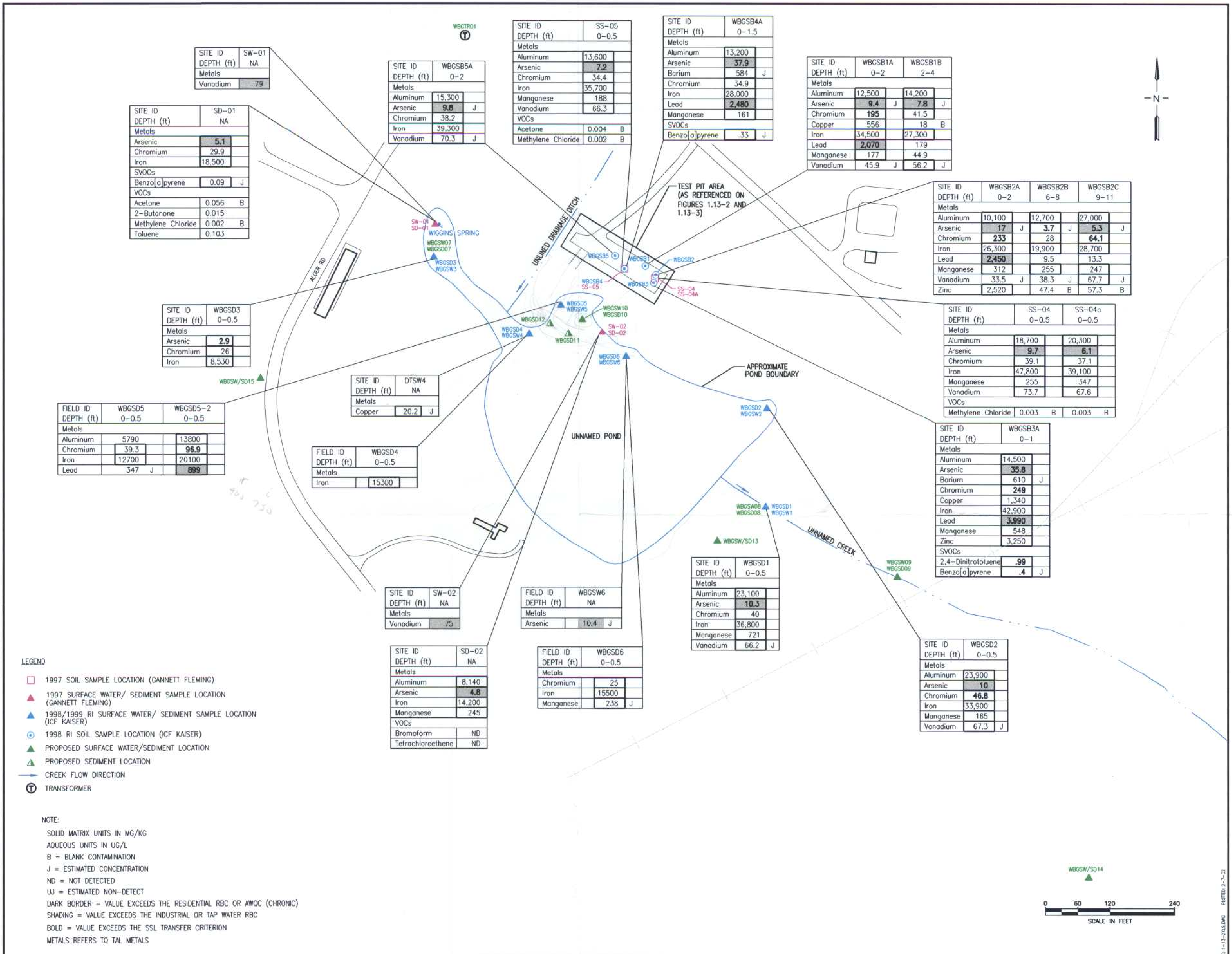
Surface water/sediment. Three collocated surface water/sediment samples were collected from the unnamed pond and creek south of the burning ground to assess potential contamination associated with activities at the burning ground. Samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, and explosives. Analytical results for surface water samples indicate that thallium exceeded the tap water RBC in samples WBGSW1 and WBGSW3. Both of these results, however, were "B" flagged during data validation, indicating that thallium was also detected in associated laboratory blanks. Copper exceeded the AWQC of 9 μg/L in the samples, however, these results were also "B" flagged. TCL VOCs and explosives were not detected. Diethylphthalate was the sole SVOC detected; however, concentrations were reported below tapwater RBCs. Detected analytical results for detected parameters in surface water are presented in Table A-70.

Sediment sample results indicated that arsenic exceeded the industrial RBC of 3.8 mg/kg in samples WBGSD1 (10.3 mg/kg) and WBGSD2 (10.0 mg/kg). Aluminum, chromium, iron, manganese, thallium and vanadium were reported at concentrations above residential soil RBCs, but below industrial soil RBCs. VOCs, SVOCs and explosives were not reported at concentrations greater than residential soil RBCs. Detected analytical results are presented in Tables A-71 (TAL metals) and A-72 (organics).

Remedial Investigation, ICF KE, 1999. ICF KE initiated a second phase of the RI in 1999 because elevated lead concentrations were reported in surface soil during the 1998 RI sampling activities. The purpose of the 1999 RI was to augment existing data to further define the extent of elevated lead in soil and identify impacts on surface water or sediment.

The RI field program included the following:

- Collection of 27 soil samples from 17 soil borings in the burning area, including:



SITE ID	SW-01
DEPTH (ft)	NA
Metals	
Vanadium	79

SITE ID	SD-01	
DEPTH (ft)	NA	
Metals		
Arsenic	**5.1**	
Chromium	29.9	
Iron	18,500	
SVOCs		
Benzo[a]pyrene	0.09	J
VOCs		
Acetone	0.056	B
2-Butanone	0.015	
Methylene Chloride	0.002	B
Toluene	0.103	

SITE ID	WBGSB5A	
DEPTH (ft)	0-2	
Metals		
Aluminum	15,300	
Arsenic	**9.8**	J
Chromium	38.2	
Iron	39,300	
Vanadium	70.3	J

SITE ID	SS-05	
DEPTH (ft)	0-0.5	
Metals		
Aluminum	13,600	
Arsenic	7.2	
Chromium	34.4	
Iron	35,700	
Manganese	188	
Vanadium	66.3	
VOCs		
Acetone	0.004	B
Methylene Chloride	0.002	B

SITE ID	WBGSB4A	
DEPTH (ft)	0-1.5	
Metals		
Aluminum	13,200	
Arsenic	**37.9**	
Barium	584	J
Chromium	34.9	
Iron	28,000	
Lead	**2,480**	
Manganese	161	
SVOCs		
Benzo[a]pyrene	.33	J

SITE ID	WBGSB1A		WBGSB1B	
DEPTH (ft)	0-2		2-4	
Metals				
Aluminum	12,500		14,200	
Arsenic	**9.4**	J	**7.8**	J
Chromium	**195**		41.5	
Copper	556		18	B
Iron	34,500		27,300	
Lead	**2,070**		179	
Manganese	177		44.9	
Vanadium	45.9	J	56.2	J

SITE ID	WBGSB2A		WBGSB2B		WBGSB2C	
DEPTH (ft)	0-2		6-8		9-11	
Metals						
Aluminum	10,100		12,700		27,000	
Arsenic	**17**	J	**3.7**	J	**5.3**	J
Chromium	**233**		28		**64.1**	
Iron	26,300		19,900		28,700	
Lead	**2,450**		9.5		13.3	
Manganese	312		255		247	
Vanadium	33.5	J	38.3	J	67.7	J
Zinc	2,520		47.4	B	57.3	B

SITE ID	SS-04		SS-04a	
DEPTH (ft)	0-0.5		0-0.5	
Metals				
Aluminum	18,700		20,300	
Arsenic	**9.7**		**6.1**	
Chromium	39.1		37.1	
Iron	47,800		39,100	
Manganese	255		347	
Vanadium	73.7		67.6	
VOCs				
Methylene Chloride	0.003	B	0.003	B

SITE ID	WBGSB3A	
DEPTH (ft)	0-1	
Metals		
Aluminum	14,500	
Arsenic	**35.8**	
Barium	610	J
Chromium	**249**	
Copper	1,340	
Iron	42,900	
Lead	**3,990**	
Manganese	548	
Zinc	3,250	
SVOCs		
2,4-Dinitrotoluene	**.99**	
Benzo[a]pyrene	**.4**	J

SITE ID	WBGSD3
DEPTH (ft)	0-0.5
Metals	
Arsenic	**2.9**
Chromium	26
Iron	8,530

SITE ID	DTSW4	
DEPTH (ft)	NA	
Metals		
Copper	20.2	J

FIELD ID	WBGSD5		WBGSD5-2
DEPTH (ft)	0-0.5		0-0.5
Metals			
Aluminum	5790		13800
Chromium	39.3		**96.9**
Iron	12700		20100
Lead	347	J	**899**

FIELD ID	WBGSD4
DEPTH (ft)	0-0.5
Metals	
Iron	15300

SITE ID	SW-02
DEPTH (ft)	NA
Metals	
Vanadium	75

FIELD ID	WBGSW6	
DEPTH (ft)	NA	
Metals		
Arsenic	10.4	J

SITE ID	SD-02
DEPTH (ft)	NA
Metals	
Aluminum	8,140
Arsenic	**4.8**
Iron	14,200
Manganese	245
VOCs	
Bromoform	ND
Tetrachloroethene	ND

FIELD ID	WBGSD6	
DEPTH (ft)	0-0.5	
Metals		
Chromium	25	
Iron	15500	
Manganese	238	J

SITE ID	WBGSD1	
DEPTH (ft)	0-0.5	
Metals		
Aluminum	23,100	
Arsenic	**10.3**	
Chromium	40	
Iron	36,800	
Manganese	721	
Vanadium	66.2	J

SITE ID	WBGSD2	
DEPTH (ft)	0-0.5	
Metals		
Aluminum	23,900	
Arsenic	**10**	
Chromium	**46.8**	
Iron	33,900	
Manganese	165	
Vanadium	67.3	J

LEGEND

☐	1997 SOIL SAMPLE LOCATION (GANNETT FLEMING)
▲	1997 SURFACE WATER/ SEDIMENT SAMPLE LOCATION (GANNETT FLEMING)
▲	1998/1999 RI SURFACE WATER/ SEDIMENT SAMPLE LOCATION (ICF KAISER)
⊙	1998 RI SOIL SAMPLE LOCATION (ICF KAISER)
▲	PROPOSED SURFACE WATER/SEDIMENT LOCATION
△	PROPOSED SEDIMENT LOCATION
→	CREEK FLOW DIRECTION
Ⓣ	TRANSFORMER

NOTE:

SOLID MATRIX UNITS IN MG/KG
AQUEOUS UNITS IN UG/L
B = BLANK CONTAMINATION
J = ESTIMATED CONCENTRATION
ND = NOT DETECTED
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC OR AWQC (CHRONIC)
SHADING = VALUE EXCEEDS THE INDUSTRIAL OR TAP WATER RBC
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION
METALS REFERS TO TAL METALS

Sample Summary

Previous Investigation	Contractor	TAL Metals				Cyanide			Explosives				TCL VOCs				TCL SVOCs				Perch	TCL PCBs				PAHs		Dioxins/Furans		TCLP Metals	Total
		SS	SB	SE	SW	SS	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SW	SS	SB	SE	SW	SB	SW	SS	SB	SB	
1997 Independent Sampling	GF	3	--	2	2	3	2	2	1	--	2	1	3	--	2	2	3	--	2	2	--	3	--	2	2	--	--	3	--	--	42
1998 RI	ICF Kaiser	1	7	3	3	--	--	--	1	7	3	3	1	7	3	3	1	7	3	3	--	--	--	--	--	--	1	--	--	--	57
1999 RI	ICF Kaiser	6	66	4	3	--	--	--	--	6	--	--	--	6	--	--	5	53	3	3	3	--	--	--	--	6	--	1	7	7	179

RADFORD AAP

PREPARED BY: IT CORP.	TASK NO: 870403301000000
CHECKED BY: MT	IT DWG NO: 1-13-2xls.dwg
DATE: NOVEMBER 2001	

FIGURE 1.13-1

WESTERN BURNING GROUND - PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SURFACE WATER/ SEDIMENT SAMPLING LOCATIONS

FILE: 1-13-2XLS.DWG PLOTTED: 2-7-02

~~08~~05006\350 - 1/1

  - Six soil samples from the berm surrounding the burning area,
  - 19 soil samples from ten borings along the access road to the unnamed pond, and,
  - Two soil samples from under the location of the former burn cage.
- Collection of 43 confirmatory samples to ensure that test pits were advanced to a depth greater than the extent of soil with elevated lead concentrations, and,
- Collection of three collocated surface water/sediment samples.

Surface water and sediment sample locations and chemical exceedence results are shown on **Figure 1.13-1.** Post site restoration (test pit confirmation) sample locations and chemical exceedence results are shown on **Figure 1.13-2**, and the 1999 soil boring locations and chemical exceedence results results are shown on **Figure 1.13-3**.

Soil. Near surface (< 2 ft bgs) soil samples (WBGSB6A through WBGSB11A) were collected from six soil borings located on the berm surrounding the burning area. Deeper samples were not collected due to refusal on shallow bedrock. Berm samples were analyzed for TAL metals, TCL VOCs, TCL SVOCs, PAHs, pH, explosives, and TOC (one location).

Previous investigations identified an ash layer as a potential source of lead. The ash layer was observed at various depths and thicknesses across the site. Nine borings were advanced to identify the extent of ash. Ash was found in five of the six borings (WBGPB1-WBGPB5) advanced along the dirt road. Ash was not encountered in boring WBGPB6 (along the road) or the three borings (WBGQSB1-WBGQSB3) advanced south of the test pit area.

Nineteen subsurface soil samples were collected from 10 soil borings (WGBSB12 through WBGSB21) located along the access road that leads to the unnamed pond. A shallow (0-4 ft bgs) sample was collected from boring WBGSB12 and a near surface (0-2 ft bgs) and intermediate depth (2-4 ft bgs) sample were collected from the nine remaining boring locations. Access road samples were analyzed for TCL SVOCs and/or TAL metals.

Two soil samples [WBGBC1A (0-2 ft bgs) and WBGBC1B (5-7 ft bgs)] were collected from a soil boring located beneath the former burn cage and analyzed for TAL metals and TCL SVOCs.

Soil was excavated from 19 test pit areas within the bermed area. Forty-three confirmatory soil samples (WBGTP1A through WBGTP19S) were collected and analyzed for TAL metals from the 19 test pits to augment existing data and to verify that the impacted soil was removed. Seven confirmatory samples (WBGTP2B, WBGTP7A, WBGTP10B, WBGTP12A, WBGTP12S, WBGTP18A, and WBGTP19A) were also analyzed for TCL SVOCs, pH, and dioxins/furans.

Soil results indicated that arsenic was detected at levels above the industrial RBC of 3.8 mg/kg throughout the site. Lead was detected above the industrial RBC of 750 mg/kg in test pit soil sample WBGTP1B2 at a concentration of 808 mg/kg. However, soil was already excavated to the top of bedrock at this location and therefore no more lead impacted soil could be removed. Lead was also reported at an elevated level (681 mg/kg) in sample WBGTP16A. A second sample (WBGTP16A2) was collected from the same location to verify the lead concentration. Lead was reported at a concentration of 34.2 mg/kg in this confirmatory sample. TCL SVOCs, PAHs, and dioxins/furans were detected in several soil samples at concentrations below residential RBCs. TCL VOCs were not detected. pH values ranged from 5.10 to 7.75. Detected analytical results for soil are presented in Tables A-73 (metals), A-74 (SVOCs/PAHs), and A-75 (dioxins/furans).

In summary, lead-impacted soil was excavated at the WBG area and confirmatory soil samples were collected to assess the depth and extent of soil with elevated lead concentrations. One confirmatory sample had a lead concentration slightly above the industrial RBC; however, the unconsolidated material had been excavated to bedrock at this location. The highest arsenic concentration detected in surface soil samples was 17.1 mg/kg. The highest arsenic concentration detected in subsurface soil samples was 11.4 mg/kg.

Surface water/sediment. Three collocated surface water and sediment samples were collected from the unnamed pond south of the burning ground to further evaluate potential contamination due to activities at the WBG. Samples were analyzed for TAL metals, TCL SVOCs, perchlorate (surface water), TOC and TOX (surface water).

Arsenic (8.6 and 10.4 µg/L) was detected in two surface water samples (WBGSW5 and WBGSW6, respectively) above the tap water RBC of 0.045 µg/L. Aluminum was reported in two samples at concentrations greater than the chronic AWQC of 87 µg/L. These results; however, were "B" flagged during data validation, indicating that aluminum was also detected in associated laboratory blanks. Copper was reported at a concentration greater than the chronic AWQC in sample WBGSW4 (copper concentration = 20.2 µg/L). Lead also exceeded the chronic AWQC of 2.5 µg/L in sample WBGSW5 (lead concentration = 4 µg/L). One TCL SVOC was detected in sample WBGSW5, but below the tap water RBC. Perchlorate, total organic carbon and total organic halides were not detected in the surface water samples. Detected analytical results for surface water are presented in Table A-76.

Sediment results indicated that arsenic (3.9–5.3 mg/kg) was detected slightly above the industrial soil RBC of 3.8 mg/kg in the three samples; however, these results were "B" flagged during data validation. Lead was detected above the industrial RBC of 750 mg/kg in sample WBGSD5-2 (899 mg/kg). Sample WBGSD5-2 was collocated with sample WBGSD5 and was collected to reconfirm the elevated lead concentration of 347 mg/kg in sample WBGSD5. One TCL SVOC was also detected in WBGSD5, but below the residential soil RBC. Detected analytical results are presented in Table A-77.

1.13.3 Conceptual Site Model

A conceptual site model for the WBG is presented in **Figure 1.13-4**. Potentially affected media include surface and subsurface soil, sediment, and surface water. The area surrounding the burning ground slopes gently downward to the northwest towards a low area with precipitation infiltrating into the grassy ground. A 4-ft mounded, earthen berm surrounds the burning area on the north, east and south sides. Site workers and biota are considered receptors. **Table 1.13-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs.

Elevated lead concentrations were documented in the near surface soil during RI sampling efforts in 1998 and 1999. Soil was sampled extensively within the bermed area of the burning ground during the 1999 RI. Soil was excavated to expose the subsurface during sampling activities. Confirmation samples were collected to verify that lead concentrations were below 400 mg/kg, the USEPA Interim Lead Soil Screening Value. Site restoration activities have mitigated exposure pathways associated with the surface soil within the burning area. Residual constituents in the berm or from possible disposal adjacent to the burning area would impact site workers and terrestrial receptors through incidental ingestion of soil, dermal absorption through direct contact with soil, and the inhalation of dust generated during construction activities.

Subsurface soil is also potentially impacted by past activities. A layer of ash, thought to be road bed material was encountered beneath the dirt road providing access to the unnamed pond. Select analyte classes have not been previously investigated in this area. Consequently, subsurface soil still represents a potentially affected medium. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water and sediment are present in the man-made pond and the unnamed creek receiving drainage from the pond. Samples were collected during the 1998 and 1999 sampling efforts to characterize the pond and the spring. In addition, not every analyte class was characterized in the surface water/sediment samples. Therefore, surface water and sediment exposure pathways still exist. Potential receptors and pathways associated with these media are incidental ingestion and dermal absorption by site workers and biota. Site worker and terrestrial biota may also be exposed through the inhalation of volatiles from surface water.

FIELD ID	WBGTP19S	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	12400	
Arsenic	**8.8**	
Chromium	33.5	
Iron	34800	
Vanadium	56.4	

FIELD ID	WBGTP17A	
DEPTH (ft)	0.5-1	
Metals		
Aluminum	15200	
Chromium	**45**	
Iron	47700	
Vanadium	87.9	J

FIELD ID	WBGTP16A		WBGTP16A2	
DEPTH (ft)	0.5-1		0.5-1	
Metals				
Aluminum	12100		9020	
Arsenic	**5.5**		**8.1**	J
Chromium	**47.4**		22	
Iron	36200		32700	
Lead	**681**		34.2	
Vanadium	67.9	J	51.6	

FIELD ID	WBGTP13A	
DEPTH (ft)	1.5-2	
Metals		
Aluminum	9150	
Chromium	**46.2**	
Iron	32100	
Vanadium	56.2	J

FIELD ID	WBGTP10B	
DEPTH (ft)	2.5-3	
Metals		
Iron	14300	
Thallium	.82	J

FIELD ID	WBGTP18A	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	23800	
Chromium	**72.8**	
Iron	52900	
Vanadium	99.4	J

FIELD ID	WBGTP19A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	13500	
Arsenic	**9.6**	
Chromium	30.3	
Iron	34800	
Vanadium	55.5	

FIELD ID	WBGTP18S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	12300	
Chromium	32.1	
Iron	34700	
Manganese	170	
Vanadium	59.8	J

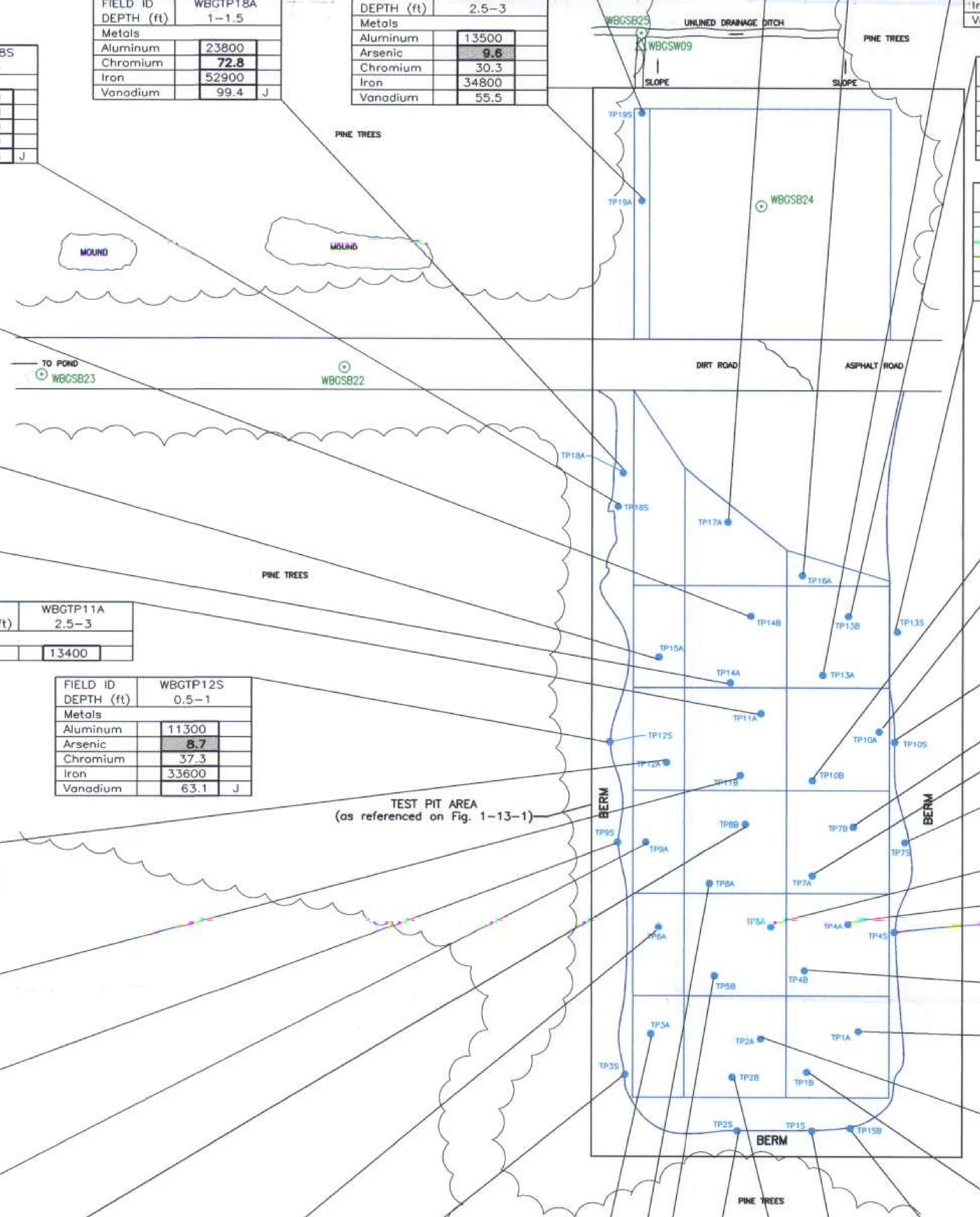
FIELD ID	WBGTP13B	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	11000	
Chromium	**42.4**	
Iron	39200	
Vanadium	68.3	J

FIELD ID	WBGTP10A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	10800	
Chromium	28.9	
Iron	30600	
Vanadium	58.4	J

FIELD ID	WBGTP13S	
DEPTH (ft)	1.5-2	
Metals		
Aluminum	18700	
Chromium	**45.8**	
Iron	34200	
Manganese	297	
Vanadium	63.6	J

FIELD ID	WBGTP10S	
DEPTH (ft)	0.5-1	
Metals		
Aluminum	13300	
Arsenic	**13**	
Chromium	36.6	
Iron	44100	
Manganese	208	
Vanadium	77.1	J

FIELD ID	WBGTP14B	
DEPTH (ft)	1.5-2	
Metals		
Aluminum	25400	
Arsenic	**10.7**	J
Chromium	**67**	
Iron	52400	
Vanadium	96.4	J



FIELD ID	WBGTP7B	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	9090	
Iron	16700	

FIELD ID	WBGTP15A	
DEPTH (ft)	1.5-2	
Metals		
Aluminum	8690	
Iron	17100	

FIELD ID	WBGTP7A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	11800	
Chromium	33	
Iron	25900	

FIELD ID	WBGTP14A	
DEPTH (ft)	2-2.5	
Metals		
Aluminum	11400	
Chromium	31.7	
Iron	37700	
Vanadium	65.9	J

FIELD ID	WBGTP11A	
DEPTH (ft)	2.5-3	
Metals		
Iron	13400	

FIELD ID	WBGTP7S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	15300	
Chromium	38.8	
Iron	36700	
Vanadium	91.1	J

FIELD ID	WBGTP12S	
DEPTH (ft)	0.5-1	
Metals		
Aluminum	11300	
Arsenic	**8.7**	
Chromium	37.3	
Iron	33600	
Vanadium	63.1	J

FIELD ID	WBGTP5A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	14300	
Chromium	30.7	
Iron	29900	
Vanadium	56.3	

FIELD ID	WBGTP12A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	9390	
Chromium	23.4	
Iron	19700	

FIELD ID	WBGTP4A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	14700	
Arsenic	**9.7**	J
Chromium	41.1	
Iron	38900	
Vanadium	69.7	

FIELD ID	WBGTP4S	
DEPTH (ft)	0.5-1	
Metals		
Aluminum	14300	
Arsenic	**9.4**	J
Chromium	34.6	
Iron	39500	
Vanadium	71	

FIELD ID	WBGTP11B	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	13800	
Arsenic	**8.2**	
Chromium	35.1	
Iron	27300	

FIELD ID	WBGTP4B	
DEPTH (ft)	2-2.5	
Metals		
Aluminum	15000	
Arsenic	**9.2**	J
Chromium	36.4	
Iron	34700	
Vanadium	63.7	

FIELD ID	WBGTP1A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	11700	
Chromium	38.6	J
Iron	36400	
Vanadium	69.3	J

FIELD ID	WBGTP9S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	12300	
Arsenic	**9.5**	J
Chromium	34	
Iron	39500	
Vanadium	62.3	

FIELD ID	WBGTP2A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	8450	
Chromium	24.9	J
Iron	25200	

FIELD ID	WBGTP3A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	16700	
Arsenic	**9.8**	
Chromium	**45.2**	J
Iron	36300	
Manganese	160	J
Vanadium	57.4	J

FIELD ID	WBGTP1B		WBGTP1B2	
DEPTH (ft)	3-3.5		3.5-4	
Metals				
Aluminum	9950		10300	
Chromium	**47.9**	J	**69.6**	
Iron	30200		30100	
Lead	231		**808**	
Vanadium	52.3	J	57.4	J

FIELD ID	WBGTP9A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	10400	
Arsenic	**9.7**	J
Chromium	34.5	
Iron	25800	

FIELD ID	WBGTP6A	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	9480	
Chromium	29	J
Iron	22800	

FIELD ID	WBGTP8A	
DEPTH (ft)	3-3.5	
Metals		
Aluminum	13300	
Chromium	30.3	
Iron	24800	
Vanadium	56.1	J

FIELD ID	WBGTP1S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	10000	
Chromium	25	J
Iron	25000	

FIELD ID	WBGTP1SB	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	8270	
Iron	21100	

FIELD ID	WBGTP8B	
DEPTH (ft)	3-3.5	
Metals		
Aluminum	10400	
Chromium	23.8	
Iron	26400	

FIELD ID	WBGTP3S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	11200	
Chromium	35.8	J
Iron	32300	
Thallium	1.2	J

FIELD ID	WBGTP2B	
DEPTH (ft)	3-3.5	
Metals		
Chromium	23.3	J
Iron	16400	

FIELD ID	WBGTP5B	
DEPTH (ft)	2.5-3	
Metals		
Aluminum	15200	
Arsenic	**8.3**	J
Chromium	34.1	
Iron	32200	
Vanadium	60.5	

FIELD ID	WBGTP2S	
DEPTH (ft)	1-1.5	
Metals		
Aluminum	11600	
Arsenic	**7.3**	
Chromium	41.3	J
Iron	30900	
Vanadium	55.7	J

