RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Building 4343
Interim Measures Work Plan

Prepared for:

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

Prepared by:

Shaw Environmental, Inc.
2113 Emmorton Park Rd.
Edgewood, MD 21040

Final Document

October 2006

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

October 20, 2006

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

Subject: Building 4343 Interim Measures Work Plan, Final Document, October 2006
Radford Army Ammunition Plant Installation Action Plan
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is one copy of the subject document. It has been revised per your letter of September 20, 2006. Your additional copy as well as copies for the Virginia Department of Environmental Quality are to be sent under separate cover.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Russell Fish, P.E., EPA Region III

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

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JMcKenna

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U.S. Army Environmental Center, Office of Counsel
Beal Road, Bldg E4460
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Dennis Druck
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Tom Meyer
Corps of Engineers, Baltimore District
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Guy Rhodes
Corps of Engineers, Norfolk District
Southwest Virginia Area Office
Building 449
Radford, VA 24141

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

Coordination: J. McKenna M. A. Miano

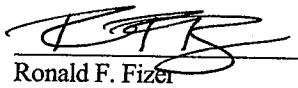
06-815-170
JMcKenna

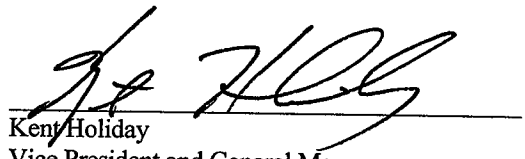
Concerning the following:

Building 4343 Interim Measures Work Plan
Final Document, October 2006

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: Ronald F. Fizer
TITLE: Lieutenant Colonel, US Army
Commanding Officer

SIGNATURE: 
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems Division
Alliant Techsystems Inc.

06-815-170
JMcKenna

C: Hoot
Reeder
Holt
Mckenna
ENV file

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

Robert Thomson, P.E.
Office of Federal Facility Remediation & Site Assessment

Direct Dial (215) 814-3357
Mail Code: 3HS11

Date: September 20, 2006

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

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

P.W. Holt
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant, Va.
Building 4343
Draft *Interim Measures Work Plan*
Review of Army's 8/31/06 response to EPA's 6/19/06 letter

Dear Mr. McKenna and Ms. Holt:

The U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army's (Army's) August 31, 2006 response to EPA's June 19, 2006 letter regarding the review of the Army's April, 2006 draft *RCRA Interim Measures Work Plan* (IMWP) for the remediation of the Building 4343 area, located at the Radford Army Ammunition Plant (RFAAP). Based upon that review, we find the Army's response to be acceptable. In accordance with Part II. (E)(5) of RFAAP's Corrective Action Permit, the *Interim Measures Work Plan* can be finalized.

Please make the appropriate revisions to the draft *Interim Measures Work Plan* based upon the Army's response, and proceed to finalize the *Interim Measures Work Plan*. Please update the IM schedule contained on Figure 2-6 to reflect the current project implementation timeline. The final Figure 2-6 contained in the final *Interim Measures Work Plan* will constitute the enforceable schedule for this project.

Please forward two complete copies of the final *Interim Measures Work Plan* for Building 4343 to EPA for insertion into the project files.

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

Sincerely,

Robert Thomson, PE, REM
Office of Federal Facility Remediation and Site Assessment

cc: Russell Fish, EPA
Leslie Romanchik, VDEQ-RCRA
James Cutler, VDEQ-CERCLA

received
9-14-06

06-99

c: Holt
Lockard
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Fleet
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COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
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Mailing address: P. O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
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David K. Paylor
Director

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

September 11, 2006

Mr. Jim McKenna
Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, Virginia 24143-0100

Re: Building 4343 Interim Measures Work Plan, Radford Army Ammunition Plant

Dear Mr. McKenna:

The Virginia Department of Environmental Quality (VDEQ) has reviewed the Building 4343 Interim Measures Work Plan dated August 2006. Per our discussions at the June 21, 2006 meeting at EPA, VDEQ concurs with the workplan as finalized.

Please contact me at (804) 698-4498 if you have any questions or comments regarding the above site.

James L. Cutler, Jr., CPG
Federal Facilities Project Manager

cc: Paige Holt, ATK
Robert Thompson, US EPA Region 3
Durwood Willis, DEQ
Norman Auldridge, VDEQ-WCRO

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

August 31, 2006

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

Subject: Building 4343 Interim Measures Work Plan, Final Document, August 2006
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Ref: EPA letter dated June 19, 2006 (06-74)

Dear Mr. Thomson:

Enclosed are two copies of the subject document and our responses to comments contained in your June 19, 2006 letter regarding the draft document. We discussed these responses in our June 21, 2006 meeting at your office and per this meeting we are proceeding with the work. Note draft minutes of this meeting were sent out July 10, 2006.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Russell Fish, P.E., EPA Region III

Jim Cutler
Virginia Department of Environmental Quality
P. O. Box 10009
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Karen Colmie
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Guy Rhodes
Corps of Engineers, Norfolk District
Southwest Virginia Area Office
Building 449
Radford, VA 24141

Coordination: J. McKenna
J. McKenna

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

Concerning the following:

Building 4343 Interim Measures Work Plan
Final Document
August 2006

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: Ronald F. Fizer
TITLE: Lieutenant Colonel, US Army
Commanding Officer

SIGNATURE: _____
PRINTED NAME: Kent Holiday
TITLE: Vice President and General Manager
ATK Energetics Systems Division

Response to USEPA Comments received 19 June 2006
for
Draft Building 4343 RCRA Interim Measures Work Plan
April 2006

EPA Comment 1

The Technical Approach presented in Section 2 states that the soil excavation will be performed using on a 20 ton excavator or trackhoe, and that soils will be directly loaded for disposal. There is no discuss presented on how the leading edge of the excavation will move forward, or what methods will be employed to prevent cross-contamination at the point of load out. Typically, plastic sheeting or tarps are used to prevent cross-contamination due to spillage during loading. Please revise the IMWP to include a detailed discussion regarding how the excavation face will be moved, where excavation will start, how it will be determined when backfilling can be initiated, how backfilling and excavation activities will remain separated to ensure all soils above the remedial goal are removed, and how the load-out area will be maintained to prevent cross-contamination or spillage.

RFAAP Response

The following text will be added to Section 2.2.2:

"Plastic sheeting and plywood will be used to construct a temporary loading zone for the trucks to stage on while being loaded. The plastic sheeting will extend from the truck to the edge of the excavation zone. The temporary loading zone will be moved as the leading edge of the excavation moves forward. Excavation will start at the top of the drainage ditch and progress down the hillside towards the base of the ditch. Backfilling will commence after the excavation has been completed and analytical results from the confirmation samples has demonstrated that soil above the RG (70.3 mg/kg) has been removed from the site."

EPA Comment 2

The IMWP indicates in Section 2 that following excavation, confirmation samples will be collected where cadmium was detected above the remedial goal of 70.3 mg/kg. The IMWP does not specify the minimum spacing between the samples, and no sampling locations are proposed. Therefore, there do not appear to be any procedures in place to ensure a minimum spacing between samples, or a sufficient number of samples are collected to confirm the remedial goal is met. Furthermore, no discussion is presented on how conservative it is to use previous data points to ensure all soils above the remedial goal have been removed. The excavation face is a dynamic environment, and it may be difficult to ensure that previous sampling locations are reproducible data points after all soils above the remedial goal have been removed. Revise the IMWP to include a discussion on how the proposed confirmation sampling program will ensure a minimum spacing of samples, which of the sampling strategies presented in SOP 30.7 is being employed, and a means of ensure the integrity of previous sampling points after the excavation of all soils above the remedial goal.

RFAAP Response

Several rounds of sampling have been conducted at B4343. 39 surface soil and 36 subsurface soil samples collected in 1999, 5 surface soil and 3 subsurface soil in 2002, and 20 surface soil samples in 2004. The work plan specifies an additional 60 samples will be collected to delineate the extent of the soil above the RG prior to excavation.

The following text will be added to Section 2.2.2 of the Work Plan:

"Locations for the confirmation samples have not been specified because they will be dependent on the exact area that will be excavated. Minimum spacing of the samples vary depending on the location along the ditch. The minimum spacing in areas along the ditch, where previous sampling has shown that contamination is confined to the ditch will be greater than the spacing in the "delta" area where deposition

of cadmium-containing soil is more variable. **Figure 2-6** shows the location of 20 of the confirmation samples. These samples will be collected from the side wall of the excavation closest to the appropriate delineation sample. Locations of the delineation samples will be marked perpendicular to the excavation. The remaining samples will be located by the site supervisor and project manager based on the final delineation of the area to be excavated. The sampling strategy to be employed is a biased sampling strategy (SOP 30.7), since known sources have been previously identified."

EPA Comment 3

The confirmation sampling proposed at the Sump/Building 4343/Concrete Floor Removal area is discussed in Section 2.2.4. Five confirmation samples are to be collected, but no proposed minimum spacing is presented, and no sampling locations are proposed. Revise the IMWP to include a discussion on how the proposed confirmation sampling program will ensure a minimum spacing between samples, and which of the sampling strategies presented in SOP 30.7 is being employed.

RFAAP Response

The following text will be added to Section 2.2.4 of the Work Plan:
"Confirmation samples will be collected from the each of the four sidewalls and the floor of the excavation. During removal of the foundation and sump, the concrete and soil under the foundation will be visibly inspected for cracks/leaks or discolored soil that may indicate a contaminant pathway Sampling will follow a biased sampling strategy (SOP 30.7) based on these observations. If visible indications are not detected, the sample beneath the floor will be collected adjacent to the sump."

EPA Comment 4

Decontamination is not discussed within the Technical Approach of the IMWP. SOP 80.1 discusses decontamination facilities, but where they will be located, or how they will be managed in conjunction with the excavation face is not discussed. Please revise the IMWP to address the decontamination process in relationship to conducting and proceeding with the excavation process.

RFAAP Response

The following text will be added to Section 2.2.2 of the Work Plan.
"A decontamination pad will be set up onsite for the excavator. The excavator will be decontaminated prior to use; after completion of the excavation phase; and after completion of the project. Decontamination procedures will follow those in SOP 80.1 for a drill rig. In addition, a small, temporary decon pad will be set up to decon sampling equipment onsite. Decon water will be pumped out of the pads and containerized in 55 gallon drums."

EPA Comment 5

Erosion and sedimentation control features are discussed in Section 6.4 of the Erosion and Sedimentation Plan, but there are no figures or drawings showing the minimum erosion and control features which need to be implemented. This is a primary concern given that some of the features to be excavated are drainage features. Please revise the IMWP to include a figure showing the minimum requirements for the erosion and control features. Please also ensure that erosion and sedimentation control is included as a definable feature of work under Section 9.10.

RFAAP Response

Sediment and erosion control are included as a definable feature of work in Section 9.10, under 9.10.1.2 – Site Preparation. A figure will be added to Section 6.4 of the Erosion and Sediment Control Plan that depicts the location and length of sediment erosion control measures, such as silt fences and hay bales. Vegetative stabilization will be performed at the completion of the project, after returning the site to its

natural grade.

EPA Comment 6
The Waste Transportation and Disposal Plan in Section 7.0 does not discuss the lead-based paint under Anticipated Waste Streams, which was discussed in the Technical Approach. Please revise the IMWP to be consistent in the discussion of waste streams. If lead-based paint is believed to be in the structure to be removed, it should be discussed as an Anticipated Waste Stream. Please also ensure that the Health and Safety Plan in Section 8.0 discusses the lead-based paint, as it is not listed in Table 8-2, or provide an explanation why it is unnecessary.

RFAAP Response

Lead based paint will be included as an Anticipated Waste Stream and included in the Health and Safety Plan.

EPA Comment 7
The Contractor Quality Control Plan in Section 9 does not provide for the procedures and means of ensuring that the items identified in Section 9.10, Definable Features of Work, are actually implemented. Criteria or procedures for verifying that each of these work features has been implemented according to the IMWP need to be established. Revise the Quality Control Plan to include a table or text with tasks that will be completed to ensure that each of these features of work has been completed.

RFAAP Response

Section 9.5 - Submittals, Section 9.6 – Inspections and Section 9.9 – Reports provide information on the Definable features of work. As stated in Section 9.6.1 – Implementation of the 3-Phase Inspection Process, "The CQC System Manager is to ensure that the 3-phase control process is implemented for each definable feature of work listed in Section 9.10." Inspection forms that track whether definable features of work have been implemented/completed are presented in **Appendix H**.

EPA Comment 8
Section 1.3.1 on page 1-7 states that cadmium is the primary constituent presenting a concern. However, the section further states that three other metals (chromium, iron, and lead) were detected at concentrations greater than industrial screening levels in soil and three metals (antimony, copper, and vanadium) and one organic compound (Arochlor-1254) had concentrations greater than residential screening levels. Based on exceedances of these other chemicals, it is unclear why a remedial goal was only developed for cadmium, and the delineation and confirmation samples will only be analyzed for cadmium. There is no information presented to support that all of these chemicals above screening levels are co-located and cleaning up for cadmium addresses all of these other chemicals. This issue should be clarified in the IM Work Plan.

RFAAP Response

Remedial goals were developed based on the Human Health Risk Assessment (HHRA) presented in the USEPA-approved Building 4343 RFI/CMS. The HHRA identified cadmium as the sole contaminant of interest (COI) for the site under both industrial and residential future land-use conditions.

EPA Comment 9

Section 3.3.3 on page 3-2 states that the borrow material and top soil will be sampled and analyzed to confirm that it is usable for site fill. Table 3-1 on page 3-5 shows that one sample will be collected from the borrow soil and the top soil for chemical analysis. One sample is not sufficient to determine if the soil is acceptable. The collection of additional soil samples for chemical analysis should be considered. In addition, it is not clear what criteria the chemical results will be compared to in order to determine if the fill is acceptable (i.e., background, human health and/or ecological screening levels). Information should be presented on how this chemical data will be evaluated.

RFAAP Response

The borrow material and top soil provider will be required to demonstrate that the material is certified clean. The sample collected and analyzed by the Army is meant to confirm that this is the case. As the site is being restored for potential future residential use, human health and background criteria will be used to determine if the fill is acceptable. This information will be added to the work plan in Section 3.3.3.

ATK
ALLIANT TECHSYSTEMS

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

August 14, 2006

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

Subject: Building 4343 Interim Measures Work Plan, Draft Final Document, April 2006
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

We request an extension to September 30, 2006, to respond to comments from your letter dated June 19, 2006 on the subject document. We are in the process of finalizing the subcontractor information to include in the final document that is to be submitted with our responses. We discussed our responses to these comments in our June 21, 2006 meeting at your office and per this meeting we are proceeding with the work. Note draft minutes of this meeting were sent out July 10, 2006.

Please coordinate with and provide any questions or comments to myself at (540) 639-8658, Jerry Redder of my staff (540) 639-7536 or Jim McKenna, ACO Staff (540) 639-8641.

Sincerely,

P.W. Holt, Environmental Manager
Alliant Techsystems Inc.

c: Russell Fish, P.E., EPA Region III

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

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Building 449
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Coordination: J. McKenna

bc: Administrative File
J. McKenna, ACO Staff
Rob Davie-ACO Staff
P. W. Holt
J. J. Redder
Env. File

06-815-145
JMcKenna

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

June 19, 2006

In reply
Refer to 3HS11

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

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

Paige Holt
Environmental Manager
Alliant Techsystems, Inc.
Radford Army Ammunition Plant
P.O. Box 1
Radford, VA 24141-0100

Re: Radford Army Ammunition Plant, Radford , Va
Building 4343
Review of the Army's draft *RCRA Interim Measures Work Plan*

Dear Mr. McKenna and Ms. Holt:

The U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army's (Army's) April, 2006 draft *RCRA Interim Measures Work Plan* (IMWP) for the remediation of the Building 4343 area, located at the Radford Army Ammunition Plant (RFAAP). Outlined below, please find EPA's comments based upon that review:

1. The Technical Approach presented in Section 2 states that the soil excavation will be performed using on a 20 ton excavator or trackhoe, and that soils will be directly loaded for disposal. There is no discuss presented on how the leading edge of the excavation will move forward, or what methods will be employed to prevent cross-contamination at the point of load out. Typically, plastic sheeting or tarps are used to prevent cross-contamination due to spillage during loading. Please revise the IMWP to include a detailed discussion regarding how the excavation face will be moved, where excavation will start, how it will be

determined when backfilling can be initiated, how backfilling and excavation activities will remain separated to ensure all soils above the remedial goal are removed, and how the load-out area will be maintained to prevent cross-contamination or spillage.

2. The IMWP indicates in Section 2 that following excavation, confirmation samples will be collected where cadmium was detected above the remedial goal of 70.3 mg/kg. The IMWP does not specify the minimum spacing between the samples, and no sampling locations are proposed. Therefore, there do not appear to be any procedures in place to ensure a minimum spacing between samples, or a sufficient number of samples are collected to confirm the remedial goal is met. Furthermore, no discussion is presented on how conservative it is to use previous data points to ensure all soils above the remedial goal have been removed. The excavation face is a dynamic environment, and it may be difficult to ensure that previous sampling locations are reproducible data points after all soils above the remedial goal have been removed. Revise the IMWP to include a discussion on how the proposed confirmation sampling program will ensure a minimum spacing of samples, which of the sampling strategies presented in SOP 30.7 is being employed, and a means of ensure the integrity of previous sampling points after the excavation of all soils above the remedial goal.

3. The confirmation sampling proposed at the Sump/Building 4343/Concrete Floor Removal area is discussed in Section 2.2.4. Five confirmation samples are to be collected, but no proposed minimum spacing is presented, and no sampling locations are proposed. Revise the IMWP to include a discussion on how the proposed confirmation sampling program will ensure a minimum spacing between samples, and which of the sampling strategies presented in SOP 30.7 is being employed.

4. Decontamination is not discussed within the Technical Approach of the IMWP. SOP 80.1 discusses decontamination facilities, but where they will be located, or how they will be managed in conjunction with the excavation face is not discussed. Please revise the IMWP to address the decontamination process in relationship to conducting and proceeding with the excavation process.

5. Erosion and sedimentation control features are discussed in Section 6.4 of the Erosion and Sedimentation Plan, but there are no figures or drawings showing the minimum erosion and control features which need to be implemented. This is a primary concern given that some of the features to be excavated are drainage features. Please revise the IMWP to include a figure showing the minimum requirements for the erosion and control features. Please also ensure that erosion and sedimentation control is included as a definable feature of work under Section 9.10.

6. The Waste Transportation and Disposal Plan in Section 7.0 does not discuss the lead-based paint under Anticipated Waste Streams, which was discussed in the Technical Approach. Please revise the IMWP to be consistent in the discussion of waste streams. If lead-based paint is believed to be in the structure to be removed, it should be discussed as an Anticipated Waste Stream. Please also

ensure that the Health and Safety Plan in Section 8.0 discusses the lead-based paint, as it is not listed in Table 8-2, or provide an explanation why it is unnecessary.

7. The Contractor Quality Control Plan in Section 9 does not provide for the procedures and means of ensuring that the items identified in Section 9.10, Definable Features of Work, are actually implemented. Criteria or procedures for verifying that each of these work features has been implemented according to the IMWP need to be established. Revise the Quality Control Plan to include a table or text with tasks that will be completed to ensure that each of these features of work has been completed.

8. Section 1.3.1 on page 1-7 states that cadmium is the primary constituent presenting a concern. However, the section further states that three other metals (chromium, iron, and lead) were detected at concentrations greater than industrial screening levels in soil and three metals (antimony, copper, and vanadium) and one organic compound (Arochlor-1254) had concentrations greater than residential screening levels. Based on exceedances of these other chemicals, it is unclear why a remedial goal was only developed for cadmium, and the delineation and confirmation samples will only be analyzed for cadmium. There is no information presented to support that all of these chemicals above screening levels are co-located and cleaning up for cadmium addresses all of these other chemicals. This issue should be clarified in the IM Work Plan.