LEGEND

- ☐ 1999 RI TEST PIT (ICF KAISER)
- ● 1999 RI TEST PIT CONFIRMATION SAMPLE (ICF KAISER)
- ⊙ PROPOSED SOIL BORING LOCATION
- △ PROPOSED SURFACE WATER SAMPLE

NOTE:

ALL UNITS IN MG/KG
J = ESTIMATED CONCENTRATION
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION
METALS REFERS TO TAL METALS

Sample Summary

Previous Investigation	Contractor	TAL Metals				Cyanide			Explosives				TCL VOCs				TCL SVOCs				Perch	TCL PCBs				PAHs		Dioxins/Furans		TCLP Metals	Total
		SS	SB	SE	SW	SS	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SW	SS	SB	SE	SW	SB	SW	SS	SB	SB	
1997 Independent Sampling	GF	3	--	2	2	3	2	2	1	--	2	1	3	--	2	2	3	--	2	2	--	3	--	2	2	--	--	3	--	--	42
1998 RI	ICF Kaiser	1	7	3	3	--	--	--	1	7	3	3	1	7	3	3	1	7	3	3	--	--	--	--	--	--	1	--	--	--	57
1999 RI	ICF Kaiser	6	66	4	3	--	--	--	--	6	--	--	--	6	--	--	5	53	3	3	3	--	--	--	--	6	--	1	7	7	179

0 9 18 36
SCALE IN FEET

FILE: 1-13-1_Avls2.dwg PLOTTED: 2-8-02

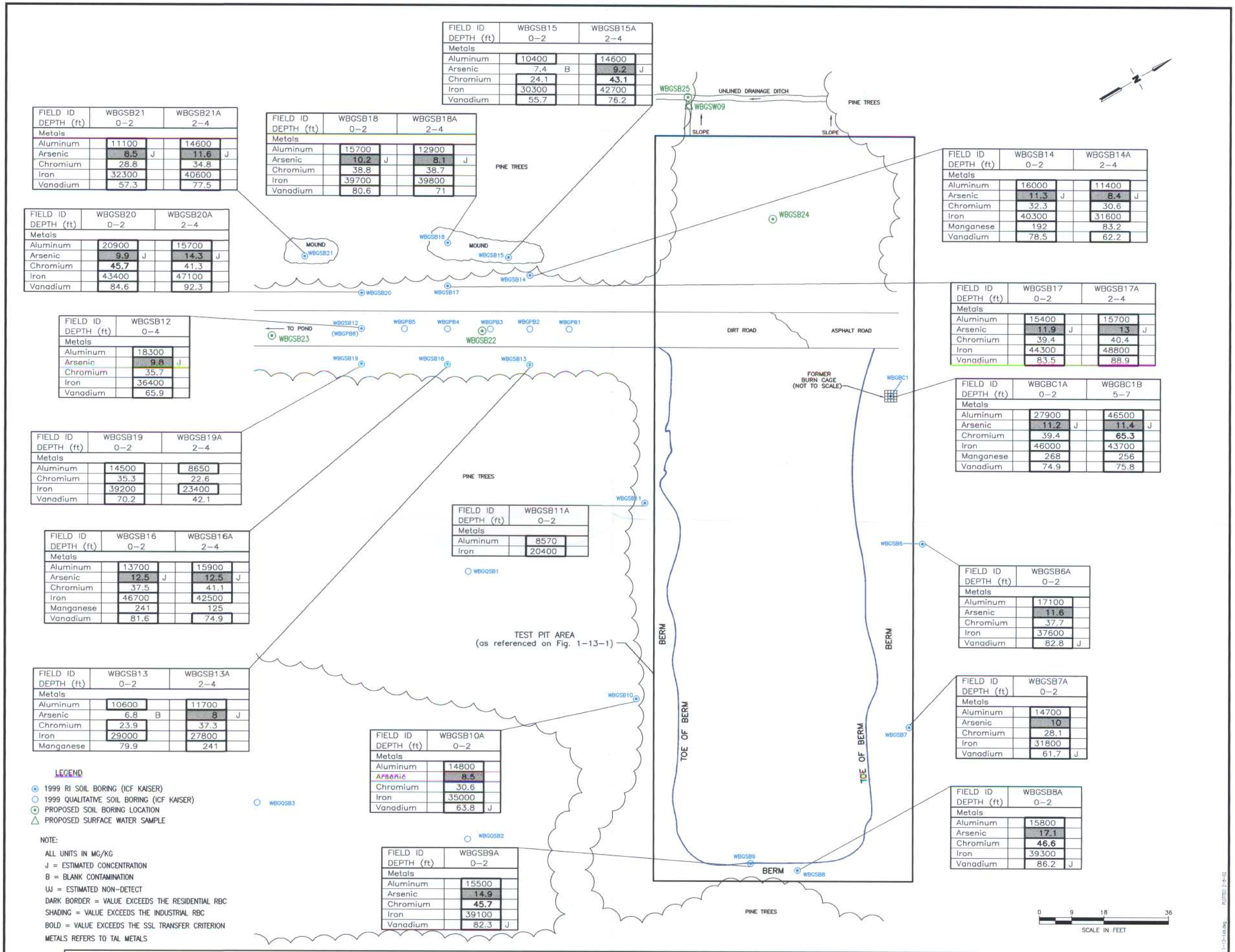
RADFORD AAP

PREPARED BY: IT CORP.
TASK NO: 8704033010000
CHECKED BY: MT
IT DWG NO: 1-13-1_Avls2.dwg
DATE: FEBRUARY 2002

FIGURE 1.13-2

WESTERN BURNING GROUND - POST SITE RESTORATION SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS

05006 \ 332 - 1/2



FIELD ID	WBGSB15		WBGSB15A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	10400		14600	
Arsenic	7.4	B	9.2	J
Chromium	24.1		**43.1**	
Iron	30300		42700	
Vanadium	55.7		76.2	

FIELD ID	WBGSB21		WBGSB21A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	11100		14600	
Arsenic	8.5	J	11.6	J
Chromium	28.8		34.8	
Iron	32300		40600	
Vanadium	57.3		77.5	

FIELD ID	WBGSB18		WBGSB18A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	15700		12900	
Arsenic	10.2	J	8.1	J
Chromium	38.8		38.7	
Iron	39700		39800	
Vanadium	80.6		71	

FIELD ID	WBGSB14		WBGSB14A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	16000		11400	
Arsenic	11.3	J	8.4	J
Chromium	32.3		30.6	
Iron	40300		31600	
Manganese	192		83.2	
Vanadium	78.5		62.2	

FIELD ID	WBGSB20		WBGSB20A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	20900		15700	
Arsenic	9.9	J	14.3	J
Chromium	**45.7**		41.3	
Iron	43400		47100	
Vanadium	84.6		92.3	

FIELD ID	WBGSB17		WBGSB17A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	15400		15700	
Arsenic	11.9	J	13	J
Chromium	39.4		40.4	
Iron	44300		48800	
Vanadium	83.5		88.9	

FIELD ID	WBGSB12	
DEPTH (ft)	0–4	
Metals		
Aluminum	18300	
Arsenic	9.8	J
Chromium	35.7	
Iron	36400	
Vanadium	65.9	

FIELD ID	WBGBC1A		WBGBC1B	
DEPTH (ft)	0–2		5–7	
Metals				
Aluminum	27900		46500	
Arsenic	11.2	J	11.4	J
Chromium	39.4		**65.3**	
Iron	46000		43700	
Manganese	268		256	
Vanadium	74.9		75.8	

FIELD ID	WBGSB19		WBGSB19A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	14500		8650	
Chromium	35.3		22.6	
Iron	39200		23400	
Vanadium	70.2		42.1	

FIELD ID	WBGSB11A	
DEPTH (ft)	0–2	
Metals		
Aluminum	8570	
Iron	20400	

FIELD ID	WBGSB16		WBGSB16A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	13700		15900	
Arsenic	12.5	J	12.5	J
Chromium	37.5		41.1	
Iron	46700		42500	
Manganese	241		125	
Vanadium	81.6		74.9	

FIELD ID	WBGSB6A	
DEPTH (ft)	0–2	
Metals		
Aluminum	17100	
Arsenic	11.6	
Chromium	37.7	
Iron	37600	
Vanadium	82.8	J

FIELD ID	WBGSB13		WBGSB13A	
DEPTH (ft)	0–2		2–4	
Metals				
Aluminum	10600		11700	
Arsenic	6.8	B	8	J
Chromium	23.9		37.3	
Iron	29000		27800	
Manganese	79.9		241	

FIELD ID	WBGSB7A	
DEPTH (ft)	0–2	
Metals		
Aluminum	14700	
Arsenic	10	
Chromium	28.1	
Iron	31800	
Vanadium	61.7	J

FIELD ID	WBGSB10A	
DEPTH (ft)	0–2	
Metals		
Aluminum	14800	
Arsenic	8.5	
Chromium	30.6	
Iron	35000	
Vanadium	63.8	J

FIELD ID	WBGSB8A	
DEPTH (ft)	0–2	
Metals		
Aluminum	15800	
Arsenic	17.1	
Chromium	**46.6**	
Iron	39300	
Vanadium	86.2	J

FIELD ID	WBGSB9A	
DEPTH (ft)	0–2	
Metals		
Aluminum	15500	
Arsenic	14.9	
Chromium	**45.7**	
Iron	39100	
Vanadium	82.3	J

LEGEND

- ◉ 1999 RI SOIL BORING (ICF KAISER)
- ○ 1999 QUALITATIVE SOIL BORING (ICF KAISER)
- ⊙ PROPOSED SOIL BORING LOCATION
- △ PROPOSED SURFACE WATER SAMPLE

NOTE:

ALL UNITS IN MG/KG
J = ESTIMATED CONCENTRATION
B = BLANK CONTAMINATION
UJ = ESTIMATED NON-DETECT
DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC
SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC
BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION
METALS REFERS TO TAL METALS

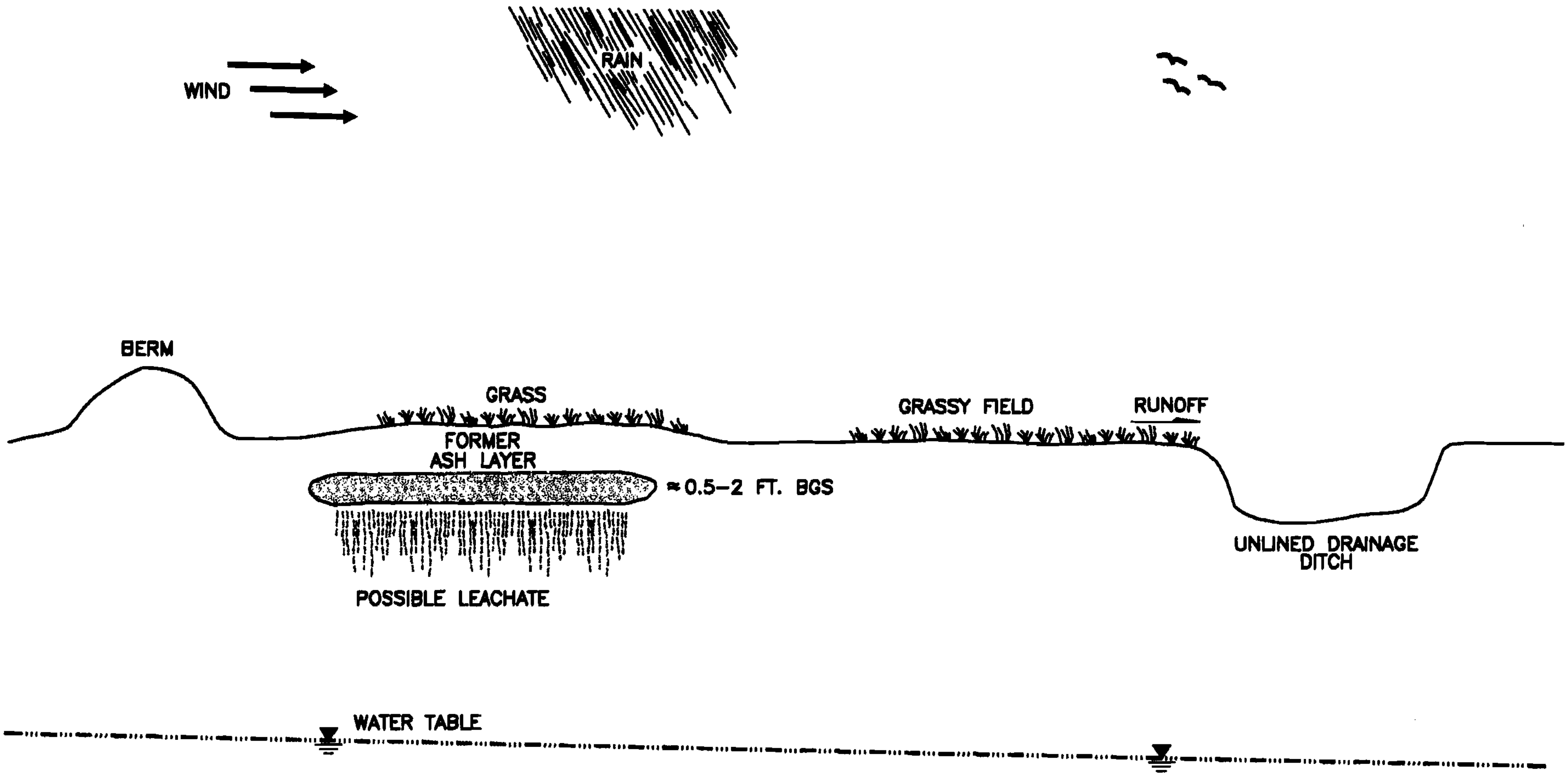
Sample Summary

Previous Investigation	Contractor	TAL Metals				Cyanide			Explosives				TCL VOCs				TCL SVOCs				Perch	TCL PCBs				PAHs		Dioxins/Furans		TCLP Metals	Total
		SS	SB	SE	SW	SS	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SW	SS	SB	SE	SW	SB	SW	SS	SB	SB	
1997 Independent Sampling	GF	3	--	2	2	3	2	2	1	--	2	1	3	--	2	2	3	--	2	2	--	3	--	2	2	--	--	3	--	--	42
1998 RI	ICF Kaiser	1	7	3	3	--	--	--	1	7	3	3	1	7	3	3	1	7	3	3	--	--	--	--	--	--	1	--	--	--	57
1999 RI	ICF Kaiser	6	66	4	3	--	--	--	--	6	--	--	--	6	--	--	5	53	3	3	3	--	--	--	--	6	--	1	7	7	179

RADFORD AAP		FIGURE 1.13-3
PREPARED BY: IT CORP.	TASK NO: 870403301000000	WESTERN BURNING GROUND- 1999 SOIL BORING SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS
CHECKED BY: MT	IT DWG NO: 1-13-1xls.dwg	
DATE: NOVEMBER 2001		

FILE: 1-13-1xls.dwg

05006 \ 332 - 2/2



"NOT TO SCALE"

NOTE:

SEE TABLE 1.13–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-7-02

FILE 1-13-3.DWG

RADFORD AAP		**FIGURE 1.13–4**
PREPARED BY: IT CORP.	TASK NO: [illegible]	CONCEPTUAL MODEL WESTERN BURNING GROUND
CHECKED BY: TL	IT DWG NO: 1–13–3	
DATE: FEBRUARY 2002		

Table 1.13-1
Potential Exposure Pathways and Receptors—Western Burning Ground

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, INH, DA	IN, INH, DA	IN, DA	IN, DA	Direct volatilization from surface water.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.13-4 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

1.13.4 Data Gap Analysis

TCL VOCs. Samples were collected from surface soil, subsurface soil, surface water, and sediment during the 1998 and 1999 RI sampling efforts for TCL VOC analysis. The 1999 expanded sampling effort has eliminated exposure pathways within the bermed area associated with soil. Surface and subsurface soil have not been characterized for VOCs in other areas at the WBG, and therefore represent a data gap. Results from surface water and sediment do not show constituents at concentrations greater than RBCs. Surface water and sediment in other areas of the site represent a data gap in the characterization of TCL VOCs.

TCL SVOCs/PAHs. Samples were collected from surface soil, subsurface soil, surface water, and sediment during the 1998 and 1999 RI sampling efforts. The 1999 expanded sampling effort has eliminated exposure pathways within the bermed area associated with soil. Surface and subsurface soil have not been characterized for SVOCs in other areas at the WBG, representing a data gap. Results from surface water and sediment do not indicate constituents at concentrations greater than RBCs. Six near surface soil samples were collected during the 1999 RI sampling effort for PAH analysis. Results indicate that PAHs were not present at levels greater than industrial RBCs. Surface water and sediment in uncharacterized areas represent a data gap for TCL SVOCs and PAHs.

TCL PCBs. Samples were collected during the 1997 independent sampling investigation for TCL PCB analysis from surface soil, sediment, and surface water. Subsurface soil has not been characterized for TCL PCBs. Additional samples will be collected from each medium to provide an adequate number of samples from each media for risk assessment purposes. Therefore, TCL PCBs are a data gap at the WBG.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. During the 1998 and 1999 RI sampling efforts, samples were collected for explosives analysis from surface soil, subsurface soil, surface water and sediment. Because this site is associated with the burning of explosive or propellant-contaminated material, uncharacterized area media samples will be analyzed for explosives.

TAL metals. Lead-impacted soil was identified, excavated, and disposed of as nonhazardous waste during the 1999 RI sampling effort. Confirmatory sampling indicated that lead was primarily confined to the bermed area. Excavation and disposal of soil has mitigated exposure pathways associated with the soil in this area. Lead concentrations have not been fully delineated across the entire site; therefore, TAL metals are a data gap in the surface and subsurface soil at the end of the access road where it meets the pond. Metals are also a data gap in the characterization of the surface water and sediment/soil in the low area north of the site.

Dioxins/furans. The WBG is associated with the burning of explosive/propellant-contaminated material; therefore, dioxins/furans are potential chemicals of concern. One surface and seven subsurface soil samples were collected and analyzed for dioxins/furans during the 1999 RI sampling effort. Based on the results of these samples, dioxins/furans are not a data gap in the characterization of soils in the bermed area. Dioxins/furans do represent a data gap in the characterization of areas to the north and west of the bermed area.

Perchlorate. Three samples were collected for perchlorate analysis during the 1999 RI sampling effort. These samples were collected from the pond and creek to the southwest of the WBG. Perchlorate is a data gap in the characterization of surface water in uncharacterized areas of the site.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.13.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed surface water and sediment sampling locations are presented in **Figure 1.13-1** and proposed soil samples are shown on **Figures 1.13-2 and 1.13-3**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.13-2**, includes the following media samples and analyses:

Surface soil. A surface soil sample will be collected from each of four soil borings (WBGSB22, WBGSB23, WBGSB24 and WBGSB25) advanced northwest and west of the WBG. Samples will be collected from 0–0.5 ft bgs to complete the characterization of the site. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals and dioxins/furans. One of these samples (WBGSB23A) will also be analyzed for TOC, grain size and pH to assess the bioavailability and mobility of constituents at the site. One surface soil sample (WBGTR01) will be collected at the former location of a pole-mounted transformer at the site and analyzed for TCL PCBs.

Subsurface soil. Two subsurface soil samples will be collected from each of four soil borings advanced northwest (WBGSB24 and WBGSB25) and west (WBGSB22 and WBGSB23) of the WBG. The two subsurface (2–4 and 6–8 ft bgs) soil samples will be collected from each boring to complete the characterization of the site. The subsurface samples from each boring location will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxins/furans.

Surface water. Six surface water samples will be collected from the unnamed pond and creek to fill data gaps associated with this media. One sample (WBGSW07) will be collected near Wiggins Spring, which feeds the pond. A second sample (WBGSW10) will be collected from the pond downslope from the burning ground. Two samples (WBGSW08 and WBGSW09) will be collected from the unnamed creek below the pond. Samples will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate and hardness. Two of the samples (WBGSW08 and WBGSW10) will also be analyzed for TCL pesticides and herbicides. Two additional samples (WBGSW13 and WBGSW14) will be collected from potential drainage pathways downslope from the WBG. These two samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate and hardness. One sample (WBGSW15) will be collected from the drainage pathway at the western end of the installation to evaluate surface water as it enters the NRU. This sample will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate and hardness. Water quality parameters will be measured using a Hydrolab or equivalent and will include temperature, dissolved oxygen, pH, specific conductivity, and turbidity.

Sediment. One sediment sample (WBGSD07) will be collected from Wiggins Spring, collocated with surface water sample WBGSW07. Three sediment samples will be collected from the unnamed pond. One of these samples (WBGSD10) will be collocated with surface water sample WBGSW10. Two additional sediment samples (WBGSD11 and WBGSD12) will be collected from the pond at the locations shown on **Figure 1.13-1**. Two samples (WBGSD08 and WBGSD09) will be collected from the unnamed creek below the pond. Samples WBGSD07 – WBGSD12 will be collected from the surface water/sediment interface and will be analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals and dioxins/furans. Two of the samples (WBGSD08 and WBGSD10) will also be analyzed for TCL pesticides and herbicides. One of these samples will be located at a surface water discharge point where large organic molecules (TCL PCBs and dioxins/furans) would most likely accumulate. Two additional samples (WBGSD13 and WBGSD14) will be collected from potential drainage pathways downslope from the WBG. Samples WBGSD13 and WBGSD14 will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides and TAL metals. One sediment sample (WBGSD15) will be collected from the drainage pathway at the western end of the installation, collocated with surface water sample WBGSW15. This sample will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides and TAL metals.

Table 1.13-2
Site-Specific Proposed Sampling and Analysis Plan—Western Burning Ground

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Soil	WBGSB22A	0–0.5 ft bgs	w. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB23A	0–0.5 ft bgs	w. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, TOC, grain size, pH
	WBGSB24A	0–0.5 ft bgs	nw. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB25A	0–0.5 ft bgs	nw. of WBG	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	WBGTR01	0–0.5 ft bgs	former transformer location	TCL PCBs
Subsurface Soil	WBGSB22B	2–4 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB22C	6–8 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB23B	2–4 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB23C	6–8 ft bgs	w. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB24B	2–4 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB24C	6–8 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB25B	2–4 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSB25C	6–8 ft bgs	nw. of WBG	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
Surface Water	WBGSW07	NA	near spring	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
	WBGSW08	NA	creek below pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
	WBGSW09	NA	creek below pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
	WBGSW10	NA	unnamed pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
	WBGSW13	NA	drainage pathway	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
	WBGSW14	NA	drainage pathway	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
	WBGSW15	NA	drainage at western end of NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness

Table 1.13-2 (Cont'd)
Site-Specific Proposed Sampling and Analysis Plan—Western Burning Ground

Sediment	WBGSD07	0–0.5 ft bgs	near spring	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD08	0–0.5 ft bgs	creek below pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD09	0–0.5 ft bgs	creek below pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD10	0–0.5 ft bgs	unnamed pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD11	0–0.5 ft bgs	unnamed pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD12	0–0.5 ft bgs	unnamed pond	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
	WBGSD13	0–0.5 ft bgs	drainage pathway	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
	WBGSD14	0–0.5 ft bgs	drainage pathway	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
	WBGSD15	0–0.5 ft bgs	drainage at western end of NRU	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides

1.14 RAIL YARD (NEW RIVER UNIT)

1.14.1 Site Description

The RY is located south of the NBG and east of the WBG (**Figure 1.1-2**). It encompasses an open area approximately 3,200 ft long by 530 ft wide with four small bermed spurs to the north. The area contains three open transfer platforms and one bermed transfer platform. Two large grass covered mounds exist in aerial photographs between Tracks A and B from 1949 through 1991, and are still present at the site. According to facility representatives, heavily packaged NIKE and JOHN rockets and propellants were loaded onto railcars at the site during the 1960s.

The RY is surrounded by dense vegetation to the west and north, open fields to the east, and by the unnamed creek to the south. Two unnamed tributaries to an unnamed creek drain the RY from the northern and southern ends of the site. Engineered drainage control ditches channel runoff in the areas between the tracks, ultimately draining into one of the two tributaries. The two tributaries meet at a confluence downstream of the RY and immediately upstream from the BDDT. After flowing by the BDDT, the unnamed creek leaves the NRU.

Stratigraphic characterization performed during the 1998 RI sampling effort indicated that the subsurface consists of a layer of mostly strong brown clay with some silt to a depth of 1–2 ft bgs. Beneath this layer, to a depth of at least 23 ft bgs, the soil is predominantly strong brown with some yellowish-brown to yellowish-red soft to very hard clay. A surficial gravel layer to a depth of approximately 1 ft bgs exists between Track A and the four transfer platforms. A surficial layer of coal ash lines Tracks B and C and the four bermed spurs.

Previous investigation activities at the RY include two rounds of independent sampling conducted by Gannett Fleming in 1997 and 1998 and a RI by ICF KE in 1998. Each of these investigations is summarized in the following sections.

1.14.2 Previous Investigations

Independent Sampling, Gannett Fleming, Inc., 1997. The objective of the 1997 independent sampling was to characterize sludge and surface soil conditions at the RY. Investigative activities included the collection of one sludge sample and two surface soil samples. Sample locations and chemical exceedence results are shown on **Figure 1.14-1**. Samples were analyzed for TAL metals, cyanide, TCL VOCs, TCL SVOCs, pesticides/PCBs, and explosives.

Surface soil. Two surface soil samples (SS-07 and SS-08) were collected from 0–0.5 ft bgs in the vicinity of transfer platform 603. Metals, TCL SVOCs, one TCL VOC, one explosive, one PCB and four pesticides were detected in the samples. Arsenic was detected at a concentration greater than the industrial RBC of 3.8 mg/kg in sample SS-08, with a reported concentration of 20.8 mg/kg. Aluminum, barium, chromium, iron, manganese and vanadium were detected at concentrations greater than residential RBCs, but below industrial RBCs. One PCB, aroclor-1254, was detected in sample SS-08 (1.7 mg/kg) at a concentration between the residential RBC (0.32 mg/kg) and industrial RBC (2.9 mg/kg). Detected analytical results are presented in Table A-78. SVOCs, VOCs, pesticides and explosives were reported below residential RBCs.

Sludge. One composite sludge sample (SL-05) was collected from a manhole between Tracks B and C, north of transfer platform 603. Several TAL metals, nine TCL SVOCs, one TCL VOC, and two pesticides were detected in the sample. PCBs and explosives were not detected. Results indicated that arsenic and iron were present in the sample at concentrations greater than or equal to industrial RBCs. Arsenic was detected at 22.3 mg/kg (RBC = 3.8 mg/kg); and the iron concentration was equal to the industrial RBC of 120,000 mg/kg. Detected analytical results are presented in Table A-79.

Independent Sampling, Gannett Fleming, Inc., 1998. The objective of the 1998 independent sampling was to provide additional characterization for portions of the RY considered as potential areas of concern based on results from the 1997 independent sampling. Sampling activities included the collection of one sludge and one water sample from the crawlspace inside transfer platform 602, and the collection of three surface soil samples. Sample locations and chemical exceedence results are presented in **Figure 1.14-1**.

Sludge. One composite sludge sample (SL-08) and a duplicate sample (SL-108) were collected inside the crawlspace under transfer platform 602. Samples were analyzed for TAL metals, cyanide, TCL SVOCs, TCL

VOCs, explosives, and pesticides/PCBs. Arsenic (9.2 mg/kg and 19.4 mg/kg) was detected above the industrialRBC of 3.8 mg/kg in these samples. Aluminum, antimony, chromium, iron, manganese and vanadium were detected in the samples at concentrations between residential and industrial RBCs. SVOCs, VOCs, explosives and PCBs were reported at concentrations below the residential RBCs. Detected analytical results are presented in Table A-80.

Water. One platform water sample (WW-04) was collected from the crawlspace inside transfer platform 603 and analyzed for TAL metals, cyanide, TCL SVOCs, TCL VOCs, explosives, and pesticides/PCBs. Iron and manganese were reported at concentrations greater than the tap water RBC in the sample. Five TAL metals, aluminum, copper, iron, lead and zinc, exceeded chronic AWQCs in the samples. SVOCs, VOCs, pesticides/PCBs and explosives were not detected in the sample. Detected analytical results are presented in Table A-81.

Surface soil. One surface soil sample (SS-08a) was collected from 0–0.5 ft bgs in the area between Track A and transfer platform 603 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, explosives, TAL metals, and cyanide. Explosives and SVOCs were not detected. Arsenic (8.9 mg/kg) was detected above the industrial RBC of 3.8 mg/kg in the sample. Aluminum, chromium, iron, manganese and vanadium were reported at concentrations between residential and industrial RBCs. One PCB, aroclor-1254, was detected at a concentration greater than the residential RBC, but below the industrial RBC.

Two surface soil samples (TR-02A and TR-02C) were collected from 0–0.2 ft bgs in the area adjacent to a standing utility pole (with transformer) near Calhoun Road, approximately halfway between transfer platforms 602 and 603. Laboratory analysis for SVOCs, and pesticides/PCBs was performed on these two samples. Pentachlorophenol exceeded the industrial RBC (48 mg/kg) in sample TR-02C with a reported concentration of 826 mg/kg. Pentachlorophenol is a wood preservative and its presence here is likely related to the utilty pole. Two SVOCs (benzo[a]pyrene and benzo[b]fluoranthene) and two pesticides (dieldrin and heptachlor) were detected at concentrations greater than residential RBCs, but below industrial RBCs. PCBs were not detected in these samples. Detected analytical results for surface soil samples are presented in Tables A-82 (metals) and A-83 (organics).

Sediment. Three sediment samples were collected from the tributaries of the unnamed creek draining the RY. These samples (SD-03, SD-04, and SD-05) were analyzed for TCL VOCs, SVOCs, pesticides/PCBs, explosives, TAL metals, and cyanide. Arsenic concentrations exceeded industrial soil RBCs in two samples (SD-03 and SD-04). Concentrations above the industrial RBC ranged from 4.6 mg/kg to 4.9 mg/kg. Aluminum, chromium, iron and manganese were reported at concentrations greater than residential RBCs, but below residential RBCs. Organic compounds were reported at levels below the residential soil RBCs in the samples. Detected analytical results are presented in Table A-84.

The two rounds of independent sampling were successful in meeting the stated goals of characterizing media at the site. Elevated levels of several constituents, primarily metals, were detected, necessitating the need for additional characterization.

Remedial Investigation, ICF KE, 1998. The purpose of the 1998 RI sampling effort was to further characterize the nature and extent of contamination and assess potential exposure pathways through the investigation of subsurface soils.

To complete these goals, the following tasks were performed:

- Aerial photography review to assess past use patterns,
- A site reconnaissance to assess current site conditions, and
- Collection of 15 subsurface soil samples from seven soil borings.

Due to a lack of historical information and limited previous investigation data at the time of the 1998 RI sampling effort, aerial photographs and site reconnaissance were used to select subsurface soil sample locations. A total of 15 subsurface soil samples were collected from seven soil borings (RYSB1 through RYSB7) advanced using direct push methods to characterize the nature and extent of impacts to soil and to assess whether remedial action is warranted. Sample locations and chemical exceedence results are presented in **Figure 1.14-1**. Samples were analyzed for TAL metals, TCL SVOCs, and explosives. Samples were collected at shallow and intermediate depths from each boring. Additionally, one deep sample (RYSB1C) was collected to characterize the lower subsurface region. A surficial gravel layer is present to a depth of approximately 1 ft bgs between Track A and the transfer platforms; samples were collected below this layer. Detected analytical results are presented in Tables A-85 (TAL metals) and A-86 (organics). Metals and three TCL SVOCs were detected in the soil samples. Explosives were not

SITE ID DEPTH (ft)	RYSB1A 0–2		RYSB1B 4–8		RYSB1C 19–23	
Metals						
Aluminum	817		12,400		10,400	
Arsenic	**1.6**	J	**4.9**	J	**4.5**	J
Iron	2,600		24,700		20,200	
Manganese	105	J	151	J	235	J

SITE ID DEPTH (ft)	SS–07 0–0.5	
Metals		
Arsenic	**1.8**	
Barium	1,770	J
VOCs		
Methylene Chloride	0.0007	B

SITE ID DEPTH (ft)	SL–05 NA
Metals	
Aluminum	8,190
Arsenic	**22.3**
Chromium	**103**
Copper	373
Iron	120,000
Manganese	908
Vanadium	72.2
VOCs	
Methylene Chloride	0.001 B

SITE ID DEPTH (ft)	RYSB2A 0–2		RYSB2B 4–6	
Metals				
Aluminum	5,630		12,700	
Arsenic	**2.9**	J	**4.9**	J
Chromium	7		**46.3**	
Iron	7,120		31,900	
Manganese	202	J	70.9	J
Vanadium	23.7	J	72.4	J

SITE ID DEPTH (ft)	SD–03 NA
Metals	
Aluminum	9,370
Arsenic	**4.9**
Chromium	24.6
Iron	12,500
Manganese	446

SITE ID DEPTH (ft)	SD–04 NA
Metals	
Aluminum	11,000
Arsenic	**4.6**
Chromium	14,200
Iron	**1,220**

SITE ID DEPTH (ft)	RYSB3A 1–3		RYSB3B 3–4.2	
Metals				
Aluminum	7,470		11,100	
Arsenic	**2.1**	J	**3.9**	J
Iron	11,200		21,800	

SITE ID DEPTH (ft)	RYSB4A 0–4		RYSB4B 4–6	
Metals				
Aluminum	17,500		23,300	
Arsenic	**5.6**	J	**4.9**	J
Iron	27,700		23,600	
Manganese	301	J	342	J
Vanadium	60.4	J	42.6	J

SITE ID DEPTH (ft)	SD–05 NA
Metals	
Aluminum	27,000
Arsenic	**2.2**
Chromium	32.9
Iron	22,000

SITE ID DEPTH (ft)	WW–04 NA
Metals	
Aluminum	258
Copper	38
Iron	4,470
Lead	31
Manganese	102
Zinc	274

SITE ID DEPTH (ft)	RYSB5A 0–4		RYSB5B 4–6	
Metals				
Aluminum	14,200		10,200	
Arsenic	**7**	J	**4.3**	J
Iron	31,200		14,800	J
Manganese	108	J	405	J
Vanadium	57.1	J	36.3	J

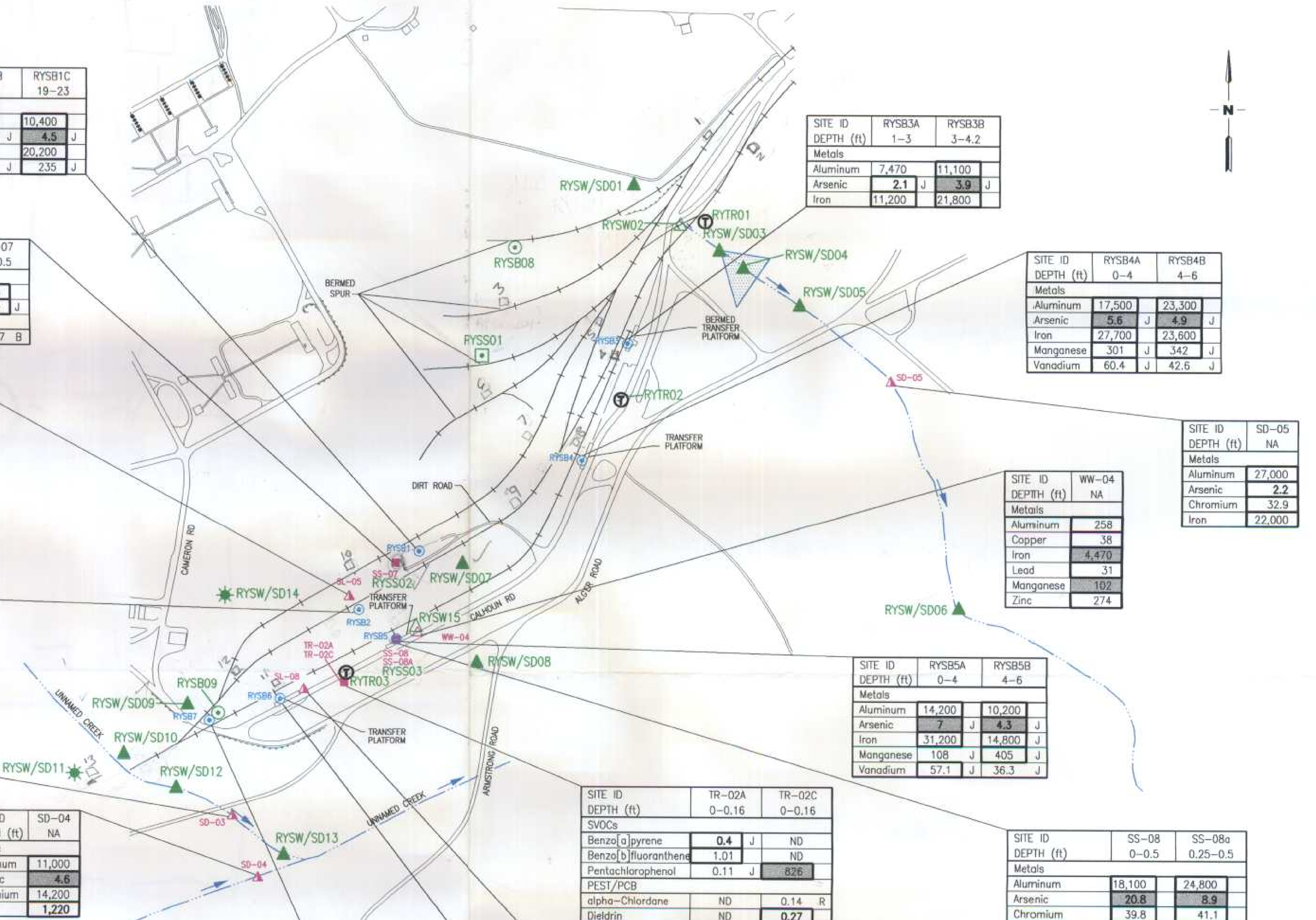
SITE ID DEPTH (ft)	TR–02A 0–0.16		TR–02C 0–0.16	
SVOCs				
Benzo[a]pyrene	**0.4**	J	ND	
Benzo[b]fluoranthene	1.01		ND	
Pentachlorophenol	0.11	J	826	
PEST/PCB				
alpha–Chlordane	ND		0.14	R
Dieldrin	ND		**0.27**	
Heptachlor	ND		0.2	R

SITE ID DEPTH (ft)	SS–08 0–0.5		SS–08a 0.25–0.5	
Metals				
Aluminum	18,100		24,800	
Arsenic	**20.8**		**8.9**	
Chromium	39.8		41.1	
Iron	39,600		48,400	
Manganese	203		233	
Vanadium	75.9		91.5	
VOCs				
Methylene Chloride	0.003	B	0.003	B
PEST/PCB				
Aroclor–1254	**1.7**		1.0	
Dieldrin	0.02	R	0.01	R
Explosives				
2,6–Dinitrotoluene	**0.32**	C	ND	

SITE ID DEPTH (ft)	RYSB7A 0–4		RYSB7B 4–6	
Metals				
Aluminum	8,180		11,400	
Arsenic	**3.2**	J	**5.5**	J
Iron	14,900		18,500	
Manganese	709	J	395	J

SITE ID DEPTH (ft)	RYSB6A 0–4		RYSB6B 4–6	
Metals				
Aluminum	12,100		15,400	
Arsenic	**7.8**	J	**5.4**	J
Chromium	19.8		26.9	
Iron	27,200		30,300	
Manganese	213	J	133	J
Vanadium	48.4	J	55.9	J

SITE ID DEPTH (ft)	SL–08 NA
Metals	
Aluminum	21,600
Antimony	ND
Arsenic	**9.2**
Chromium	34.3
Iron	42,600
Manganese	249
Vanadium	71.9
VOCs	
Methylene Chloride	0.003 B



0 200 400 800

SCALE IN FEET

LEGEND

- ■ 1997/1998 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)
- ▲ 1997/1998 INDEPENDENT SAMPLING SEDIMENT/SLUDGE SAMPLE (GANNETT FLEMING)
- △ 1998 INDEPENDENT SAMPLING SURFACE WATER SAMPLE (GANNETT FLEMING)
- ⊙ 1998 RI SOIL BORING (ICF KAISER)
- ⊙ PROPOSED SOIL BORING LOCATION
- ⊡ PROPOSED SURFACE SOIL LOCATION
- △ PROPOSED SURFACE WATER LOCATION
- ▲ PROPOSED SURFACE WATER/SEDIMENT LOCATION
- ✹ PROPOSED SEWER SAMPLE LOCATION
- → CREEK FLOW DIRECTION
- △ POND
- Ⓣ TRANSFORMER

NOTE:

SOLID MATRIX UNITS IN MG/KG

AQUEOUS MATRIX UNITS IN UG/L

B = BLANK CONTAMINATION

C = SEE REPORT NARRATIVE FOR ANALYST'S OBSERVATION CONCERNING RESULT

J = ESTIMATED CONCENTRATION

ND = NOT DETECTED

R = REJECTED RESULT

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC OR AWQC (CHRONIC)

SHADING = VALUE EXCEEDS THE INDUSTRIAL OR TAP WATER RBC

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

METALS REFERS TO TAL METALS

Sample Summary

Previous Investigation	Contractor	TAL Metals				Cyanide			Explosives				TCL VOCs				TCL SVOCs				TCL PCBs			Total
		SS	SB	SE	SW	SS	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SB	SE	SW	SS	SE	SW	
1997 Independent Sampling	GF	2	––	1 (SL)	––	2	1(SL)	––	2	––	1(SL)	––	2	––	1(SL)	––	2	––	1(SL)	––	2	1(SL)	––	18
1998 Independent Sampling	GF	1	––	1(SL),3(SE)	1	1	1(SL),3(SE)	1	1	––	1(SL),3(SE)	1	1	––	1(SL),3(SE)	1	3	––	1(SL),3(SE)	1	3	1(SL),3(SE)	1	40
1998 RI	ICF Kaiser	––	15	––	––	––	––	––	––	15	––	––	––	––	––	––	––	15	––	––	––	––	––	45

PLOTTED: 2-7-02

FILE: 1-14-1xls.dwg

RADFORD AAP

PREPARED BY: IT CORP.

TASK NO: 870403301000000

CHECKED BY: MT

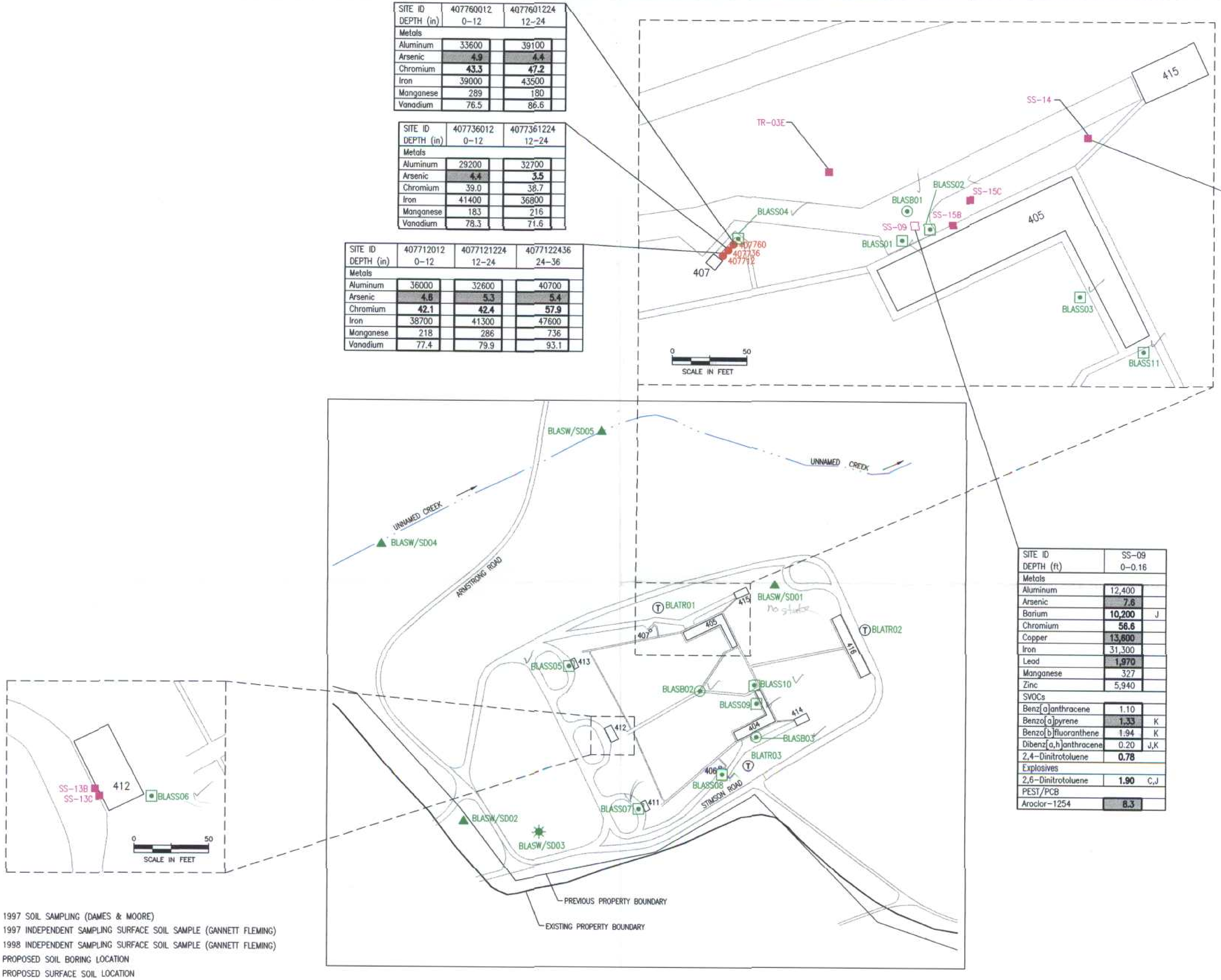
IT DWG NO: 1-14-1xls.dwg

DATE: NOVEMBER 2001

FIGURE 1.14-1

RAIL YARD
PREVIOUS INVESTIGATIONS
SAMPLE RESULTS AND
PROPOSED SAMPLING
LOCATIONS

05006\ 342-1/2



SITE ID DEPTH (in)	407760012 0-12	4077601224 12-24
Metals		
Aluminum	33600	39100
Arsenic	**4.9**	**4.4**
Chromium	**43.3**	**47.2**
Iron	39000	43500
Manganese	289	180
Vanadium	76.5	86.6

SITE ID DEPTH (in)	407736012 0-12	4077361224 12-24
Metals		
Aluminum	29200	32700
Arsenic	**4.4**	**3.5**
Chromium	39.0	38.7
Iron	41400	36800
Manganese	183	216
Vanadium	78.3	71.6

SITE ID DEPTH (in)	407712012 0-12	4077121224 12-24	4077122436 24-36
Metals			
Aluminum	36000	32600	40700
Arsenic	**4.6**	**5.3**	**5.4**
Chromium	**42.1**	**42.4**	**57.9**
Iron	38700	41300	47600
Manganese	218	286	736
Vanadium	77.4	79.9	93.1

SITE ID DEPTH (ft)	SS-14 0-0.16
Metals	
Aluminum	35,600
Arsenic	**4.7**
Chromium	**44.0**
Iron	40,000
Manganese	573
Vanadium	78.3

SITE ID DEPTH (ft)	SS-09 0-0.16	
Metals		
Aluminum	12,400	
Arsenic	**7.6**	
Barium	**10,200**	J
Chromium	**56.6**	
Copper	**13,600**	
Iron	31,300	
Lead	**1,970**	
Manganese	327	
Zinc	5,940	
SVOCs		
Benz[a]anthracene	1.10	
Benzo[a]pyrene	**1.33**	K
Benzo[b]fluoranthene	1.94	K
Dibenz[a,h]anthracene	0.20	J,K
2,4-Dinitrotoluene	**0.78**	
Explosives		
2,6-Dinitrotoluene	**1.90**	C,J
PEST/PCB		
Aroclor-1254	**8.3**	

LEGEND:

●	1997 SOIL SAMPLING (DAMES & MOORE)
☐	1997 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)
■	1998 INDEPENDENT SAMPLING SURFACE SOIL SAMPLE (GANNETT FLEMING)
⊙	PROPOSED SOIL BORING LOCATION
▣	PROPOSED SURFACE SOIL LOCATION
✹	PROPOSED SEWER SAMPLE LOCATION
▲	PROPOSED SURFACE WATER/SEDIMENT LOCATION
Ⓣ	TRANSFORMER

NOTE:

ALL UNITS IN MG/KG

C = SEE REPORT NARRATIVE FOR ANALYST'S OBSERVATION CONCERNING RESULT

I = AN INTERFERENCE EXISTS WHICH MASKS THE TRUE RESPONSE

K = ESTIMATED CONCENTRATION BIAS HIGH

J = ESTIMATED CONCENTRATION

UJ = ESTIMATED NON-DETECT

DARK BORDER = VALUE EXCEEDS THE RESIDENTIAL RBC

SHADING = VALUE EXCEEDS THE INDUSTRIAL RBC

BOLD = VALUE EXCEEDS THE SSL TRANSFER CRITERION

METALS REFERS TO TAL METALS

Sample Summary

Previous Investigation	Contractor	TAL Metals		Cyanide	Explosives		TCL VOCs		TCL SVOCs		TCL PCBs		Total
		SS	SB	SS	SS	SB	SS	SB	SS	SB	SS	SB	
1997 Soil Sampling	D&M	3	4	--	--	--	3	4	3	4	3	4	28
1997 Independent Sampling	GF	1	--	1	1	--	1	--	1	--	1	--	6
1998 Independent Sampling	GF	1	--	1	5	--	1	--	2	--	2	--	12

0 125 250 500
SCALE IN FEET

FILE: BL-AREA2.DWG PLOT: 4-3-02

RADFORD AAP

PREPARED BY: IT CORP.
TASK NO: 870403301000000
CHECKED BY: MT
IT DWG NO: BL-AREA2.DWG
DATE: REVISED MARCH 2002

FIGURE 1-15.1

BAG LOADING AREA PREVIOUS INVESTIGATIONS SAMPLE RESULTS AND PROPOSED SAMPLING LOCATIONS

05006\342_2/2

detected. Arsenic was detected at concentrations greater than the industrial RBC in 11 of the 15 samples. Arsenic concentrations above the industrial RBC of 3.8 mg/kg ranged from 3.9 to 7.8 mg/kg. Aluminum, chromium, iron, manganese, thallium, and vanadium were reported at concentrations greater than residential RBCs, but below industrial RBCs. SVOCs were detected at concentrations below residential RBCs.

1.14.3 Conceptual Site Model

A conceptual site model for the RY is presented in **Figure 1.14-2**. Potentially affected media include surface and subsurface soil, sediment, and surface water. The area surrounding the RY is generally flat with drainage controlled by ditches. Site workers and biota are considered receptors. **Table 1.14-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs. Train loading and maintenance activities may have impacted surface soil. Packaged explosives were loaded onto train cars from four transfer platforms and routine maintenance was likely performed on trains in the yard as well. Explosives, propellants, degreasers, cleaning agents, and lubricants may have been spilled or discharged near the rail spurs. Contamination associated with these operations would impact site workers and terrestrial biota through incidental ingestion of soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust generated during construction activities.

Subsurface soil is also potentially impacted by past loading/maintenance activities. Site workers could be negatively impacted through the inhalation of dust during removal/construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water and sediment are present in the drainage ditch parallel to Cameron Road and the northern and southern tributaries of the unnamed creek. Surface water and sludge also collect under the four loading platforms in the RY. Aquatic or benthic organisms are not likely to utilize these media. Site workers and biota may be exposed through incidental ingestion or dermal absorption. Site workers and terrestrial biota may also be exposed through inhalation of volatiles from surface water. Therefore, surface water and sediment exposure pathways still exist.

1.14.4 Data Gap Analysis

TCL VOCs. Samples were collected from surface soil, sediment (sludge), and surface water for TCL VOC analysis during the 1997 and 1998 independent sampling events. Results from this investigation indicated that TCL VOCs were not detected at a concentration greater than applicable criteria. Samples were not collected for TCL VOC analysis from the subsurface soil. Therefore, TCL VOCs represent a data gap in the characterization of the subsurface soil, and in other media in uncharacterized portions of the RY.

TCL SVOCs/PAHs. Previous investigations have characterized surface and subsurface soil, sediment, and surface water for TCL SVOC analysis. Results indicate that low levels of TCL SVOCs, including PAHs, were detected in surface soil and sludge/sediment. None of these compounds exceeded residential RBCs. Samples, however, were not collected in the bermed spurs area. Therefore, SVOCs/PAHs are a data gap in this area.

TCL PCBs. Samples were collected from surface soil, sediment, and surface water during the 1997 and 1998 independent sampling. Subsurface soil samples were not characterized for TCL PCBs. Therefore, TCL PCBs represent a data gap in the characterization of subsurface soil and in other media where samples have not been previously collected.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, one or two samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

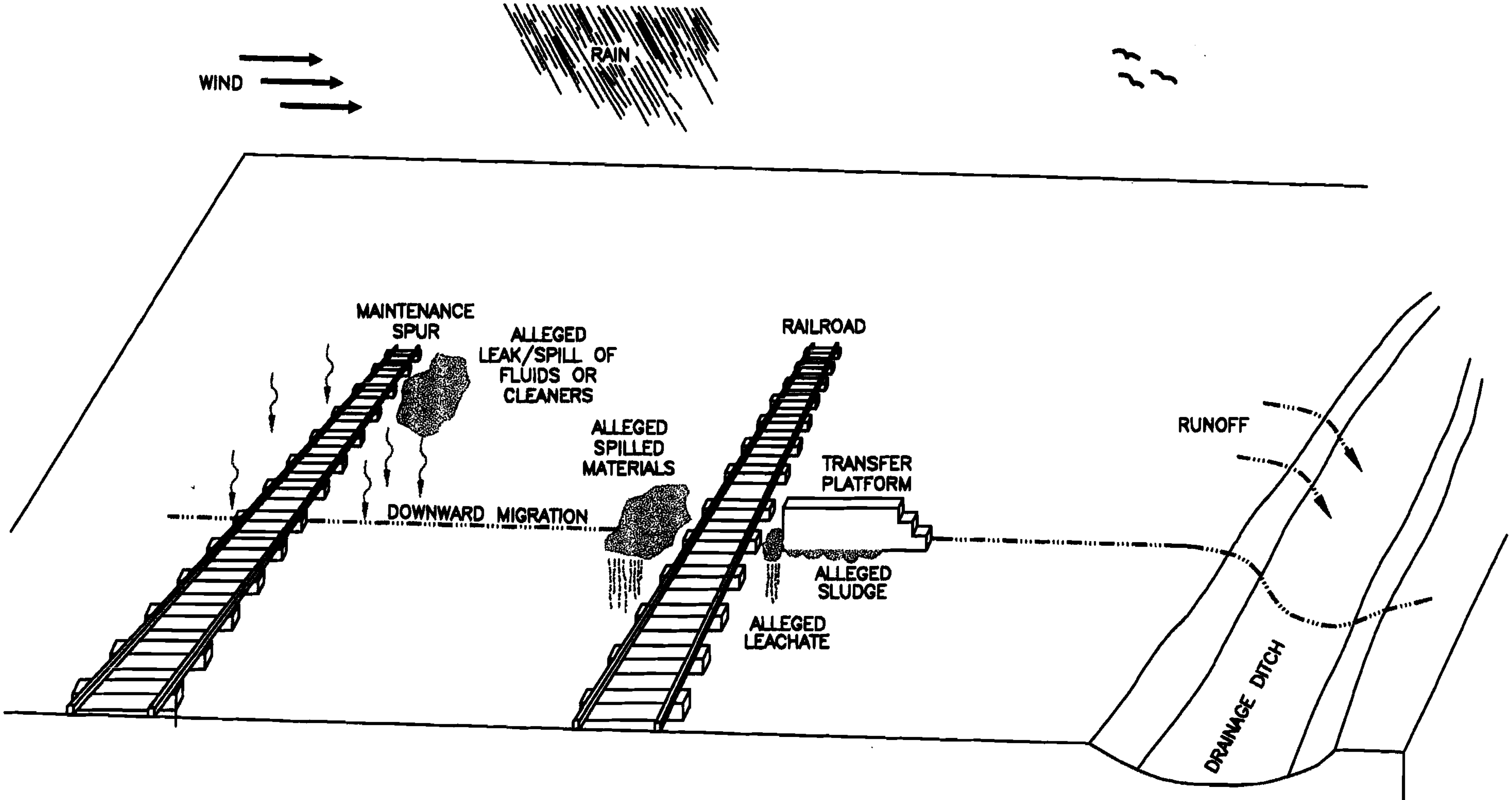
Explosives. Samples were collected and analyzed for explosives from surface and subsurface soil, sediment, and surface water during previous investigations. Analytical results indicated that one surface sample contained 26DNT at concentrations below the residential RBC. Explosives were not reported in the other media. Soil samples have not been collected along the bermed spurs; therefore, explosives are a data gap in surface and subsurface soils in this area and the unnamed tributaries draining the RY.

TAL metals. Samples were collected and analyzed for TAL metals from surface and subsurface soil, sediment, and surface water during previous investigations. Results indicated that arsenic was detected at concentrations greater than the industrial RBC. Previous investigations have not collected soil samples from the

Table 1.14-1
Potential Exposure Pathways and Receptors—Rail Yard

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, INH, DA	IN, INH, DA	IN, DA	IN, DA	Present in crawlspace under transfer platforms and northern and southern tributaries.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.14-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.



"NOT TO SCALE"

NOTE:

SEE TABLE 1.14-1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

PLOTTED: 2-7-02

FILE: 1-14-2.DWG

RADFORD AAP

PREPARED BY: IT CORP.
CHECKED BY: TL
DATE: FEBRUARY 2002
TASK NO: [illegible]
IT DWG NO: 1-14-2

FIGURE 1.14-2

CONCEPTUAL MODEL
RAIL YARD

247

bermed spurs. TAL metals are a data gap in surface and subsurface soils in the bermed spurs area and in the unnamed tributaries draining the RY.

Dioxins/furans. The RY was not used for burning or disposal/storage of burned wastes or combustion byproducts, therefore, samples will not be analyzed for dioxins/furans. Based on the CSM, dioxins/furans are not considered a data gap.