9. Section 3.3.3 on page 3-2 states that the borrow material and top soil will be sampled and analyzed to confirm that it is usable for site fill. Table 3-1 on page 3-5 shows that one sample will be collected from the borrow soil and the top soil for chemical analysis. One sample is not sufficient to determine if the soil is acceptable. The collection of additional soil samples for chemical analysis should be considered. In addition, it is not clear what criteria the chemical results will be compared to in order to determine if the fill is acceptable (i.e., background, human health and/or ecological screening levels). Information should be presented on how this chemical data will be evaluated.

The referenced draft *IMWP* for Building 4343 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, REM
Office of Federal Facility Remediation

cc: Russell Fish, EPA
Leslie Romanchik, VDEQ-RCRA
James Cutler, VDEQ-CERCLA

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

April 19, 2006

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

Subject: Building 4343 Interim Measures Work Plan, Draft Final Document, April 2006
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

Enclosed is one copy of the subject document. Your additional three copies will be delivered under separate cover as well as those on the distribution list below.

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,

Phillip Holland for

P. W. Holt, Environmental Manager
Alliant Ammunition and Powder Company LLC

c: Russell Fish, P.E., EPA Region III

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Richmond, VA 23240-0009

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Env. File

Coordination:

J. McKenna

M. A. Miano

06-815-75
JMcKenna

Concerning the following:

Building 4343 Interim Measures Work Plan
Draft Final Document, April 2006

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: Ronald F. Fizer
TITLE: Lieutenant Colonel, US Army
Commanding Officer

SIGNATURE:
PRINTED NAME: James W. Cates
TITLE: Vice President and General Manager
ATK Ammunition and Energetics

06-815-75
JMcKenna

Radford Army Ammunition Plant
Route 114, P.O. Box 1
Radford, VA 24143-0100
USA

March 10, 2006

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

Subject: Notification of Interim Measures Action at Building 4343: Excavation of Soil for Clean Close Out, Off-site Disposal, Removal of Sumps, and Demolition of Building 4343
Radford Army Ammunition Plant
EPA ID# VA1 210020730

Dear Mr. Thomson:

This letter is to serve as certified notification of Interim Measures (IM) actions that are to be performed at Building 4343 of Radford Army Ammunition Plant (RFAAP). The IM to be performed is discussed in the Building 4343 RCRA Facility Investigation/Corrective Measures Study Report, Final Document, February 2004 (RFI/CMS). Draft IM work plans consistent with the Building 4343 RFI/CMS will be coordinated with your office and the Department of Environmental Quality for approval prior to the start of work.

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,

P. W. Holt, Environmental Manager
Alliant Ammunition and Powder Company LLC

c: Russell Fish, P.E., EPA Region III

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Rob Davie-ACO Staff
C. A. Jake
J. J. Redder
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Coordination:

J. McKenna

M. A. Miano

06-815-56
JMcKenna

Concerning the following:

Notification of Interim Measures Action at Building 4343:
Excavation of Soil for Clean Close Out, Off-site Disposal, Removal of Sumps, and Demolition of Building 4343

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: Ronald F. Fizer
TITLE: Lieutenant Colonel, US Army
Commanding Officer

SIGNATURE: _____
PRINTED NAME: K. D. Dolph
TITLE: Vice President Operations
Alliant Ammunition and Powder Company LLC

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RADFORD ARMY AMMUNITION PLANT, VIRGINIA

Building 4343
Interim Measures Work Plan

Prepared for:

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

Prepared by:

Shaw Environmental, Inc.
2113 Emmorton Park Rd.
Edgewood, MD 21040

Final Document

October 2006

RADFORD ARMY AMMUNITION PLANT
BUILDING 4343 INTERIM MEASURES

INTERIM MEASURES WORK PLAN

FINAL DOCUMENT

Jeff Parks, P.G. Date
Project Manager

Charles Hunter Date
EMARC QC Manager

Joe Hoyt, C.H.S.T. Date
EMARC Health and Safety Manager

Tom Meyer Date
USACE Project Manager

Prepared By:

SHAW ENVIRONMENTAL, INC.
2113 EMMORTON PARK ROAD
EDGEWOOD, MARYLAND 21040

OCTOBER 2006

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH.....American Conference of Governmental Industrial Hygienists
ACM .....asbestos containing material
AHERA.....Asbestos Hazardous Emergency Response Act
ARAR .....Applicable or Relevant and Appropriate Requirement
ATK .....Alliant TechSystems
CAP.....Corrective Action Plan
CAR .....Corrective Action Request
CCB.....continuing calibration blank
CCV .....continuing calibration verification
CDC .....Center for Disease Control
CFR.....Code of Federal Regulations
CGI/O2.....Combustible Gas Indicator/Oxygen
CIH.....Certified Industrial Hygienist
CMO .....Corrective Measures Objective
CMS .....Corrective Measures Study
COC .....chain-of-custody
COI.....contaminant of interest
CQC .....Contractor Quality Control
CQCP .....Contractor Quality Control Plan
CRZ.....Contamination Reduction Zone
CSP .....Certified Safety Professional
CVAA .....cold vapor atomic absorption
DOT .....Department of Transportation
DPW.....Department of Public Works
DQO.....Data Quality Objective
E&SCP.....Erosion and Sediment Control Plan
ECD.....Electron Capture Detector
EMARC .....Environmental Management and Remediation Contract
EZ.....Exclusion Zone
FAR.....Federal Acquisition Regulation
FSP.....Field Sampling Plan
ft .....feet
ft bgs.....feet below ground surface
ft msl .....feet mean sea level
GC.....gas chromatography
GC/FID .....gas chromatograph/flame ionization detector
GFAA.....Graphite Furnace Atomic Adsorption
GPC.....Gel Permeation Chromatography
HBV .....hepatitis B virus
HDPE .....high density polyethylene
HHRA .....human health risk assessment
HIV .....human immunodeficiency virus
ICP .....inductively coupled plasma emission spectroscopy
ICV.....Initial calibration verification
IDL.....Instrument Detection Limit
IDLH .....Immediately Dangerous to Life or Health
IDM.....investigation-derived material
IM.....Interim Measures
IMWP.....IMWP
LEL .....lower explosive limit
LOC.....Level of Concern
LQAP .....Laboratory Quality Assurance Plan
LCS .....laboratory control sample
mg/kg .....milligrams per kilogram Level of Concern
MMA.....Main Manufacturing Area
MS.....Matrix Spike
MSD.....Matrix Spike Duplicate
M&TE.....measurement and test equipment
MDL.....Method Detection Limit
MedEvac .....medical evacuation
MSDS.....Material Safety Data Sheet
MWP.....Master Work Plan
NEC.....National Electronics Council
NESC .....National Electric Safety Code

NIOSH .....National Institute for Occupational Safety and Health
OSHA.....Occupational Safety and Health Administration
OSIC .....On-Scene Incident Commander
OSWER.....Office of Solid Waste and Emergency Response
PAH.....polynuclear aromatic hydrocarbon
PCB.....polychlorinated biphenyl
PEL .....Permissible Exposure Limit
PID.....photoionization detector
PPE.....personal protective equipment
QA.....quality assurance
QAPP .....Quality Assurance Project Plan
QC.....quality control
QIP .....Quality Improvement Process
RCRA.....Resource Conservation and Recovery Act
RDW .....remediation-derived wastes
RFAAP.....Radford Army Ammunition Plant
RFI .....RCRA Facility Investigation
RFI .....Request for Information
RG.....Remedial Goal
RMSF.....Rocky Mountain Spotted Fever
RPD.....relative percent difference
Shaw.....Shaw Environmental, Inc.
SOP .....Standard Operating Procedure
SSHO .....Site Safety and Health Officer
SSHP.....Site Safety and Health Plan
STEL.....Short-Term Exposure Limit
SVOC.....semi-volatile organic compound
SZ.....Support Zone
TAL.....Target Analyte List
TAT.....turnaround time
TBC.....To-Be-Considered
TCL.....Target Compound List
TCLP.....Toxicity Characteristic Leaching Procedure
TLV.....Threshold Limit Value
TSCA .....Toxic Substance Control Act
USCG.....U.S. Coast Guard
TSD.....Treatment/Storage/Disposal
TSDF.....Treatment, Storage, Disposal Facility
TWA .....Time-Weighted Average
USACE .....U.S. Army Corps of Engineers
USEPA.....U.S. Environmental Protection Agency
UST.....underground storage tank
VDEQ .....Virginia Department of Environment Quality
VOC.....volatile organic compound
WTDP .....Waste Transportation and Disposal Plan

1.0 INTRODUCTION

Shaw Environmental, Inc. (Shaw) has been contracted by the U.S. Army Corps of Engineers (USACE) to perform an Interim Measures (IM) action at Building 4343, the Cadmium Plating Facility, at Radford Army Ammunition Plant (RFAAP), Radford, VA. This work plan comprises ten sections as follows: Introduction; Organization and Technical Approach Plan; Field Sampling Plan (FSP); Quality Assurance Project Plan (QAPP); Environmental Protection Plan; Erosion and Sediment Control Plan; Waste Transportation and Disposal Plan (WTDP); Site Safety and Health Plan (SSHP); Contractor Quality Control Plan (CQCP); and References. This Interim Measures Work Plan (IMWP) is presented as an addendum to, and incorporates by reference, the elements of the RFAAP Master Work Plan (MWP) (URS, 2003), including Section 8, which discusses entry to the Installation and security concerns and requirements.

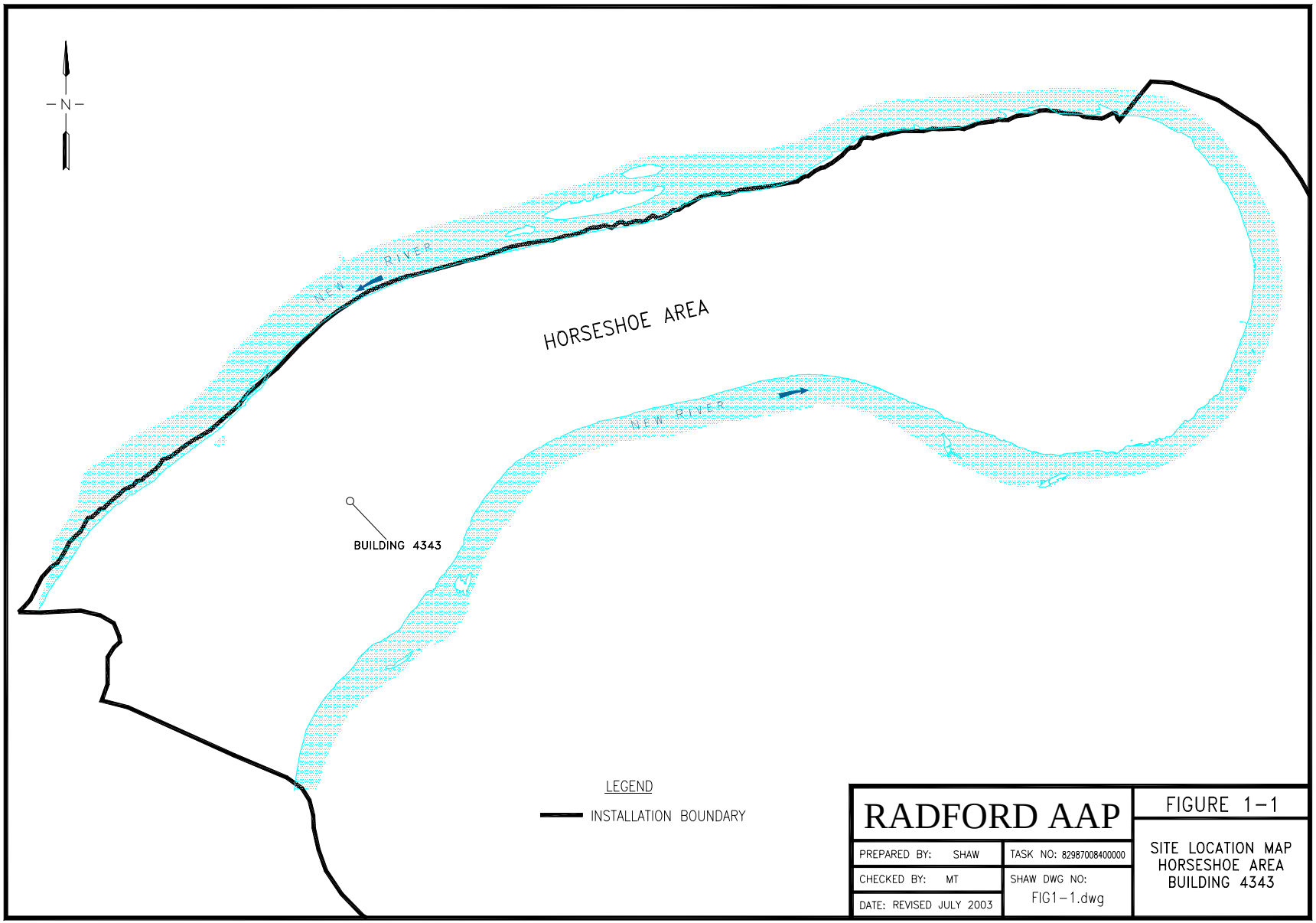
This IMWP details site-specific procedures for the interim measures at Building 4343. Specifically, this IMWP addresses the removal of soil with concentrations of cadmium to below the Residential Remedial Goal of 70.3 mg/kg to facilitate clean close out in accordance with Part II(D)(11-21) Interim Measures of the RFAAP Corrective Action Permit (USEPA, 2000a). This work plan also includes the removal of Building 4343 (including the outside concrete water tank supports), which contains asbestos and lead based paint, and the sumps (2) where elevated metals have been identified. This removal action work is being performed under the Environmental Management and Remediation Contract (EMARC), Contract No. W912DR-05-D-0026, Task Order 0002, RFAAP Interim Measures.

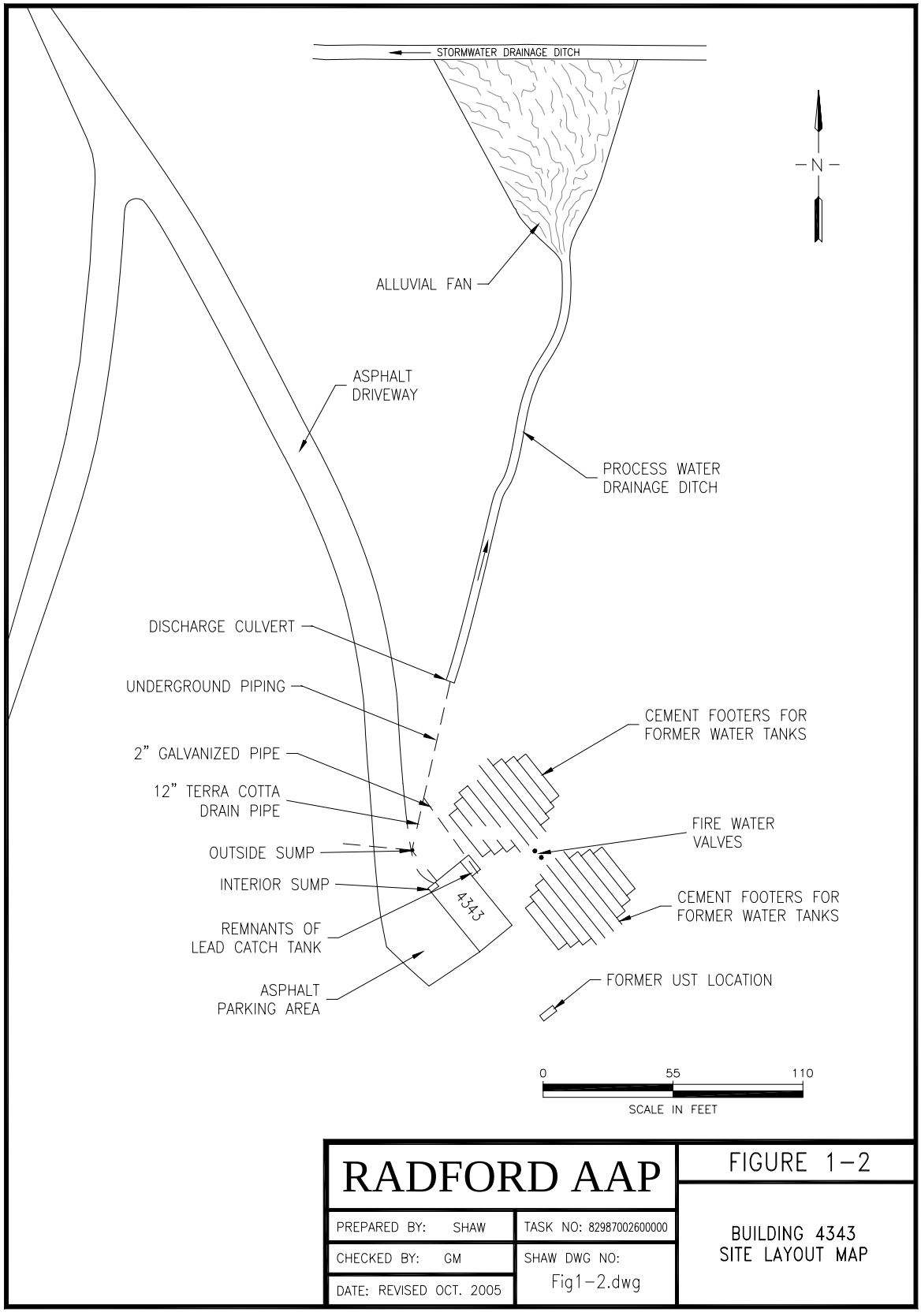
1.1 BACKGROUND

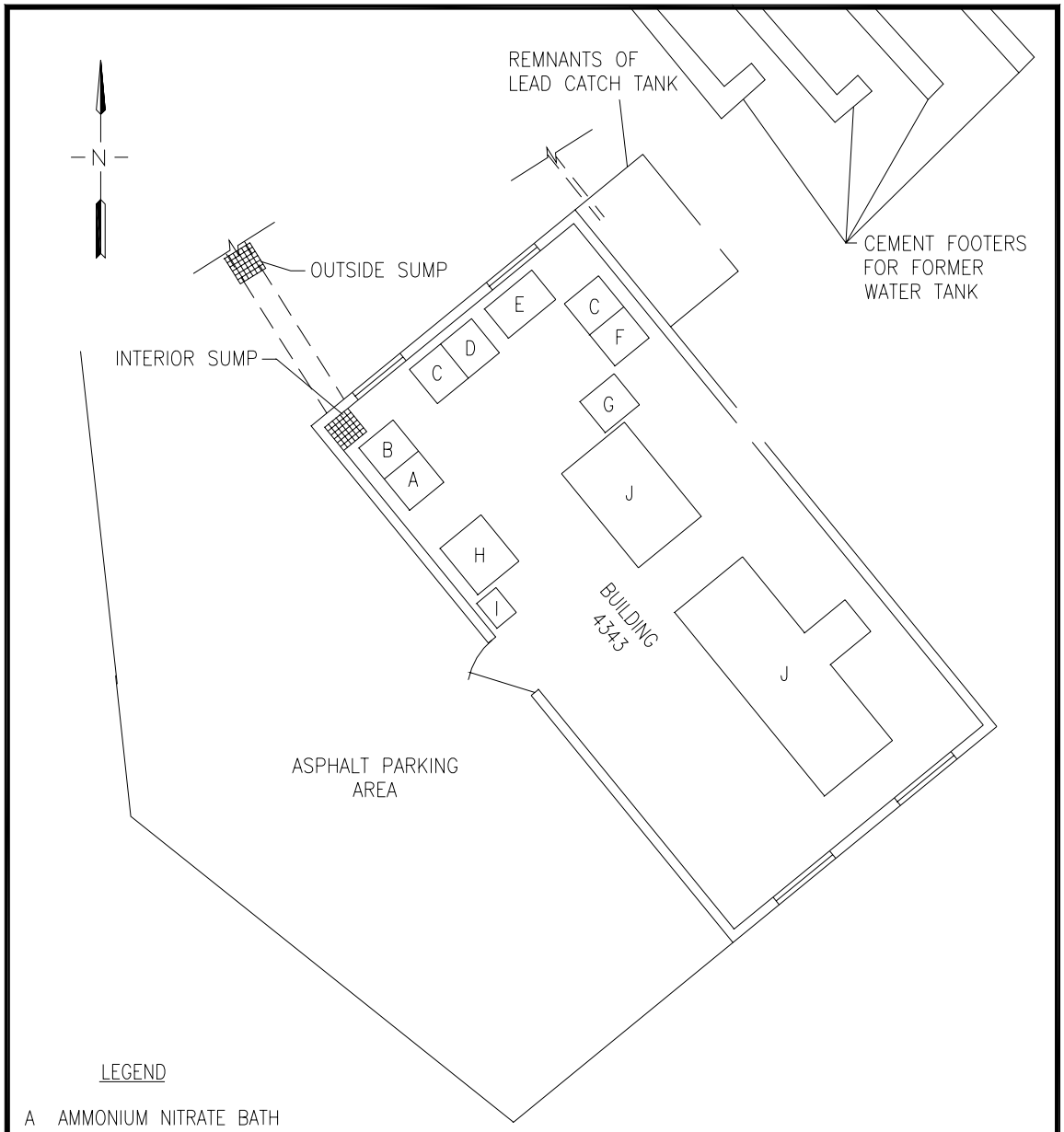
1.1.1 Site Description

Building 4343, the Former Cadmium Plating Facility, is situated in the west central portion of the Horseshoe Area **(Figure 1-1)**. The area surrounding the building is mowed grass at an elevation of approximately 1,830 feet mean sea level (ft msl). Surface water runoff flows to the north to an east-west trending storm water drainage ditch that grades to approximately 1,810 ft msl. Site features, as shown on **Figure 1-2**, include:

- Building 4343, approximately 34 ft long by 16 ft wide building, which housed the former cadmium plating operations equipment and a floor sump **(Figure 1-3 and Photo 1)**;
- an asphalt driveway leading to an asphalt parking lot southwest of Building 4343;
- underground piping that discharged to a north-south trending process water ditch (unlined) used to drain the sump within Building 4343, an exterior sump outside the building, a cemented closed pipe located under the road leading from the outside sump, and the former lead catch tank;
- cement footers used to support the former fire water tanks;
- above ground fire water valves; and,
- an east-west trending storm water drainage ditch that receives overland flow from Building 4343.


N
NEW RIVER
HORSESHOE AREA
NEW RIVER
BUILDING 4343
LEGEND
INSTALLATION BOUNDARY
RADFORD AAP
FIGURE 1-1
PREPARED BY: SHAW
TASK NO: 82987008400000
CHECKED BY: MT
SHAW DWG NO: FIG1-1.dwg
DATE: REVISED JULY 2003
SITE LOCATION MAP
HORSESHOE AREA
BUILDING 4343


STORMWATER DRAINAGE DITCH
N
ALLUVIAL FAN
ASPHALT DRIVEWAY
PROCESS WATER DRAINAGE DITCH
DISCHARGE CULVERT
UNDERGROUND PIPING
2" GALVANIZED PIPE
12" TERRA COTTA DRAIN PIPE
OUTSIDE SUMP
INTERIOR SUMP
REMNANTS OF LEAD CATCH TANK
ASPHALT PARKING AREA
4343
CEMENT FOOTERS FOR FORMER WATER TANKS
FIRE WATER VALVES
CEMENT FOOTERS FOR FORMER WATER TANKS
FORMER UST LOCATION
0
55
110
SCALE IN FEET
RADFORD AAP
FIGURE 1-2
PREPARED BY: SHAW
TASK NO: 82987002600000
CHECKED BY: GM
SHAW DWG NO: Fig1-2.dwg
DATE: REVISED OCT. 2005
BUILDING 4343
SITE LAYOUT MAP



LEGEND

A AMMONIUM NITRATE BATH
B MATAWAN 40-D CLEANER BATH
C COLD WATER RINSE
D CYANIDE DIP BATH
E STEAM TABLE
F HOT WATER RINSE
G CADMIUM PLATING BATH
H DRYING CABINET
I LAVATORY SINK
J PLYWOOD COVERED TABLE

NOTE: NOT DRAWN TO SCALE

RADFORD AAP		FIGURE 1-3
PREPARED BY: SHAW	TASK NO: 82987008400000	BUILDING 4343 INTERIOR LAYOUT
CHECKED BY: MT	SHAW DWG NO: Fig1-3.dwg	
DATE: REVISED JULY 2003		

1.2 SITE GEOLOGY

Detailed discussion about the regional geology of the Main Manufacturing Area (MMA) is presented in the Facility-Wide Background Study Report (IT, 2001). Building 4343 is underlain by the Braddock Loam soil type. This soil type has a variable slope between 2% and 30% and does not have a seasonal high water table within six feet of the surface. Typically, the surface layer is seven inches thick and is dark yellowish-brown. Permeability of the Braddock Loam soil is moderate, natural fertility is low, and organic matter content is moderately low. This soil type is generally acidic or very strongly acidic (pH of 4.5–5.5). However, the pH for twenty-two surface soil samples collected from the site ranged from 5.03–7.4, with a mean pH of 6.2 (slightly acidic). The pH of nineteen subsurface soil samples ranged from 5.90–8.35, with a mean pH of 6.6 (neutral). TOC detected in site soil ranged in concentration from 2,038 to 6,160 milligrams per kilogram (mg/kg).

Photo 1. Northwest view of Building 4343

Subsurface soil samples were collected from borings located around Building 4343, parallel to and below the process water drainage ditch, and in the alluvial fan at the toe of the ditch. The deepest of these borings was advanced to a depth of 60 feet below ground surface (ft bgs). Information from these borings was used to construct a geologic cross-section of the site. Logging descriptions indicate that the subsoil is yellowish-red and red clay down to bedrock. The clay is the result of the weathering of carbonate bedrock formations. The clay has low to medium plasticity and is dry to slightly moist. Groundwater was not encountered in the borings. The clays are underlain by bedrock of the Elbrook Formation. Depth to bedrock ranges from 18 to more than 60 ft bgs. The Elbrook Formation is composed of thickly bedded, blue-gray dolomite interspersed with blue-gray to white limestone; brown, green, and red shale;

argillaceous limestone; and brecciated limestone (colors range from mottled light- to dark-gray and yellow-brown).

1.3 SITE HISTORY

Building 4343 was originally designated as the Fire Water Pump House. The building was used to house a 5-inch, one-stage, 500-gallon/minute gasoline-powered pump. A 550-gallon underground storage tank (UST), located approximately 40 ft south of Building 4343, was used to store the pump fuel. The tank and approximately seven tons of soil were subsequently removed in June 1998 (ATK, 1998). A letter from the Virginia Department of Environmental Quality (VDEQ) dated 24 August 1998 approved the closure and agreed that no further action was warranted at that time. The letter and tank closure report are presented in the RFI/CMS (Shaw, 2004). The location of the former UST and remnants of the fire water valves and cement footers used to support the fire water tanks are shown on **Figure 1-2**.

In 1956, the pump and pump engine were removed and the building was converted to conduct cadmium plating operations in support of the NIKE missile program. Conversion activities included the installation of a drying cabinet, cadmium plating, ammonium nitrate, and cyanide dip baths, an exterior lead catch tank, and an exhaust system for the acid fumes. Because cadmium ingots in an acid bath were used in the plating process, it is not believed that cadmium as a dust or volatile would be transported through the exhaust system. The location of these features housed within the building is shown on **Figure 1-3**. The initial procedures of the plating process involved the cleaning of parts using ammonium nitrate, cold water, Matawan 40-D, and hydrochloric acid baths. Following the cleaning process, the parts went through a series of baths including: cold and hot water, sodium cyanide dip, cadmium plating [using ingots of cadmium (Cd^o) and small amounts of cadmium oxide (CdO)], and sodium cyanide rinse water. Rinse water used in the plating process was then neutralized as described in the following paragraph.

Rinse water from the cadmium plating operations was process water containing cyanide, cadmium, and chromium. The probable source of the chromium contained in the process water most likely resulted from the cleaning of metal parts that may have contained chromium. The metal parts were subjected to acid bath cleaning prior to cadmium plating. The process water was collected and stored in the exterior lead-lined catch tank located on the northeast corner of the building **(Figures 1-2 and 1-3)**. When a sufficient amount of process water accumulated in the tank, it was treated with an alkaline chlorine solution to neutralize the cyanide. This process would also cause trace metals to precipitate and form the sludge contained in the process sumps. Following treatment, the process water was checked for chlorine residual. If no free chlorine was found, additional chlorine solution was added to the process water. If free chlorine was found, the process water was then drained through underground pipes to the process water ditch north of Building 4343. The amount of cadmium and chromium present in the process water was not considered sufficient to require further treatment (Hercules, 1959).

1.3.1 Environmental Investigation

Two investigations conducted at Building 4343 in 1996 and 1999 identified cadmium concentrations in soil and building sumps at levels exceeding regulatory screening criteria. Previous investigation sampling strategies were targeted towards chemicals that may have been used at Building 4343. Per the 2000 Resource Conservation and Recovery Act (RCRA) permit, a broader sampling strategy was required to complete the delineation of known site contaminants and characterize the site for chemical parameters not previously investigated.

A sampling strategy was developed in MWP Addendum 012 (IT, 2002) to complete the delineation and characterization of the site. RCRA Facility Investigation (RFI) activities included the collection and chemical and physical analysis of five surface and two subsurface soil samples. These samples and chemical results from previous investigations were combined for the nature and extent assessment. This assessment indicated that cadmium is the primary constituent presenting a concern. Three other metals, chromium, iron, and lead, were detected at concentrations greater than their respective industrial screening levels (USEPA, 2005) in soil and aluminum, antimony, copper, vanadium, and one organic compound (Aroclor-1254) exceeded the residential screening levels (USEPA, 2005) in soil. Although there were isolated exceedances of other constituents, the Human Health Risk Assessment identified cadmium as the sole contaminant of interest (COI) for the site under both industrial and residential future land-use conditions. The most elevated concentrations of detected metals in soil were at the point where process water was discharged from Building 4343 to an unlined process water drainage ditch, collocated with the cadmium.

Nature and extent analysis indicated that cadmium is the major constituent migrating into the environment. Elevated levels of cadmium were detected in surface soil near the former lead catch tank, in the process water drainage ditch, and in the alluvial fan/storm water drainage ditch area. Boundary samples in the storm water drainage ditch indicate that cadmium is not being transported from the site. Boundary samples along the process water drainage ditch indicate that there is minimal migration of cadmium into the subsurface of the process water ditch. Subsurface soil samples in the alluvial fan area indicate that cadmium concentrations decrease 95 percent from respective surface soil concentrations within the first six feet below the surface. Cadmium has the greatest vertical and horizontal extent of each of the metals with comparison criteria exceedances. Analysis indicates that defining the extent of cadmium also defines the extent of these other metals. Fate and transport analysis of subsurface soil sample results and empirical data for the site indicates that vertical migration of cadmium is limited and it is unlikely that groundwater would be impacted at the site.

Remedial goals (RGs) for soil associated with Building 4343 were calculated in the RFI/CMS (Shaw, 2004) for industrial and residential scenarios and are presented in **Table 1-1**. The future land use identified for the Building 4343 study area is industrial. However, for comparison purposes in the RFI/CMS, remedial goals for both residential and industrial exposure scenarios were developed. The residential RG was selected as a clean-up goal based on long term cost considerations associated with 5-year sampling and reporting under the industrial clean-up scenario.

Table 1-1
Identification of Remedial Goals for Cadmium in Building 4343 Soil

Medium	Receptor	Calculated RG (HI=1.0)	Background (mg/kg)	Industrial RG (mg/kg)	Residential RG (mg/kg)
Industrial Scenarios					
Surface and Total Soil	Maintenance Worker	4,030	0.69	276	---
Surface and Total Soil	Industrial Worker	895	0.69		
Total Soil	Excavation Worker	276	0.69		
Residential Scenarios					
Total Soil	Adult Resident	629	0.69	---	70.3
Total Soil	Child Resident	70.3	0.69		

Details on the methodology used to calculate the remedial goals are presented in **Appendix H** of the RFI/CMS (Shaw, 2004).

Ecological HQs estimated for metals and DDT in soil were found to be elevated. These estimates are associated with a considerable degree of uncertainty and are, by themselves, not appropriately definitive to recommend ecologically-based Corrective Measures Objectives (CMOs). **Table 1-2** presents estimated residual ecological hazards for chemicals found to be ecological "risk drivers" for at least one of the receptors evaluated for the respective environmental medium. The receptor with the highest (i.e., "critical") EEQ value from the SLERA is shown in the table. Details on the methodology used to calculate the risk reductions for ecological receptors are presented in Section 8 of the RFI/CMS (Shaw, 2004).

Table 1-2
Ecological Implications of Human Health Soil RGs on Ecological Receptors

Chemical[a]	Human Health RG (mg/kg)	Expected Residual Conc.[b] (mg/kg)	Critical Ecological LOAEL EEQ (and receptor) [c]		EPC for Critical [d] Ecological Receptor (mg/kg)	Scaled [e] Ecological LOAEL EEQ Using Expected Residual Conc.	Estimated Reduction in Ecological Hazard (%)[f]
Residential Scenario							
Cadmium	70.3	19.3	790	shrew	24,300	0.63	99.9%
Cadmium	70.3	19.3	1,215	earthworm	24,300	0.97	99.9%
Copper	-	22.1	1.4	earthworm	85	0.36	74.0%
Chromium	-	32.1	74	robin	223	10.7	85.6%
Chromium	-	32.1	7.0	earthworm	223	1.01	85.6%
Lead	-	19.3	0.27	earthworm	133	0.04	85.5%
Mercury	-	0.126 [g]	1.3	earthworm	0.126	1.3	0.0%
Zinc	-	43.2	1.9	earthworm	189	0.43	77.1%
4,4-DDT	-	0.0153	21.2	robin	0.0218	14.9	29.8%

[a] Chemicals shown are those having the highest ecological EEQ values in the RFI Screening Level Ecological Risk Assessment (SLERA) (*Section 7.0*). Human health COIs are bolded.

[b] Residual concentrations in surface soil were estimated by removing the soil samples from the ecological data base that are within the proposed excavation footprint and recalculating the 95% UCL exposure point concentration following the methodology used in the SLERA. Dilution from clean backfill was not considered in estimating residual concentrations.

[c] Value and corresponding receptor shown are for the highest Tier 2 EEQ value among receptors evaluated in the SLERA. For earthworms, trivalent chromium EEQ presented.

[d] Value shown is from the SLERA.

[e] Estimated using the following scaling relationship:

Scaled EEQ = Residual Conc. x (pre-remediation EEQ/pre-remediation EPC).

[f] Estimated as follows: (Critical Ecological LOAEL EEQ - Scaled Ecological LOAEL EEQ)/Critical Ecological LOAEL EEQ x 100%

[g] No change in residual concentration, as no mercury "hot spot" locations targeted for removal.

Notes:

COI = chemical of interest

EPC = exposure point concentration (original EPC used in SLERA for surface soil exposure)

EEQ = ecological effects quotient from SLERA.

LOAEL = lowest-observed-adverse-effect level

NA = not applicable RG = remedial goal.

1.4 REMOVAL ACTION SCOPE

Based on the *Building 4343 RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) Report, Final Document*, February 2004, interim measures are to be performed at Building 4343. The interim measures are being conducted to mitigate the threat of a contaminant release, migration, and/or exposure to the public and the environment, as well as facilitate clean close out in accordance with Part II(D)(11-21) Interim Measures of the RFAAP Corrective Action Permit (USEPA, 2000a). The interim measures include:

1. **Soil Delineation**. Delineation of soil containing cadmium above the Residential Remedial Goal;
2. **Soil Excavation**. Excavation of the delineated area such that the remaining soil is below the Residential Remedial Goal;
3. **Sump Removal**. Removal of the sumps (2) and piping where elevated metals have been identified;
4. **Building 4343 Demolition**. Demolition of Building 4343 including outside concrete water tank supports;
5. **Transportation and Disposal of Wastes**. Transporation and off-site disposal of soil, sump material, and building debris; and,
6. **Site Restoration**.

Specific details on the contractor organization and technical approach for the interim measures listed above are provided in the Organization and Technical Approach Plan, *Section 2.0*.

1.5 WORK PLAN CONTENT

This IMWP is composed of an Introduction (*Section 1.0*), eight sub-plans (*Sections 2.0 through 9.0*), and references (*Section 10.0*). The eight sub-plans are as follows:

Section 2 – Organization and Technical Approach Plan

> Identifies the Shaw project staff and subcontractors, their roles and responsibilities, and identifies the technical approach to be followed for the interim measures.

Section 3 – Field Sampling Plan (FSP)

> Describes the sampling rationale and field sampling procedures that will be used to collect field samples.

Section 4 – Quality Assurance Project Plan (QAPP)

> Identifies the sample management methods, analytical methods, and QC requirements necessary to achieve data quality objectives associated with chemical sampling.

Section 5 – Environmental Protection Plan

> Identifies environmental considerations and adequate safeguards to protect the environment during implementation of interim measures.

Section 6 – Erosion and Sediment Control Plan (E&SCP)

> Defines the steps that will be taken to minimize and/or eliminate erosion and sedimentation during removal action work.

Section 7 – Waste Transportation and Disposal Plan (WTDP)

Identifies safe handling, transportation, and disposal procedures for waste material resulting from interim measures.

Section 8 – Site Safety and Health Plan (SSHP)

Provides site-specific safety and health controls to prevent and/or minimize personal injuries, illnesses, and physical damage to equipment and property.

Section 9 – Contractor Quality Control Plan (CQCP)

Defines the contractor QC organization and program for the interim measures.

Section 10 – References

1.6 WORK PLAN CHANGES

Work outside the scope of this Work Plan is not to be performed without the approval of the USACE Baltimore District. Amendments or supplements to this Work Plan will be submitted in writing to the USACE for approval prior to being implemented by project personnel.

2.0 ORGANIZATION AND TECHNICAL APPROACH PLAN

This section describes the organization and activities to be conducted to accomplish the interim measures at Building 4343. Specifically, this section outlines the organization and responsibilities for project personnel as well as presents the step by step approach to be performed for each of the interim measures tasks.

2.1 ORGANIZATION AND RESPONSIBILITIES

The organizational structure established for this project is depicted in **Figure 2-1** and includes the Shaw management and field staff, and subcontractors. The lines of authority and the lines of communication for the project can be determined from this organizational structure. Communication of project objectives will be provided to project staff through meetings.

Statements of qualifications and resumes of key Shaw staff are given in **Appendix A**. Names, addresses, and phone numbers of key Shaw individuals are presented in **Table 2-1**. The duties and responsibilities of the key members of this organization are described below.

EMARC Program Manager, Mr. Mike Vollo, has complete management authority and responsibility for all work performed under the EMARC contract. The Program Manager directs the program management organization as a central resource for management, continuity, and control of all EMARC program activities. The centralized program management is organized to facilitate communication with and reporting to USACE and to expedite and support project execution. The Program Manager has total authority, responsibility, and accountability for managing the contract. He will be involved in the decision-making process and oversight of the management of the project.

RFAAP Project Manager, Mr. Jeff Parks, P.G., reports to the EMARC Program Manager. He is responsible for ensuring that all activities are conducted in accordance with contractual specifications and technical requirements. The Project Manager will also coordinate with the USACE Project Officer. The Project Manager will monitor the budget and schedule to ensure availability of necessary personnel, equipment, subcontractors, and services.

Building 4343 IM Task Manager, Ms. Gretchen Miller, P.E., reports to the RFAAP Project Manager. She is responsible for ensuring that all activities are conducted in accordance with the IMWP. The IM Task Manager is responsible for management of all operations conducted for this project. She will ensure that all personnel assigned to this project, including subcontractors, have reviewed the technical plans before any task associated with the project is initiated. She will participate in the development of the field program, evaluation of data, and reporting.