Perchlorate. Surface water is present in the two tributaries to the unnamed creek; under the transfer platforms in ephemeral ponds/puddles; and possibly in the drainage ditch. Previous investigations have not analyzed surface water for perchlorate; therefore, perchlorate represents a data gap in the characterization of surface water.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.14.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.14-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.14-2**, includes the following media samples and analyses:

Surface soil. Five surface soil (0–0.5 ft bgs) samples will be collected at the RY. One sample will be collected from each of two soil borings advanced to complete the characterization of the RY. One of the sample locations (RYSB08A) will be positioned along the bermed spurs located in the northwestern portion of the site. This area has not been previously investigated; therefore, samples will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size and pH. The second boring (RYSB09) will be collocated with 1998 RI previous investigation sample location RYSB7 and will be analyzed for TCL VOCs, pesticides/PCBs and herbicides. A second surface soil sample (RYSS01) will be collected from the bermed spurs and analyzed for TCL VOCs, SVOCs, PCBs, PAHs, explosives and TAL metals. Sample RYSS02 will be collocated with previous sample SS-07 and analyzed for TCL PBCs and TAL metals to verify elevated levels of barium and arsenic detected in that sample. Sample RYSS03 will be collocated with previous sample SS-08 and analyzed for TCL PCBs and explosives. Three surface soil samples (RYTR01 – RYTR03) will be collected at three former pole-mounted transformer locations at the RY. These three samples will be analyzed for TCL PCBs.

Subsurface soil. Three subsurface soil samples will be collected from two soil borings advanced to complete the characterization of subsurface soil. One subsurface soil sample (RYSB08B) will be collected at 4–6 ft bgs in the boring advanced along the northernmost spur and analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, PAHs, explosives, and TAL metals. Two subsurface soil samples (RYSB09B and RYSB09C) will be collected at 4–6 and 8–10 ft bgs from the boring collocated with 1998 RI boring RYSB7. Samples will be analyzed for TCL VOCs and TCL PCBs.

Surface water. Fifteen surface water samples will be collected from the RY and the unnamed creeks that drain the RY. Six samples will be collected from the unnamed tributary that drains the northern portion of the RY. The samples will be spaced from a major drainage culvert at the RY (RYSW01) to the confluence of another unnamed creek near the BDDT (RYSW06). Sample RYSW02 will be a sample from a spring near a small flood control pond. These six samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, PAHs, TAL metals, herbicides, explosives, perchlorate and hardness. Four surface water samples (RYSW07, RYSW08, RYSW09 and RYSW10) will be collected from drainage ditches and culverts that drain the RY. Two surface water samples (RYSW12 and RYSW13) will be collected from the unnamed creek that drains the southern portion of the RY. These samples will also be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, explosives, perchlorate and hardness. Two surface water samples (RYSW11 and RYSW14) will be collected from manholes in the former sewage system. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, and hardness. If present, one surface water sample (RYSW15) will be collocated with 1997 independent sampling location WW-04. This sample will be analyzed for perchlorate and hardness, which were not previously investigated at the RY. Water quality parameters will be measured using a Hydrolab or equivalent and will include temperature, dissolved oxygen, pH, specific conductivity, and turbidity.

Sediment. Thirteen sediment samples will be collected from the RY and the two creeks that drain the RY. Five of the sediment samples will be collocated with the surface water samples collected from the unnamed tributary that drains the northern section of the RY. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, and explosives. Four sediment samples (RYSD07, RYSD08, RYSD09 and RYSD10) will be collected from the drainage ditches and culverts that drain the RY. Two samples (RYSD12 and RYSD13) will be collected from the unnamed creek that drains the southern portion of the RY, collocated with the surface water samples. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides and explosives. Two sediment samples (RYSD11 and RYSD14) will be collected from manholes in the former sewage system. These samples will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, and herbicides.

Table 1.14-2
Site-Specific Proposed Sampling and Analysis Plan—Rail Yard

Media	Sampling ID	Depth	Location	Analytes
Surface Soil	RYSS01	0–0.5 ft bgs	bermed spur	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	RYSS02	0–0.5 ft bgs	at SS-07	TCL PCBs, TAL metals
	RYSS03	0-0.5 ft bgs	at SS-08	TCL PCBs, explosives
	RYSB08A	0–0.5 ft bgs	bermed spur	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, TOC, grain size, pH
	RYSB09A	0–0.5 ft bgs	at RYSB7	TCL VOCs, pesticides/PCBs, herbicides
	RYTR01	0–0.5 ft bgs	Former transformer location	TCL PCBs
	RYTR02	0–0.5 ft bgs	Former transformer location	TCL PCBs
	RYTR03	0–0.5 ft bgs	Former transformer location	TCL PCBs
Subsurface Soil	RYSB08B	4–6 ft bgs	bermed spur	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals
	RYSB09B	4–6 ft bgs	at RYSB7	TCL VOCs, PCBs
	RYSB09C	8–10 ft bgs	at RYSB7	TCL VOCs, PCBs
Surface Water	RYSW01	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW02	NA	spring sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW03	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW04	NA	flood control pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW05	NA	below flood control pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW06	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
	RYSW07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	RYSW08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	RYSW09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness

Table 1.14-2 (cont'd)
Site-Specific Proposed Sampling and Analysis Plan—Rail Yard

Media	Sampling ID	Depth	Location	Analytes
Surface Water (cont'd)	RYSW10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	RYSW11	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
	RYSW12	NA	southern tributary	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	RYSW13	NA	southern tributary	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	RYSW14	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides, perchlorate, hardness
	RYSW15	NA	transfer platform	Perchlorate, hardness
Sediment	RYSD01	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
	RYSD03	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
	RYSD04	NA	flood control pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
	RYSD05	NA	below flood control pond	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
	RYSD06	NA	northern tributary	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives
	RYSD07	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	RYSD08	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	RYSD09	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	RYSD10	NA	drainage sample	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	RYSD11	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides
	RYSD12	NA	southern tributary	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	RYSD13	NA	southern tributary	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, explosives, herbicides
	RYSD14	NA	sewer sample	TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, herbicides

1.15 BAG LOADING AREA (NEW RIVER UNIT)

1.15.1 Site Description

The BLA is located on a topographic high of approximately 2,090 ft msl along the southwestern property boundary of the NRU, south of the RY. The site is approximately 1,400 ft long by 800 ft wide and consists of former process buildings and support structures. The site was developed to run two black powder bag loading production lines. The production and process flow of the two lines were set up to be identical. The area was active from approximately 1941-1943. What remains are concrete foundations and walls. Buildings 411/413 were Powder Service Magazines. Building 412 was the Container and Shipping Magazine. Buildings 404/405 were Bag Loading Buildings. Buildings 406/407 were Igniter Service Magazines. The floors in these buildings contain a conductive flooring material which indicates that explosive material was handled. The flooring has degraded to varying degrees and red leachate has migrated on to the surrounding soil.

Buildings 414/415 were general warehouse buildings. Physical evidence of these buildings no longer exists. Substantial concrete foundations/blast walls with associated conductive flooring do not exist (similar to the other buildings at BLA), therefore, it is reasonable to conclude that explosives were not present or handled in these buildings. Building 416 was a boiler house and canteen for workers at the site. Therefore, these three buildings (414, 415, 416) and the areas around them are not considered to be of environmental concern at the BLA.

The areas between the buildings are generally flat. Vegetation is mostly limited to grass and small shrubs. Surface water drainage is controlled by engineered drainage ditches and culverts. Stratigraphic characterization completed during the 1998 independent sampling indicated that the surface soil at the BLA consists of tan to dark brown silty clay and clay.

Previous investigation activities at the BLA include a soil sampling effort conducted by Dames and Moore, Inc., in 1997 and two rounds of independent sampling conducted by Gannett Fleming, Inc., in 1997 and 1998. Sample locations from each of these investigations are presented in **Figure 1.15-1**. These investigations are summarized in the following sections.

1.15.2 Previous Investigations

Soil Sampling, Dames and Moore, Inc., 1997. The objective of the 1997 soil sampling effort was to provide an assessment of the lateral and vertical distribution of organic and inorganic constituents around Building 407 at the BLA. Three soil sample locations were positioned in a line perpendicular to the building at distances of 12, 36, and 60 inches out from the sidewalk. Sample locations and chemical exceedence results are shown on **Figure 1.15-1**. Three samples were collected from depths of 0-12, 12-24, and 24-36 inches at the location 12 inches away from the sidewalk. For the sampling locations 36 and 60 inches away from the sidewalk, two samples were collected from each location, at depths of 0-12 and 12-24 inches. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals.

A total of seven soil samples were collected on the north side of Building 407. Arsenic was the single TAL metal detected above the industrial RBC of 3.8 mg/kg in six of the seven samples, with concentrations ranging from 4.4 to 5.4 mg/kg. Aluminum, chromium, iron, manganese, and vanadium were reported at concentrations between the residential and industrial RBCs in every sample. Thallium slightly exceeded the residential RBC in the surface soil sample closest to the building. VOCs, SVOCs, pesticides, and PCBs were not detected in the samples. Detected analytical results for metals are presented in Table A-87.

Independent Sampling, Gannett Fleming, Inc., 1997. The objective of the 1997 independent sampling was to characterize surface soil at the BLA. Investigative activities included the collection of one surface soil sample (SS-09) on the north side of Building 405 and a sample of the floor (WS-01) from Building 405. Samples were analyzed for TAL metals, cyanide, TCL VOCs, TCL SVOCs, pesticides/PCBs, and explosives.

Three TAL metals, arsenic, copper and lead, were reported at concentrations greater than the industrial RBC. Lead exceeded the industrial RBC of 750 mg/kg in sample SS-09, with a reported concentration of 1,970 mg/kg, and the residential RBC of 400 mg/kg in floor sample WS-01, with a reported concentration of 492 mg/kg. Arsenic and copper exceeded the industrial RBCs (arsenic = 3.8 mg/kg; copper = 8,200mg/kg) in both samples collected. Arsenic concentrations were 7.6 mg/kg (sample SS-09) and 9.5 mg/kg (sample WS-01). Copper concentrations were 13,600 mg/kg and 59,600 mg/kg in samples SS-09 and WS-01, respectively. Aluminum (SS-09), barium, cadmium, chromium, iron, manganese, and zinc were reported at concentrations between the residential and industrial RBCs. VOCs were not reported at concentrations exceeding residential RBCs. One SVOC (benzo[a]pyrene) and one PCB (Aroclor-1254) were reported above their respective industrial RBCs of 0.78 and 2.9 mg/kg in sample SS-09 at concentrations of 1.33 and 8.3 mg/kg. Three additional SVOCs (benz[a]anthracene, benzo[b]fluoranthene, and dibenz[a,h]anthracene) were reported between residential and industrial RBCs. However, five SVOCs, including benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene were reported above their respective industrial RBCs in floor sample WS-01. Sample concentrations were as follows, benz[a]anthracene- 20.80 mg/kg (industrial RBC of 7.8 mg/kg), benzo[a]pyrene- 22.20 mg/kg (industrial RBC of 0.78 mg/kg), benzo[b]fluoranthene- 27.30 mg/kg (industrial RBC of 7.8 mg/kg), dibenz[a,h]anthracene- 1.00 mg/kg (industrial RBC of 0.78), and indeno[1,2,3-cd]pyrene- 16.00 (industrial RBC of 7.8 mg/kg). Detected analytical results for soil samples are presented in Tables A-88 (metals) and A-89 (organics). Detected analytical results for the conductive flooring are presented in Tables A-90 (metals) and A-91 (organics). This investigation confirmed the presence of elevated levels of metal and SVOC constituents in the soil and conductive floor at Building 405. The extent of these constituents was not, however, assessed.

Independent Sampling, Gannett Fleming, Inc., 1998. The objective of the 1998 independent sampling was to further characterize portions of the BLA considered to be potential areas of concern based on results from the 1997 independent sampling. Investigative activities included the collection of six surface soil samples and two conductive flooring samples for laboratory analysis. Conductive flooring samples will be discussed further in other reports.

Six surface soil samples (SS-13b, SS-13c, SS-14, SS-15b, SS-15c, and TR-03e) were collected within the vicinity of Buildings 405 and 412. Sample locations and chemical exceedence results are shown in **Figure 1.15-1**. Samples SS-13b and SS-13c were collected from an area of apparent stressed vegetation adjacent to the west side of Building 412. Samples SS-15b and SS-15c were collected on the north side and adjacent to Building 405. These four samples (SS-13b, SS-13c, SS-15b, and SS-15c) were solely analyzed for explosives. Sample SS-14 was collected in an apparent drainage swale located off the northeast corner of Building 405 and analyzed for TAL metals, cyanide, TCL VOCs, TCL SVOCs, pesticides/PCBs, and explosives. Sample TR-03e was collected northwest of Building 405in the vicinity of a suspected former utility pole and analyzed for TCL SVOCs and pesticides/PCBs. The utility pole was not located.

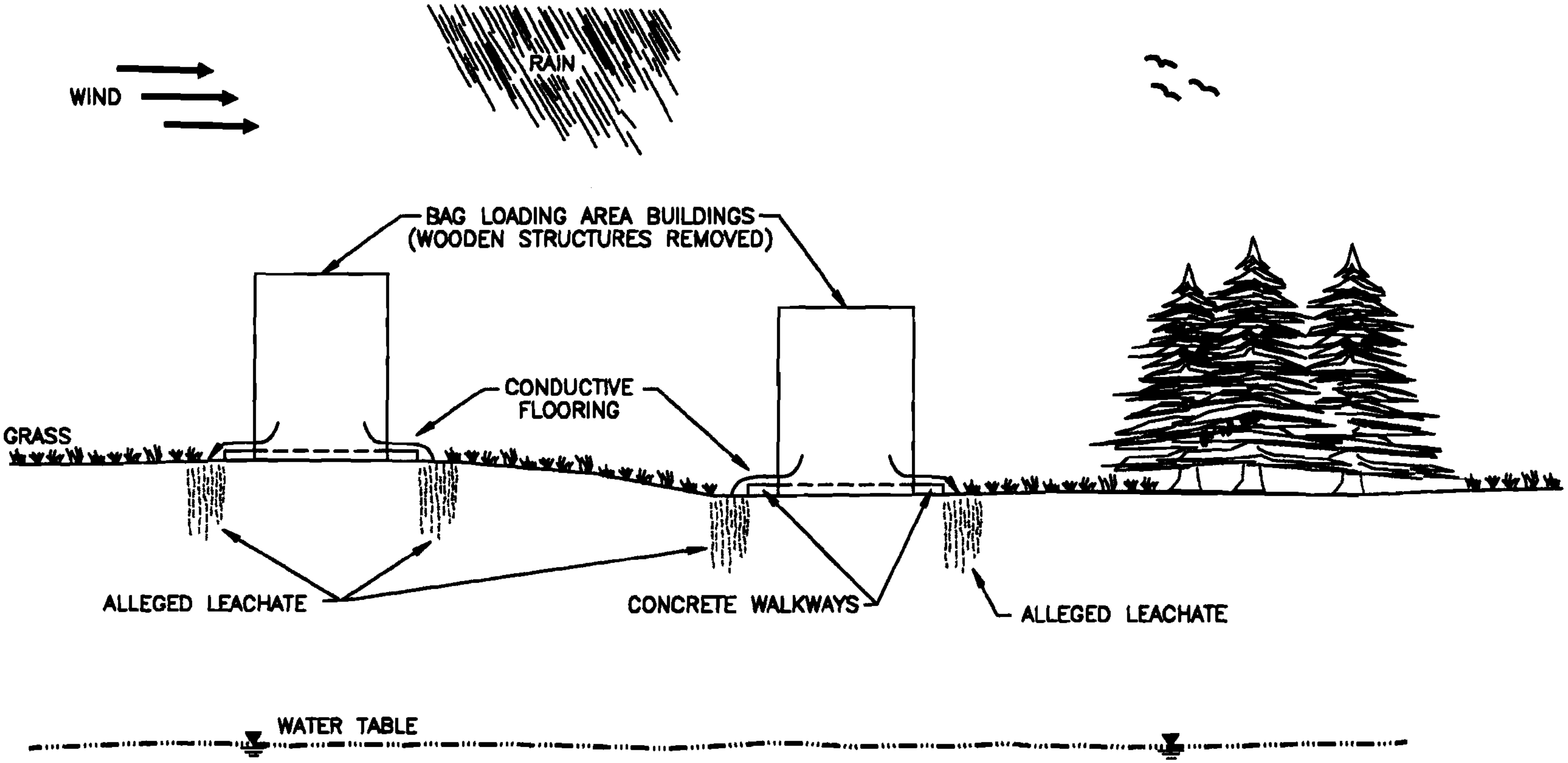
Surface soil results for sample SS-14 indicated that arsenic was the single metal detected at a concentration (4.7 mg/kg) exceeding its industrial RBC of 3.8 mg/kg. Aluminum, chromium, iron, manganese, and vanadium were detected at concentrations greater than the residential RBC; however, none of these analytes exceeded their respective industrial RBCs. One VOC (methylene chloride) was detected below the residential RBC criterion; however, this result was "B flagged" during the data validation process. Two SVOCs [bis(2-Ethylhexyl)phthalate and phenol] were also detected below residential RBCs. Explosives and pesticides/PCBs were not detected. Explosives were also not detected in samples SS-13b, SS-13c, 15b, or 15c. Analytical results for sample TR-03e indicated that ten SVOCs and one PCB (Aroclor-1254) were detected at concentrations below residential RBCs. Detected analytical results are presented in Tables A-92 (metals) and A-93 (organics).

The 1998 independent sampling verified the results of the 1997 independent sampling and identified additional areas where BLA activities impacted the soil. The full extent of the area with elevated levels of metals was not bounded during this investigation.

1.15.3 Conceptual Site Model

A conceptual site model for the BLA is presented on **Figure 1.15-2**. Potentially affected media include surface soil and subsurface soil, sediment, and surface water. The site is located on a grassy knoll in the southwest corner of the NRU. The areas between the BLA buildings are generally flat, lightly wooded and grassy. Precipitation is expected to flow overland north and east to the unnamed creek. Site workers and biota are considered receptors. **Table 1.15-1** presents the exposure pathways for each receptor. Each media type is described in more detail in the following paragraphs. The CSM for the BLA is similar to that for the IAA (Section 1.11-3). As stated in the CSM for the IAA, the characterization of the conductive flooring at the IAA will be used to characterize every site with conductive flooring.

Surface soil is potentially impacted by the leachate from the conductive flooring. Demolition and removal of the wooden portions of the buildings has exposed the conductive flooring material (composed of asbestos and heavy metals) to the elements. Site workers and terrestrial biota could be impacted though incidental ingestion of



"NOT TO SCALE"

NOTE:

SEE TABLE 1.15–1 FOR ASSOCIATED EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS.

FILE: 1-15-2.DWG

PLOTTED: 4-3-02

RADFORD AAP

PREPARED BY: IT CORP.

TASK NO: [illegible]

CHECKED BY: MT

IT DWG NO:
1–15–2

DATE: REVISED MARCH 2002

FIGURE 1.15–2

CONCEPTUAL MODEL
BAG LOADING
AREA

303

Table 1.15-1
Potential Exposure Pathways and Receptors—Bag Loading Area

Site	Media	Potentially Affected Media	Exposure Pathways and Receptors				Comments
			Human	Biota			
			Site Workers	Terrestrial	Aquatic	Benthic	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Surface Water	Yes	IN, INH, DA	IN, INH, DA	IN, DA	IN, DA	Present in unnamed creek and site drainage and sewer systems.
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Subsurface Soil	Yes	IN, INH, DA	—	—	—	During construction activity.

NOTE: Refer to Figure 1.15-2 for conceptual model.
Abbreviations: IN = ingestion, INH = inhalation, DA = dermal absorption.

soil, dermal absorption through direct contact with contaminated soil, and the inhalation of dust.

Subsurface soil is also potentially impacted by leachate from the conductive flooring material. Site workers could be negatively impacted through the inhalation of dust during removal or construction activities. Incidental ingestion and dermal absorption may also affect site workers during construction activities that expose the subsurface soil.

Surface water and sediment are present in the unnamed creek to the north and may be present in the site drainage ditches. Surface water and sludge also collect in the BLA sewer system. Potential receptors and pathways associated with the unnamed creek are incidental ingestion and dermal absorption by benthic and aquatic organisms However, these organisms are not likely to utilize the site drainage and sewer systems. Site workers and terrestrial biota may be exposed through incidental ingestion or dermal absorption of surface water and sediment or through inhalation of volatiles from surface water.

Conductive flooring appears in the process buildings throughout the NRU. Sampling of this material and surrounding media suggests that similar results will be obtained from the buildings with conductive flooring. This investigation and future investigations will continue to characterize this material and its impact on surrounding environmental media.

1.15.4 Data Gap Analysis

TCL VOCs. Five surface and four subsurface soil samples were collected for TCL VOC analysis during the previous investigations. Results from soil samples indicated that TCL VOCs were not detected at concentrations greater than applicable criteria. However, samples were collected from a limited portion of the site. Samples were not collected for TCL VOC analysis from surface water or sediment. Therefore, TCL VOCs represent a data gap in the characterization of these media.

TCL SVOCs/PAHs. Six surface and four subsurface soil samples were collected during the previous investigations to characterize the site for TCL SVOCs. 1997 independent sampling SVOC results indicated that elevated levels of PAHs were present in the surface soil and flooring material collected from Building 405. Samples were collected from a limited portion of the site. Subsurface soil has not been characterized for PAHs in this area or other areas; therefore, data gaps exist for this medium. SVOCs/PAHs represent a data gap in soil, surface water and sediment.

TCL PCBs. Six surface and four subsurface soil samples were collected for TCL PCB analysis during the previous investigations. Analytical results indicated that Aroclor-1254 was present in surface soil adjacent to Building 405 at concentrations exceeding industrial RBCs. Subsurface soil has not been characterized for TCL PCBs in this area; therefore, data gaps exist for this medium. Additional samples will also be collected from both surface and subsurface soil to provide adequate locations and number of samples for risk assessment. A data gap also exists in the characterization of surface water and sediment for PCB analysis.

Pesticides/herbicides. Sites were not consistently characterized for pesticides/herbicides during previous investigations. In order to characterize the sites for pesticides/herbicides, samples will be collected and analyzed for pesticides/herbicides. Samples will be collected from surface soil and/or sediment in locations where these compounds would tend to accumulate.

Explosives. Six surface soil samples were collected for explosives analysis during the 1997 and 1998 independent sampling events. Results from these samples indicate that individual explosive compounds were not detected above residential RBCs in surface soil. However, the RBC for total DNT compounds was exceeded. Therefore, explosives represent a data gap in this medium. Subsurface soil samples have not been analyzed for explosives, representing a data gap. Surface water and sediment samples will also be collected for explosives analysis.

TAL metals. TAL metals analysis was performed on five surface and four subsurface soil samples during the previous investigations. Results from these samples indicate that arsenic exceeded its industrial RBC in almost every soil sample. In addition, copper and lead exceeded industrial RBCs in the surface soil sample collected adjacent to Building 405. Because these samples were collected in a limited area, TAL metals are a data gap. Additional samples will be collected for TAL metals in order to complete the delineation of the area of elevated metals concentrations. Surface water and sediment samples will also be collected for TAL metals analysis.

Dioxins/furans. The BLA was not used for burning or disposal/storage of burned wastes or combustion byproducts; therefore, samples will not be analyzed for dioxins/furans. Based on the CSM, dioxins/furans are not considered a data gap.

Other. Soil samples from each site will be analyzed for TOC, grain size, and pH to assess the bioavailability and mobility of constituents in soil. Surface water, where present, will be analyzed for hardness. One or two samples per site will be analyzed for these parameters.

1.15.5 Planned Field Activities and Technical Approach

Based on the results of the Data Gap Analysis, additional sampling and analysis is proposed to fully characterize this site. The new data will supplement existing data and provide a sufficient data set for completion of a risk assessment. Proposed sampling locations are presented in **Figure 1.15-1**. Sampling locations were selected based on previous sample results, site visit observations, negotiations with regulators, and the CSM. Proposed analyses for various media types were identified by the results of the analyte-specific Data Gap Analysis. The proposed sampling program, summarized in **Table 1.15-2**, includes the following media samples and analyses:

Surface soil. Seventeen surface soil (0–0.5 ft bgs) samples will be collected to complete the characterization of the BLA and delineate the extent of previously detected constituents. One sample will be collected from Building 411 (BLASS07), Building 412 (BLASS06) and Building 413 (BLASS05) to characterize these areas. These samples will be analyzed for TCL VOCs, SVOCs, TAL metals and explosives. Samples will also be collected at Buildings 406 (BLASS08) and 407 (BLASS04). BLASS08 will be analyzed for TAL metals and explosives, and BLASS04 will be analyzed for explosives, since previous sampling near this building has characterized the soil for other constituents. Samples BLASS01, BLASS02 and BLASB01 will be positioned in a triangular pattern surrounding former sample SS-09 to delineate elevated concentrations of heavy metals, SVOCs, and Aroclor-1254 reported during the 1997 independent sampling. These samples will be analyzed for TCL VOCs, PCBs, PAHs, TAL metals and explosives. Sample BLASB01A will also be analyzed for TOC, grain size, and pH to assess bioavailability of constituents in soil. Samples BLASS03 and BLASS11 will be collected from other egress points at Building 405. These samples will be analyzed for TCL VOCs, SVOCs, TAL metals and explosives. Samples BLASS09, BLASS10 and BLASB03A will be collected from outside Building 404 at egress points. These samples will be analyzed for TCL VOCs, SVOCs, TAL metals and explosives. Sample BLASS10 will also be analyzed for TCL pesticides/PCBs and herbicides. One surface soil sample (BLASB02A) will be collected from the center of the site near the three-way "Y" walkway junction. This sample will be analyzed for TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals and explosives. Finally, three surface soil samples (BLATR01 – BLATR03) will be collected at three former pole-mounted transformer locations and analyzed for TCL PCBs.

Subsurface soil. Subsurface soil samples will be collected from 2-4 ft bgs from three soil borings advanced to complete the characterization of subsurface soil and sample for analytes not previously tested. One sample (BLASB02B) will be collected from a boring advanced at the center of the site at the three way "Y" walkway intersection at the site. This sample will be analyzed for TCL VOCs, SVOCs, TAL metals and explosives. One sample (BLASB01B) will be collected from the outer edge of Building 405 near previous sample SS-09 to characterize the vertical extent of constituents detected in that sample. This sample will also be analyzed for TCL VOCs, PCBs, PAHs, TAL metals and explosives. The third subsurface soil sample (BLASB03B) will be collected from a similar position relative to Building 404. This sample will analyzed for TCL VOCs, SVOCs, TAL metals and explosives.

Surface water. Five surface water samples will be collected from around the BLA. Two samples will be collected from the unnamed creek that drains the northern portion of the BLA. The samples will be positioned east and west of Armstrong Road. Two surface water samples will be collected from the drainage culverts at the northeast and southwestern portions of the site. Samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, and hardness. If present, one surface water sample (BLASW03) will be collected from the sewer system at the southwestern portion of the site. This sample will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, perchlorate, and hardness. Water quality parameters will be measured using a Hydrolab or equivalent and will include temperature, dissolved oxygen, pH, specific conductivity, and turbidity.

Sediment. Five sediment samples will collocated with the BLA surface water samples, as mentioned above. Two samples will be collected from the unnamed creek that drains the northern portion of the BLA. The samples will be positioned east and west of Armstrong Road. Two surface water samples will be collected from the drainage culverts at the northeast and southwestern portions of the site. Samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, and hardness. Sediment sample (BLASD03) will be collected from the sewer system at the southwestern portion of the site. This sample will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, and TAL metals.