EMARC Health and Safety Manager, Mr. Joe Hoyt, CHST, will oversee the development and implementation of the SSHP to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are defined.

EMARC Quality Control (QC) Manager, Mr. Charles Hunter, is responsible for ensuring that quality planning is accomplished, QC procedures are available and a qualified CQC System Manager is assigned to the project. The EMARC QC Manager will review and ensure that the CQCP (*Section 9.0*) addresses all project specific QC needs and that all appropriate QC requirements are addressed. The EMARC will also assess the effective implementation of the CQC Plan through scheduled audits or assessments.

Figure 2-1
RFAAP Building 4343 Interim Measures Organizational Chart

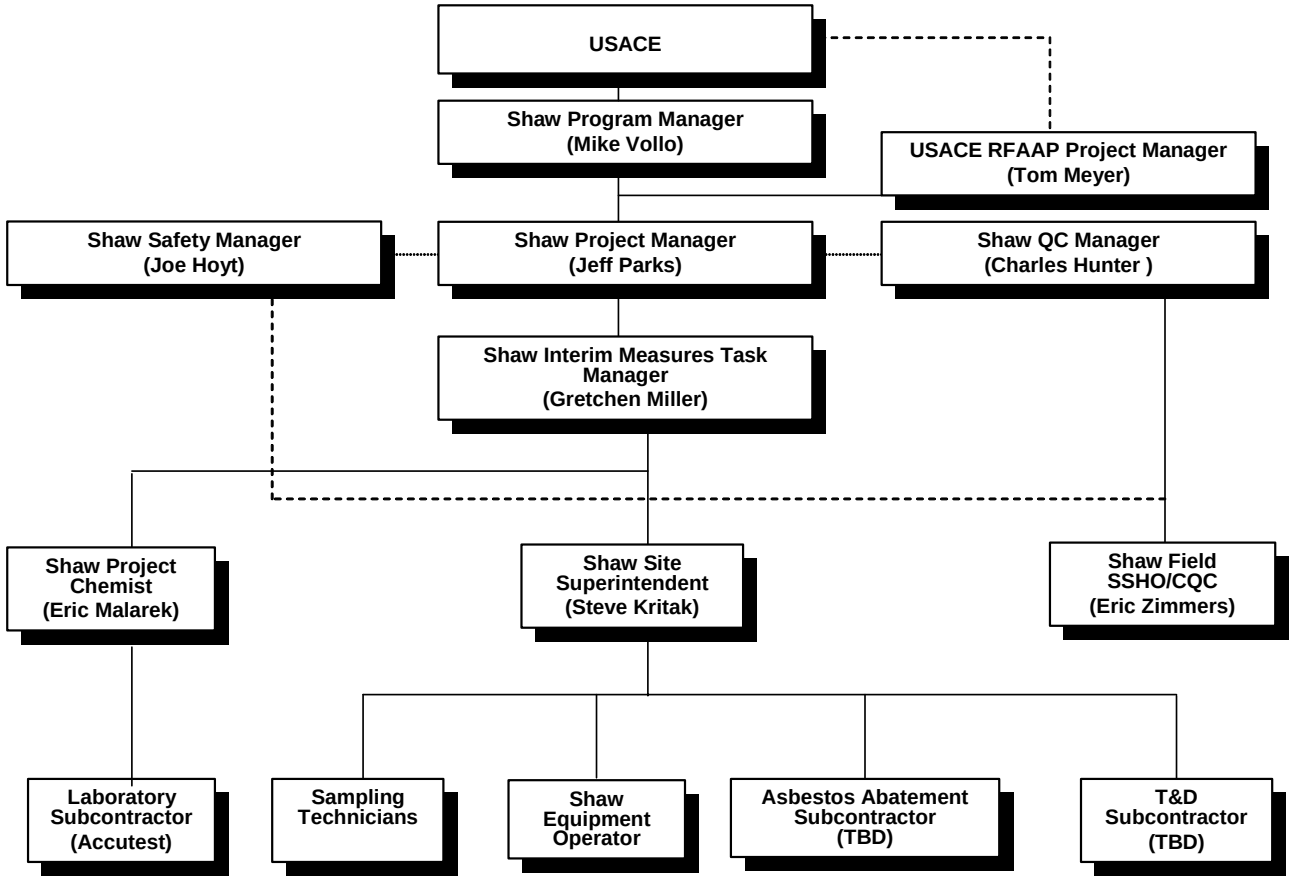


Table 2-1. Shaw Environmental, Inc. and Subcontractor Key Points of Contact

Shaw Environmental, Inc./Subcontractor Personnel	Contact Information
Mike Vollo Shaw Environmental, Inc. EMARC Program Manager	200 Horizon Center Blvd. Trenton, NJ 08691 Phone No.: (609) 588-6430 Fax No.: (609) 588-6404 E-Mail: mike.vollo@shawgrp.com
Jeff Parks, P.G. Shaw Environmental, Inc. RFAAP Project Manager	2113 Emmorton Park Road Edgewood, MD 21040 Phone No.: (410) 612-6326 Fax No.: (410) 612-6351 E-Mail: jeffrey.parks@shawgrp.com
Gretchen Miller, P.E. Shaw Environmental, Inc. Building 4343 IM Task Manager	2113 Emmorton Park Road Edgewood, MD 21040 Phone No.: (410) 612-6308 Cellular No.: (443) 255-6961 Fax No.: (410) 612-6351 E-Mail: gretchen.miller@shawgrp.com
Joe Hoyt, C.H.S.T. Shaw Environmental, Inc. EMARC Health and Safety Manager	304 Harlow Town Road Louisa, VA 23093 Phone No.: (804) 337-6982 Cellular No.: (804) 337-6982 E-Mail: joseph.hoyt@shawgrp.com
Charles Hunter Shaw Environmental, Inc. EMARC QC Manager	200 Horizon Center Boulevard Trenton, NJ 08910 Phone No.: (609) 584-6840 Fax No.: (609) 588-6300 E-Mail: charles.hunter@shawgrp.com
Steve Kritak Shaw Environmental, Inc. Site Superintendent/CQC System Manager	101 Fieldcrest Ave. Edison, NJ 08837 Phone No.: (609) 584-8900 Cellular No.: (973) 865-8064 E-Mail: steve.kritak@shawgrp.com
Erik Zimmers Shaw Environmental, Inc. SSHO	1725 Duke Street Alexandria, VA 22314 Phone No.: (814) 521-9431 (cell) Fax No.: (202) 261-1943 E-Mail: erik.zimmers@shawgrp.com
Eric Malarek Shaw Environmental, Inc. Project Chemist	2113 Emmorton Park Road Edgewood, MD 21040 Phone No.: (410) 612-6322 Fax No.: (410) 612-6351 E-Mail: eric.malarek@shawgrp.com
Asbestos Abatement Subcontractor WACO, Inc. Contact: Cyrus Hall	211 Roanoke Street, Suite 15 Christiansburg, VA 24073 Phone No: (540) 382-6311 Fax No.: (540) 382-6411
Analytical Laboratory Subcontractor Accutest Laboratories, Inc. Contact: Sue Bell	4405 Vineland Road, Suite C-15 Orlando, FL 32811 Direct Phone No.: (813) 741-3338 Lab Phone No.: (407) 425-6700 Fax No.: (407) 425-0707 E-Mail: Sueb@accutest.com

Shaw Environmental, Inc./Subcontractor Personnel	Contact Information
Waste Transportation and Disposal Subcontractor Capitol Environmental Terri Fort	416 S. Jefferson Street Roanoke, VA 24011 Phone No: (540) 777-6547 Fax: (540) 777-6549 E-Mail: terri.fort@capitol-environmental.com

Site Superintendent, Mr. Steve Kritak, will provide onsite management of field activities during removal actions. The Site Superintendent is responsible for coordinating field team activities and meeting schedule deadlines. The Site Superintendent will ensure that the work is being conducted in accordance with the IMWP. The Site Superintendent will coordinate the initial orientation and safety meeting, as well as the daily safety meeting prior to the start of work each day.

Site Safety and Health Officer (SSHO)/Contractor Quality Control (CQC) System Manager, Mr. Eric Zimmers, will be responsible for dual roles during the removal action work: SSHO and CQC System Manager. As SSHO, he will be responsible for implementing and oversight of the on-site health and safety program, and maintaining health and safety documentation. He will ensure that an adequate level of personal protection is worn by field personnel for anticipated potential hazards and will work in coordination with the IM Task Manager to ensure compliance of project activities with health and safety requirements as outlined in the SSHP. As the CQC System Manager, he will be responsible for daily QC oversight of field operations and all aspects of environmental samples. He will be responsible for ensuring that the requirements specified in the CQCP are followed during field activities and will maintain all QC documentation. Additional details on the responsibilities of the SSHO and CQC System Manager are provided in the SSHP (*Section 8.0*) and CQCP (*Section 9.0*), respectively.

Project Chemist, Mr. Eric Malarek, will be responsible for sample tracking, data management, laboratory coordination, and data validation activities. The Project Chemist will work with field sampling technicians and the contract laboratory to ensure that the work performed is in accordance with the QAPP (*Section 4.0*).

Equipment Operator. An equipment operator will be utilized to perform the IM work in the field. The equipment operator will be experienced and qualified in operating equipment essential to the project. The equipment operator will be a properly trained Occupational Safety and Health Administration (OSHA) qualified worker.

Field Sampling Technicians. Field sampling technicians will be responsible for collecting all samples associated with the removal action work. These technicians will be under the direction of the Site Superintendent. The technicians will coordinate sampling activities with the Project Chemist who in turn coordinates with the contract laboratory.

Subcontractors. Shaw will procure the following subcontractors: asbestos abatement, waste transportation and disposal; and laboratory support.

2.2 TECHNICAL APPROACH

The following sections describe the background and technical approach to the Building 4343 IM. The field activities to be performed include: final delineation of soil containing cadmium above the Residential Remedial Goal; excavation of the delineated area such that the remaining soil is below the Residential Remedial Goal; removal of the sumps (2) and piping where elevated metals have been identified; demolition of Building 4343 including outside concrete water tank supports; and, transportation and off-site disposal of soil, sump material, and building debris. Detailed safety and health requirements for this scope of work are presented in *Section 8.0*.

2.2.1 Background

RFI activities were conducted at Building 4343 from 1996 to 2002. The results from these investigations indicated that elevated levels of cadmium were detected in surface soil near the former lead catch tank, in the process water drainage ditch, and in the alluvial fan/storm water drainage ditch area. Boundary samples in the storm water drainage ditch indicate that cadmium is not being transported from the site. Boundary samples along the process water drainage ditch indicate that there is minimal migration of cadmium into the subsurface of the process water ditch. Subsurface soil samples in the alluvial fan area indicate that cadmium concentrations decrease 95 percent from respective surface soil concentrations within the first six feet below the surface.

The human health and ecological risk assessments determined that unacceptable risks to potential future residential and industrial receptors were associated with the concentrations of chemicals detected. Because the RFI demonstrated that cadmium contamination is present at concentrations associated with unacceptable human health concerns and potential impacts to ecological receptors, a corrective measures study (CMS) was performed to address elevated cadmium concentrations in soil. The alternatives evaluated were as follows:

- Alternative One: No Further Action;
- Alternative Two: Excavation of Soil with Waste in Place, Off-site Disposal, Removal of Sumps, Demolition of Building 4343, and Land Use Controls;
- Alternative Three: Excavation of Soil for Clean Close Out, Off-site Disposal, Removal of Sumps, and Demolition of Building 4343; and,
- Alternative Four: Stabilization, Removal of Sumps, Demolition of Building 4343, and Land Use Controls.

These four alternatives were evaluated using the selection criteria: effectiveness, implementability, and cost. The corrective measures objective is to reduce contaminant concentrations in soil to levels that are protective of industrial workers at the site. However, the Army also elected to evaluate residential exposure pathways to assess what the increase in remedial effort would be to remediate the site for unrestricted future reuse and facilitate clean close out. Therefore, a Residential Remedial Goal and credit was given to those alternatives that met this more stringent criterion. Based on this assessment, Alternative Three was selected as the final alternative for Building 4343.

The objective of the interim measures action is to reduce the concentrations of cadmium to below the Residential Remedial Goal of 70.3 mg/kg and facilitate clean close out in accordance with Part II.(D)(11-21) Interim Measures of the RFAAP Corrective Action Permit (USEPA, 2000a).

2.2.1.1 Site Preparation

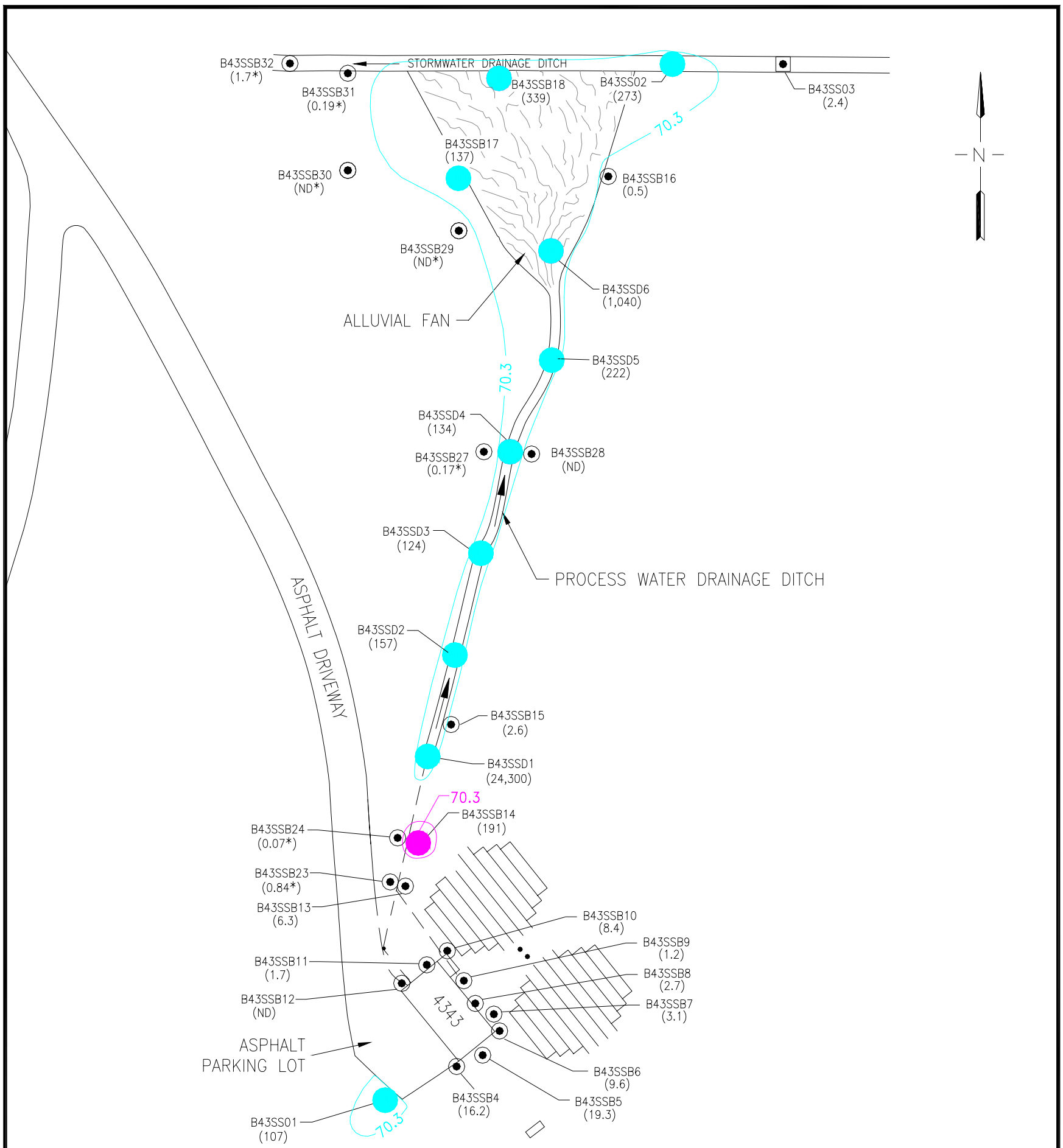
Prior to performing any intrusive activities at Building 4343, a utility survey to identify underground service lines within or near the excavation site will be performed and dig permits will be obtained from Alliant TechSystems (ATK). A hazard analysis has been completed as detailed in *Section 8.0*, and all potential hazards identified will be reviewed prior to commencement of work activities. Erosion and sediment controls will be utilized according to the procedures outlined in *Section 6.0*, as needed. Shaw will mobilize their own office trailers and supply all office equipment and supplies. The office trailer will be located inside of Gate 10, per ATK direction. Shaw will also spot bathroom facilities onsite at Building 4343, sufficient for the crew size. A nearby water hydrant will be employed to supply water for site activities (decontamination/dust control).

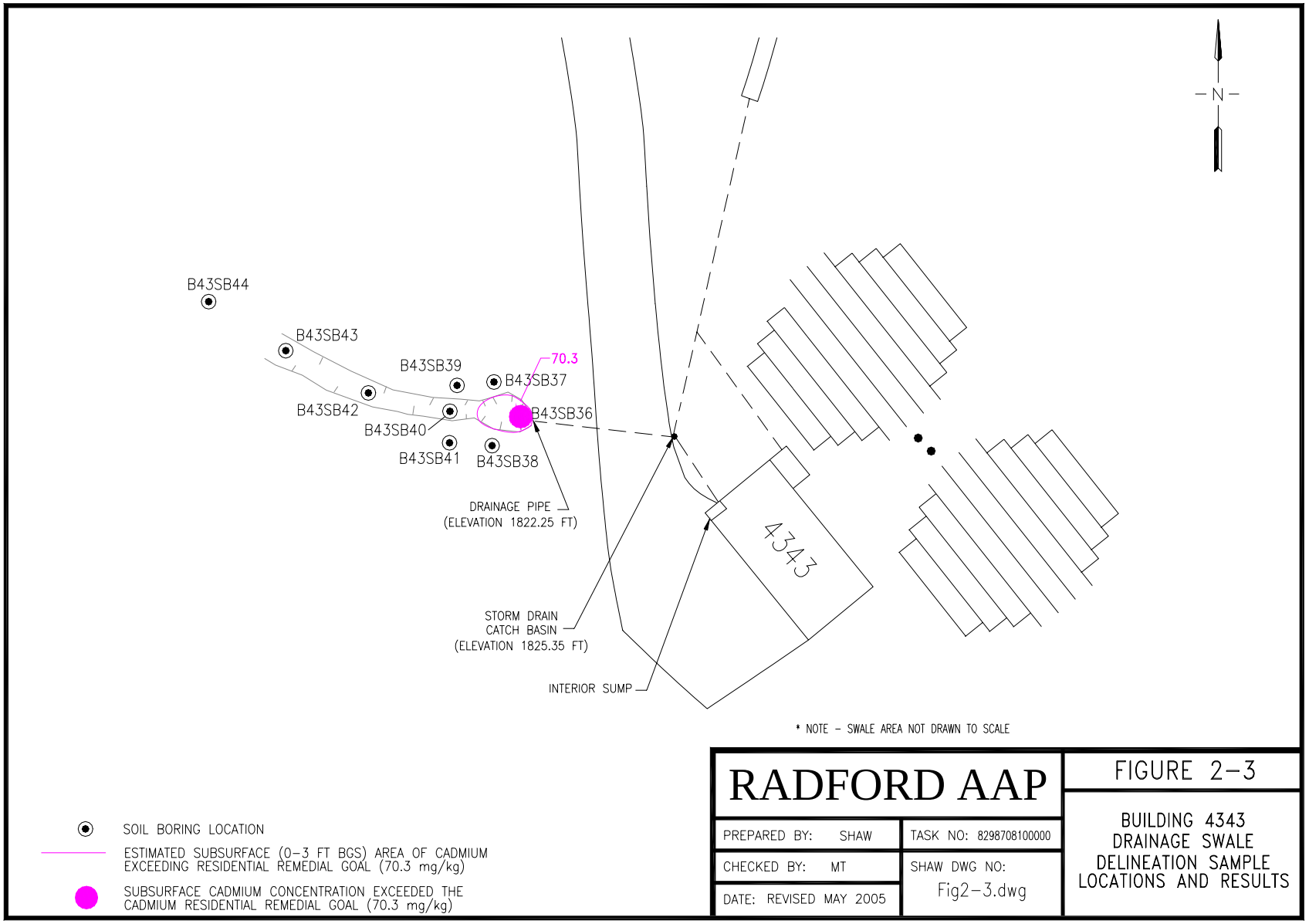
2.2.2 Soil Delineation Sampling and Excavation

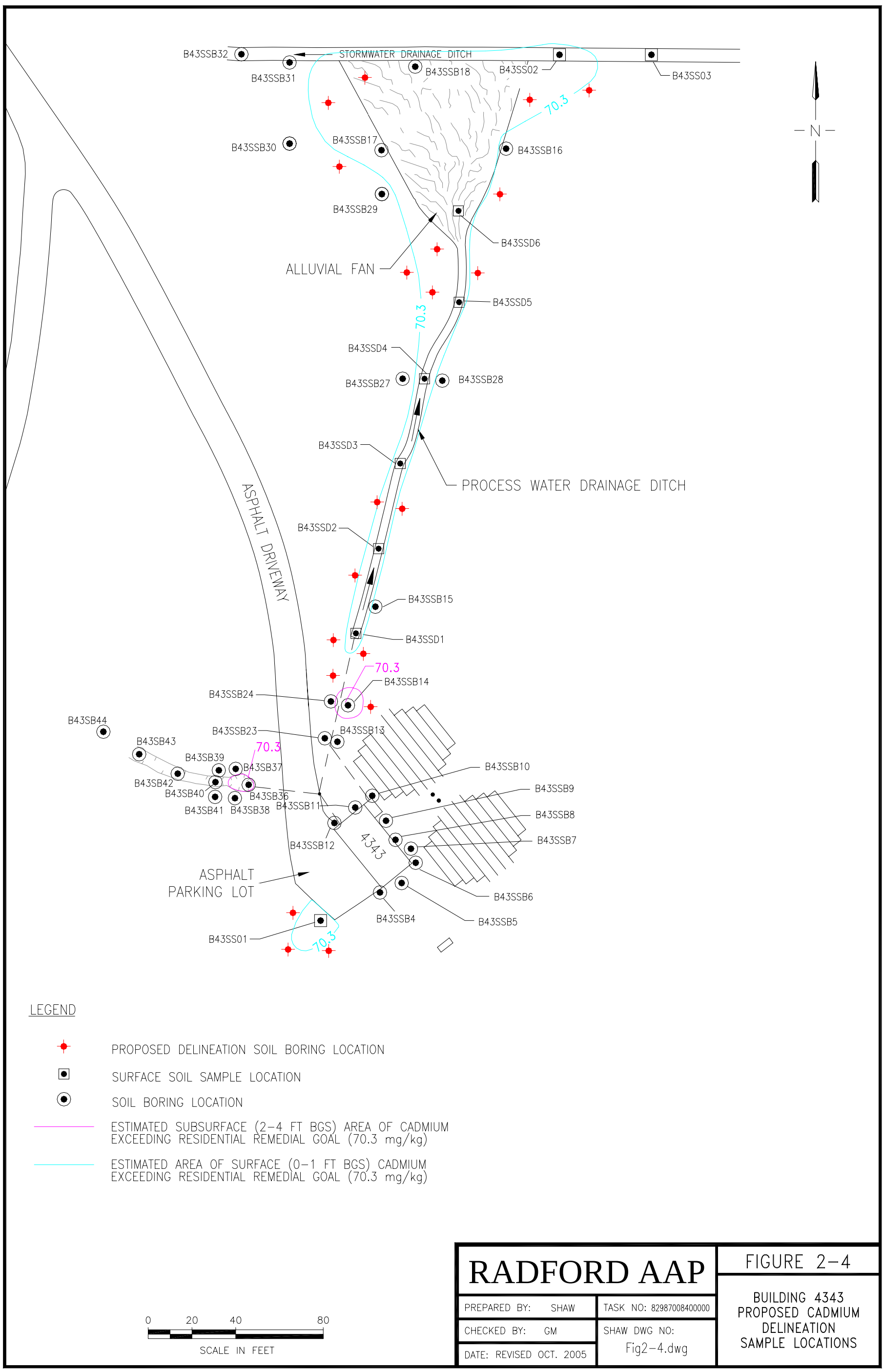
Prior to mobilization of excavation personnel, discrete soil delineation samples will be collected from surface and subsurface locations within the area determined during the RFI field activities to contain elevated levels of cadmium (see **Figure 2-2**). These delineation samples will also be used as waste characterization samples to determine the appropriate disposal options for the soil prior to excavation activities.

In addition, on 16 May 2005, delineation samples to support the interim measures action were collected to investigate the drainage pipe and swale located to the west of Building 4343 that had not been previously delineated. Twenty delineation soil samples were collected from nine borings advanced in and around the drainage swale on the west side of the Building 4343 asphalt driveway to delineate the area of cadmium contamination in this area (see **Figure 2-3**). At each location, one surface (0-0.5 ft) and one shallow soil sample (1-2 ft) were collected and analyzed for cadmium, only. In two of the borings (B43SB36 and B43SB40), a deeper sample was collected from 2-4 ft and analyzed for cadmium. The results from this sampling are presented on **Figure 2-3**.

One surface and two subsurface soil samples (to 4 ft bgs) will be collected from a total of 20 additional locations (60 samples, see **Figure 2-4**). Samples will be collected from each location from the following intervals: 0-0.5 ft bgs, 2-2.5 ft bgs, and 3.5-4.0 ft bgs and analyzed at an off-site laboratory for cadmium on a 24 hour Turnaround Time (TAT) in order to delineate the final area to be excavated. The limits of the area to be excavated will be bounded by soil characterization samples with concentrations below the remedial goal, which is the calculated residential remedial goal of 70.3 mg/kg. Soils will be excavated to a depth that is one foot below where the "hit" was detected.


B43SSB32
(1.7*)
B43SSB31
(0.19*)
STORMWATER DRAINAGE DITCH
B43SSB18
(339)
B43SS02
(273)
B43SS03
(2.4)
70.3
B43SSB17
(137)
B43SSB30
(ND*)
B43SSB16
(0.5)
B43SSB29
(ND*)
B43SSD6
(1,040)
ALLUVIAL FAN
B43SSD5
(222)
70.3
B43SSD4
(134)
B43SSB27
(0.17*)
B43SSB28
(ND)
B43SSD3
(124)
PROCESS WATER DRAINAGE DITCH
ASPHALT DRIVEWAY
B43SSD2
(157)
B43SSB15
(2.6)
B43SSD1
(24,300)
70.3
B43SSB14
(191)
B43SSB24
(0.07*)
B43SSB23
(0.84*)
B43SSB13
(6.3)
B43SSB10
(8.4)
B43SSB9
(1.2)
B43SSB11
(1.7)
B43SSB8
(2.7)
B43SSB12
(ND)
4343
B43SSB7
(3.1)
ASPHALT
PARKING LOT
B43SSB6
(9.6)
B43SSB4
(16.2)
B43SSB5
(19.3)
B43SS01
(107)
70.3
N
LEGEND
SURFACE SOIL SAMPLE LOCATION
SOIL BORING LOCATION
SUBSURFACE CADMIUM CONCENTRATION EXCEEDED THE CADMIUM RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
SURFACE CADMIUM CONCENTRATION EXCEEDED THE CADMIUM RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
(0.19*) CADMIUM SOIL CONCENTRATION (mg/kg) BACK-CALCULATED FROM TCLP CONCENTRATION (ug/L)
(2.6) CADMIUM SOIL CONCENTRATION (mg/kg)
(ND) CADMIUM NOT DETECTED
ESTIMATED SUBSURFACE (2-4 FT BGS) AREA OF CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
ESTIMATED AREA OF SURFACE (0-1 FT BGS) CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
0 20 40 80
SCALE IN FEET
RADFORD AAP
PREPARED BY: SHAW
TASK NO: 82987008400000
CHECKED BY: MT/GM
SHAW DWG NO: Fig8-1.dwg
DATE: REVISED FEB. 2004
FIGURE 2-2
BUILDING 4343 CADMIUM CONTAMINATION ABOVE RESIDENTIAL RG


B43SB44
B43SB43
B43SB39
B43SB37
70.3
B43SB42
B43SB36
B43SB40
B43SB41
B43SB38
DRAINAGE PIPE
(ELEVATION 1822.25 FT)
4343
STORM DRAIN
CATCH BASIN
(ELEVATION 1825.35 FT)
INTERIOR SUMP
N
* NOTE - SWALE AREA NOT DRAWN TO SCALE
SOIL BORING LOCATION
ESTIMATED SUBSURFACE (0-3 FT BGS) AREA OF CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
SUBSURFACE CADMIUM CONCENTRATION EXCEEDED THE CADMIUM RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
RADFORD AAP
FIGURE 2-3
PREPARED BY: SHAW
TASK NO: 8298708100000
CHECKED BY: MT
SHAW DWG NO: Fig2-3.dwg
DATE: REVISED MAY 2005
BUILDING 4343
DRAINAGE SWALE
DELINEATION SAMPLE
LOCATIONS AND RESULTS


B43SSB32
STORMWATER DRAINAGE DITCH
B43SSB31
B43SSB18
B43SS02
B43SS03
70.3
B43SSB30
B43SSB17
B43SSB16
B43SSB29
B43SSD6
ALLUVIAL FAN
B43SSD5
70.3
B43SSD4
B43SSB27
B43SSB28
B43SSD3
PROCESS WATER DRAINAGE DITCH
ASPHALT DRIVEWAY
B43SSD2
B43SSB15
B43SSD1
70.3
B43SSB14
B43SSB24
B43SB44
B43SSB23
B43SSB13
B43SB43
70.3
B43SSB39
B43SB37
B43SB42
B43SB40
B43SB36
B43SSB11
B43SB41
B43SB38
B43SSB10
B43SSB9
B43SSB8
B43SSB7
B43SSB12
4343
ASPHALT
PARKING LOT
B43SSB6
B43SSB4
B43SSB5
B43SS01
70.3
N
LEGEND
PROPOSED DELINEATION SOIL BORING LOCATION
SURFACE SOIL SAMPLE LOCATION
SOIL BORING LOCATION
ESTIMATED SUBSURFACE (2–4 FT BGS) AREA OF CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
ESTIMATED AREA OF SURFACE (0–1 FT BGS) CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
0
20
40
80
SCALE IN FEET
RADFORD AAP
FIGURE 2–4
PREPARED BY: SHAW
TASK NO: 82987008400000
CHECKED BY: GM
SHAW DWG NO: Fig2–4.dwg
DATE: REVISED OCT. 2005
BUILDING 4343
PROPOSED CADMIUM
DELINEATION
SAMPLE LOCATIONS

If the delineation samples collected from the edge of the sampling area contain levels of cadmium above the remedial goal, the sampling area will be expanded outward. If contamination is determined to extend horizontally or vertically farther than anticipated, an evaluation of whether or not additional soil removal will occur will be conducted with input from all stakeholders, and modifications needed to complete the interim measures action will be made to the work plan, as necessary.

Excavation will be performed using one 20 Ton excavator (trackhoe). Contaminated soils will be excavated and directly loaded into dump trucks and transported offsite. The sides of all excavations in which employees are exposed to danger from moving ground shall be guarded by a support system, sloping or benching of the ground, or other equivalent means. Sloping and benching, if required, will be in accordance with EM 385-1-1. Excavations less than 5 feet in depth and which a "competent person" examines and determines there to be no potential for cave-in do not require protective systems. EM 385-1-1 defines a "competent person" as "one who can identify existing and predictable hazards in the working environment or working conditions that are dangerous to personnel and who has the authority to take prompt corrective measures to eliminate them." Shaw H&S provides Excavation Competent Person Training and Shaw will ensure that the site supervisor for the project has completed this training. Excavation work will comply with EM 385-1-1 and 29CFR1926 Subpart P – *Excavations*. Excavations greater than 5 feet may constitute a confined space. If a situation arises where confined space entry is necessary, work will be halted until confined space entry procedures can be developed and approved.

Plastic sheeting and plywood will be used to construct a temporary loading zone for the trucks to stage on while being loaded. The plastic sheeting will extend from the truck to the edge of the excavation zone. The temporary loading zone will be moved as the leading edge of the excavation moves forward. Excavation will start at the top of the drainage ditch and progress down the hillside towards the base of the ditch. Backfilling will commence after the excavation has been completed and analytical results from the confirmation samples has demonstrated that soil above the RG (70.3 mg/kg) has been removed from the site.

Following soil excavation, confirmation samples will be collected from the excavation bottom and sidewalls to confirm all contaminated soils have been removed above the remedial goal (RG). Discrete confirmation sampling locations will be collected from the locations where cadmium was detected above the remedial goal of 70.3 mg/kg during the site delineation sampling event. These samples will be collected from the side wall of the excavation closest to the appropriate delineation sample. Locations of the delineation samples will be marked perpendicular to the excavation. The remaining samples will be located by the site supervisor and project manager based on the final delineation of the area to be excavated. The sampling strategy to be employed is a biased sampling strategy (SOP 30.7), since known sources have been previously identified. Excavation will continue until Corrective Measures Objectives (CMOs) have been met. It is estimated that 30 samples (plus QC) will be collected from the bottom and sides of the excavation area and sent to an off-site laboratory for cadmium analysis. The confirmation sample with the highest cadmium concentration will also be analyzed for TCLP cadmium to ensure that remaining leachable cadmium concentrations are below the TCLP Regulatory Limit. Locations for the confirmation samples have not been specified because they will be dependent on the exact area that will be excavated. Minimum spacing of the samples vary depending on the location along the ditch. The minimum spacing in areas along the ditch,

where previous sampling has shown that contamination is confined to the ditch will be greater than the spacing in the "delta" area where deposition of cadmium-containing soil is more variable. **Figure 2-5** shows the location of 20 of the confirmation samples.

In addition, the 4" pipe (30 linear feet) which is located under the asphalt road will be removed as well as the piping that runs from the interior and exterior sumps to the main drainage ditch **(see Figure 2-3)**. Nine (9) confirmation samples for cadmium analysis will be collected from under the pipes to confirm that the pipe did not leak and contaminate the surrounding soils.

All sampling and excavation equipment will be decontaminated according to the procedures outlined in the SSHP (*Section 8.0*). A decontamination pad will be set up onsite for the excavator. The excavator will be decontaminated prior to use; after completion of the excavation phase; and after completion of the project. Decontamination procedures will follow those in SOP 80.1 for a drill rig. In addition, a small, temporary decontamination pad will be set up to decontamination sampling equipment onsite. Decontamination water will be pumped out of the pads and containerized in 55 gallon drums

2.2.3 Waste Characterization and Off-site Disposal

Samples as described in *Section 2.2.2* will be collected from the soil and used to assess the appropriate disposal options for the soil and debris prior to excavation. Composite samples will be collected from the soil as specified by the receiving facility. These samples will be analyzed on a 24 hour TAT basis. It is anticipated that the 1996 ATK Toxicity Characteristic Leaching Procedure (TCLP) samples will be sufficient to characterize the soil as a hazardous waste (above the TCLP Regulatory Limit of 1 mg/L). However, additional samples will be collected as required. Soil will be collected for geotechnical evaluation for the receiving facility as well. These samples will be collected during the delineation phase, as discussed in *Section 2.2.2*.

One composite sample from the concrete sump materials, and five samples from the building/footer materials (plus QC samples) will be completed. Samples will be analyzed for TCLP metals and RCRA waste characteristics ignitability, reactivity, and corrosivity as pH. For reactivity, the analysis will also include explosives for the composite sample from the concrete sump and one of the building/footer samples. Additional analyses may be required by the disposal facility accepting the waste. If required, this plan will be modified to include any additional analyses. Any decontamination water generated from field activities will be analyzed for chemical oxygen demand (COD), TAL metals, and pH.

As discussed in *Section 2.2.2.*, direct load-out of the soil will be performed. Building/sump/ footer debris will be disposed following demolition. In addition to the soil and debris generated for this remedial effort, disposal of the silt/construction fence will be required.

Each waste type generated during this effort shall require a different disposal method based on its waste characterization results. Excavated soil/debris that is classified as a hazardous waste will be disposed in a RCRA Subtitle C Landfill. Excavated soil/sump/footer/building debris that is classified as a non-hazardous waste will be disposed in a RCRA Subtitle D Landfill. Decontamination fluid that is characterized as non-hazardous waste will be disposed in the RFAAP wastewater treatment plant.

B43SSB32
B43SSB31
STORMWATER DRAINAGE DITCH
B43SSB18
B43SS02
B43SS03
70.3
B43SSB30
B43SSB17
B43SSB16
B43SSB29
B43SSD6
ALLUVIAL FAN
B43SSD5
70.3
B43SSD4
B43SSB27
B43SSB28
B43SSD3
PROCESS WATER DRAINAGE DITCH
ASPHALT DRIVEWAY
B43SSD2
B43SSB15
B43SSD1
70.3
B43SSB14
B43SSB24
B43SB44
B43SSB23
B43SSB13
B43SB43
70.3
B43SB39
B43SB37
B43SSB10
B43SB42
B43SB40
B43SB36
B43SSB9
B43SB41
B43SB38
B43SSB11
B43SSB8
B43SSB12
4343
B43SSB7
ASPHALT
PARKING LOT
B43SSB6
B43SSB4
B43SSB5
B43SS01
70.3
N

LEGEND

- PROPOSED CONFIRMATION SOIL BORING LOCATION
- SURFACE SOIL SAMPLE LOCATION
- SOIL BORING LOCATION
- ESTIMATED SUBSURFACE (2–4 FT BGS) AREA OF CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)
- ESTIMATED AREA OF SURFACE (0–1 FT BGS) CADMIUM EXCEEDING RESIDENTIAL REMEDIAL GOAL (70.3 mg/kg)

0 20 40 80
SCALE IN FEET

RADFORD AAP

PREPARED BY: SHAW	TASK NO: 82987008400000
CHECKED BY: GM	SHAW DWG NO: Fig2–5.dwg
DATE: REVISED JUNE 2006	

FIGURE 2–5

BUILDING 4343
PROPOSED CADMIUM
CONFIRMATION
SAMPLE LOCATIONS

Shaw will act as the agent for the Army for T&D of the wastes. Shaw and the Installation shall select the final disposal facility for the waste based on several factors:

1. Treatment, storage, and disposal facility (TSDF) capacity to accommodate incoming waste;
2. Solicitation of bids using applicable Federal Acquisition Regulations (FARs);
3. Verification of permits and insurance (at time of award); and,
4. The disposal facility must meet the permit compliance requirements.

The selected TSDF will supply the Army with an independent audit performed by an Army approved auditor. Contact information for disposal facilities selected for the Building 4343 IM will be presented in **Table 2-1** in subsequent versions of this document, once they have been identified.

2.2.4 Sump/Building 4343/Concrete Footer Removal

Following soil removal, removal of each of the two sumps where elevated metals have been identified will be performed. In addition, 12 inches of soil from around the sidewalls and 24 inches of soil from below the bottom of the sumps will also be removed during the sump removal. The sumps will be removed using conventional equipment (hydraulic hoe ram, excavator). Sludge material in the sumps will first be removed and added to the excavated soil.