Table 1.15-2
Site-Specific Proposed Sampling and Analysis Plan—Bag Loading Area

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Soil	BLASS01	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
	BLASS02	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
	BLASS03	0-0.5 ft bgs	B-405, inside "L"	TCL VOCs, SVOCs, TAL metals, explosives
	BLASS04	0-0.5 ft bgs	Building 407	Explosives (other parameters were previously tested)
	BLASS05	0-0.5 ft bgs	Building 413	TCL VOCs, SVOCs, TAL metals, explosives
	BLASS06	0-0.5 ft bgs	Building 412	TCL VOCs, SVOCs, TAL metals, explosives
	BLASS07	0-0.5 ft bgs	Building 411	TCL VOCs, SVOCs, TAL metals, explosives
	BLASS08	0-0.5 ft bgs	Building 406	TAL metals, explosives
	BLASS09	0-0.5 ft bgs	B-404, inside "L"	TCL VOCs, SVOCs, TAL metals, explosives
	BLASS10	0-0.5 ft bgs	B-404, near walkway to 405	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	BLASS11	0-0.5 ft bgs	B-405, near walkway to 404	TCL VOCs, SVOCs, TAL metals, explosives
	BLASB01A	0-0.5 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives TOC, grain size, pH
	BLASB02A	0-0.5 ft bgs	at "Y" in walkway	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives
	BLASB03A	0-0.5 ft bgs	B-404, outside "L"	TCL VOCs, SVOCs, TAL metals, explosives
	BLATR01	0-0.5 ft bgs	Former transformer location	TCL PCBs
	BLATR02	0-0.5 ft bgs	Former transformer location	TCL PCBs
	BLATR03	0-0.5 ft bgs	Former transformer location	TCL PCBs
Subsurface Soil	BLASB01B	2-4 ft bgs	Building 405	TCL VOCs, PCBs, PAHs, TAL metals, explosives
	BLASB02B	2-4 ft bgs	at "Y" in walkway	TCL VOCs, SVOCs, TAL metals, explosives
	BLASB03B	2-4 ft bgs	B-404, outside "L"	TCL VOCs, SVOCs, TAL metals, explosives

Table 1.15-2 (Cont'd)
Site-Specific Proposed Sampling and Analysis Plan—Bag Loading Area

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Surface Water	BLASW01	NA	Near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	BLASW02	NA	Near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	BLASW03	NA	Sewer sample	TAL metals, TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, perchlorate, hardness
	BLASW04	NA	Unnamed creek	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
	BLASW05	NA	Unnamed creek	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, TAL metals, explosives, herbicides, perchlorate, hardness
Sediment	BLASD01	NA	Near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives
	BLASD02	NA	Near culvert	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives
	BLASD03	NA	Sewer sample	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals
	BLASD04	NA	Unnamed creek	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives
	BLASD05	NA	Unnamed creek	TCL VOCs, SVOCs, PAHs, pesticides/PCBs, herbicides, TAL metals, explosives

3/61

1.16 NEW RIVER UNIT SURFACE WATER DRAINAGE SAMPLING

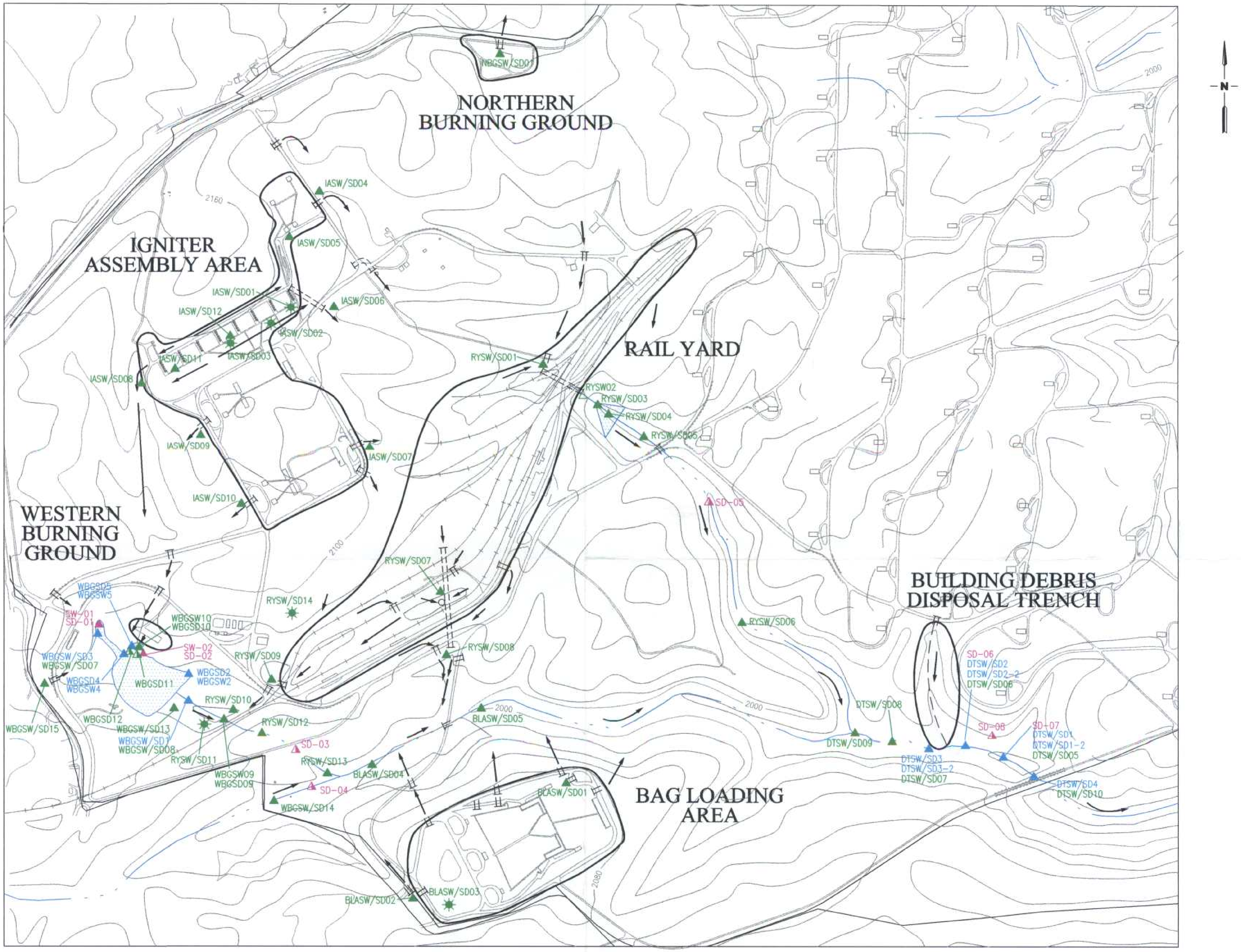
A map of the NRU showing surface water drainage pathways is provided in **Figure 1.16-1**. An unnamed creek with several tributaries provides surface water drainage for the western portion of the NRU. The watershed for this creek encompasses the NRU sites discussed in this workplan. This section is provided as an overview of the samples collected from the creek and its tributaries. Surface water and sediment samples from the creek are discussed in the individual site sampling descriptions, but the relationship between samples collected at different sites from the creek is more easily understood through a single, area-wide map. Watershed surface water/sediment samples are shown on **Figure 1.16-1**. In addition to the watershed samples, six surface water/sediment samples will be collected from the abandoned sanitary sewage system. Three samples will be collected near the IAA, one near the RY and one at the BLA. Liquid and solid media remaining in the sewer lines will be investigated to assess whether production wastes were discharged to the sewer system and whether potential constituents of concern remain in the lines. Proposed surface water/sediment samples are shown on the figure as green triangles, sewer samples are depicted by green asterisks, and previously collected samples are identified by the investigation when they were collected. 1997 Gannett Fleming independent sampling samples are depicted in magenta, and 1998/1999 ICF Kaiser RI samples are shown in cyan. **Table 1.16-1** provides a summary of the proposed samples and analyte suite for which each sample will be analyzed.

Table 1.16-1
NRU Drainage Samples

[illegible]	[illegible]
DTSW/SD05	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
DTSW/SD06	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
DTSW/SD07	TCL VOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness
DTSW/SD08	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
DTSW/SD09	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
DTSW/SD10	TCL VOCs, PCBs, PAHs, TAL metals, perchlorate, hardness
[illegible]	
IASW/SD04	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD05	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD06	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD07	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD08	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD09	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD10	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
IASW/SD11	TCL VOCs, SVOCs, PCBs, PAHs, TAL metals, explosives, perchlorates, hardness
IASW/SD12	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorates, hardness, TOC, grain size, pH
[illegible]	
NBGSW/SD01	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, dioxin/furans, perchlorate, hardness
[illegible]	
WBGSW/SD07	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
WBGSW/SD08	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
WBGSW/SD09	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
WBGSW/SD10	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, explosives, TAL metals, dioxins/furans, perchlorate, hardness
WBGSD11	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans
WBGSD12	TCL VOCs, SVOCs, PCBs, PAHs, explosives, TAL metals, dioxins/furans

Table 1.16-1 (cont'd)
NRU Drainage Samples

[illegible]	[illegible]
WBGSW/SD13	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate, hardness
WBGSW/SD14	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate, hardness
WBGSW/SD15	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate, hardness
[illegible]	[illegible]
RYSW/SD01	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
RYSW02	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
RYSW/SD03	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
RYSW/SD04	TCL VOCs, SVOCs, PAHs, TAL metals, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
RYSW/SD05	TCL VOCs, SVOCs, PAHs, TAL metals, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
RYSW/SD06	TCL VOCs, SVOCs, PAHs, TAL metals, explosives, pesticides/PCBs, herbicides, perchlorate, hardness
RYSW/SD07	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
RYSW/SD08	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
RYSW/SD09	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
RYSW/SD10	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
RYSW/SD12	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
RYSW/SD13	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, explosives, perchlorate, hardness
[illegible]	[illegible]
BLASW/SD01	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
BLASW/SD02	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
BLASW/SD04	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
BLASW/SD05	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, explosives, perchlorate, hardness
[illegible]	[illegible]
IASW/SD01	TCL VOCs, SVOCs, PCBs, TAL metals, perchlorate, hardness
IASW/SD02	TCL VOCs, SVOCs, PCBs, TAL metals, perchlorate, hardness
IASW/SD03	TCL VOCs, SVOCs, PCBs, TAL metals, perchlorate, hardness
RYSW/SD11	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate, hardness
RYSW/SD14	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, perchlorate, hardness
BLASW/SD03	TCL VOCs, SVOCs, pesticides/PCBs, herbicides, PAHs, TAL metals, perchlorate, hardness



LEGEND

▲ 1997 SEDIMENT SAMPLE (GANNETT FLEMING)
▲ 1997 SURFACE WATER/SEDIMENT SAMPLE (GANNETT FLEMING)
▲ 1998/1999 SURFACE WATER/SEDIMENT SAMPLE (ICF KAISER)
▲ PROPOSED SURFACE WATER/SEDIMENT SAMPLE
△ PROPOSED SURFACE WATER SAMPLE
▲ PROPOSED SEDIMENT SAMPLE
✳ PROPOSED SEWER SAMPLE

▨ POND
⊏ CULVERT
⟶ DIRECTION OF SURFACE WATER FLOW
-·-·- INTERMITTENT CREEK

FILE: NRU_DRAIN1.dwg PLOT: 4-4-02

RADFORD AAP		FIGURE 1.16-1
PREPARED BY: IT CORP.	TASK NO: 870403301000000	NRU DRAINAGE SAMPLING
CHECKED BY: MT	IT DWG NO: NRU_DRAIN1.dwg	
DATE: REVISED MARCH 2002		

05006 \ 362 - 1/1

1.17 NEW RIVER UNIT FORMER TRANSFORMER LOCATION ASSESSMENT

A utility map of the NRU was used to identify the former locations of pole-mounted transformers at the six NRU sites included in this investigation. Transformer locations are depicted on the individual site maps (Sections 1.10 – 1.15) by a black T in a circle. Former transformer locations were identified at the Igniter Assembly Area, Western Burning Ground, Rail Yard, and the Bag Loading Area. No former transformer locations were identified at the Building Debris Disposal Trench or at the Northern Burning Ground.

At each site, the former transformer locations will be assessed for evidence of the transformer or a release from a transformer, including utility poles, concrete pads or soil staining. Eight former transformer locations at the IAA, one at the WBG, three at the RY and three at the BLA were identified on NRU utility maps and will be inspected during the field investigation. One soil sample will be collected from each location based on field observation of the site. If visible evidence of the location or of a release from a transformer is encountered the soil sample will be collected from that area. Samples will be submitted for laboratory analysis for TCL PCBs. Samples will be collected from the surface soil (0 – 0.5 ft bgs) at the suspected release site.

2.0 Quality Assurance Plan Addendum

2.1 OBJECTIVE AND SCOPE

This QAPA establishes function-specific responsibilities and authorities for ensured data quality for investigative activities at RFAAP. Specific quality control requirements include DQOs, internal quality control checks, and analytical procedures during the further investigations at SWMU 39 (Wastewater Ponds from Propellant Incinerator), SWMU 48 (Oily Water Burial Area), SWMU 49 (Redwater Ash Burial #2), SWMU 50 ($CaSO_4$ Treatment/Disposal Area), SWMU 58 (Rubble Pile), SWMU 59 (Bottom Ash Pile), AOC - FLFA, AOC - Former Cadmium Plating Facility (B-4343), BDDT (NRU), IAA (NRU), NBG (NRU), WBG (NRU), RY (NRU), and BLA (NRU). This QAPA is designed to be used in conjunction with the MQAP. **Table 2-1** provides a list of general quality assurance measures that will be implemented as specified in the MQAP.

Table 2-1
Quality Assurance Measures Discussed in the MWP

Quality Assurance Measure	Section in MQAP (Volume II)	SOP No. (MWP Appendix A)
Project Organization and Responsibilities	2.0	--
Lines of Authority	2.2	--
Chemical Data Measurements	3.2	--
Documentation Requirements	5.6	10.1, 10.2, 10.3, 50.1
Chain-of-Custody	5.7	10.4, 50.2
Calibration Procedures	7.0	20.5, 20.7, 40.1, 90.1, 90.2
Data Reduction, Validation, Reporting, and Management	9.0	60.1
Corrective Action	10.0	--
Quality Assessments	11.0	--

2.2 PROJECT ORGANIZATION

2.2.1 Contractor and Subcontractor Responsibilities

Contractor and subcontractor personnel responsibilities for implementing the technical, quality, and health and safety programs are described in Section 2.1 of the MQAP. **Figure 2-1** presents the identification and the organization of IT project management personnel. Statements of Qualification for IT personnel are provided in Appendix B. Statements of qualification for subcontractor personnel will be included when subcontractors have been selected.

2.2.2 Key Points of Contact

The names and points of contact for IT personnel and subcontractors are provided in **Table 2-2**.

Figure 2-1
IT Corporation Organizational Chart

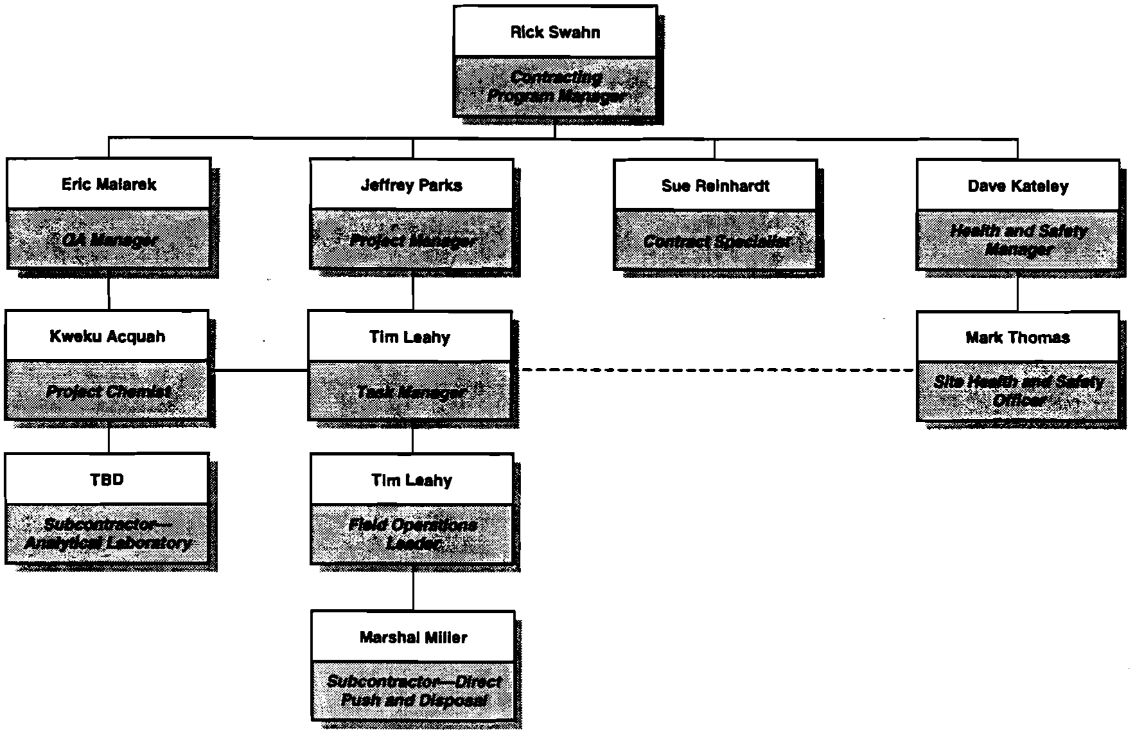


Table 2-2
Contractor and Subcontractor Key Points of Contact

Contractor	Key Point of Contact
Project Manager, Jeffrey Parks e-mail: JNParks@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6326; Fax (410) 612-6351
Quality Assurance Manager, Eric Malarek e-mail: EMalarek@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6322; Fax (410) 612-6351
Task Manager, Tim Leahy e-mail: TLeahy@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6357; Fax (410) 612-6351
Project Chemist, Kweku Acquah e-mail: KAcquah@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6335; Fax (410) 612-6351
Field Operations Leader, Tim Leahy e-mail: TLeahy@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6357; Fax (410) 612-6351
Project Contract Specialist, Susan Reinhardt e-mail: SReinhardt@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6366; Fax (410) 612-6351
Health and Safety Manager, Dave Kateley e-mail: DKateley@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6313; Fax (410) 612-6351
Site Health and Safety Officer, Mark Thomas e-mail: MAThomas@theitgroup.com	IT Corporation 2113 Emmorton Park Rd, Edgewood, MD 21040 Tel (410) 612-6375; Fax (410) 612-6351
Subcontractor	**Key Point of Contact**
Analytical Laboratory [To be Determined]	[To be Determined] Tel Fax
GeoProbe Direct Push Sampling and Disposal Management Marshall Miller	Chuck Cline Route 720, Industrial Park P.O. Box 848 Bluefield, VA 24605-0848 Tel (540) 322-5467 Fax (540) 322-1510

2.3 DATA QUALITY OBJECTIVES

Quality assurance (QA) is defined as the overall system of activities for assuring the reliability of data produced. The system integrates the quality planning, assessment, and corrective actions of various groups in the organization to provide the independent QA program necessary to establish and maintain an effective system for collection and analysis of environmental samples and related activities. The program encompasses the generation of complete data with its subsequent review, validation, and documentation.

The overall QA objective is to develop and implement procedures for sample and data collection, evaluation, and reporting that will allow reviewers to see whether the field and laboratory procedures meet the criteria and endpoints established in the DQOs. DQOs are qualitative and quantitative statements that outline the decision making process and specify the data required to support risk management decisions. DQOs specify the level of uncertainty that will be accepted in results derived from environmental data.

The DQO process used for developing RFAAP data quality criteria and performance specifications for decision making is consistent with the *Guidance For The Data Quality Objectives Process*, EPA QA/G-4, September 1994 and *USACE Shell for Analytical Chemistry Requirements*, December 1998. The DQO process consists of the seven steps below. DQO elements common to investigative areas are included in italics following each process step. Site-specific DQOs are included in **Table 2-3**.

1. **State the Problem:** Define the problem to focus the study. Specific activities conducted during this process step include (1) the identification of the planning team, (2) primary decision-maker, and (3) statement of the problem.

    (1) The planning team consists of the Installation, USACE, ATK, USEPA, Virginia Department of Environmental Quality (VDEQ), and IT.
    (2) The Army is the primary decision-maker.
    *(3) Refer to **Table 2-3**.*

2. **Identify the Decision:** Define the decision statement that the study will attempt to resolve. Activities conducted during this step of the process involve (1) identification of the principal study question and (2) definition of resultant alternative actions.

    (1) A further investigation to see if a human health and ecological risk assessments indicate conditions adverse to human health or the environment?
    (2) Resultant alternative actions include:
        (2a) Additional data is required.
        (2b) There are no impacts to human health or the environment.
        (2c) Significant impacts to human health or the environment exist.

3. **Identify Inputs to the Decision:** Identify information inputs required to resolve the decision statement and which inputs require environmental measurements. This step of the process includes (1) identification of the data that will be required to make the decision, (2) information source determination, (3) identification of data required for study action levels, and (4) confirmation of appropriate field sampling and analytical methods.

    *(1) Refer to **Table 2-3**.*
    (2) Samples will be analyzed using ASTM, Standard Methods, Chemical Analysis of Water and Wastewater, and USEPA SW-846 Update III methodology. Refer to Section 2.5.
    (3) Refer to Table 2-6 for the action levels.
    (4) Field sampling will be performed in accordance with the MWP (ICF KE, 1998). Analytical methods are contained in Section 2.5.

4. **Define the Boundaries:** Define decision statement spatial and temporal boundaries. This step specifies (1) the spatial boundary, (2) population characteristics, applicable geographic areas and associated homogeneous characteristics, and (3) constraints on sample collection.

    *(1, 2, 3) Refer to **Table 2-3**.*

Table 2-3
Site-Specific Data Quality Objectives

DQO ELEMENT	**INVESTIGATION AREAS**			
	SWMU 39 - Wastewater Ponds from Propellant Incinerator	**SWMU 48 - Oily Water Burial Area**	**SWMU 49 – Redwater Ash Burial #2**	**SWMU 50 - CaSO4 Treatment/Disposal Area**
Problem Statement	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination
Decision Inputs	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Perchlorate Hardness Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans TPH Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Grain Size, TOC, pH
Study Boundary	1. See Figure 1.2-1 2. In-situ 3. NA	1. See Figure 1.3-1 2. In-situ 3. NA	1. See Figure 1.3-1 2. In-situ 3. NA	1. See Figure 1.3-1 2. In-situ 3. NA
DQO ELEMENT	**SWMU 58 - Rubble Pile**	**SWMU 59 - Bottom Ash Pile**	**AOC – Former Lead Furnace Area (FLFA)**	**AOC - Former Cadmium Plating Facility (B-4343)**
Problem Statement	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination
Decision Inputs	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Perchlorate Hardness Grain Size, TOC, pH
Study Boundary	1. See Figure 1.6-1 2. In-situ 3. NA	1. See Figure 1.3-1 2. In-situ 3. NA	1. See Figures 1.8-1 and 1.8-2 2. In-situ 3. NA	1. See Figures 1.9-1 and 1.9-2 2. In-situ 3. NA
DQO ELEMENT	**Building Debris Disposal Trench (NRU)**	**Igniter Assembly Area (NRU)**	**Northern Burning Ground (NRU)**	**Western Burning Ground (NRU)**
Problem Statement	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination
Decision Inputs	TAL Metals PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Perchlorate Hardness Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Perchlorate Hardness Grain Size, TOC, pH Asbestos	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Perchlorate Hardness Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Dioxins/furans Perchlorate Hardness Grain Size, TOC, pH
Study Boundary	1. See Figure 1.10-1 2. In-situ 3. NA	1. See Figure 1.11-1 2. In-situ 3. NA	1. See Figures 1.12-1 and 1.12-2 2. In-situ 3. NA	1. See Figures 1.13-1, 1.13-2, and 1.13-3 2. In-situ 3. NA

Table 2-3
Site-Specific Data Quality Objectives, Continued

DQO ELEMENT	Railyard (NRU)	Bag Loading Area (NRU)	NRU and MMA Areas
Problem Statement	Further characterize the nature and extent of contamination	Further characterize the nature and extent of contamination	Characterization of Investigative Derived Material
Decision Inputs	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Perchlorate Hardness Grain Size, TOC, pH	TAL Metals TCL SVOCs/PAHs TCL VOCs TCL Pesticides/PCBs Herbicides Explosives Perchlorate Hardness Grain Size, TOC, pH	TCLP VOCs TCLP SVOCs TCLP Metals TCLP Pesticides Reactive Cyanide Reactive Sulfide Ignitability Corrosivity as pH Chemical Oxygen Demand TCL PCBs Note: Decision inputs will be analyzed based upon historical data.
Study Boundary	1. See Figure 1.14-1 2. In-situ 3. NA	1. See Figure 1.15-1 2. In-situ 3. NA	1. See Figures 1.1-1 and 1.1-2 2. In-situ 3. NA

5. **Develop a Decision Rule:** Define the (1) parameters of interest, (2) action levels, and (3) develop a decision rule.

   (1) Parameters of interest are listed in the decision inputs. Refer to ***Table 2-3****.*
   (2) Refer to Table 2-6 for the action levels.
   (3) Decision rules will be developed as appropriate.

6. **Specify Acceptable Limits on Decision Errors:** Specify the decision maker's tolerable limits on decision errors. This step of the process includes (1) parameter range of interest, (2) decision errors, (3) potential parameter values, and (4) the probability tolerance for decision errors are identified during this phase.

   (1) Parameter ranges are not defined at this time.
   (2) Decision errors include:
      (2a) Deciding that human health or environmental impacts exist when they do not and (II) deciding that human health or environmental impacts do not exist when they actually do. The consequences of deciding that human health or environmental impacts exist when they do not will result in unnecessary remedial actions. The consequences of deciding that human health or environmental impacts do not exist when they do will result in liabilities associated with future damages and environmental clean-up costs. Additionally, public opinion will be compromised.
      (2b) The true state when the most severe decision error occurs (human health or environmental impacts do not exist when they actually do) is that human health or environmental impacts do exist. The true state when the less severe decision error occurs (human health or environmental impacts exist when they do not) is that human health or environmental impacts do not exist.
      (2c) The null hypothesis (H_0) is: human health or environmental impacts do exist. The alternative hypothesis (H_a) is : human health or environmental impacts do not exist.
      (2d) The false positive decision error occurs when H_0 is erroneously rejected corresponding to decision error I. The false negative decision error occurs when H_a is erroneously accepted corresponding to decision error II. Project specific Type I and Type II error rates are 0.05 and 0.2, respectively.
   (3, 4) The consequence of decision errors and acceptable probability will be assessed.

7. **Optimize Data Design:** Identify data collection activities commensurate with data quality specifications. This final step in the process consists of (1) reviewing DQO outputs and existing environmental data, (2) developing data collection design alternatives, (3) formulating mathematical expressions to resolve design problems for each alternative, (4) selecting cost-effective data design capable of achieving DQOs, and (5) documentation of operational details and theoretical assumptions.

   (1) This addendum contains the proposed WPA 12 sampling design program. DQO refinement will be an iterative process throughout the project life cycle.
   (2) Non-statistical sampling procedures are proposed. Biased and judgmental sampling will be performed to verify previous data results and complete site characterization.
   (3) The mathematical equations will be established during the refinement process.
   (4) This addendum contains the proposed WPA 12 sampling design program based on cost and project DQOs.
   (5) Refer to Section 1.2.

2.4 SAMPLE MANAGEMENT

2.4.1 Number and Type

The estimated number and type of environmental samples proposed during the sampling events at each area are included in **Table 2-4**.

2.4.2 Sample Containers, Preservation, and Holding Times

Parameter, container and preservation requirements, and holding times are presented in **Table 2-5** and should follow SOP 50.3 (Appendix A, MWP).

2.4.3 Sample Identification

The sample identification number will be in a similar manner with past nomenclature at RFAAP. The sample identification will consist of an alphanumeric designation related to the sampling location, media type, and sequential order according to the sampling event. The sample identification number should not exceed eight characters for subsequent entry into the ERIS database system. Samples will be coded in the following order to ensure a unique identification.

- **Site Location Code:** The first two or three characters will be the site location number or code. The identification will include the following:

  39 = SWMU 39
  48 = SWMU 48
  49 = SWMU 49
  50 = SWMU 50
  58 = SWMU 58
  59 = SWMU 59
  LF = Former Lead Furnace Area
  B43 = Building 4343
  DT = Building Debris Disposal Trench
  IA = Igniter Assembly Area
  NBG = Northern Burning Ground
  WBG = Western Burning Ground
  RY = Rail Yard
  BLA = Bag Loading Area

- **Sample/Media Type:** The second two characters will be the sample/media type. Sample types will be designated by the following codes:

  AS = Asbestos
  DW = Investigative Derived Material
  SB = Subsurface Soil
  SD = Sediment
  SS = Surface Soil
  SW = Surface Water

- **Sampling Location Number:** The next two characters will be the number of the sampling location (e.g., 01, 02, 03,...).

- **Sample Depth:** At sites where there are several samples to be collected at different depths, the sequential collection order will be followed by a letter in alphabetic order indicating shallow to deep depths (e.g., A, B, C,...), where A would be the shallow sample.

- **Duplicate:** Duplicate samples will be identified with a "D" designation. A record of the samples that correspond to the duplicates will be kept in the field logbook.

Table 2-4
Estimated Number and Location of Samples

Sample	SWMU and/or AREA OF CONCERN														Total Samples
	39	48	49	50	58	59	FLFA	Building 4343	Bldg. Debris Disposal Trench	Igniter Assembly Area	Northern Burning Ground	Western Burning Ground	Rail Yard	Bag Loading Area	
Surface Soil	8	3	2	5	2	4	7	5	2	12	9	4	5	17	85
Subsurface Soil	4	6	3	4	3	2	12	2	2	9	13	8	3	3	74
Surface Water	2	NA	NA	NA	NA	NA	NA	1	6	12	1	7	13	5	47
Sediment	2	NA	NA	NA	NA	NA	NA	NA	6	12	1	9	11	5	46
Asbestos	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	2
Total Environmental	**16**	**9**	**5**	**9**	**5**	**6**	**19**	**8**	**16**	**47**	**24**	**28**	**32**	**30**	**254**
Trip Blank	1	NA	NA	NA	NA	NA	NA	1	1	1	NA	1	NA	NA	5
Rinse Blank SS	1	1	1	1	1	1	1	1	1	1	1	1	1	2	15
Rinse Blank SB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Rinse Blank SD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Field Duplicate	2	1	1	1	1	1	2	1	2	5	3	3	3	2	28
MS	1	1	1	1	1	1	1	1	1	3	2	2	2	1	19
MSD	1	1	1	1	1	1	1	1	1	3	2	2	2	1	19
Total QC	**8**	**6**	**6**	**6**	**6**	**6**	**7**	**7**	**8**	**15**	**10**	**11**	**10**	**8**	**114**
Total Samples	**24**	**15**	**11**	**15**	**11**	**12**	**26**	**15**	**24**	**62**	**34**	**39**	**42**	**38**	**368**
IDM (Aqueous)	1*	*	*	*	*	*	*	*	1**	**	**	**	**	**	2
IDM (Solid)	2*	*	*	*	*	*	*	*	2**	**	**	**	**	**	4
Total IDM	**3***	*****	*****	*****	*****	*****	*****	*****	**3****	******	******	******	******	******	**6**

NA = Not Applicable
IDM = Investigative Derived Material
QC = Quality Control
MS = Matrix Spike
MSD = Matrix Spike Duplicate
*SWMUs 39, 48, 49, 50, 58, 59, FLFA, and Building 4343 IDM to be combined.
**Bldg. Debris Disposal Trench, Igniter Assembly Area, Northern Burning Ground, Western Burning Ground, Rail Yard, and Bag Loading Area IDM to be combined.