Once the sumps and soil have been removed, demolition of Building 4343 and the concrete footers will commence. Based on observations and bulk chip samples obtained during site visits, it is confirmed that lead-based paints and asbestos are present in Building 4343. It was estimated that approximately 30 linear feet of asbestos are present and shall require abatement prior to demolition. Asbestos abatement activities considered in this scope of work include completion of an asbestos survey, reporting, abatement, and disposal. Shaw plans to implement a subcontractor for asbestos containing materials (ACM) removal and disposal. All ACM removal and disposal activities will be performed in accordance with the Virginia Commonwealth, USEPA, and USACE requirements. Paint, which is confirmed to be lead based, is present on the inside of Building 4343 (the outside is unpainted). Therefore, lead based paint health and safety measures and all required abatement will be performed as required. Suppression of dust generation will also be performed during demolition of the building. The building is constructed of cinder blocks approximately 8 inches in thickness and has a poured concrete floor, approximately 8-inches thick and a corrugated metal roof. A backhoe and excavator will be used to demolish the building and a loader will be used to place the material into trucks to be hauled off-site. A pneumatic hammer will then be used to breakup the floor and the pieces will be picked up with the thumb attachment on the arm of the trackhoe and placed into piles to await transport off-site.

Removal of 20 concrete footers (formerly held holding water tanks) will also be performed as part of the building demolition. The footers are an average of 27.5 feet long and have a T-shaped cross-sectional area of approximately 4 ft^2. The footers extend approximately 1.5 ft above ground surface and the top of the T is buried 1 ft below ground surface and is approximately 1 ft thick. The footers will be removed using the same equipment as that used for the building demolition.

Following building/footer demolition, confirmation samples (5 plus QC) shall be collected from under the building to assess whether cadmium is present at concentrations exceeding the residential remedial goal. Select confirmation samples will also be analyzed for TCLP cadmium to ensure that remaining soil concentrations are below the TCLP Regulatory Limit of 1 mg/L. Confirmation samples will be collected from the each of the four sidewalls and the floor of the excavation. During removal of the foundation and sump, the concrete and soil under the foundation will be visibly inspected for cracks/leaks or discolored soil that may indicate a contaminant pathway Sampling will follow a biased sampling strategy (SOP 30.7) based on these observations. If visible indications are not detected, the sample beneath the floor will be collected adjacent to the sump. It is assumed that no additional soil removal will be required.

2.2.5 Site Restoration

Following removal of the soil and demolition debris, site restoration activities will commence. Off-site borrow material will be placed to bring the excavated areas up to the surrounding grade. It should be noted that, this includes the process water drainage ditch which will be filled with borrow material to match the existing grade. Six inches of topsoil will then be placed and the area will be graded. In addition, asphalt will be placed to repair the driveway that was damaged during removal of the concrete pipe.

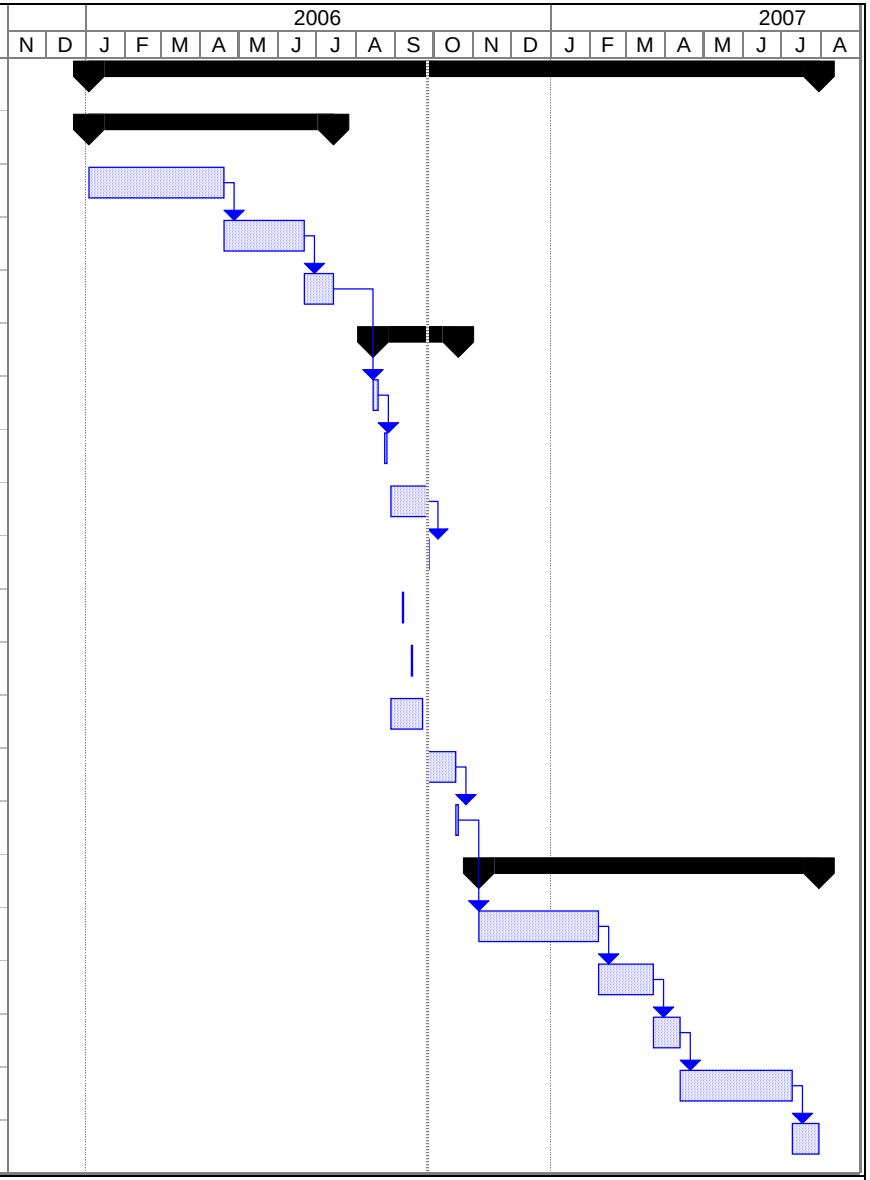
Borrow material will be selected that has physical characteristics consistent with the existing soil at Building 4343. The borrow material/topsoil will be sampled at a rate of 1 sample/1,000 yards (i.e., 1 samples from the borrow material, 1 sample from the topsoil) for Target Analyte List (TAL) metals, Target Compound List (TCL) volatile organic compound (VOCs), TCL semi-volatile organic compound (SVOCs), Pesticides/polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and pH prior to placement. Erosion control measures will be implemented and excavation areas will be seeded.

After the site restoration activities are completed, Shaw will demobilize all equipment offsite.

2.2.6 Project Schedule

The field activities to be performed as part of the Building 4343 IM are scheduled to commence in May 2006. The proposed schedule of project tasks is provided in **Figure 2-6**.

ID	Task Name	Duration	Start	Finish
1	**Radford - Bldg 4343 Interim Measures**	**569 days**	**Wed 1/4/06**	**Mon 7/30/07**
2	**Interim Measures Work Plan**	**191 days**	**Wed 1/4/06**	**Fri 7/14/06**
3	Draft - Work Plan	76 days	Wed 1/4/06	Wed 4/19/06
4	Regulator Review	44 days	Thu 4/20/06	Wed 6/21/06
5	Final Interim Measures Work Plan	16 days	Thu 6/22/06	Fri 7/14/06
6	**Field Work**	**47 days**	**Tue 8/15/06**	**Fri 10/20/06**
7	Soil Contamination Delineation	4 days	Tue 8/15/06	Fri 8/18/06
8	Mobilization / Site Setup	2 days	Thu 8/24/06	Fri 8/25/06
9	Soil Excavation and Load-out	20 days	Tue 8/29/06	Tue 9/26/06
10	Confirmation Sampling	1 day	Wed 9/27/06	Wed 9/27/06
11	Sump Removal	1 day	Thu 9/7/06	Thu 9/7/06
12	Building 4343 ACM Abatement	1 day	Thu 9/14/06	Thu 9/14/06
13	Building 4343/Footer Demo	18 days	Tue 8/29/06	Fri 9/22/06
14	Site Restoration	15 days	Wed 9/27/06	Wed 10/18/06
15	Demobilization	2 days	Thu 10/19/06	Fri 10/20/06
16	**Interim Action Report**	**182 days**	**Mon 11/6/06**	**Mon 7/30/07**
17	Internal Draft - Interim Action Report	62 days	Mon 11/6/06	Wed 2/7/07
18	USACE/RFAAP Review	30 days	Thu 2/8/07	Thu 3/22/07
19	Draft Interim Action Report	15 days	Fri 3/23/07	Thu 4/12/07
20	Regulator Review	60 days	Fri 4/13/07	Mon 7/9/07
21	Final Interim Action Report	15 days	Tue 7/10/07	Mon 7/30/07



Radford - Bldg 4343 Interim Measure Schedule

Figure 2-6

3.0 FIELD SAMPLING PLAN

This FSP describes the field sampling activities that will be performed and defines the procedures and methods that will be used to collect field samples. Contents included in this FSP include procedures for collection of soil delineation, confirmation samples, waste characterization samples; and requirements for sample chain-of-custody (COC), documentation, and shipping. This FSP also addresses investigation-derived material (IDM), contractor chemical quality control, corrective action procedures, and the schedule for field activities. This FSP was developed in accordance with USACE EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans* and is to be used in conjunction with the QAPP, *Section 4.0*.

3.1 PROJECT DESCRIPTION

A detailed description of the project history and the planned removal action work has been presented in the Introduction, *Section 1.0*, and the Organization and Technical Approach Plan, *Section 2.0*, of this IMWP, respectively. As part of the planned removal action work, field sampling activities will be conducted. These field sampling activities are discussed below.

3.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

A detailed discussion of project personnel organization and responsibilities was previously provided in *Section 2.0*. Coordination of sample collection activities will be the responsibility of the Site Superintendent who is responsible for running site operations. Field sampling technicians will be responsible for collection and delivery of samples to the laboratory. After delivery, the Project Chemist will be responsible for ensuring proper analysis, and timely delivery of sample results by the laboratory.

3.3 SCOPE AND OBJECTIVES

Samples to be collected during the interim measures work include: soil delineation and confirmation samples; and waste characterization samples. QC samples (i.e., field duplicate samples, rinse blanks, MS/MSD, etc.) will also be collected as described in the QAPP, *Section 4.0*. The following sections describe the function of each type of field sample. Details on the methods used for collection of the samples are presented in **Appendix B**.

3.3.1 Soil Delineation Samples

Soil delineation samples will be used to determine the extent of cadmium contamination in surface and subsurface soil at Building 4343. Soil delineation samples will be collected from the area where cadmium was determined to be present above remedial goals during the previous RFI sampling events **(see Figures 2-2 and 2-3)** and analyzed by an off-site laboratory for cadmium. These samples will be used to characterize the soil as waste for off-site disposal. Soil containing leachable cadmium at a concentration greater than the TCLP Regulatory Limit of 1 mg/L will be treated as hazardous waste. Analytical methods to be used for sample analysis are detailed in the QAPP (*Section 4.0*). Analytical results will be compared to the remediation goal and will be used as the basis for soil removal.

3.3.2 Soil Confirmation Samples

Soil confirmation samples will be used to determine whether or not all contaminated soil has been completely removed from the excavated area(s). Soil confirmation samples will be collected from the excavated area (as described in *Section 2.0*) and analyzed for cadmium. Samples will be submitted to a USACE-approved laboratory for analysis. Analytical methods to be used for sample analysis and additional field QC samples are detailed in the QAPP (*Section 4.0*). Analytical results will be compared to the remediation goal and will be used as the basis for either confirming the completion of the excavation or the requirement for additional soil removal.

3.3.3 Waste and Borrow Characterization Samples

Waste characterization samples will be collected and analyzed to determine the appropriate disposal methods of waste streams resulting from the interim measures at Building 4343. Several types of waste streams will be generated during the interim measures: solid (soil), solid (building materials: wood, metal, concrete, roofing material), solid (sump materials), and liquid (decontamination water). In addition, the provider will demonstrate that the borrow material and top soil is clean and one sample will be collected and analyzed to confirm that the fill is usable for site fill.

Soil waste characterization samples will be collected (during site delineation) to assess the appropriate disposal options for the soil and debris. The samples will be submitted to a USACE-approved laboratory and analyzed for TCLP metals and RCRA waste characteristics corrosivity as pH, reactivity, and ignitability. For reactivity, the analysis will also include explosives for the composite sample from the concrete sump and one of the building/footer samples. Liquid waste characterization samples from decontamination procedures will be submitted to a USACE-approved laboratory and analyzed for chemical oxygen demand, TAL metals, and pH. The borrow material and top soil will be analyzed for TAL metals, TCL VOCs, TCL SVOCs, PAHs, Pesticides/PCBs, and pH. Analytical methods to be used for sample analysis are detailed in the QAPP (*Section 4.0*).

3.3.4 Anticipated Sampling Program

The sampling program for Building 4343 removal action is discussed in detail in *Section 2.2*. Samples anticipated for collection during this scope of work include: Soil Delineation; Soil Confirmation; Waste and Borrow Characterization; and, Quality Control. A list of all anticipated analytical samples, QC samples, and analyses associated with the Building 4343 IM are provided on **Table 3-1**. Analytical methods to be used for sample analysis are detailed in the QAPP (*Section 4.0*). Additional samples and/or analyses may be required depending on site conditions and specific disposal facility requirements. If required, this plan will be modified to include any additional analyses.

Table 3-1
Anticipated Sampling Program for Building 4343 IM

Site ID	Sample ID	Cadmium	TCLP Metals, Corrosivity as pH, Reactivity, & Ignitability	TAL metals, COD, & pH	TAL metals, TCL VOCs, TCL SVOCs, PAHs, Pesticides/PCBs, & pH
Building 4343 IM – Soil Delineation Samples					
B43DE01	B43DE01A	X	---	---	---
B43DE01	B43DE01B	X	---	---	---
B43DE01	B43DE01C	X	---	---	---
B43DE02	B43DE02A	X	---	---	---
B43DE02	B43DE02B	X	---	---	---
B43DE02	B43DE02C	X	---	---	---
B43DE03	B43DE03A	X	---	---	---
B43DE03	B43DE03B	X	---	---	---
B43DE03	B43DE03C	X	---	---	---
B43DE04	B43DE04A	X	---	---	---
B43DE04	B43DE04B	X	---	---	---
B43DE04	B43DE04C	X	---	---	---
B43DE05	B43DE05A	X	---	---	---
B43DE05	B43DE05B	X	---	---	---
B43DE05	B43DE05C	X	---	---	---
B43DE06	B43DE06A	X	---	---	---
B43DE06	B43DE06B	X	---	---	---
B43DE06	B43DE06C	X	---	---	---
B43DE07	B43DE07A	X	---	---	---
B43DE07	B43DE07B	X	---	---	---
B43DE07	B43DE07C	X	---	---	---
B43DE08	B43DE08A	X	---	---	---
B43DE08	B43DE08B	X	---	---	---
B43DE08	B43DE08C	X	---	---	---
B43DE09	B43DE09A	X	---	---	---
B43DE09	B43DE09B	X	---	---	---
B43DE09	B43DE09C	X	---	---	---
B43DE10	B43DE10A	X	---	---	---
B43DE10	B43DE10B	X	---	---	---
B43DE10	B43DE10C	X	---	---	---
B43DE11	B43DE11A	X	---	---	---
B43DE11	B43DE11B	X	---	---	---
B43DE11	B43DE11C	X	---	---	---
B43DE12	B43DE12A	X	---	---	---
B43DE12	B43DE12B	X	---	---	---
B43DE12	B43DE12C	X	---	---	---
B43DE13	B43DE13A	X	---	---	---
B43DE13	B43DE13B	X	---	---	---
B43DE13	B43DE13C	X	---	---	---
B43DE14	B43DE14A	X	---	---	---
B43DE14	B43DE14B	X	---	---	---
B43DE14	B43DE14C	X	---	---	---
B43DE15	B43DE15A	X	---	---	---

Site ID	Sample ID	Cadmium	TCLP Metals, Corrosivity as pH, Reactivity, & Ignitability	TAL metals, COD, & pH	TAL metals, TCL VOCs, TCL SVOCs, PAHs, Pesticides/PCBs, & pH
B43DE15	B43DE15B	X	---	---	---
B43DE15	B43DE15C	X	---	---	---
B43DE16	B43DE16A	X	---	---	---
B43DE16	B43DE16B	X	---	---	---
B43DE16	B43DE16C	X	---	---	---
B43DE17	B43DE17A	X	---	---	---
B43DE17	B43DE17B	X	---	---	---
B43DE17	B43DE17C	X	---	---	---
B43DE18	B43DE18A	X	---	---	---
B43DE18	B43DE18B	X	---	---	---
B43DE18	B43DE18C	X	---	---	---
B43DE19	B43DE19A	X	---	---	---
B43DE19	B43DE19B	X	---	---	---
B43DE19	B43DE19C	X	---	---	---
B43DE20	B43DE20A	X	---	---	---
B43DE20	B43DE20B	X	---	---	---
B43DE20	B43DE20C	X	---	---	---
Building 4343 IM – Soil Confirmation Samples*					
B43SC01	B43SC01	X	---	---	---
B43SC02	B43SC02	X	---	---	---
B43SC03	B43SC03	X	---	---	---
B43SC04	B43SC04	X	---	---	---
B43SC05	B43SC05	X	---	---	---
B43SC06	B43SC06	X	---	---	---
B43SC07	B43SC07	X	---	---	---
B43SC08	B43SC08	X	---	---	---
B43SC09	B43SC09	X	---	---	---
B43SC10	B43SC10	X	---	---	---
TMSC##	TMSC##	X	---	---	---
B43SC11	B43SC11	X	---	---	---
B43SC12	B43SC12	X	---	---	---
B43SC13	B43SC13	X	---	---	---
B43SC14	B43SC14	X	---	---	---
B43SC15	B43SC15	X	---	---	---
B43SC16	B43SC16	X	---	---	---
B43SC17	B43SC17	X	---	---	---
B43SC18	B43SC18	X	---	---	---
B43SC19	B43SC19	X	---	---	---
B43SC20	B43SC20	X	---	---	---
TMSC##	TMSC##	X	---	---	---
MMDDYYR1	MMDDYYR1	X	---	---	---
B43SC21	B43SC21	X	---	---	---
B43SC22	B43SC22	X	---	---	---
B43SC23	B43SC23	X	---	---	---
B43SC24	B43SC24	X	---	---	---
B43SC25	B43SC25	X	---	---	---
B43SC26	B43SC26	X	---	---	---
B43SC27	B43SC27	X	---	---	---
B43SC28	B43SC28	X	---	---	---

Site ID	Sample ID	Cadmium	TCLP Metals, Corrosivity as pH, Reactivity, & Ignitability	TAL metals, COD, & pH	TAL metals, TCL VOCs, TCL SVOCs, PAHs, Pesticides/PCBs, & pH
B43SC29	B43SC29	X	---	---	---
B43SC30	B43SC30	X	---	---	---
TMSC##	TMSC##	X	---	---	---
B43SC31	B43SC31	X	---	---	---
B43SC32	B43SC32	X	---	---	---
B43SC33	B43SC33	X	---	---	---
B43SC34	B43SC34	X	---	---	---
B43SC35	B43SC35	X	---	---	---
B43SC36	B43SC36	X	---	---	---
B43SC37	B43SC37	X	---	---	---
B43SC38	B43SC38	X	---	---	---
B43SC39	B43SC39	X	---	---	---
TMSC##	TMSC##	X	---	---	---
MMDDYYR2	MMDDYYR2	X	---	---	---
Building 4343 IM – Waste and Borrow Characterization					
B43DW01	B43DW01	---	---	X (Aq.)	---
B43DW02	B43DW02	---	X (Soil)	---	---
B43DW03	B43DW03	---	X (Concrete)**	---	---
B43DW04	B43DW04	---	X (Footers)**	---	---
B43DW05	B43DW05	---	X (Footers)	---	---
B43DW06	B43DW06	---	X (Footers)	---	---
B43DW07	B43DW07	---	X (Footers)	---	---
B43DW08	B43DW08	---	X (Footers)	---	---
B43DW09	B43DW09	---	---	---	X (Top Soil)
B43DW10	B43DW10	---	---	---	X (Borrow Material)

TM: Blind Field Duplicate Sample (## to be assigned in field)
A: Sample Collected from 0-2 ft bgs
B: Sample Collected from 2-4 ft bgs
C: Sample Collected from 4-6 ft bgs
R: Rinse Blank
DE: Soil Delineation Sample
SC: Soil Confirmation Sample
DW: Waste and Borrow Characterization Sample
X: Sample group collected
---: Sample type not collected
Note: MS/MSD samples will be collected at a frequency of 5% of the total environmental sample volume.
*: Confirmation sample will be collected from bottom and sides of excavated area as described in *Section 2.0*.
**: For reactivity, the analysis will also include explosives for the composite sample from the concrete sump and one of the building/footer samples.

4.0 QUALITY ASSURANCE PROJECT PLAN

This QAPP describes the policy, organization, functional activities, analytical methods, and quality assurance (QA) and QC protocols necessary to achieve the project Data Quality Objectives (DQOs). This QAPP was developed in accordance with USACE *EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans* (USACE, 2001) and is to be used in conjunction with the FSP, *Section 3.0*.

4.1 PROJECT DESCRIPTION

A detailed description of the project history and the planned interim measures (IM) work is presented in the Introduction (*Section 1.0*) and the Organization and Technical Approach Plan (*Section 2.0*) of this IMWP addendum, respectively. As part of the planned interim measures work, field sampling and analysis activities will be conducted. This QAPP, in conjunction with the FSP (*Section 3.0*), describes the sampling and analysis requirements to ensure DQOs are met.

4.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

A detailed discussion of project personnel organization and responsibilities has been presented in the Organization and Technical Approach Plan, *Section 2.0*. Coordination of sample collection activities will be the responsibility of the Site Superintendent who is responsible for running site operations. Field sampling technicians will be responsible for collection and delivery of samples to the laboratory. After delivery, the Project Chemist will be responsible for ensuring proper analytical analysis and timely delivery of sample results by the contract laboratory according to the project SOW and QAPP requirements.

The contract laboratory that will be used to support the interim measures work at Building 4343 is Accutest Laboratories, Inc. of Orlando, Florida. A copy of the Accutest Laboratory Quality Assurance Plan (LQAP) is presented in **Appendix C**.

4.3 DATA QUALITY OBJECTIVES

Quality assurance 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 determine 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 corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from environmental data.

The overall QA objective is to develop and implement procedures for sample and data collection, shipment, evaluation, and reporting that will allow reviewers to assess 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 corrective actions. DQOs specify the level of uncertainty that will be

accepted in results derived from environmental data. *Guidance for the Data Quality Objectives Process* (USEPA, 1994), *USEPA Data Quality Objectives Process for Hazardous Waste Site Investigations EPA QA/G-4HW* (USEPA, 2000b), and the *USACE Shell for Analytical Chemistry Requirements* (USACE, 2001) formed the basis for the DQO process and development of RFAAP data quality criteria and performance specifications. The DQO process consists of the seven steps specified below. Each phase is broken out in the following DQO elements. DQO elements are included in italics following each process step. Project-specific DQOs may be found on **Table 4-1** for Building 4343 IM.

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, (3) statement of the problem, and (4) available resources and relevant deadlines.

   (1) The planning team consists of representatives from the VDEQ, United States Environmental Protection Agency (USEPA), USACE and RFAAP.
   (2) The Army is the primary decision-maker.
   *(3) Refer to **Table 4-1**.*
   (4) Resource specifications are contained in the RFAAP Building 4343 IMWP. The period of performance for this project is approximately 18 months.

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) What is the extent and characteristics of the cadmium contaminated soil at Building 4343 and does the soil exceed set remediation goals? If the areas impacted are above cleanup levels, the soil will be removed for treatment and replaced with clean fill.
   (2) Resultant alternative actions include:
      (2a) Further determine extent of contaminated soil for removal
      (2b) The extent of contamination has been determined.

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 level goals, and (4) confirmation of appropriate field sampling and analytical methods.

   *(1) Refer to **Table 4-1**.*
   (2) Samples for the soil delineation, confirmation, and waste and borrow characterization will be analyzed using USEPA SW-846 and USEPA Method of Chemical Analysis of Water and Wastes methodology. Refer to Section 4.6.
   (3) The removal action remediation goals for Building 4343 are identified and will be evaluated against state of Maryland Unrestricted Use criterion, disposal facility permit levels, and/or USEPA disposal criteria (40 CFR 261.24, 40 CFR 761.50, and USEPA SW-846 Chapter 7).
   (4) Field sampling will be performed in accordance with the RFAAP Building 4343 IMWP. Refer to Section 3.0.

Table 4-1
Specific Data Quality Objectives for Building 4343 IM

DQO Elements		Pre-excavation Soil Delineation Sampling and Analysis	Post-excavation Soil Confirmation Sampling and Analysis	Waste Characterization Sampling and Analysis	Borrow/Top Soil Characterization Sampling and Analysis
PROBLEM STATEMENT	PROBLEM AND OBJECTIVES	Characterize cadmium-contaminated soil, if any, to determine if a soil removal is warranted.	Confirm all cadmium contaminated soil has been removed.	Waste characterization for disposal.	Confirm borrow soil and top soil is suitable for fill.
DECISION INPUTS	CHEMICAL DATA	Discrete surface and subsurface soil characterization samples will be collected from the area determined during the RFI as containing cadmium above remedial goals and analyzed off-site for cadmium. The field standard operating procedures (SOPs) may be found in Appendix B.	Discrete confirmation soil samples will be collected from the bottom and sides of the excavation area and analyzed for total cadmium and analyzed at an off-site laboratory. Field SOPs may be found in Appendix B	Discrete waste characterization samples will be collected and analyzed off-site. The soil samples will be analyzed for TCLP metals, Corrosivity as pH, Reactivity, and Ignitability. For reactivity, the analysis will also include explosives for the composite sample from the concrete sump and one of the building/footer samples. Decon water will be analyzed for chemical oxygen demand (COD), TAL metals, and pH. Field SOPs may be found in Appendix B	Discrete characterization samples will be collected for borrow material and top soil prior to placement and analyzed off-site for TAL metals, TCL VOCs, TCL SVOCs, PAHs, Pesticides/PCBs, and pH. Field SOPs may be found in Appendix B.
	PHYSICAL DATA	NA	Map locations for all sample locations will be generated.	NA	NA
	SAMPLING METHOD	Environmental, biased, grab, and intrusive.	Environmental, biased, grab, and non-intrusive.	Environmental, biased, grab and non-intrusive.	Environmental, grab and non-intrusive.
	DATA USE	Interim Measures	Interim Measures	Waste Characterization	Interim Measures
	VALIDATION DATA LEVEL	USACE Level I	USACE Level II (USEPA Region III Validation IM2)	USACE Level I	USACE Level II (USEPA Region III Validation M3 & IM2)
	ANALYTICAL METHOD	Chemical Data (USEPA SW-846): Cadmium: 3050A/6010B	Chemical Data (USEPA SW-846): Cadmium: 3050A/6010B	Chemical Data (USEPA SW-846) TCLP Metals: 1311/3010A/6010B/7470A, Explosives (incl. NG/PETN): 8330A & 8332 Corrosivity as pH and pH: 9045D (Soil) & 9040C (Aq.) Ignitability: 1030 (Soil) Reactivity (CN & H2S): Ch. 7.3.3 & 7.3.4 (Soil) TAL Metals: 3010A/6010B/7470A (Aq.) COD: EPA 410.4 (Aq.)	Chemical Data (USEPA SW-846) TAL Metals: 3050A/6010B/7471A TCL Pesticides & PCBs: 3540C/8081A/8082, TCL VOCs: 5035/8260B, TCL SVOCs: 3540C/8270C, PAHs: 3540C/8270C SIM, pH: 9045D
	METHOD QUANTITATION LIMIT	Refer to Table 4-2.	Refer to Table 4-2.	Refer to Table 4-2.	Refer to Table 4-2.
	FIELD QUALITY CONTROL SAMPLES	NA	Rinse Blank (5% frequency) and Field Duplicate (10% frequency)	NA	NA
STUDY BOUNDARY		1) 450' x 225' 2) in-situ 3) None	1) 450' x 225' 2) in-situ 3) None	1) 450' x 225' 2) in-situ 3) None	1) 450' x 225' 2) in-situ 3) None

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 4-1**.*

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 4-1**.*
(2) The removal action remediation goals for Building 4343 are identified as the calculated residential risk-based RG, disposal facility permit levels, and/or USEPA disposal criteria (40 CFR 261.24, 40 CFR 761.50, and USEPA SW-846 Chapter 7).
(3) If the soil characterization sample exceeds the remediation goal, the soil will be removed. If the confirmation samples exceed remediation goals, excavation will continue until all soil above remedial goals has been removed. Waste characterization samples will be compared to disposal facility criteria. If concentrations of chemicals in these samples exceed target levels, the soil will be disposed at an appropriate disposal facility.

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 the soil characteristics exceed cleanup goals (soil removed) when they do not and deciding that the soil characteristics do not exceed cleanup goals (soil not removed) when they actually do. The consequences of deciding that the soil characteristics exceed cleanup goals (soil removed) when they do not will result in unnecessary removal actions. The consequences of deciding that the soil characteristics do not exceed cleanup goals (soil not removed) when they do will result in liabilities associated with future damages and environmental clean-up costs. Additionally, public opinion will be compromised.
(2b) (I) The true state when the most severe decision error occurs [deciding that the soil characteristics exceed cleanup goals (soil removed) when they actually do] is that the soil characteristics exceed cleanup goals and it is removed. (II) The true state when the less severe decision error occurs (deciding the soil characteristics do not exceed cleanup goals (soil not removed) when they do not) is that the soil characteristics do not exceed cleanup goals and no removal occurs.
(2c) The null hypothesis (H0) is: the soil characteristics exceed cleanup goals (soil removed). The alternative hypothesis (Ha) is the soil characteristics do not exceed cleanup goals (soil not removed).
(2d) The false positive decision error occurs when H0 is erroneously rejected corresponding to decision error I. The false negative decision error occurs when Ha is erroneously accepted corresponding to decision error II. Project-specific Type I and II error rates are 0.05 and 0.2, respectively.
(3, 4) The consequence of decision errors and acceptable probability will be determined as part of the final report.

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 interim measures sampling design program for Building 4343. A phased focus approach has been adopted for site characterization, confirmation, and waste characterization to optimize resource utilization and minimize decision errors. 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 for the collection of the characterization and confirmation samples for the removal action.
    (3) Mathematical and qualitative assessments will be established during the refinement process.
    (4) This addendum contains the proposed interim measures sampling design program based on cost and project DQOs.
    (5) Refer to the RFAAP Building 4343 IMWP.

4.3.1 Background

The cadmium-contaminated soil removal action objective, rationale, and sampling scope for Building 4343 are presented on **Table 4-1**.

4.3.2 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) selected for the cadmium-contaminated soil removal action at Building 4343 may be found on **Table 4-2** and include:

- Waste Disposal Criteria per U.S. Environmental Protection Agency (USEPA) 40 Code of Federal Regulations (CFR) 261.24; USEPA SW-846 Chapter 7 for TCLP analysis; and,
- Waste Disposal Criteria of 50 mg/kg for total PCBs (USEPA 40 CFR 761.50).

To-Be-Considered (TBC) Guidance selected for the cadmium-contaminated soil removal action at Building 4343 include:

- Remediation Goal not to exceed 70.3 mg/kg for cadmium in soil (calculated residential remedial goal);
- RFAAP Metals Background Concentrations; and,
- USEPA Region III Industrial and Residential Soil Risk Based Concentrations (USEPA, October 2005). [Note: RBCs will be updated as new versions of the RBC table are available.]

Sampling locations and procedures and sampling activities and procedures for the interim measures at Building 4343 are presented in the FSP (*Section 3.0*). Parameter, container and preservation requirements, and holding times for analytical samples to be collected as part of the Building 4343 IM are presented on **Table 4-3**.

Table 4-2
Analyte List and Levels of Concern for Building 4343 IM

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
TAL Metals						
Aluminum	N	200	20	NA	NA	40,041
Antimony	N	5	0.5	3.1	41	NA
Arsenic	C	3	0.5	0.43	1.9	15.8
Barium	N	20	2	1,600	20,000	209
Beryllium	N	2	0.2	16	200	1.02
Cadmium[1]	N	2	0.1	70.3	276	0.69
Calcium	NA	100	10	NA	NA	NA
Chromium	N	10	1	23	310	65.3
Cobalt	N	50	5	NA	NA	72.3
Copper	N	20	2	310	4,100	53.5
Iron	N	50	5	2,300	31,000	50,962
Lead	NA	2	0.3	400	750	26.8
Magnesium	NA	100	10	NA	NA	NA
Manganese	N	10	1	160	2,000	2,543
Mercury	N	0.1	0.05	2.3	31	0.13
Nickel	N	40	4	160	2,000	62.8
Potassium	NA	3,000	300	NA	NA	NA
Selenium	N	5	1	39	510	NA
Silver	N	10	1	39	510	NA
Sodium	NA	200	20	NA	NA	NA
Thallium	N	2	0.3	0.55	7.2	2.11
Vanadium	N	50	5	7.8	102	108
Zinc	N	20	2	2,300	31,000	202
Miscellaneous						
pH	NA	±0.1	±0.1	NA	NA	NA
TCL SVOCs						
1,2-Dichlorobenzene	N	5	0.170	700	9,200	NA
1,2,4-Trichlorobenzene	N	5	0.170	78	1,000	NA
1,3-Dichlorobenzene	N	5	0.170	23.5	310	NA
1,4-Dichlorobenzene	C	5	0.170	27	120	NA
2-Chloronaphthalene	N	5	0.170	630	8,200	NA
2-Chlorophenol	N	5	0.170	39	510	NA
2-Methylnaphthalene	N	5	0.170	31.3	410	NA
2-Methylphenol	N	5	0.170	390	5,100	NA
2-Nitroaniline	N	5	0.170	NA	NA	NA
2-Nitrophenol	NA	5	0.170	NA	NA	NA

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
2,4-Dichlorophenol	N	5	0.170	23	310	NA
2,4-Dimethylphenol	N	5	0.170	160	2,000	NA
2,4-Dinitrophenol	N	25	0.830	16	200	NA
2,4-Dinitrotoluene	N	5	0.170	16	200	NA
2,4,5-Trichlorophenol	N	5	0.170	780	10,000	NA
2,4,6-Trichlorophenol	C	5	0.170	58	260	NA
2,6-Dinitrotoluene	N	5	0.170	7.8	100	NA
3-Nitroaniline	C!	5	0.170	2.3	140	NA
3,3'-Dichlorobenzidine	C	5	0.170	NA	NA	NA
4-Bromophenylphenylether	NA	5	0.170	NA	NA	NA
4-Chloro-3-methylphenol	NA	5	0.170	NA	NA	NA
4-Chloroaniline	N	5	0.170	31	410	NA
4-Chlorophenylphenylether	NA	5	0.170	NA	NA	NA
3+4-Methylphenol	N	5	0.170	39	510	NA
4-Nitroaniline	C!	5	0.170	23.5	140	NA
4-Nitrophenol	N	25	0.830	63	820	NA
4,6-Dinitro-2-methylphenol	N	25	0.830	0.78	10	NA
Acenaphthylene	NA	5	0.170	NA	NA	NA
Acenaphthene	N	5	0.170	470	6,100	NA
Anthracene	N	5	0.170	2,300	31,000	NA
Benz[*a*]anthracene	C	5	0.170	0.87	3.9	NA
Benzo[*b*]fluoranthene	C	5	0.170	0.87	3.9	NA
Benzo[*a*]pyrene	C	5	0.170	0.087	0.39	NA
Benzo[*g,h,i*]perylene	N	5	0.170	230	3,100	NA
Benzo[*k*]fluoranthene	C	5	0.170	8.7	39	NA
Benzoic acid	N	25	0.170	31,000	410,000	NA
Benzyl alcohol	N	5	0.170	2,300	31,000	NA
Bis(2-chloroethoxy)methane	NA	5	0.170	NA	NA	NA
Bis(2-chloroethyl)ether	C	5	0.170	0.58	2.6	NA
Bis(2-chloroisopropyl)ether	C	5	0.170	9.1	41	NA
Bis(2-ethylhexyl)phthalate	C	5	0.170	46	200	NA
Butylbenzylphthalate	C	5	0.170	336	1,500	NA
Carbazole	C	5	0.170	32	140	NA
Chrysene	C	5	0.170	87	390	NA
Di-*n*-butylphthalate	N	5	0.170	780	10,000	NA
Di-*n*-octylphthalate	N	5	0.170	NA	NA	NA
Dibenz[*a,h*]anthracene	C	5	0.170	0.087	0.39	NA
Dibenzofuran	N	5	0.170	NA	NA	NA
Diethylphthalate	N	5	0.170	6,300	82,000	NA

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
Dimethylphthalate	N	5	0.170	NA	NA	NA
Fluoranthene	N	5	0.170	310	4,100	NA
Fluorene	N	5	0.170	310	4,100	NA
Hexachlorobenzene	C	5	0.170	0.4	1.8	NA
Hexachlorobutadiene	C!	5	0.170	1.6	37	NA
Hexachlorocyclopentadiene	N	5	0.170	47	610	NA
Hexachloroethane	C!	5	0.170	7.8	200	NA
Indeno[1,2,3-*cd*]pyrene	C	5	0.170	0.87	3.9	NA
Isophorone	C	5	0.170	670	3,000	NA
N-Nitrosodi-*n*-propylamine	C	5	0.170	0.091	0.41	NA
N-Nitrosodiphenylamine	C	5	0.170	130	580	NA
Naphthalene	N	5	0.170	160	2,000	NA
Nitrobenzene	N	5	0.170	3.9	51	NA
Pentachlorophenol	C	25	0.830	5.3	24	NA
Phenanthrene	N	5	0.170	230	3,100	NA
Phenol	N	5	0.170	2,300	31,000	NA
Pyrene	N	5	0.170	230	3,100	NA
PAHs						
Acenaphthylene	N	0.05	0.0017	230	3,100	NA
Acenaphthene	N	0.05	0.0017	470	6,100	NA
Anthracene	N	0.05	0.0017	2,300	31,000	NA
Benz[*a*]anthracene	C	0.05	0.0017	0.87	3.9	NA
Benzo[*b*]fluoranthene	C	0.05	0.0017	0.87	3.9	NA
Benzo[*a*]pyrene	C	0.05	0.0017	0.087	0.39	NA
Benzo[*g,h,i*] perylene	N	0.05	0.0017	230	3,100	NA
Benzo[*k*]fluoranthene	C	0.05	0.0017	8.7	39	NA
Chrysene	C	0.05	0.0017	87	390	NA
Dibenz[*a,h*]anthracene	C	0.05	0.0017	0.087	0.39	NA
Fluoranthene	N	0.05	0.0017	310	4,100	NA
Fluorene	N	0.05	0.0017	310	4,100	NA
Indeno[1,2,3-*cd*]pyrene	C	0.05	0.0017	0.87	3.9	NA
2-Methylnaphthalene	N	0.05	0.0017	160	2,000	NA
Naphthalene	N	0.05	0.0017	160	2,000	NA
Phenanthrene	N	0.05	0.0017	230	3,100	NA
Pyrene	N	0.05	0.0017	230	3,100	NA
TCL VOCs						
Acetone	N	5	0.005	7,000	92,000	NA
Benzene	C	1	0.005	12	52	NA
Bromochloromethane	NA	1	0.005	NA	NA	NA