Table 2-5
Parameter, Container, Preservation Requirements, and Holding Times

Parameter	Sample Container*		Preservation Requirement*	Holding Time
	Solid	Aqueous		
Site Characterization				
TCL VOCs	3, 5 gram EnCore sampler, zero headspace	3, 40 mL vials with Teflon septum, zero headspace	Cool: 4 ± 2°C, HCl to pH<2 for aqueous, No Sodium Bisulfate for solids due to sample effervescence	Aqueous: Preparation: 2 days Solid: Analysis: 14 days
TCL SVOCs	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days
TCL Pesticides/ PCBs	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days
Herbicides	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days
Explosives	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days
Polynuclear Aromatic Hydrocarbons	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days
Dioxins/furans	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 30 days; Analysis: 45 days Solid: Extraction: 30 days; Analysis: 45 days
TAL Metals, Hardness	1, 8 oz, wide mouth glass with Teflon cap	1-L polyethylene	Cool: 4 ± 2°C, HNO_3 to pH<2 for aqueous	Metals: 180 days Mercury: 28 days
pH	1, 4 oz, wide mouth glass with Teflon cap	250 mL glass or HDPE	Cool: 4 ± 2°C	ASAP
Perchlorate	1, 4 oz, wide mouth glass with Teflon cap	250 mL glass or HDPE	Cool: 4 ± 2°C	28 days
Grain Size	3, 8 oz, wide mouth glass with Teflon cap	NA	Cool: 4 ± 2°C	None
Total Organic Carbon	1, 4 oz, wide mouth glass with Teflon septum, zero headspace	3, 40 mL vials with Teflon septum, zero headspace	Cool: 4 ± 2°C, HCl or H_2SO_4 to pH<2 for aqueous	28 days

*Parameters with same preservation requirements may be combined at laboratory's discretion.

Table 2-5
Parameter, Container, Preservation Requirements, and Holding Times, Continued

Parameter	Sample Container*		Preservation Requirement*	Holding Time
	Solid	Aqueous		
Waste Characterization				
TCLP VOCs	1, 4 oz, wide mouth glass with Teflon septum, zero headspace	3, 40 mL vials with Teflon septum, zero headspace	Cool: 4 ± 2°C	TCLP Extraction: 14 days; Sample Analysis: 14 days
TCLP SVOCs	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	TCLP Extraction: 14 days So; 7 days Aq Extraction : 7 days Sample Analysis: 40 days
TCLP Pesticides	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	TCLP Extraction: 14 days So; 7 days Aq Extraction : 7 days Sample Analysis: 40 days
TCLP Metals	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	TCLP Extraction: 180 days ICP; Mercury : 28 days Sample Analysis: 180 days ICP Mercury : 28 days
Ignitability	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	28 days
Reactive Sulfide	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	7 days
Reactive Cyanide	1, 8 oz, wide mouth glass with Teflon cap	1-L glass or HDPE	Cool: 4 ± 2°C	14 days
Corrosivity as pH	1, 8 oz, wide mouth glass with Teflon cap	250 mL glass or HDPE	Cool: 4 ± 2°C	ASAP days
Chemical Oxygen Demand	1, 8 oz, wide mouth glass with Teflon cap	250 mL glass	Cool: 4 ± 2°C, HCl or H_2SO_4 to pH<2 for aqueous	28 days
TCL PCBs	1, 8 oz, wide mouth glass with Teflon cap	2, 1-L amber glass with Teflon lined cap	Cool: 4 ± 2°C	Aqueous: Extraction: 7 days; Analysis: 40 days Solid: Extraction: 14 days; Analysis: 40 days

*Parameters with same preservation requirements may be combined at laboratory's discretion.

Legend:
ASAP = As Soon As Possible
NA = Not Applicable
PCB = Polychlorinated Biphenyl
TAL = Target Analyte List
TCL = Target Compound List
TCLP = Toxicity Characteristic Leachate Procedure
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Sample Identification Examples:

1. A subsurface soil sample at location 22 at the Western Burning Ground collected at a point would be identified as WBGSB22. The field duplicate for the same sample would be WBGSB22D.
2. The second subsurface soil sample depth collected at soil boring location 6 (with two depths) at the Northern Burning Ground would be identified as NBGSB6B. The duplicate for the same sample would be WBGSB6BD.
3. A surface water sample collected in the settling pond at SWMU39 at sample location 1 would be identified as 39SW01. The field duplicate for the same sample would be 39SW01D.

- **Quality Control Samples:** QC samples will be identified by date (mo,day,yr), followed by QC sample type, and sequential order number at one digit. The QC sample types include:

R = Rinse Blank
T = Trip Blank

For example, the second trip blank collected on 07 April 2001, would be identified as 040701T2.

2.5 ANALYTICAL PROCEDURES

2.5.1 Laboratory Procedures for Chemical Analyses

Analytical compound lists and method reporting limits to be used are given in **Table 2-6**. They will be in accordance with USEPA approved methods for the analysis of TCL VOCs, TCL SVOCs, TCL Pesticides/PCBs, herbicides, dioxins/furans, explosives, PAHs, TAL metals, total hardness, perchlorate, grain size, pH, and TOC. Waste characterization includes TCLP, VOCs, TCLP SVOCs, TCLP metals, TCLP Pesticides, reactive cyanide, reactive sulfide, ignitability, corrosivity as pH, chemical oxygen demand (COD), and TCL PCBs. Waste characterization will be performed for each specific parameter group based upon data generated from the investigation, which indicates the possibility of a presence (e.g., TAL metals would be justification to analyze TCLP metals). The following sections briefly describe the analytical methodologies to be used in the RFAAP site investigation.

2.5.2 Waste Characterization (TCLP Extraction, Reactivity, Ignitability, Corrosivity, COD)

Samples for disposal will undergo TCLP extraction by SW-846 Method 1311. Samples are separated by phase, particle size reduced (for solids), and extracted for 18 hours in an extraction fluid. The final liquid extract is separated from the solid material and combined with the initial liquid phase (if applicable). The sample TCLP extract is then treated as an aqueous sample for analysis for VOCs, SVOCs, and metals.

Reactivity comprises of reactive sulfide and reactive cyanide. Reactive sulfide will be analyzed in aqueous and solid samples using USEPA SW-846 Method Chapter 7.3.4. This procedure is a colorimetric determination. Sulfide reacts with dimethyl-p-phenylenediamine in the presence of ferric chloride to produce methylene blue. Reactive cyanide will be analyzed in aqueous and solid samples using USEPA SW-846 Method Chapter 7.3.3. See section 2.5.3 for further discussion.

Ignitability will be analyzed in using USEPA SW-846 Method 1010 or 1030. A sample is heated at a slow, constant rate with continual stirring. A small flame is directed into the cup at regular intervals with simultaneous interruption of stirring. The flash point is the lowest temperature at which application of the test flame ignites the vapor above the sample.

Corrosivity as pH will be analyzed using USEPA SW-846 Method 9040B for aqueous samples and Method 9045C for solid samples. A sample pH is directly measured electrometrically using either a glass electrode in combination with a reference potential or a combination electrode. For solids, samples are mixed 1:1 with reagent water prior to measurement.

COD will be analyzed using USEPA Method of Chemical Analysis of Water and Wastes Method 410.4. A sample is heated under acidic conditions at a slow, constant rate in an oven or block digestor in the presence of dichromate at 150°C for two hours. The COD is measured at 600 nm spectrophotometrically.

2.5.3 Site Characterization (Inorganics)

Samples will be analyzed for USEPA TAL metals and hardness using a combination of the following methodologies to achieve project DQOs: inductively coupled plasma (ICP) and cold vapor atomic absorption (CVAA). Trace metals will be analyzed using USEPA SW-846 Method 3010A/6010B for aqueous samples and Method 3050B/6010B for solid samples. Total hardness may be calculated from the calcium and magnesium concentrations using Standard Method 2340B. The ICP method involves the simultaneous or sequential multi-element determination of trace elements in solution. The basis of the method is the measurement of atomic emission by optical spectrometry. Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency ICP. A background correction technique is utilized to compensate for variable background contribution for the determination of trace elements.

Mercury will be analyzed using CVAA according to USEPA SW-846 Method 7470A for aqueous samples and Method 7471A for solid samples. A sample aliquot is initially digested with nitric acid to free combined mercury. The mercury is then reduced to its elemental state and aerated from the solution into a closed system. The mercury vapor is passed through a cell positioned in the path of the mercury light source and the measured abundance is proportional to the concentration of mercury in the sample.

Cyanide will be analyzed for using USEPA SW-846 Method 9010B for aqueous or 9013 for solid matrices. The cyanide as hydrocyanic acid (HCN) is released from cyanide complexes by means of a reflux-distillation operation and absorbed in a scrubber containing sodium hydroxide solution. The cyanide ion in the absorbing solution is then assessed by volumetric titration or colorimetrically. In the colorimetric measurement, the cyanide is converted to cyanogen chloride, (CNCl), by reaction with chloramine-T at a pH less than 8.0 without hydrolyzing the cyanate. After the reaction is complete, color is formed on the addition of pyridine-pyrazolone or pyridine-barbituric acid reagent. The absorbance is read at 620 nm when using pyridine-pyrazolone or 578 nm for pyridine-barbituric acid. To obtain colors of comparable intensity, the sample and the standards will contain the same salt content. The titrimetric measurement uses a standard solution of silver nitrate to titrate cyanide in the presence of a silver sensitive indicator.

Perchlorate will be analyzed using ion chromatographic method USEPA SW-846 Method 9056 modified for aqueous samples. The method modification is adopted from the *State of California Department of Health Services Sanitation and Radiation Laboratories Branch Determination of Perchlorate by Ion Chromatography*. The perchlorate is measured by the peak height or area generated from the sample elution through an anion separator column with a conductivity detector. The sample eluent contains a support resin, p-cyanophenol to deactivate potential active sites. Samples with large particulates should be filtered to avoid damage to the column and flow systems.

2.5.4 Site Characterization (Organics)

Samples will be analyzed for TCL VOCs using USEPA SW-846 Method 5030B/8260B for aqueous samples and USEPA SW-846 5035/8260B for solid matrices using purge and trap technology. Samples are to be collected using an EnCore sampling device and subsequently sent to the laboratory for analysis. No Sodium Bisulfate should be added to the soils due to the possibility of effervescence and ketone formation. Initially, the extract should be screened on a gas chromatograph/flame ionization detector (GC/FID) to quantitate the approximate concentration of organic constituents in the sample. An inert gas is bubbled through a mixture of reagent water and 5 g solid sample or through a 25 mL groundwater or surfacewater sample contained in a specifically designed purging chamber at 40°C for solid and ambient temperature for water. The vapor is swept through a sorbent column where the purgeable compounds are trapped. After purging is completed for both solid and aqueous samples, the sorbent column is heated and backflushed with the inert gas to desorb the purgeable compounds onto a gas chromatography programmed to separate the purgeable compounds, which are then detected with a mass spectrometer.

Samples will be analyzed for TCL semivolatiles using USEPA SW-846 Method 8270C. Solid samples will be extracted using soxhlet according to USEPA SW-846 Method 3540C and aqueous samples will be extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 3520C. Gel Permeation Chromatography may be used to clean the samples if they contain fatty solids. The extract is injected into a gas chromatograph programmed to separate the compounds, which are then detected with a mass spectrometer.

Samples will be analyzed for TCL pesticides using USEPA SW-846 Method 8081A and for TCL PCBs using USEPA SW-846 Method 8082. Aqueous and solid samples were prepared for analysis using extraction techniques. Solid samples will be extracted using soxhlet method USEPA SW-846 Method 3540C for samples. Aqueous samples were extracted using a continuous liquid-liquid extraction technique by USEPA SW-846 Method 3520C. The extract was injected onto a gas chromatography programmed to separate the compounds, which are then detected with an ECD detector. Sulfur cleanups were employed to aid in the quantification based upon the matrix interferences. Sample concentrations are confirmed on dissimilar columns.

Samples will be analyzed for herbicides according to USEPA SW-846 Method 8151A. Aqueous and solid samples are extracted with diethyl ether and then esterified with either diazomethane or pentafluorobenzyl bromide. The derivatives are determined by gas chromatography with an electron capture detector (GC/ECD). The results are reported as acid equivalents. Solid samples are extracted and esterified with diazomethane or pentafluorobenzyl bromide only. Sample concentrations are confirmed on dissimilar columns.

Samples will be analyzed for explosives using USEPA SW-846 Method 8330. Aqueous samples of low concentration are extracted by a salting-out extraction procedure with acetonitrile and sodium chloride. The small volume of acetonitrile that remains undissolved above the salt water is drawn off and transferred to a smaller volumetric flask. It is back extracted by vigorous stirring with a specific volume of salt water. After equilibration, the phases are allowed to separate and the small volume of acetonitrile residing in the narrow neck of the volumetric flask is removed. The concentrated extract is diluted with reagent grade water, and an aliquot is separated on a C-18 reverse phase column. The wavelength is set at 254 nanometers and confirmed on a cyanide reverse column. Solid samples are extracted using acetonitirile in an ultrasonic bath, then filtered and chromatographed similarly to aqueous samples. Sample concentrations are confirmed on dissimilar columns.

Samples will be analyzed for PAHs using USEPA SW-846 Method 8310. Solid samples will be extracted using soxhlet extraction USEPA SW-846 Method 3540C and aqueous samples will be extracted using a continuous liquid-liquid extraction technique according to USEPA SW-846 Method 3520C. A 1 to 25 µl aliquot of the extract is injected into a high performance liquid chromatography, and compounds in the effluent are detected by ultraviolet (UV) and fluorescence detectors. The reported PAH concentrations using this method does not provide a confirmation. Due to selectivity issues with the UV detectors and the possibility of other compounds responding at a particular wavelength, data will be estimated. The detector selectivity was 2-D type detectors characterized by broad absorption bands. It cannot be ruled out, therefore, that the PAH detections may be possibly false positives. Therefore, PAH data will be considered as estimated, unless confirmed by GC/MS analysis.

Samples will be analyzed for dioxin/furans using USEPA SW-846 Method 8290. The analytical method used for the analysis of dioxins and furans calls for the use of high-resolution gas chromatography and high-resolution mass spectrometry (HRGC/HRMS) on purified sample extracts. This method is specific for the analysis of 2,3,7,8-tetrachlorinated dibenzofuran (2,3,7,8-TCDD), substituted penta-, hexa-, hepta- and octachlorinated dibenzo-p-dioxins and substituted penta-, hexa-, hepta- and octachlorinated dibenzofurans in water and solid samples. Measurements of toxicity are required for the analysis.

2.5.5 Site Characterization (Physical Parameters)

Grain size distribution will be determined using ASTM Method D-422 for solid samples. This method covers the quantitative determination of the distribution of particle sizes in soil. A No. 200 sieve is used to separate particles larger than 75µm from the soil, while the distribution of particles smaller than 75µm is determined by a sedimentation process, using a hydrometer to secure the necessary data.

Samples will be analyzed for total organic carbon (TOC) using the Kahn Method for solid samples. Samples are subjected to either a catalytic combustion or wet chemical oxidation to convert the organic carbon in the sample to carbon dioxide. The carbon dioxide formed is then measured directly by an infrared detector or converted to methane and measured by a flame ionization detector. The amount of carbon dioxide or methane produced is directly proportional to the concentration of carbonaceous material.

pH will be analyzed using USEPA SW-846 Method 9045C for solid samples. A sample pH is directly measured electrometrically using either a glass electrode in combination with a reference potential or a combination electrode. For solids, samples are mixed 1:1 with reagent water prior to measurement.

Table 2-6 Analyte List

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)				Back-ground
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:		Soil (mg/kg)
												Acute	Chronic	Water & Organisms	Organisms Only	
TAL Metals																
Aluminum	N	200	40	50	3,700	7,800	200,000	NA	25	1	NA	750	87	NA	NA	40,041
Antimony	N	60	12	6	1.5	3.1	82	13	30	0.48	150	NA	NA	14	4,300	NA
Arsenic	C	10	2	10	0.04	0.43	3.8	0.026	48	328	8.2	340	150	0.018	0.14	15.8
Barium	N	200	40	2,000	260	550	14,000	2,100	10,000	440	NA	NA	NA	1,000	NA	209
Beryllium	N	5	1	4	7.3	16	410	1,200	5.3	0.02	NA	NA	NA	NA	NA	1.02
Cadmium	N	5	1	5	1.8	3.9	100	27	0.53	3	1.2	4.3	2.2	NA	NA	0.69
Calcium	NA	5,000	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	N	10	2	100	11	23	610	42	2	0.02	81	16	11	NA	NA	65.3
Cobalt	N	50	10	NA	73	160	4,100	NA	35,000	0.1	NA	NA	NA	NA	NA	72.3
Copper	N	25	5	1,000	150	310	8,200	11,000	6.5	15	34	13	9	1,300	NA	53.5
Iron	N	100	20	300	2,200	4,700	120,000	NA	320	3,260	NA	NA	1,000	300	NA	50,962
Lead	NA	3	0.6	15	NA	400	750	400	3.2	2	46.7	65	2.5	NA	NA	26.8
Magnesium	NA	5,000	1,000	NA	NA	NA	NA	NA	NA	4,400	NA	NA	NA	NA	NA	NA
Manganese	N	15	3	50	73	160	4,100	950	14,500	330	NA	NA	NA	50	100	2,543
Mercury	N	0.2	0.1	2	NA	2.3	61	NA	0.012	0.058	0.15	1.4	0.77	0.05	0.051	0.13
Nickel	N	40	8	NA	73	160	4,100	NA	160	2	20.9	470	52	610	4,600	62.8
Potassium	NA	5,000	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	N	5	1	50	18	39	1,000	19	5	1.8	NA	NA	5	170	11,000	NA
Silver	N	10	2	100	18	39	1,000	31	0.0001	0.0000098	1	3.4	NA	NA	NA	NA
Sodium	NA	5,000	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	N	10	2	2	0.26	0.55	14	3.6	40	0.001	NA	NA	NA	1.7	6.3	2.11
Vanadium	N	50	10	NA	26	55	1,400	5,100	10,000	0.5	NA	NA	NA	NA	NA	108
Zinc	N	20	4	5,000	1,100	2,300	61,000	14,000	30	10	150	120	120	9,100	69,000	202

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
Inorganic															
Cyanide	N	10	0.4	200	73	160	4,100	150	5.2	0.005	NA	22	5.2	700	220,000
Perchlorate	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	NA	±0.1	±0.1	6.5-8.5	NA	NA	NA	NA	NA	NA	NA	NA	6.5-9	5-9	NA
Grain Size	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organic															
Total Organic Carbon	NA	1,000	1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Halides	NA	5	1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives															
Cyclotrimethylene-trinitramine (RDX)	C	0.5	0.2	NA	0.61	5.8	52	NA	NA	NA	NA	NA	NA	NA	NA
Cyclotetramethylene-tetranitramine (HMX)	N	0.5	2.1	NA	180	390	10,000	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	N	0.5	0.2	NA	0.37	0.78	20	0.037	1,200	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	N	0.5	0.2	NA	7.3	16	410	0.57	230	NA	NA	NA	NA	0.11	9.1
2,6-Dinitrotoluene	N	0.5	0.2	NA	3.7	7.8	200	0.25	230	NA	NA	NA	NA	NA	NA
Dinitrotoluene Mix	C	0.5	0.2	NA	0.09	0.94	8.4	NA	230	NA	NA	NA	NA	NA	NA
TETRYL	N	0.5	0.2	NA	37	78	2,000	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	N	0.5	0.2	NA	0.35	3.9	100	0.023	27,000	NA	NA	NA	NA	17	1,900
Nitroglycerin	C	2.5	1.1	NA	4.8	0.3	2.7	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	N	0.5	0.2	NA	110	230	6,100	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	C	0.5	0.2	NA	2.2	21	190	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	C	0.5	0.2	NA	6.1	78	2,000	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	C	0.5	0.2	NA	12	160	4,100	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	C	0.5	0.2	NA	6.1	78	2,000	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-dinitrotoluene	C	0.5	0.2	NA	0.22	0.47	12	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
												Freshwater		Human Health Risk for Consumption of:	
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Acute	Chronic	Water & Organisms	Organisms Only
SVOCs															
2-Amino-4,6-dinitrotoluene	C	0.5	0.2	NA	0.22	0.47	12	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	N	10	0.33	600	27	700	18,000	0.46	763	0.1	0.035	NA	NA	2,700	17,000
1,2,3-Trichlorobenzene	NA	10	0.33	NA	NA	NA	NA	NA	50	0.1	0.040	NA	NA	NA	NA
1,2,4-Trichlorobenzene	N	10	0.33	70	19	78	2,000	7.5	50	0.1	0.040	NA	NA	260	940
1,3-Dichlorobenzene	N	10	0.33	NA	18	230	6,100	0.087	763	NA	NA	NA	NA	400	2,600
1,4-Dichlorobenzene	C	10	0.33	75	0.47	27	240	0.0071	763	0.1	0.11	NA	NA	400	2,600
2-Chloronaphthalene	N	10	0.33	NA	49	630	16,000	32	NA	NA	NA	NA	NA	1,700	4,300
2-Chlorophenol	N	10	0.33	NA	3	39	1,000	NA	970	0.1	NA	NA	NA	120	400
2-Methylnaphthalene	N	10	0.33	NA	12	160	4,100	22	NA	NA	0.07	NA	NA	NA	NA
2-Methylphenol	N	10	0.33	NA	180	390	10,000	NA	NA	0.1	0.063	NA	NA	NA	NA
2-Nitroaniline	NA	50	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	10	0.33	NA	NA	NA	NA	NA	150	0.1	NA	NA	NA	NA	NA
2,4-Dichlorophenol	N	50	1.6	NA	11	23	610	1.2	365	0.1	NA	NA	NA	93	790
2,4-Dimethylphenol	N	10	0.33	NA	73	160	4,100	6.7	2,120	0.1	0.029	NA	NA	540	2,300
2,4-Dinitrophenol	N	10	0.33	NA	7.3	16	410	NA	150	0.1	NA	NA	NA	70	14,000
2,4-Dinitrotoluene	N	10	0.33	NA	7.3	16	410	0.57	230	NA	NA	NA	NA	0.11	9.1
2,4,5-Trichlorophenol	N	10	0.33	NA	370	780	20,000	NA	63	0.1	NA	NA	NA	2,600	9,800
2,4,6-Trichlorophenol	C	10	0.33	NA	6.1	58	520	NA	970	0.1	NA	NA	NA	2.1	6.5
1,2,4-Trimethylbenzene	N	10	0.33	NA	1.2	390	10,000	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	N	10	0.33	NA	1.2	390	10,000	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	N	10	0.33	NA	3.7	7.8	200	0.25	230	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	50	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	C	20	0.65	NA	0.15	1.4	13	0.0049	NA	NA	NA	NA	NA	0.04	0.077
4-Bromophenyl-phenylether	NA	10	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
4-Chloro-3-methylphenol	NA	20	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	N	20	0.65	NA	15	31	820	0.97	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	NA	10	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Isopropyltoluene	NA	10	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3+4-Methylphenol	N	10	0.33	NA	18	39	1,000	NA	NA	0.1	0.67	NA	NA	NA	NA
4-Nitroaniline	C	50	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	N	50	1.6	NA	29	63	1,600	2	150	0.1	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	N	50	1.6	1.6	0.37	0.78	20	NA	NA	NA	NA	NA	NA	13.4	765
Acenaphthylene	NA	10	0.33	NA	NA	NA	NA	NA	NA	0.1	0.044	NA	NA	NA	NA
Acenaphthene	N	10	0.33	NA	37	470	12,000	100	520	0.1	0.016	NA	NA	1,200	2,700
Anthracene	N	10	0.33	NA	180	2,300	61,000	470	0.1	0.1	0.853	NA	NA	9,600	110,000
Benz[*a*]anthracene	C	10	0.33	NA	0.092	0.87	7.8	1.5	6.3	0.1	0.261	NA	NA	0.0044	0.049
Benzo[*b*]fluoranthene	C	10	0.33	NA	0.092	0.87	7.8	4.5	NA	0.1	3.20	NA	NA	0.0044	0.049
Benzo[*a*]pyrene	C	10	0.33	0.2	0.0092	0.087	0.78	0.37	NA	0.1	0.430	NA	NA	0.0044	0.049
Benzo[*g,h,i*]pyrene	NA	10	0.33	NA	NA	NA	NA	NA	NA	0.1	0.670	NA	NA	NA	NA
Benzo[*k*]fluoranthene	C	10	0.33	NA	0.92	8.7	78	45	NA	0.1	NA	NA	NA	0.0044	0.049
Bis(2-chloro-ethoxy)methane	NA	10	0.33	NA	NA	NA	NA	NA	11,000	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	C	10	0.33	NA	0.0096	0.58	5.2	0.00004	NA	NA	NA	NA	NA	0.031	1.4
Bis(2-chloroisopropyl)-ether; 2,2'-oxybis(1-chloropropane)	C	10	0.33	NA	0.26	9.1	82	0.0017	NA	NA	NA	NA	NA	1,400	170,000
Bis(2-ethylhexyl)-phthalate	C	10	0.33	6	4.8	46	410	2,900	30	NA	1.30	NA	NA	1.8	5.9
Bromobenzene	NA	10	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Butylbenzene	N	10	0.33	NA	24	310	8,200	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	N	10	0.33	NA	24	310	8,200	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
tert-Butylbenzene	N	10	0.33	NA	24	310	8,200	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	N	10	0.33	NA	730	1,600	41,000	17,000	3	NA	0.063	NA	NA	3,000	5,200
Carbazole	C	10	0.33	NA	3.3	32	290	0.47	NA	NA	NA	NA	NA	NA	NA
Chrysene	C	10	0.33	NA	9.2	87	780	150	NA	0.1	0.384	NA	NA	0.0044	0.049
Di-*n*-butylphthalate	N	10	0.33	NA	370	780	20,000	5,000	0.3	NA	1.40	NA	NA	2,700	12,000
Di-*n*-octylphthalate	N	10	0.33	NA	7.3	160	4,100	2,400,000	0.3	NA	6.20	NA	NA	NA	NA
Dibenz[*a,h*]anthracene	C	10	0.33	NA	0.0092	0.087	0.78	1.4	NA	0.1	0.063	NA	NA	0.0044	0.049
Dibenzofuran	N	10	0.33	NA	2.4	31	820	8	NA	NA	NA	NA	NA	NA	NA
Diethylphthalate	N	10	0.33	NA	2,900	6,300	160,000	450	3	NA	0.20	NA	NA	23,000	120,000
Dimethylphthalate	N	10	0.33	NA	37,000	78,000	2,000,000	NA	3	NA	0.07	NA	NA	313,000	2,900,000
Fluoranthene	N	10	0.33	NA	150	310	8,200	6,300	3,980	0.1	0.600	NA	NA	300	370
Fluorene	N	10	0.33	NA	24	310	8,200	140	430	0.1	0.019	NA	NA	1,300	14,000
Hexachlorobenzene	C	10	0.33	1	0.042	0.4	3.6	0.052	3.68	NA	0.022	NA	NA	0.00075	0.00077
Hexachlorobutadiene	C	10	0.33	NA	0.86	8.2	73	1.8	9.3	NA	0.011	NA	NA	0.44	50
Hexachlorocyclopentadiene	N	10	0.33	50	22	47	1,200	180	5.2	NA	NA	NA	NA	240	17,000
Hexachloroethane	C	10	0.33	NA	4.8	46	410	0.36	540	NA	NA	NA	NA	1.9	8.9
Indeno[1,2,3-*cd*]pyrene	C	10	0.33	NA	0.092	0.87	7.8	13	NA	0.1	0.600	NA	NA	0.0044	0.049
Isophorone	C	10	0.33	NA	70	670	6,000	0.41	117,000	NA	NA	NA	NA	36	2,600
Isopropylbenzene	NA	10	0.33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-*n*-propylamine	C	10	0.33	NA	0.0096	0.091	0.82	0.000047	NA	NA	NA	NA	NA	0.005	1.4
N-Nitrosodiphenylamine	C	10	0.33	NA	14	130	1,200	0.76	5,850	NA	0.028	NA	NA	5	16
N-Propylbenzene	N	10	0.33	NA	24	310	8,200	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	N	10	0.33	NA	0.65	160	4,100	0.15	100	0.1	0.160	NA	NA	NA	NA
Nitrobenzene	N	10	0.33	NA	0.35	3.9	100	0.023	27,000	NA	NA	NA	NA	17	1,900
Pentachlorophenol	C	50	1.6	1	0.56	5.3	48	NA	13	0.1	0.36	19	15	0.28	8.2
Phenanthrene	NA	10	0.33	NA	NA	NA	NA	NA	6.3	0.1	0.240	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
Phenol	N	10	0.33	NA	2,200	4,700	120,000	130	79	0.1	0.42	NA	NA	21,000	4,600,000
Pyrene	N	10	0.33	NA	18	230	6,100	680	NA	0.1	0.665	NA	NA	960	11,000
Dioxins/Furans															
2,3,7,8-TCDD	C	0.00001	0.000001	0.00003	0.00000045	0.0000043	0.000038	0.0000086	0.00001	0.010	NA	NA	NA	0.000000013	0.000000014
1,2,3,7,8-PeCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-PeCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-PeCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-HxCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-HxCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HxCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDD	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PeCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
Total HxCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total HpCDF	NA	0.00001	0.000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs															
Acenaphthylene	NA	1	0.033	NA	NA	NA	NA	NA	NA	0.1	0.044	NA	NA	NA	NA
Acenaphthene	N	0.1	0.017	NA	37	470	12,000	100	520	0.1	0.016	NA	NA	1,200	2,700
Anthracene	N	0.05	0.0017	NA	180	2,300	61,000	470	0.1	0.1	0.853	NA	NA	9,600	110,000
Benz[*a*]anthracene	C	0.05	0.0017	NA	0.092	0.87	7.8	1.5	6.3	0.1	0.261	NA	NA	0.0044	0.049
Benzo[*b*]fluoranthene	C	0.1	0.0033	NA	0.092	0.87	7.8	4.5	NA	0.1	3.20	NA	NA	0.0044	0.049
Benzo[*a*]pyrene	C	0.05	0.0017	0.2	0.0092	0.087	0.78	0.37	NA	0.1	0.430	NA	NA	0.0044	0.049
Benzo[*g,h,i*]pyrene	NA	0.01	0.0033	NA	NA	NA	NA	NA	NA	0.1	0.670	NA	NA	NA	NA
Benzo[*k*]fluoranthene	C	0.05	0.0017	NA	0.92	8.7	78	45	NA	0.1	NA	NA	NA	0.0044	0.049
Chrysene	C	0.05	0.0017	NA	9.2	87	780	150	NA	0.1	0.384	NA	NA	0.0044	0.049
Dibenz[*a,h*]anthracene	C	0.1	0.0033	NA	0.0092	0.087	0.78	1.4	NA	0.1	0.063	NA	NA	0.0044	0.049
Fluoranthene	N	0.1	0.0033	NA	150	310	8,200	6,300	3,980	0.1	0.600	NA	NA	300	370
Fluorene	N	0.01	0.0033	NA	24	310	8,200	140	430	0.1	0.019	NA	NA	1,300	14,000
Indeno[1,2,3-*cd*]pyrene	C	0.05	0.0017	NA	0.092	0.87	7.8	13	NA	0.1	0.600	NA	NA	0.0044	0.049
Naphthalene	N	0.1	0.017	NA	0.65	160	4,100	0.15	100	0.1	0.160	NA	NA	NA	NA
Phenanthrene	NA	0.05	0.0017	NA	NA	NA	NA	NA	6.3	0.1	0.240	NA	NA	NA	NA
Pyrene	N	0.05	0.0017	NA	18	230	6,100	680	NA	0.1	0.665	NA	NA	960	11,000
TCL VOCs															
Acetone	N	5	0.005	NA	61	780	20,000	2.5	9,000,000	NA	NA	NA	NA	NA	NA
Acrolein	N	50	0.050	NA	0.0042	160	4,100	NA	21.0	NA	NA	NA	NA	320	780
Acrylonitrile	C	50	0.050	NA	0.037	1.2	11	NA	2600	NA	NA	NA	NA	0.059	0.66
Benzene	C	1	0.005	5	0.32	12	100	0.0018	5,300	0.1	NA	NA	NA	1.2	71
Bromochloromethane	NA	1	0.005	NA	NA	NA	NA	NA	11,000	3,000	NA	NA	NA	NA	NA
Bromodichloromethane	C	1	0.005	80	0.17	10	92	0.0011	11,000	450	NA	NA	NA	0.56	46
Bromoform	C	1	0.005	80	8.5	81	720	0.067	NA	NA	NA	NA	NA	4.3	360

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
												Freshwater		Human Health Risk for Consumption of:	
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Acute	Chronic	Water & Organisms	Organisms Only
Bromomethane	N	1	0.005	NA	0.85	11	290	0.041	NA	NA	NA	NA	NA	48	4,000
2-Butanone	N	5	0.005	NA	190	4,700	120,000	8	3,220,000	NA	NA	NA	NA	NA	NA
Carbon disulfide	N	5	0.005	NA	100	780	20,000	19	2	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	C	1	0.005	5	0.16	4.9	44	0.0021	35,200	0.3	NA	NA	NA	0.25	4.4
Chlorobenzene	N	1	0.005	100	11	160	4,100	0.8	50	0.1	NA	NA	NA	680	21,000
Chloroethane	C	1	0.005	NA	3.6	220	2,000	0.019	NA	NA	NA	NA	NA	NA	NA
Chloroform	C	1	0.005	80	0.15	100	940	0.00089	1,240	0.3	NA	NA	NA	5.7	470
Chloromethane	C	1	0.005	NA	2.1	49	440	0.01	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	N	1	0.005	NA	1.2	160	4,100	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorotoluene	NA	1	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl vinyl ether	NA	50	0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane	C	5	0.005	0.2	0.047	0.46	4.1	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromoethane	C	1	0.005	NA	0.00075	0.0075	0.067	NA	18,000	5	NA	NA	NA	NA	NA
Dibromomethane	N	1	0.005	NA	6.1	78	2,000	NA	11,000	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	N	1	0.005	NA	35	1,600	41,000	NA	11,000	NA	NA	NA	NA	NA	NA
Dibromochloromethane	C	1	0.005	80	0.13	7.6	68	0.00083	11,000	NA	NA	NA	NA	0.41	34
1,1-Dichloroethane	N	1	0.005	NA	80	780	20,000	4.5	160,000	0.3	NA	NA	NA	NA	NA
1,2-Dichloroethane	C	1	0.005	5	0.12	7	63	0.001	20,000	870	NA	NA	NA	0.38	99
1,1-Dichloroethene	C	1	0.005	7	0.044	1.1	9.5	0.00036	11,600	NA	NA	NA	NA	0.057	3.2
cis-1,2-Dichloroethene	N	1	0.005	70	6.1	78	2,000	0.35	11,600	0.3	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	N	1	0.005	100	12	160	4,100	0.82	11,600	0.3	NA	NA	NA	700	140,000
1,2-Dichloropropane	C	1	0.005	5	0.16	9.4	84	0.0021	NA	NA	NA	NA	NA	0.52	39
1,3-Dichloropropane	NA	1	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	NA	1	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloropropene	NA	1	0.005	NA	NA	NA	NA	NA	244	0.3	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	C	1	0.005	NA	0.44	6.4	57	0.0031	244	0.3	NA	NA	NA	10	1,700

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
trans-1,3-Dichloropropene	C	1	0.005	NA	0.44	6.4	57	0.0031	244	0.3	NA	NA	NA	10	1,700
Ethylbenzene	N	1	0.005	700	130	780	20,000	15	32,000	0.1	0.010	NA	NA	3,100	29,000
2-Hexanone	N	5	0.005	NA	150	310	8,200	NA	428,000	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone	N	5	0.005	NA	14	630	16,000	NA	460,000	100	NA	NA	NA	NA	NA
Methylene chloride	C	5	0.005	5	4.1	85	760	0.019	11,000	0.3	NA	NA	NA	4.7	1,600
Styrene	N	1	0.005	100	160	1,600	41,000	57	NA	0.1	NA	NA	NA	NA	NA
1,1,1,2-Tetrachloroethane	C	1	0.005	NA	0.41	25	220	NA	2,400	0.3	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	C	1	0.005	NA	0.053	3.2	29	0.00068	2,400	0.3	NA	NA	NA	0.17	11
Tetrachloroethene	C	1	0.005	5	1.1	12	110	0.048	840	0.3	0.057	NA	NA	0.8	8.85
Toluene	N	1	0.005	1,000	75	1,600	41,000	8.8	17,000	0.1	NA	NA	NA	6,800	200,000
1,1,1-Trichloroethane	N	1	0.005	200	320	2,200	57,000	60	9,400	0.3	0.031	NA	NA	NA	NA
1,1,2-Trichloroethane	C	1	0.005	5	0.19	11	100	0.00078	9,400	0.3	0.031	NA	NA	0.6	42
Trichloroethene	C	1	0.005	5	1.6	58	520	0.015	21,900	0.3	NA	NA	NA	2.7	81
Trichlorofluoromethane	N	1	0.005	NA	130	2,300	61,000	NA	11,000	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	C	1	0.005	NA	0.0053	0.32	2.9	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl acetate	N	5	0.005	NA	41	7,800	200,000	1.7	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	C	5	0.005	2	0.015	0.09	7.9	0.00033	11,600	0.3	NA	NA	NA	2	525
m- & *p*-Xylene	N	1	0.005	10,000	1,200	16,000	410,000	250	6,000	0.1	0.040	NA	NA	NA	NA
o-Xylene	N	1	0.005	10,000	1,200	16,000	410,000	230	6,000	0.1	0.040	NA	NA	NA	NA
Xylene (total)	N	1	0.005	10,000	1,200	16,000	410,000	170	6,000	0.1	0.040	NA	NA	NA	NA
Herbicides															
2,4-D	N	4	0.080	70	37	78	2000	0.90	NA	NA	NA	NA	NA	100	NA
2,4-DB	N	4	0.080	NA	29	63	1600	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)	N	1	0.020	50	29	63	1600	2.1	NA	NA	NA	NA	NA	10	NA
2,4,5-T	N	1	0.020	NA	37	78	2000	0.20	NA	NA	NA	NA	NA	NA	NA
Dalapon	N	2	0.040	200	110	230	6100	0.71	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
												Freshwater		Human Health Risk for Consumption of:	
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Acute	Chronic	Water & Organisms	Organisms Only
Dicamba	N	2	0.040	NA	110	230	6100	0.45	NA	NA	NA	NA	NA	NA	NA
Dichloroprop	NA	4	0.080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dinoseb	N	1	0.012	7.0	3.7	7.8	200	0.017	NA	NA	NA	NA	NA	NA	NA
MCPA	N	400	8.0	NA	1.8	3.9	100	NA	NA	NA	NA	NA	NA	NA	NA
MCPP	N	400	8.0	NA	3.7	7.8	200	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	C	1	0.010	1.0	0.56	5.3	48	NA	13.0	0.10	0.36	NA	NA	NA	NA
TCL Pesticides & PCBs															
Aldrin	C	0.050	0.0017	NA	0.0039	0.038	0.34	0.0077	3.0	0.10	NA	3	NA	0.00013	0.00014
Alpha-BHC	C	0.050	0.0017	NA	0.011	0.10	0.91	0.00089	NA	NA	NA	NA	NA	0.0039	0.013
beta-BHC	C	0.050	0.0017	NA	0.037	0.35	3.2	0.0031	NA	NA	NA	NA	NA	0.014	0.046
delta-BHC	NA	0.050	0.0017	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC (Lindane)	C	0.050	0.0017	0.2	0.052	0.49	4.4	0.0043	0.08	0.10	NA	0.95	NA	0.019	0.063
alpha-Chlordane	NA	0.050	0.0017	2	NA	NA	NA	NA	0.0043	0.10	NA	2.4	0.0043	0.0021	0.0022
gamma-Chlordane	NA	0.050	0.0017	2	NA	NA	NA	NA	0.0043	0.10	NA	2.4	0.0043	0.0021	0.0022
Dieldrin	C	0.10	0.0033	NA	0.0042	0.040	0.36	0.0022	0.0019	0.10	16	0.24	0.056	0.00014	0.00014
4,4'-DDD	C	0.10	0.0033	NA	0.28	2.7	24	11	0.60	0.10	2.2	NA	NA	0.00083	0.00084
4,4'-DDE	C	0.10	0.0033	NA	0.20	1.9	17	35	1050	0.10	1.58	NA	NA	0.00059	0.00059
4,4'-DDT	C	0.10	0.0033	NA	0.20	1.9	17	1.2	0.001	0.10	NA	1.1	0.001	0.00059	0.00059
Endosulfan I	N	0.050	0.0017	NA	22	47	1200	2.0	0.056	NA	NA	0.22	0.056	110	240
Endosulfan II	N	0.10	0.0033	NA	22	47	1200	2.0	0.056	NA	NA	0.22	0.056	110	240
Endosulfan sulfate	NA	0.10	0.0033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110	240
Endrin	N	0.10	0.0033	2	1.1	2.30	0.61	0.54	0.0023	0.10	NA	0.086	0.036	0.76	0.81
Endrin aldehyde	NA	0.10	0.0033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.76	0.81
Endrin ketone	NA	0.10	0.0033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	C	0.050	0.0017	0.4	0.015	0.14	1.3	0.84	0.0038	NA	NA	0.52	0.0038	0.00021	0.00021
Heptachlor epoxide	C	0.050	0.0017	0.2	0.0074	0.070	0.63	0.025	0.0038	0.10	NA	0.52	0.0038	0.001	0.00011
Methoxychlor	N	0.50	0.017	40	550	1200	31000	NA	0.03	0.10	NA	NA	0.03	100	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		Drinking Water MCLs (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
												Freshwater		Human Health Risk for Consumption of:	
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Acute	Chronic	Water & Organisms	Organisms Only
Toxaphene	C	3.0	0.17	3.0	0.061	0.58	5.2	0.63	0.0002	NA	NA	0.73	0.0002	0.00073	0.00075
Aroclor-1016	C	1	0.033	0.5	0.96	5.5	82	4.2	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1221	C	2	0.067	0.5	0.033	0.32	2.9	NA	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1232	C	1	0.033	0.5	0.033	0.32	2.9	NA	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1242	C	1	0.033	0.5	0.033	0.32	2.9	NA	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1248	C	1	0.033	0.5	0.033	0.32	2.9	NA	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1254	C	1	0.033	0.5	0.033	0.32	2.9	1.1	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Aroclor-1260	C	1	0.033	0.5	0.033	0.32	2.9	NA	0.014	0.1	0.022	NA	0.014	0.00017	0.00017
Waste Characterization															
TCLP SVOCs				**TCLP Limits (µg/L)**											
1,4-Dichlorobenzene	NA	100	NA	7,500,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (*o*-cresol)	NA	100	NA	200,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	100	NA	130	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methylphenol (*o*-cresol)	NA	100	NA	200,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol (*o*-cresol)	NA	100	NA	200,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	100	NA	130	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	100	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	100	NA	3000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	100	NA	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	250	NA	100,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyridine	NA	100	NA	5000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	250	NA	400,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	100	NA	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		TCLP Limits (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
TCLP Metals															
Arsenic	NA	100	NA	5,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	2000	NA	100,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	50	NA	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	100	NA	5,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	30	NA	5,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	2	NA	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	50	NA	1,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	100	NA	5,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCLP VOCs															
Benzene	NA	10	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	10	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	10	NA	100,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	10	NA	6,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	NA	10	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	10	NA	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl ethyl ketone	NA	10	NA	200,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	NA	10	NA	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	10	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	10	NA	200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCLP Pesticides															
Chlordane	NA	0.05	NA	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	0.10	NA	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	0.05	NA	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	0.05	NA	8.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	0.05	NA	8.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	NA	5.0	NA	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-6 Analyte List, Continued

Parameter	Effect	Quantitation Limits		TCLP Limits (µg/L)	Tap Water RBCs (µg/L)	Region III Soil Risk Based Concentration September 2001		SSL Transfers Soil to Groundwater (DAF 20) (mg/kg)	Region III BTAG Screening Levels			USEPA Water Quality Criteria (µg/L)			
		Aqueous (µg/L)	Soil (mg/kg)			Residential (mg/kg)	Industrial (mg/kg)		Aqueous (µg/L)	Soil (mg/kg)	Sediment (mg/kg)	Freshwater		Human Health Risk for Consumption of:	
												Acute	Chronic	Water & Organisms	Organisms Only
Toxaphene	NA	3.0	NA	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Miscellaneous															
Ignitability	NA	±1°F	NA	140°F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Corrosivity as Ph	NA	±1 Units	NA	<2 or >12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reactive Cyanide	NA	5 mg/kg	NA	250 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reactive Sulfide	NA	20 mg/kg	NA	500 mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Oxygen Demand (COD)	NA	3,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES: (1) Referenced RBCs and SSLs are from the USEPA Region III RBC table dated 9/25/01. (2) Referenced MCLs are from USEPA 40 CFR 141 and 142. (3) Referenced BTAG values are from the USEPA Region III BTAG Screening Levels table dated 8/9/95. (4) Referenced TCLP limits are from USEPA 40 CFR 261.4. (5) The RBC levels for noncarcinogenic chemicals are presented with a hazard quotient of 0.1 to allow for cumulative effects, multiple contaminated media, and multiple routes of exposure. (6) The SSLs for soil to groundwater migration contains a default value of 20 for the dilution attenuation factor (DAF). (7) Lead values were provided by USEPA Region III.

NA = Not Applicable.

2.6 INTERNAL QUALITY CONTROL CHECKS

This section discusses the internal QC components that will be used by IT during operations at RFAAP. The internal quality components include the field QC samples and the laboratory QC elements to be followed.

2.6.1 Field Quality Control Samples

Rinse blanks, trip blanks, and field duplicates will be collected during the acquisition of environmental samples at RFAAP. **Table 2-7** presents guidelines for the collection of QC samples that will be taken in conjunction with environmental sampling. The estimated number of associated field QC samples is presented in **Table 2-4.** Field QC acceptance criteria are summarized in **Table 2-8.**

Table 2-7
Field Quality Control Samples

Control	Purpose of Sample	Collection Frequency
Duplicate Sample	Ensure precision in sample homogeneity during collection and analysis	10% of field samples per matrix
Rinse Blank	Ensure the decontamination of sampling equipment has been adequately performed; to assess cross contamination and/or incidental contamination to the sample container	1 per 20 samples per matrix per sample technique
Temperature Blank	Verify sample cooler temperature during transport	1 temperature blank per cooler
Trip Blank	Assess if cross contamination occurs during shipment or storage with aqueous VOC samples	1 trip blank per cooler containing aqueous VOC samples

Table 2-8
Field Quality Control Elements Acceptance Criteria

Item	DQO	Parameter	Frequency of Association	Criteria Requirement
Field Duplicate	P	Inorganics	1 per 10 samples	RPD ≤ 20% Aqueous RPD ≤ 35% Solid
		Organics	1 per 10 samples	RPD ≤ 50% Aqueous RPD ≤ 100% Solid
Trip Blank	A,R	VOCs in water	1 per cooler with aqueous VOCs	No target analytes detected in the blanks or <5% of the LOC
Rinse Blank	A,R	All	1 per 20 samples per matrix per equipment type	No target analytes detected in the blanks or <5% of the LOC
Chain of Custody Forms	R	All	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Field Parameter Forms	R	All	Every sample	Filled out correctly to include signatures; no missing or incorrect information.
Field Logbook	R	All	Every sample	Filled out correctly to include analytical parameters; map file data; and applicable coding information.
Field Instrument Calibration Logs	A	All	Every measurement	Measurements must have associated calibration reference

A = Accuracy; P = Precision; R = Representativeness

2.6.2 Laboratory Quality Control Elements

The laboratory QC elements are summarized in **Table 2-9**. Specific laboratory analytical QC criteria and corrective actions are summarized in **Tables 2-10 through 2-20** for the parameters specified in Section 2.5.

Table 2-9
Analytical Quality Control Elements of a Quality Assurance Program

Item	DQO	Parameter	Frequency of Association	Criteria Requirement
Analytical Method	C	All	Each analysis	Method analysis based on USEPA methods as defined in Section 2.5.
Chemical Data Packages	A,P,C	All	Each lot/batch	Pass peer review and formal QA/QC check.
Laboratory Chain of Custody	R	All	Each lot/batch	No deficiencies
Laboratory System Controls	A,R	All	During laboratory operations	Custody of sample within laboratory fully accounted for and documented
Holding Time	A,P,R	All	Each analysis	No deficiencies (USEPA Region III Modifications)
Method Blanks	A	All	Each lot/batch	No target analytes detected in the method blanks or <5% of the LOC
Matrix Spikes and Duplicates	A,P	All	Each lot/batch	Must meet USEPA criteria as defined in **Tables 2-10 through 2-20.**
Surrogates	A	All	Organic fractions, including QC samples	Required to meet the stricter of the USEPA criteria.
Serial dilution	A	Metals	Each lot/batch	Must meet USEPA criteria as defined in **Table 2-14.**

Legend: A = Accuracy C = Comparability R = Representativeness P = Precision

Table 2-10
Quality Control Method Criteria for Volatile Organic Compounds by USEPA SW-846 8260B

Procedure	Frequency	Acceptance Criteria			Corrective Action
Initial Calibration 5-pt curve	Set-up, major maintenance, and quarterly	RRF > 0.30 for SPCCs; except bromoform >0.25. RSD ≤ 30% for CCCs response factors.			If RSD of the average RRF for calibration check compounds > 30%, the initial calibration must be repeated. Data reviewer should review and judge the target compounds against the acceptance criteria.
Continuing calibration check	Every 12 hours	%Difference for RF of CCCs of continuing calibration compounds ±25% from initial calibration. RRF > 0.30 for SPCCs; except bromoform >0.25.			Samples cannot begin until this criterion is met. Data reviewer should review and judge the target compounds against the acceptance criteria.
Method blanks	Every 12 hours	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.			Document source of contamination.
Tuning BFB	Prior to calibration	Must meet tuning criteria.			Re-tune, re-calibrated.
LCS (Advisory Limits)	Every batch	Water: 80–120%. Solids: 75–125%. Or as specified QC limits.			Qualify associated data biased high or biased low as appropriate.
Internal Standards	Every sample	Standards Bromochloromethane 1,4-difluorobenzene chlorobenzene	Retention time ±30 seconds of last CC Area changes by a factor of two (-50% to +100%)		Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with standards outside criteria.
Surrogate (Advisory Limits)	Every sample	Standards 4-bromofluorobenzene 1,2-dichloroethane-d$_4$ toluene-d$_8$	Solid 75–125% 75–125% 75–125%	Aqueous 80–120% 80–120% 80–120%	If surrogate compounds do not meet criteria, there should be a re-analysis to confirm that the non-compliance is due to the sample matrix effects rather than laboratory deficiencies.
Matrix Spike and Duplicate (Advisory Limits)	1 per 20 per matrix	Standards 1,1-dichloroethane trichloroethene benzene toluene chlorobenzene	Solid %Rec. %RPD 70–130% ≤30 70–130% ≤30 70–130% ≤30 70–130% ≤30 70–130% ≤30	Aqueous %Rec. %RPD 70–130% ≤30 70–130% ≤30 70–130% ≤30 70–130% ≤30 70–130% ≤30	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-11
Quality Control Method Criteria for Semivolatile Organic Compounds by USEPA SW-8270C

Procedure	Frequency	Acceptance Criteria	Corrective Action
Initial calibration curve (5-pt curve)	Set-up, major maintenance	RRF > 0.05 for SPCCs; RSD ≤30% for CCC compounds.	Must meet criteria prior to sample analysis. Data reviewer should review and judge the target compounds against the acceptance criteria.
Continuing calibration standard	12 hours	RRF > 0.05 for SPCCs. The percent difference for CCCs must be ≤30%. If this criteria is met, the relative response factors of the compounds are calculated.	If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, calibration must be repeated. Data reviewer should review and judge the target compounds against the acceptance criteria.
Internal standards	Every sample	Retention time ±30 seconds of last CC Area changes by a factor of two (-50% to +100%)	Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with standards outside criteria.
Tuning DFTPP	12 hours	Must meet tuning criteria.	Re-tune, re-calibrate.
Method blanks	Per extraction batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Document source of contamination.
LCS (Advisory Limits)	Every batch	60–120%% or as specified QC limits	Qualify associated data biased high or biased low as appropriate.
Surrogate spikes (Advisory Limits)	Every sample	Standards / Aqueous (%Rec.) / Solid (%Rec.) nitrobenzene-d_5 45–135% 45–135% 2-fluorobiphenyl 45–135% 45–135% p-terphenyl-d14 45–135% 45–135% phenol-d5 45–135% 45–135% 2-fluoroprophenol-d6 45–135% 45–135% 2,4,6-tribromophenol 45–135% 45–135% 2-chlorophenol 45–135% 45–135% 1,2-dichlorobenzene 45–135% 45–135%	If two base/neutral or acid surrogates are out of specification, or if one base/neutral or acid extractable surrogate has a recovery of less than 10%, then there should be a re-analysis to confirm that the non-compliance is due to sample matrix effects rather than laboratory deficiencies.
Matrix spike and duplicate (Advisory Limits)	1 per 20 samples per matrix	Standards / Aqueous Rec. %RPD / Solid Rec. %RPD Phenol 45–135% ≤50 45–135% ≤60 2-chlorophenol 45–135% ≤50 45–135% ≤60 1,4-dichlorobenzene 45–135% ≤50 45–135% ≤60 n-nitroso-di-n-propylamine 45–135% ≤50 45–135% ≤60 1,2,4-trichlorobenzene 45–135% ≤50 45–135% ≤60 4-chloro-3-methylphenol 45–135% ≤50 45–135% ≤60 acenaphthene 45–135% ≤50 45–135% ≤60 4-nitrophenol 45–135% ≤50 45–135% ≤60 2,4-dinitrotoluene 45–135% ≤50 45–135% ≤60 pentachlorophenol 45–135% ≤50 45–135% ≤60 pyrene 45–135% ≤50 45–135% ≤60	If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-12
Quality Control Method Criteria for Polynuclear Aromatic Hydrocarbons by USEPA SW-846 8310

Procedure	Frequency of QC Procedure	Acceptance Criteria					Corrective Action
Initial calibration curve 5-pt curve	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve.					Must meet criteria prior to sample analysis
Continuing calibration (calibration check)	Daily	%D recovery ± 15% of the response factor from the initial curve.					If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated.
Independent reference standard (LCS)	1 per batch	70-130% or as specified QC limits.					Qualify associated data biased high or biased low as appropriate.
Method blanks	1 per batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.					Document source of contamination.
Surrogate spikes (Advisory Limits)	Every sample	Standards	Aqueous %R		Solid %R		If surrogate compounds do not meet criteria, there should be a re-analysis to confirm that the non-compliance is due to the sample matrix effects rather than laboratory deficiencies.
		p-Terphenyl	50-110%		30-124%		
Matrix spike and duplicate (Advisory Limits)	1 per 20 samples per matrix	Standards	Aqueous		Solid		Data reviewer may use the MS and MSD results in conjunction with other QC sample results to assess the need for some qualification of the data.
			%R	RPD	%R	RPD	
		acenaphthene	49-109	≤30	0-124	≤50	
		acenaphthylene	53-103	≤25	0-139	≤50	
		anthracene	44-124	≤40	0-126	≤50	
		benzo(a)pyrene	45-121	≤38	27-151	≤62	
		benzo(k)fluoranthene	41-123	≤41	22-132	≤55	
		fluorene	40-110	≤35	25-123	≤49	
		naphthalene	21-117	≤48	0-122	≤50	
		phenanthrene	52-116	≤32	0-155	≤50	

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-13
Quality Control Method Criteria for Explosives by USEPA SW-846 8330

Procedure	Frequency	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve.	Must meet criteria prior to sample analysis
Continuing calibration standard	Daily	%D recovery ± 15% of the response factor from the initial curve.	If criteria are not met, re-analyze the daily standard. If the daily standard fails a second time, perform a new initial curve.
Independent reference standard (LCS)	1 per batch	60-120% or as specified QC limits.	Qualify associated data biased high or biased low as appropriate.
Instrument Blank	12 hours, after analytical run and highly contaminated samples.	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Demonstrated "clean." Affected sample will be re-analyzed.
Method blanks	Per extraction batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Identify source of contamination. Take appropriate action and document. If preparation is in error, re-prep sample. If samples cannot be re-prepared, qualify the sample. Document actions taken.
Surrogate spikes (Advisory Limits)	Every sample	<u>Standards</u> / <u>Aqueous %Rec.</u> / <u>Solid %Rec.</u> 4-nitroaniline / 60–140% / 50–150%	Examine each QC element (LCS, MB, ICV, CCV, etc.). If surrogate is out for the QC samples, check quantitation, then re-analyze (if still out of control). If QC passes, qualify samples after checking preparation steps. 2. If re-analysis of original extracts is out of control, re-extract and re-analyze samples. Follow step 1. If still out of control or samples cannot be re-extracted, qualify data.
Matrix spike and duplicate samples (Advisory Limits)	1 per 20 samples per matrix	<u>Standards</u> / <u>Aqueous %Rec.</u> <u>RPD</u> / <u>Solid %Rec.</u> <u>%RPD</u> RDX / 50–140% ≤50 / 50–140% ≤50 135TNB / 50–140% ≤50 / 50–140% ≤50 NB / 50–140% ≤50 / 50–140% ≤50 246TNT / 50–140% ≤50 / 50–140% ≤50 24DNT / 50–140% ≤50 / 50–140% ≤50	Investigate to identify cause and document actions taken; data are acceptable. Data reviewer may use the MS and MSD results in conjunction with other QC sample results to assess the need for some qualification of the data.
Standard spikes	1 low spike and 2 high spikes per sample lot.	LWL<%Rec<UWL LWL: lower warning limit UWL: upper warning limit	Investigate to identify cause and document actions taken; data are acceptable.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-14
Quality Control Method Criteria for Metals by USEPA SW-846 6010B/7470A/7471A/ SM 2340B

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve (3-pt curve Hg) (1-pt curve low level ICP)	Daily or major maintenance, instrument modification, replacement of the torch, replacement of the mirror	r > 0.995 for each element r: linear correlation coefficient	If r < 0.995 for an element, the standards for that element must be prepared again and/or the lower/upper range standard must be used.
Continuing calibration verification (CCV)	Every 10 samples or 2 per 8 hr and end of run.	Recovery ±10% of true value for ICP Recovery ±20% of true value for Hg	Reanalyze CCV. If the CCV fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Highest mixed standard	Before sample analysis	Recovery ±5% of true value for ICP NA for Hg	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Interference check	Beginning and end of each sample analytical run or 2 per 8 hr.	Recovery ±20% of true value.	Terminate the analysis, correct the problem, re-calibrate, re-verify the calibration, and reanalyze the samples.
Continuing calibration blank (CCB)	Every 10 samples, end of analytical run	Concentration < 3 X s of the background mean (ICP). No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	If the average in not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.
Serial Dilution (ICP)	1 per 20 samples per matrix for samples >10x IDL	Difference between diluted and undiluted sample <10%.	Chemical or physical interference should be suspected. Investigate to identify cause.
Preparation blank	1 per batch per matrix	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Documented source of contamination.
Laboratory Control Sample (Advisory Limits)	1 per 20 samples	80%≤%Rec.≤120%	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate and sample duplicate (Advisory Limits)	1 per 20 samples per matrix	75%≤%Rec.≤125%; %RPD<25%; If spike(s) outside of limits, analyze PDS. PDS limits are 75–125% for 6010B 80%≤Rec.≤120; %RPD<20% for 7000 methods. PDS limits are 85–115% for 7000 methods.	If matrix spike recovery does not meet criteria (except Ag), a post digestion spike is required for each method except GFAA. Qualify results in accordance with Regional criteria.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-15
Quality Control Method Criteria for Dioxin/Furans by USEPA SW-8290

Procedure	Frequency	Acceptance Criteria					Corrective Action
Initial calibration curve (5-pt curve)	Set-up, major maintenance	%RSD ±20% for standard compounds, %RSD ±30% for reference compounds. Isotopic ratio must be within the established control limits. The signal to noise ratio must be ≥2.5 for each selected ion current profile.					Must meet criteria prior to sample analysis. Data reviewer should review and judge the target compounds against the acceptance criteria.
Continuing calibration standard	12 hours	The percent difference must be ±20% for each standard compounds and ±30% for reference compounds.					If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, calibration must be repeated. Data reviewer should review and judge the target compounds against the acceptance criteria.
Internal standards	Every sample	Retention time ±30 seconds of last CC Area changes by a factor of two (-50% to +100%)					Inspect for malfunction. Demonstrate that system is functioning properly. Reanalyze samples with standards outside criteria.
Tuning PFK	12 hours	Must meet tuning criteria with resolving power of ≥ 10000.					Re-tune, re-calibrate.
Method blanks	Per extraction batch	No target analytes.					Document source of contamination.
LCS	Every batch	Specified QC Limits					Qualify associated data biased high or biased low as appropriate.
Surrogate spikes	Every sample	Specified QC Limits					Investigate to identify cause and document actions taken; data are acceptable.
Matrix spike and duplicate	1 per 20 samples per matrix (Advisory Limits)	Standards	Aqueous		Solid		If MS/MSD results do not meet criteria, the reviewer should review the data in conjunction with other QC results to identify whether the problem is specific to the QC samples or systematic.
			Rec.	%RPD	Rec.	%RPD	
		2,3,7,8-TCDD	70-130%	≤20	70-130%	≤20	
		2,3,7,8-TCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,4-TCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,7,8- PeCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,7,8-PeCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,6,7,8-HxCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,4,7,8-HxCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,7,8,9-HxCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,6,7,8-HxCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,4,7,8-HxCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,7,8,9-HxCDF	70-130%	≤20	70-130%	≤20	
		2,3,4,6,7,8-HxCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,4,6,7,8-HpCDD	70-130%	≤20	70-130%	≤20	
		1,2,3,4,6,7,8-HpCDF	70-130%	≤20	70-130%	≤20	
		1,2,3,4,7,8,9-HpCDF	70-130%	≤20	70-130%	≤20	
		OCDD	70-130%	≤20	70-130%	≤20	
		OCDF	70-130%	≤20	70-130%	≤20	

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-16
Quality Control Method Criteria for Total Organic Carbon by USEPA SW-846 9060A

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve	Major maintenance, instrument modification, per manufacturer's specifications	$r > 0.995$ r: linear correlation coefficient	If $r < 0.995$, the standards must be prepared again.
Initial calibration standard (calibration verification)	1 per batch	Recovery ±10% of true value.	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Continuing calibration verification (CCV)	Every 10 samples, end of analytical run	Recovery ±10% of true value.	Reanalyze CCV. If the CCV fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Continuing calibration blank (CCB)	Every 10 samples, end of analytical run	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	If not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.
Preparation blank	1 per 20 samples per matrix	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Documented source of contamination.
Laboratory Control Sample (Advisory Limits)	1 per 20 samples	90%≤%Rec.≤110% or ± 3 standard deviations of the mean from historical data points.	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate (Advisory Limits)	1 per 20 samples per matrix	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	If matrix spike recovery does not meet criteria (except Ag), a post digestion spike is required for each method except GFAA. Qualify results in accordance with Regional criteria.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-17
Quality Control Method Criteria for Perchlorate by USEPA SW-846 9056 Modified

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve	Major maintenance, instrument modification, per manufacturer's specifications	r > 0.995 (advisory) r: linear correlation coefficient Predicted response within ±10%	If outside criteria, the standards must be prepared again.
Initial calibration standard (calibration verification)	1 per batch	Recovery ±10% of true value.	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Continuing calibration verification (CCV) or Instrument Performance Check (IPC)	Every 10 samples, end of analytical run	Recovery ±10% of true value.	Reanalyze CCV or IPC. If the CCV or IPC fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Continuing calibration blank (CCB)	Every 10 samples, end of analytical run	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	If not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.
Preparation Reagent blank	1 per 20 samples or batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Documented source of contamination.
Laboratory Control Sample (Advisory Limits)	1 per 20 samples	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	Qualify associated data biased high or biased low as appropriate.
Laboratory Fortified Spike (Advisory Limits)	1 per batch	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	If matrix spike recovery does not meet criteria (except Ag), a post digestion spike is required for each method except GFAA. Qualify results in accordance with Regional criteria.
Matrix spike and duplicate (Advisory Limits)	1 per 10 samples per batch	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	If matrix spike recovery does not meet criteria (except Ag), a post digestion spike is required for each method except GFAA. Qualify results in accordance with Regional criteria.

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-18
Quality Control Method Criteria for Pesticides and PCBs by USEPA SW-846 8081A & 8082

Procedure	Frequency of QC Procedure	Acceptance Criteria					Corrective Action
Initial calibration curve Single/multi-component (5pt)	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve. Lab may use first or higher order regression fit (r ≥ 0.99) if %RSD > 20%.					Must meet criteria prior to sample analysis
Continuing calibration standard	12 hours or every 20 samples	%D recovery ± 15% of the response factor from the initial curve.					If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated.
Independent reference standard (calibration check)	Weekly	Recovery ± 25%					Initiate investigation and document actions taken.
Endrin/4,4-DDT Breakdown	Per batch	endrin/4,4-DDT degradation ≤15%.					If criterion is not met, system must be deactivated and the affected sample reanalyzed if endrin or 4,4-DDT or their degradation products are detected in the samples.
Instrument blank	12 hours, after analytical run and highly contaminated samples.	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.					Demonstrated "clean". Affected sample will be reanalyzed.
Method blanks	Per extraction batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.					Document source of contamination.
Surrogate spikes	Every sample (Advisory Limits)	Surrogate	Aqueous %R		Solid %R		Investigate to determine cause, correct the problem, and document actions taken; re-extract and re-analyze sample. If still out, qualify.
		Dibutylchlorendate	60-150		60-150		
		2,4,5,6-Tetrachloro- m-xylene	60-150		60-150		
Matrix spike and duplicate	1 per 20 samples per matrix (Advisory Limits)	Standards	Aqueous %R	RPD	Solid %R	RPD	Data reviewer may use the MS and MSD results in conjunction with other QC sample results to determine the need for some qualification of the data. Specific method cleanups may be used to eliminate or minimize sample matrix effects.
		gamma-BHC	56-123	≤15	46-127	≤50	
		heptachlor	40-131	≤20	35-130	≤31	
		aldrin	40-120	≤22	34-132	≤43	
		dieldrin	52-126	≤18	31-134	≤38	
		endrin	56-121	≤21	42-139	≤45	
		4,4'-DDT	38-127	≤27	23-132	≤50	
		Aroclor-1016	40-140	≤50	40-140	≤50	
		Aroclor-1260	40-140	≤50	40-140	≤50	

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

Table 2-19
Quality Control Method Criteria for Chemical Oxygen Demand by USEPA Method of Chemical Analysis of Water and Wastes 410.4

Procedure	Frequency of QC Procedure	Acceptance Criteria	Corrective Action
Initial calibration curve 5-pt curve	Major maintenance, instrument modification, per manufacturer's specifications	r > 0.995 (advisory) r: linear correlation coefficient Predicted response within ±10%	If outside criteria, the standards must be prepared again.
Initial calibration standard (calibration verification)	1 per batch	Recovery ±10% of true value.	If criteria are not met, reanalyze the daily standards. If the daily standard fails a second time, initial calibration must be repeated.
Continuing calibration verification (CCV)	Every 10 samples, end of analytical run	Recovery ±10% of true value.	Reanalyze CCV. If the CCV fails second time, the analysis must be terminated, the problem corrected, the instrument re-calibrated, and the calibration re-verified prior to continuing sample analyses.
Continuing calibration blank (CCB)	Every 10 samples, end of analytical run	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	If not within criteria, terminate the analysis, correct the problem, re-calibrate, and reanalyze each sample analyzed since the last acceptable CCB.
Preparation Reagent blank	1 per 20 samples or batch per matrix	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.	Documented source of contamination.
Laboratory Control Sample (Advisory Limits)	1 per 20 samples per matrix	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate (Advisory Limits)	1 per 10 samples per batch, per matrix	75%≤%Rec.≤125% or ± 3 standard deviations of the mean from historical data points.	If matrix spike recovery does not meet criteria, qualify results in accordance with Regional criteria.

Sources: Analytical Method, USEPA 1983; Advisory Limits, USACE 1998.

Table 2-20
Quality Control Method Criteria for Herbicides by SW-846 8151A

Procedure	Frequency of QC Procedure	Acceptance Criteria					Corrective Action
Initial calibration curve 5-pt curve	Set-up, major maintenance	%RSD<20% of the response factor from the initial curve. Lab may use first or higher order regression fit (r ≥ 0.99) if %RSD > 20%.					Must meet criteria prior to sample analysis
Continuing calibration (calibration check)	Daily	%D recovery ± 15% of the response factor from the initial curve.					If criteria are not met, reanalyze the daily standard. If the daily standard fails a second time, initial calibration must be repeated.
Independent reference standard (LCS)	Every batch for all compounds (advisory limits)	70-130% or as lab specified QC limits.					%R are outside criteria, sample batch should be re-calibrated and re-analyzed. If still outside criteria, qualify associated data biased high or biased low as appropriate.
Method blanks	1 per batch	No target analytes below 5% of the decision limit, 5% of the sample concentrations, or the MDL, whichever is higher.					Document source of contamination.
Surrogate spikes	Every sample	Standards	Aqueous %R		Solid %R		Investigate to determine cause, correct the problem, and document actions taken; re-extract and re-analyze sample. If still out, qualify.
		2,4-dichlorophenyl-acetic acid	70-130%		70-130%		
Matrix spike and duplicate	1 per 20 samples per matrix (Advisory Limits)	Standards	Aqueous %R	RPD	Solid %R	RPD	Data reviewer may use the MS and MSD results in conjunction with other QC sample results to determine the need for some qualification of the data. Specific method cleanups may be used to eliminate or minimize sample matrix effects.
		2,4-D	50-150	≤25	50-150	≤35	
		2,4,5-TP	50-150	≤25	50-150	≤35	
		Pentachlorophenol	50-150	≤25	50-150	≤35	

Sources: Analytical Method, USEPA 1996; Advisory Limits, USACE 1998.

3.0 Health and Safety Plan Addendum

1.0 INTRODUCTION

This document is an addendum to the RFAAP MHSP (URS, 2002). The purpose of this addendum is to supplement the MHSP with site-specific information. This Health and Safety Plan Addendum (HSPA) follows the outline of the MHSP, with changes or additions to each section of the MHSP noted in the corresponding section of the HSPA.

1.1 OBJECTIVE AND SCOPE

The objective of this HSPA is to identify and communicate potential health and safety concerns associated with the completion of WPA 12 that are not covered in the MHSP. WPA 12 consists of sampling activities at eight sites in the MMA and six sites in the NRU at RFAAP. MMA sites are SWMU 39, SWMU 48, SWMU 49, SWMU 50, SWMU 58, SWMU 59, AOC–FLFA, and AOC–Former Cadmium Plating Facility (Building 4343). NRU sites covered in Addendum 12 are the BDDT, IAA, NBG, WBG, RY, and the BLA.

1.2 REGULATIONS AND GUIDELINES

There are no changes to this section of the MHSP.

1.3 REFERENCES

There are no changes to this section of the MHSP.

1.4 SITE SAFETY AND HEALTH DOCUMENTATION

There are no changes to this section of the MHSP.

1.5 SAFETY STATEMENT

There are no changes to this section of the MHSP.

2.0 PROJECT ORGANIZATION

2.1 HEALTH AND SAFETY PERSONNEL AND RESPONSIBILITIES

There are no changes to this section of the MHSP.

2.2 SUBCONTRACTOR RESPONSIBILITIES

There are no changes to this section of the MHSP.

2.3 SITE PERSONNEL

There are no changes to this section of the MHSP.

2.4 VISITORS

There are no changes to this section of the MHSP.

2.5 RFAAP PROJECT PERSONNEL

There are no changes to this section of the MHSP.

3.0 PROJECT ASSESSMENT AND HAZARD CONTROL

3.1 CHEMICAL HAZARDS

Chemical hazards that may be potentially encountered during the implementation of this WPA include constituents of the following analyte classes:

- TCL VOCs,
- TCL SVOCs, including PAHs,
- TCL pesticides/PCBs,

- Explosives,
- Metals,
- Herbicides,
- Dioxins and/or furans, and
- Perchlorate.

Table 9-1 of the MHSP presents occupational exposure limits (if available) for potential contaminants, including OSHA PELS, ACGIH TLVs, and NIOSH IDLH values.

3.2 PHYSICAL HAZARDS

There are no changes to this section of the MHSP.

3.3 BIOLOGICAL HAZARDS

There are no changes to this section of the MHSP.

4.0 TRAINING PLAN

4.1 GENERAL

There are no changes to this section of the MHSP.

4.2 OSHA HAZARDOUS WASTE OPERATIONS TRAINING

There are no changes to this section of the MHSP.

4.3 SITE-SPECIFIC AND HAZARD INFORMATION TRAINING

There are no changes to this section of the MHSP.

4.4 FIRST AID AND CPR TRAINING

There are no changes to this section of the MHSP.

4.5 BLOODBORNE PATHOGEN TRAINING

There are no changes to this section of the MHSP.

4.6 HEARING CONSERVATION TRAINING

There are no changes to this section of the MHSP.

4.7 HAZARD COMMUNICATION TRAINING

There are no changes to this section of the MHSP.

4.8 CONFINED SPACE ENTRY TRAINING

No confined space entry will be performed as part of this investigation.

4.9 ADDITIONALLY REQUIRED OSHA TRAINING

There are no changes to this section of the MHSP.

4.10 BUDDY SYSTEM TRAINING

There are no changes to this section of the MHSP.

4.11 DAILY SAFETY MEETINGS

A Site Safety Briefing will be conducted daily by the SHSO to communicate health and safety information to field team members. There are no changes to this section of the MHSP.

4.12 WEEKLY SAFETY MEETINGS

61

A Weekly Safety Meeting will be held for intrusive work to discuss status of site health and safety. There are no changes to this section of the MHSP.

5.0 MEDICAL SURVEILLANCE PLAN

5.1 INTRODUCTION

There are no changes to the medical surveillance plan.

6.0 SITE SAFETY AND CONTROL

6.1 SITE SAFETY

There are no changes to this section of the MHSP.

6.2 SITE CONTROL

There are no changes to this section of the MHSP.

7.0 PERSONNEL PROTECTIVE EQUIPMENT AND CLOTHING

7.1 LEVELS OF PROTECTION

There are no changes to this section of the MHSP.

7.2 PROTOCOLS FOR CHANGING LEVELS OF PROTECTION

There are no changes to this section of the MHSP.

7.3 RESPIRATOR SELECTION AND FIT TEST

There are no changes to this section of the MHSP.

8.0 PERSONNEL AND EQUIPMENT DECONTAMINATION

8.1 MODIFIED LEVEL D DECONTAMINATION

There are no changes to this section of the MHSP.

8.2 LEVEL C DECONTAMINATION

Fieldwork will be conducted in USEPA Modified Level D PPE. Therefore, this section does not apply to the WPA.

8.3 LEVEL B DECONTAMINATION

Fieldwork will be conducted in USEPA Modified Level D PPE. Therefore, this section does not apply to the WPA.

8.4 LEVEL A DECONTAMINATION

Fieldwork will be conducted in USEPA Modified Level D PPE. Therefore, this section does not apply to the WPA.

8.5 OTHER DECONTAMINATION/DISPOSAL PROCEDURES

There are no changes to this section of the MHSP.

8.6 DECONTAMINATION DURING MEDICAL PROCEDURES

There are no changes to this section of the MHSP.

8.7 PERSONNEL DECONTAMINATION SEQUENCE

Fieldwork will be conducted in USEPA Modified Level D PPE. Therefore, Section 8.7.2 applies to this WPA.

9.0 MONITORING PLAN

9.1 INTRODUCTION

There are no changes to this section of the MHSP.

9.2 MONITORING INSTRUMENTS

There are no changes to this section of the MHSP.

9.3 TYPES OF MONITORING

There are no changes to this section of the MHSP.

9.4 ACTION LEVELS

There are no changes to this section of the MHSP.

9.5 NOISE MONITORING

Hearing protection will be worn during direct push and drilling activities.

9.6 HEAT AND COLD STRESS MONITORING

There are no changes to this section of the MHSP.

9.7 METEOROLOGICAL MONITORING

There will be no removal activities to produce chemical releases. Thus, meteorological monitoring will not be required.

9.8 CALIBRATION AND MAINTENANCE OF MONITORING EQUIPMENT

There are no changes to this section of the MHSP.

10.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

There are no changes to this section of the MHSP.

10.1 PRE-EMERGENCY PLANNING

There are no changes to this section of the MHSP.

10.2 EMERGENCY RESPONSE RESPONSIBILITIES

There are no changes to this section of the MHSP.

10.3 EMERGENCY TRAINING

There are no changes to this section of the MHSP.

10.4 EMERGENCY SITE CONTROL AND SECURITY

There are no changes to this section of the MHSP.

10.5 ONSITE EMERGENCY EQUIPMENT

There are no changes to this section of the MHSP.

10.6 MEDICAL FACILITIES

Maps to medical facilities will be posted in the field trailer and each field vehicle during field operations. There are no changes to this section of the MHSP.

10.7 CONTINGENCY PLANS

There are no changes to this section of the MHSP.

10.8 EMERGENCY RESPONSE AND DECONTAMINATION PROCEDURES

There are no changes to this section of the MHSP.

10.9 EMERGENCY CONTACT/NOTIFICATION SYSTEM

There are no changes to this section of the MHSP.

4.0 References

Alliant Techsystems, Inc. (ATK). 1998. *Risk Assessment and Closure Certification for the Former Incinerator Spray Pond at the Radford Army Ammunition Plant, Radford, VA.*

Dames & Moore. 1992. *Final Draft Verification Investigation.* Prepared for U.S. Army Toxic and Hazardous Materials Agency, Radford Army Ammunition Plant, October 1992.

Dames & Moore. 1998. *Draft Summary Report – Soil Sampling Results at Bldgs. 8102-7, 8102-2, 407, 502, 504 & 571, New River Storage Depot, Radford Army Ammunition Plant, Radford, Virginia.* Prepared for Alliat TechSystems, Inc.

ICF Kaiser Engineers, Inc. (ICF KE). 1999. *RCRA Facility Investigation Reports for Solid Waste Management Units 31, 39, 48, 49, and 58.* Draft, Radford Army Ammunition Plant. Prepared for the U.S. Army Environmental Center, Aberdeen Proving Ground, MD.

Parsons Engineering Science, Inc. (Parsons). 1996. *RCRA Facility Investigation Work Plan for Solid Waste Management Units 17, 31, and 48 and Corrective Measures Study Work Plan for Unit 54 at Radford Army Ammunition Plant.* Prepared for the U.S. Army Environmental Center.

URS. 2002. *Master Work Plan Update, Draft, Radford Army Ammunition Plant.* Prepared for the U.S. Army Corps of Engineers (USACE), Baltimore District.

U.S. Army Corps of Engineers (USACE). 1998. *Shell for Analytical Chemistry Requirements.* December.

U.S. Environmental Protection Agency (USEPA). 1987. *RCRA Facility Assessment of Radford Army Ammunition Plant, Radford, Virginia.*

U.S. Environmental Protection Agency (USEPA). 1992. *Installation Assessment, Radford Army Ammunition Plant, Radford, VA.* Environmental Photographic Interpretation Center (EPIC).

U.S. Environmental Protection Agency (USEPA). 1996. *Test Methods for Evaluating Solid Waste Physical/ Chemical Methods, Update III.* December.

411

Appendix A
Previous Investigation
Analytical Results Tables

Appendix B
Statements of Qualifications

STATEMENTS OF QUALIFICATIONS

Rick Swahn – Program Manager, is a registered professional geologist with more than sixteen years experience managing large Army HTRW environmental projects throughout the USACE North Atlantic District (NAD), most of them cost reimbursable. Mr. Swahn has managed as well as performed all aspects of these projects to include preliminary assessments, site investigations, RI/FS studies, proposed plan and ROD decision documents, remedial action planning and design, and military installation compliance activities. Throughout his career, Mr. Swahn's responsibilities have included scoping, estimating, scheduling, and managing numerous multi-tasked, multi-disciplined projects most budgeted in the multi-million dollar range. Currently, Mr. Swahn is managing the preparation of an EE/CA decision document of the Colonie FUSRAP site, located in Albany, NY for the NAD under the Baltimore TERC.

Jeffrey Parks – Project Manager, is a registered professional geologist with over 19 years of personnel and project management, geologic, hydrogeologic, and hazardous waste management experience. Mr. Parks' expertise is in HTRW projects, RI/FSs, RFIs, RCRA permitting and remedial actions. He is currently responsible for senior management of U.S. Army Corps of Engineers remedial investigation, feasibility study, and remediation projects. He has just completed and submitted a RCRA Part B, Subpart X permit application for open burning and open demolition for a U.S. Army Arsenal in New Jersey. Mr. Parks has been the senior hydrogeologist and project manager for USEPA-funded uncontrolled hazardous waste sites, and for soil and groundwater investigations for the Washington D.C. Department of Public Works and the Washington Metropolitan Area Transit Authority, and a team member of the Federal Aviation Authority-expedited response action group. Mr. Parks is the Technical Manager for Scientists in IT's Edgewood office and Assistant Manager of Hydrogeology for IT's Northern Division. Responsibilities included guidance for scientists in addition to project staffing, mentoring, and yearly progress evaluations.

Timothy Leahy – Task Manager, is a geologist with eight years experience in the environmental field. Mr. Leahy has been employed by the IT Corporation for one year. His prior work experience includes seven years as a geologist at Dames and Moore, where he gained considerable and valuable experience with CERCLA RI/FSs at military installations in the northeastern United States. He has served as a Field Manager, Field Team Leader, Geologist and Site Health and Safety Officer on these projects. His academic background includes a MS in geology, specializing in geochemistry, from Dartmouth College in Hanover, New Hampshire and a BA in geology from the University of Pennsylvania in Philadelphia, PA. Mr. Leahy is skilled in the areas of technical analysis and report writing, monitoring well design and installation, and geologic field methods. He has recently completed the design of a field program to characterize and delineate groundwater contamination at a regional level for the central industrial area at Picatinny Arsenal in northern New Jersey.

Mark Thomas – Field Team Leader & Site Health and Safety Officer, is a biologist and has been involved in the environmental field for the past eleven years. His academic background includes a strong emphasis on both wildlife and fisheries management. Mr. Thomas has gained considerable and valuable experience during his tenure with ICF Kaiser and the IT Corporation. He has served as the Field Operations Leader, Field Team Leader and Site Health and Safety Officer for the sampling of sediment, sludge, surface soil, subsurface soil, surface water, groundwater, air, fish, and crabs. Mr. Thomas is skilled in the areas of technical report writing, water quality analysis, Global Positioning System (GPS) and LORAN operation, necropsy techniques, and motor boat operation, navigation, and maintenance. Mr. Thomas is also experienced in the collection and identification of estuarine fish, plants, and invertebrates. Before joining the IT Corporation, Mr. Thomas was employed by the Maryland Department of Natural Resources under the Fisheries Division where he gained valuable field sampling and research experience.

Dave Kateley – Health and Safety Manager, has over twenty years of experience in environmental management. He has served as a Site Safety Officer, Hazardous Materials Specialist, Construction Superintendent/Site Safety Officer, and Construction Engineer. Mr. Kateley acted as the Safety Officer at the Hunter Army Airfield tank removal and site remediation project at Fort Drum, New York. The project demanded close interactions with the U.S. Army Corps of Engineers and implementation of all related safety concerns. Duties included daily safety meetings, site sampling, and keeping all records and logs pertaining to the safety program. As a Construction Superintendent and Site Safety Officer, Mr. Kateley supervised the construction of the out buildings and fencing at the G Street Superfund project on Aberdeen Proving Grounds, Edgewood Area. He incorporated procedures dealing with Superfund and hazardous waste sites, as in air monitoring, donning/doffing levels A through C PPE, and writing the Site Specific Safety Plan. As a Construction Engineer, Mr. Kateley was responsible for all construction layout procedures, including the use of transits and building levels for grade and line. He also coordinated subcontract work for various multi-million dollar contracts.

Eric Malarek – Quality Assurance Manager, is a chemist for the IT Corporation. His primary responsibilities include project chemical management, consulting, and technical support for a variety of public and private environmental projects. He has over 10 years of professional experience in the environmental testing field including laboratory management, quality assurance and quality control, data management, field sampling, and methods development. This includes three years of managing a laboratory and seven years as Quality Assurance Officer. His experience with the laboratory covers environmental analysis for sample matrices including groundwater, surface water, drinking water, soil, sediment, sludge, and waste. His familiarity with laboratory methods includes CLP Statements of Work, USEPA 500- and 600-Series Organic Methods, SW-846 Test Methods for Evaluating Solid Waste, Standard Methods for the Examination of Water and Wastes, and Methods for Chemical Analysis of Water and Waste. As QA Officer, he has written and implemented FLDEP Laboratory Quality Assurance Plans and Site-Specific Quality Assurance Project Plans. He has served as the Laboratory CLP Coordinator for Inorganics with the USEPA CLP Program. Mr. Malarek has performed system and performance audits and implemented corrective action procedures. In addition, he was involved in data reduction, review, and validation to ensure date integrity to meet the data quality objectives. He also was employed by the USEPA to perform inorganic analysis on environmental samples. He holds a Bachelor's degree in Chemistry from Rutgers University and a MBA degree from the University of Central Florida.

Wendell Barner – Senior Hydrogeologist, is a registered professional geologist in five states, has more than 17 years of geological, engineering, and environmental consulting experience, and is currently the Geology and Hydrogeology Group Manager at IT Corporation's corporate office located in Monroeville, PA. His primary expertise is in karst hydrogeology and he has performed numerous RI/FS and RCRA facility investigations in karst regions throughout the United States and at international locations. Mr. Barner has authored and presented more than 16 papers on karst hydrogeology at regional and international conferences and symposiums. His experience with interdisciplinary environmental projects combines a wide-variety of responsibilities and experience including hazardous waste site characterization, groundwater-tracing studies, geologic and hydrogeologic data acquisition and analysis, and addressing aquifer remediation through the evaluation of various technologies including natural attenuation. He has worked on a number of DoD, DoE, RCRA, and CERCLA facilities, in USEPA Regions I, III, IV, V, VII, and IX, and in over 20 U.S. states and territories. Other responsibilities include project management, managing multi-PRP groups, supervising and mentoring junior staff, procuring and scheduling subcontractors, client development and proposal preparation. Other experience includes compliance monitoring, landfill and monitoring design, land planning and development, design of small wastewater treatment and disposal systems, design of stormwater systems, and land surveying.

Kweku Acquah – Project Chemist, is a chemist with the IT Corporation, Edgewood, Maryland office. His primary responsibility includes project chemical data management and validation, consulting, and technical support for a variety of environmental projects. He has over twenty years of industrial experience in various capacities with responsibilities for process and quality control management, research and development, instrumental and wet chemical analysis, laboratory management, environmental compliance, environmental site assessment and characterization, chemical waste characterization, lab-packing, manifesting and coordinating hazardous waste disposal activities. He has worked for such reputable companies as General Electric Company in Liverpool, NY, Polaroid Corporation in New Bedford and Norwood, MA, SGS/Commercial Testing & Engineering in Dundalk, MD, Chem Clear of Baltimore (Clean Harbor) in Baltimore, MD and Chemical Waste Management at DOD sites at APG, Aberdeen, MD, Bermuda, Puerto Rico and the US Virgin Islands. He holds a Bachelor's degree in Chemistry and Environmental Science from Syracuse University and also undertook some graduate studies in Analytical Chemistry and Economics at Northeastern University in Boston, MA.

Sue Reinhardt - Contract Specialist, has twelve years of experience in finance, contracts, and business planning. She holds a B.B.A. in finance from James Madison University, Harrisonburg, Virginia, and a M.S.B. in International Business from Johns Hopkins University, Baltimore, Maryland. At the IT Corporation, Ms. Reinhardt is currently working under two multi-task order projects for the U.S. Army. The contracts total over $50 M and work is performed at various Army installations in the U.S. Ms. Reinhardt is the contract, subcontract, and financial manager for these programs. Ms. Reinhardt also provides the property and warehouse management for these programs. In addition, she provides business unit financial support for the Abingdon/Edgewood office. Ms.

Reinhardt has recently increased her responsibilities by assisting the Director of Finance in the EEG Southeast reporting capacity.