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
Bromodichloromethane	C	1	0.005	10	46	NA
Bromoform	C	1	0.005	81	360	NA
Bromomethane	N	1	0.005	11	140	NA
2-Butanone	N	5	0.005	4,700	61,000	NA
Carbon disulfide	N	1	0.005	780	10,000	NA
Carbon tetrachloride	C	1	0.005	4.9	22	NA
Chlorobenzene	N	1	0.005	160	2,000	NA
Chloroethane	C	1	0.005	220	990	NA
Chloroform	C	1	0.005	78	1,000	NA
Chloromethane	N	1	0.005	NA	NA	NA
Dibromochloromethane	C	1	0.005	7.6	34	NA
1,1-Dichloroethane	N	1	0.005	1,560	20,440	NA
1,2-Dichloroethane	C	1	0.005	7	31	NA
1,1-Dichloroethene	N	1	0.005	390	5,100	NA
cis-1,2-Dichloroethene	N	1	0.005	NA	NA	NA
trans-1,2-Dichloroethene	N	1	0.005	160	2,000	NA
1,2-Dichloropropane	C	1	0.005	9.4	42	NA
cis-1,3-Dichloropropene	C	1	0.005	6.4	29	NA
trans-1,3-Dichloropropene	C	1	0.005	6.4	29	NA
Ethylbenzene	N	1	0.005	780	10,000	NA
2-Hexanone	N	5	0.005	310	4,100	NA
4-Methyl-2-pentanone	N	5	0.005	NA	NA	NA
Methylene chloride	C	1	0.005	85	380	NA
Styrene	N	1	0.005	1,600	20,000	NA
1,1,2,2-Tetrachloroethane	C	1	0.005	3.2	14	NA
Tetrachloroethene	C	1	0.005	1.2	5.3	NA
Toluene	N	1	0.005	630	8,200	NA
1,1,1-Trichloroethane	N	1	0.005	2,200	29,000	NA
1,1,2-Trichloroethane	C	1	0.005	11	50	NA
Trichloroethene	C	1	0.005	1.6	7.2	NA
Vinyl chloride	C	1	0.005	0.09	4.0	NA
m- & *p*-Xylene	N	2	0.01	1,600	200,000	NA
o-Xylene	N	1	0.005	1,600	200,000	NA
Xylene (total)	N	2	0.005	1,600	200,000	NA
TCL Pesticides & PCBs						
Aldrin	C	0.050	0.00067	0.038	0.17	NA
Alpha-BHC	C	0.050	0.00067	0.10	0.45	NA
beta-BHC	C	0.050	0.00067	0.35	1.6	NA
delta-BHC	NA	0.050	0.00067	NA	NA	NA
Gamma-BHC (Lindane)	C	0.050	0.00067	0.49	2.2	NA

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
alpha-Chlordane	C	0.050	0.00067	1.8	8.2	NA
gamma-Chlordane	C	0.050	0.00067	1.8	8.2	NA
Dieldrin	C	0.10	0.00067	0.040	0.18	NA
4,4'-DDD	C	0.10	0.00067	2.7	12	NA
4,4'-DDE	C	0.10	0.00067	1.9	8.4	NA
4,4'-DDT	C	0.10	0.00067	1.9	8.4	NA
Endosulfan I	N	0.050	0.00067	47	610	NA
Endosulfan II	N	0.10	0.00067	47	610	NA
Endosulfan sulfate	NA	0.10	0.00067	NA	NA	NA
Endrin	N	0.10	0.00067	2.30	31	NA
Endrin aldehyde	NA	0.10	0.00067	NA	NA	NA
Endrin ketone	NA	0.10	0.00067	NA	NA	NA
Heptachlor	C	0.050	0.00067	0.14	0.64	NA
Heptachlor epoxide	C	0.050	0.00067	0.070	0.31	NA
Methoxychlor	N	0.50	0.00067	39	510	NA
Toxaphene	C	3.0	0.033	0.58	2.6	NA
Aroclor-1016	C!	1.0	0.033	0.55	14.3	NA
Aroclor-1221	C	2.0	0.067	0.32	1.4	NA
Aroclor-1232	C	1.0	0.033	0.32	1.4	NA
Aroclor-1242	C	1.0	0.033	0.32	1.4	NA
Aroclor-1248	C	1.0	0.033	0.32	1.4	NA
Aroclor-1254	C!	1.0	0.033	0.16	1.4	NA
Aroclor-1260	C	1.0	0.033	0.32	1.4	NA
Waste Characterization	**Effect**	**Quantitation Limit**		**RCRA Limits (µg/L)**		**Background (mg/kg)**
		Aqueous (µg/L)	**Soil (mg/kg)**			
TCLP Metals						
Arsenic	C	100	NA	5,000		NA
Barium	N	2000	NA	100,000		NA
Cadmium	N	50	NA	1,000		NA
Chromium	N	100	NA	5,000		NA
Lead	NA	30	NA	5,000		NA
Mercury	NA	2	NA	200		NA
Selenium	NA	50	NA	1,000		NA
Silver	NA	100	NA	5,000		NA
Explosives						
Cyclotrimethylene-trinitramine (RDX)	C	NA	0.25	NA		NA
Cyclotetramethylene-tetranitramine (HMX)	N	NA	0.25	NA		NA

Parameter	Effect[2]	Quantitation Limits		USEPA Region III Soil Risk Based Concentration October 2005		Background
		Aqueous (µg/L)	Soil (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Soil (mg/kg)
1,3-Dinitrobenzene	N	NA	0.25	NA		NA
2,4-Dinitrotoluene	N	NA	0.25	NA		NA
2,6-Dinitrotoluene	N	NA	0.25	NA		NA
Nitrobenzene	N	NA	0.25	NA		NA
Nitroglycerin	C	NA	0.25	NA		NA
PETN	NA	NA	0.25	NA		NA
TETRYL	N	NA	0.25	NA		NA
1,3,5-Trinitrobenzene	N	NA	0.25	NA		NA
2,4,6-Trinitrotoluene	C!	NA	0.25	NA		NA
2-Nitrotoluene	N	NA	0.50	78	1,000	NA
3-Nitrotoluene	C	NA	0.50	NA		NA
4-Nitrotoluene	C	NA	0.50	NA		NA
4-Amino-2,6-dinitrotoluene	N	NA	0.25	NA		NA
2-Amino-4,6-dinitrotoluene	N	NA	0.25	NA		NA
Miscellaneous						
Ignitability	NA	±1°F	NA	140°F		NA
Corrosivity as pH	NA	±1 Units	NA	<2 or >12		NA
Reactive Cyanide	NA	5 mg/kg	NA	250 mg/kg		NA
Reactive Sulfide	NA	20 mg/kg	NA	500 mg/kg		NA
Chemical Oxygen Demand (COD)	NA	3,000	NA	NA		NA
TAL Metals	(See Above)					

NOTES: (1) Cadmium values are the calculated residential and industrial risk-based concentrations, rather than the USEPA Region III risk-based concentrations (USEPA, October 2005). (2) The RBC levels for noncarcinogenic "N" chemicals are presented with a hazard quotient of 0.1 to allow for cumulative effects, multiple contaminated media, and multiple routes of exposure.

NA = not applicable.

Bold border indicates that the screening levels cannot be met. However, the QLs are conservative limits and, although some exceedances of the screening levels are indicated, this does not necessarily indicate that the method will not detect the compound at, or below, the screening level. Although some QLs are above the screening levels for certain compounds because the values cannot be met practically with the given USEPA methodology, the best available methods were selected to attain screening level requirements.

Table 4-3
Parameter, Method, Container, Preservation Requirements, and Holding Times for Building 4343 IM

Parameter	Sample Container*		Preservation Requirement*	Holding Time
	Solid	Aqueous		
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: Analysis 14 days Solid: Preparation: 2 days 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
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
Explosives (including NG/PETN)	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
Cadmium	1, 4 oz, wide mouth glass with Teflon cap	1, 1-L HDPE	Cool: 4 ± 2°C, HNO_3 to pH<2 for aqueous	Cadmium: 180 days
TAL Metals	1, 8 oz, wide mouth glass with Teflon cap	1, 1-L HDPE	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	1, 250 mL glass or HDPE	Cool: 4 ± 2°C	ASAP
TCLP Metals	1, 8 oz, wide mouth glass with Teflon cap	1, 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, 1-L glass or HDPE	Cool: 4 ± 2°C	28 days
Reactive Sulfide	1, 8 oz, wide mouth glass with Teflon cap	1, 1-L glass or HDPE	Cool: 4 ± 2°C	7 days
Reactive Cyanide	1, 8 oz, wide mouth glass with Teflon cap	1, 1-L glass or HDPE	Cool: 4 ± 2°C	14 days
Corrosivity as pH & pH	1, 8 oz, wide mouth glass with Teflon cap	1, 250 mL glass or HDPE	Cool: 4 ± 2°C	ASAP
Chemical Oxygen Demand	NA	1, 250 mL glass	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.

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

4.4 NUMBER AND TYPE

The anticipated number and type of samples to be collected during the cadmium-contaminated soil removal action at Building 4343 are presented on **Table 4-4**. **Table 4-4** also presents guidelines for the collection of QC samples that will be taken in conjunction with environmental sampling during the cadmium-contaminated soil removal action at Building 4343.

Table 4-4
Estimated Number and Type of Samples for Building 4343 IM

Sample Type	Total Samples
Environmental	
Soil Delineation	60
Soil Confirmation	30
Soil Confirmation (Under Piping)	9
Total Environmental	**99**
QC (For Soil Confirmation only)	
Rinse Blank (5% frequency)	2
Matrix Spike (MS)/Matrix Spike Duplicate (MSD) (5% frequency)	2
Field Duplicate (10% frequency)	4
Total QC	**8**
Waste and Borrow Characterization	
Decontamination Rinse Water	1
Soil	1
Sump (concrete)	1
Building 4343/Footers	5
Topsoil	1
Borrow Material	1
Total Waste and Borrow	**10**
TOTAL SAMPLES	**117**

*: Total samples assuming areas sampled at Building 4343 are excavated as described in *Section 2.0*.

4.5 SAMPLE IDENTIFICATION

The sample identification system will be similar with past nomenclature at RFAAP. The sample identification number will consist of an alphanumeric designation related to the sampling location, media type, and sequential order sampling location, sample type, and sequential order according to the sampling event. Each sample will be assigned a unique sequential number at the time of sampling on the sample label, which will be permanently affixed to the sample container. **Table 3-1** in the FSP (*Section 3.0*) contains sample identification numbers that will be used for the interim measures at Building 4343. The sample identification number consists of an alphanumeric designation according to the following convention:

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 according to the sampling event. 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:

B43	= Building 4343
TM	= Blind Field Duplicate

- **Sample/Media Type:** The second two characters will be the sample/media type. Sample types will be designated by the following codes:

DE	= Soil Delineation Sample;
SC	= Soil Confirmation Sample; and
DW	= Waste and Borrow Characterization Sample

- **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 as follows:

  A = Sample Collected from 0-2 ft bgs;

  B = Sample Collected from 2-4 ft bgs;

  C = Sample Collected from 4-6 ft bgs.

- **Duplicate:** Field duplicate samples will be identified with a "TM" designation as noted in the "Site Location Code". A record of the samples that correspond to the duplicates will be kept in the field logbook.

4.5.1 Field QC Blank Samples

All field QC blanks will use the following designation system:

- Date: month, day, year as MMDDYY
- Type: R = Rinse Blank
- Sequential Collection Order (if more than one collected per day): This consists of one digit such as 1, 2, 3 and so on.

Rinse blanks will be designated with the date sampled, followed by "R", ending with the sequenced number of the rinse blanks (e.g., 062906R2 is the second rinse blank taken on June 29, 2006).

4.6 ANALYTICAL PROCEDURES AND DATA VALIDATION

4.6.1 Method Selection for Chemical Analyses

An USACE-approved laboratory will perform IM analytical activities. All analytical procedures will be in accordance with USEPA approved methods. The analysis methods, analytical compound lists, and quantitation limits (QLs) are provided in **Table 4-2**. The methods listed are in accordance with USEPA Office of Solid Waste and Emergency Response Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Update IIIA, April, 1998 and USEPA Method of Chemical Analysis of Water and Wastes, March, 1983.

Analytical QLs were compared to screening levels to ensure that they do not exceed the screening levels listed in **Table 4-2**. During the planning stage, the QLs are used for comparison rather than method reporting limits (MRLs) or method detection limits (MDLs) because MRLs are sample specific and take into account characteristics such as dilutions, sample volumes, and percent moistures which are unknown prior to sampling and analysis. The laboratory will be required to perform and report MDLs for each sample and analysis. These limits are specific to the laboratory, instrumentation, and methodology and are updated at least annually. The MDLs represent the lowest level the laboratory can detect a constituent at a 99% confidence for a specific compound. If a compound is detected >MDL and <MRL, it is treated as estimated "J". The QLs listed in **Table 4-2** are conservative limits and, although some exceedances of the screening levels are indicated, this does not necessarily indicate that the method will not detect the compound at, or below, the screening level.

Although some QLs are above the screening levels for certain compounds because the values cannot be met practically with the given USEPA methodology, the best available methods were selected to attain screening level requirements. Economical, technical, comparability, and sensitivity factors were considered during the method selection process for this IM. The MRLs and MDLs will be compared to screening levels during the data analysis stage in the IM.

4.6.2 Laboratory Procedures for Chemical Analyses

Analytical testing will be performed by the contracted USACE approved laboratory. The LQAP for Accutest Laboratories, Inc. (the subcontracted analytical laboratory for the Building 4343 IM) is presented as **Appendix C**. Analytical compound lists and minimum quantitation limits to be used are given on **Table 4-2**. The QC requirements may be found in **Tables 4-5 to 4-10**. The delineation and confirmation analysis is being performed for the cadmium contamination at Building 4343. The waste characterization analysis includes the investigative derived materials for disposal and the characterization of the borrow material and top soil.

4.6.2.1 Chemical Analyses for Delineation and Confirmation Samples

Cadmium. Cadmium will be analyzed using inductively coupled plasma (ICP) techniques using USEPA SW-846 Methods 3010A(Mod.)/6010B for aqueous samples (e.g. rinse blanks) and 3050A (Mod.)/6010B for solid samples. The ICP method involves the simultaneous or sequential multi-element assessment 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 was produced was 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 assessment of trace elements.

4.6.2.2 Chemical Analyses for Waste Characterization Samples

Explosives. Select samples for disposal analysis will be analyzed using USEPA SW-846 Method 8330A. Solid samples are extracted using acetonitirile in an ultrasonic bath, then filtered and chromatographed. 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, determined at 254 nm, and confirmed on a cyanide reverse column.

Nitroglycerine/Pentaerythritol tetranitrate (PETN). Select samples for disposal analysis will be analyzed for nitroglycerine and PETN using USEPA SW-846 Method 8332. Solid samples are extracted with acetonitrile in an ultrasonic bath, then filtered and mixed with a calcium chloride solution. The concentration is quantified using an isocratic HPLC system equipped with a column heater and UV detector. Sample concentrations were confirmed on dissimilar columns.

TCLP Metals. Samples for disposal analysis for TCLP metals will undergo a TCLP extraction by USEPA 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 of metals following the analytical procedures as noted below.

TAL Metals (excluding mercury). TAL metals (excluding mercury) will be analyzed using inductively coupled plasma (ICP) techniques. Trace ICP metals are analyzed using USEPA SW-846 Methods 3010A(Mod.)/6010B for aqueous samples (e.g. rinse blanks) and 3050A (Mod.)/6010B for solid samples. The ICP method involves the simultaneous or sequential multi-element assessment 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 was produced was 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 assessment of trace elements.

Mercury. Mercury will be analyzed using cold vapor atomic absorption (CVAA) technique 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.

Chemical oxygen demand. COD will be analyzed using USEPA Method of Chemical Analysis of Water and Wastes Method 410.4 (USEPA, 1983). 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.

pH and Corrosivity as pH. pH and corrosivity as pH will be analyzed using USEPA SW-846 Method 9040C for aqueous samples and Method 9045D 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.

Reactivity. Reactivity comprises of reactive sulfide and reactive cyanide. Reactive sulfide is 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 is analyzed in aqueous and solid samples using USEPA SW-846 Method Chapter 7.3.3.

Ignitability. Ignitability is analyzed using USEPA SW-846 Method 1010A for aqueous samples and USEPA SW-846 Method 1030 for solid samples. 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 ignited the vapor above the sample.

TCL VOCs. Samples will be analyzed for TCL VOCs using USEPA SW-846 Method 5030B/8260B for aqueous samples and USEPA SW-846 5035A/8260B for solid matrices using purge and trap technology. Soil samples will be collected using an EnCore sampling device and subsequently sent to the laboratory for analysis. No sodium bisulfate will be added to the soils due to the possibility of effervescence and ketone formation. An inert gas is bubbled through a mixture of reagent water and 5 gram soil sample in a specifically designed purging chamber at 40 degrees Celsius (°C) or through a 25 milliliters (mL) aqueous sample contained at ambient temperature. The vapor is swept through a sorbent column where the purgeable compounds were trapped. After purging was completed for both solid and aqueous samples, the sorbent column was heated and backflushed with the inert gas to desorb the purgeable compounds onto a gas chromatograph programmed to separate the purgeable compounds, which are then detected with a mass spectrometer. The gas chromatography/mass spectroscopy (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 analyte to the chemical standards used during calibration based on the analyte's retention time and mass spectra.

TCL SVOCs. Samples will be analyzed for TCL SVOCs 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. The extract is injected into a gas chromatograph programmed to separate the compounds, which are then detected with a mass spectrometer. 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 analyte to the chemical standards used during calibration based on the analyte's retention time and mass spectra.

PAHs. Samples will be analyzed for PAHs using USEPA SW-846 Method 8270C selective ion monitoring (SIM) procedures. The use of USEPA SW-846 Method 8270C SIM is employed for PAH analysis to achieve lower quantitation and detection limits in order to meet screening criteria. GC/MS methodology also provides a confirmatory mass spectroscopy step. 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. The extract is injected into a gas chromatograph programmed to separate the compounds, which are then detected with a mass spectrometer. 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 analyte to the chemical standards used during calibration based on the analyte's retention time and mass spectra.

TCL Pesticides/PCBs. Samples will be analyzed for TCL pesticides and PCBs using USEPA SW-846 Methods 8081A and 8082, respectively. Aqueous and solid samples will be prepared for analysis using extraction techniques. Solid samples will be extracted using soxhlet method USEPA SW-846 Method 3540C for samples. Aqueous samples will be extracted using a continuous liquid-liquid extraction technique by USEPA SW-846 Method 3520C. The extract will be injected into a gas chromatograph programmed to separate the compounds, which are then detected with an electron capture detector (ECD). Sulfur cleanups will be employed to aid in the quantification based upon the matrix interferences. Sample concentrations are confirmed on dissimilar columns. Identification of these target analytes is based on a comparison of the analyte to the chemical standards used during calibration based on the analyte's retention time using primary and secondary columns.

4.6.3 Data Validation for Chemical Analyses

Data validation will be conducted and documented based upon the quality assurance project plan requirements, MQAP (*Section 9.5*) requirements, USACE Shell requirements (USACE, 2001), USEPA methodology requirements, and USEPA Region III guidance, as applicable. For the IMWP, the post-excavation soil confirmation samples and borrow-top soil samples will be validated. USEPA Level IV CLP-like raw data will be provided along with the Form 1s for data validation. Data qualifications will follow the USEPA Region III Modifications to the National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration (USEPA, 1994) and USEPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (USEPA, 1993) format, as appropriate. Verification for organic data will be performed at USEPA Region III level M3 and the verification for inorganic data will be performed at USEPA Region III level IM2. The other waste characterization sample data and delineation soil sample data will not require USEPA Region III data validation. The Project Chemist will oversee the performance of data validation functions.

Shaw will direct the overall data management. Data activity for the sampling program will be divided between Shaw and Accutest Laboratories, Inc. Each firm has the equipment needed to perform the required data management functions. The laboratory will perform data entry and manipulation operations associated with the analysis of raw analytical data and provisions of chemical analysis results by sampling location. These data will be transmitted to Shaw for evaluation and interpretation. Data generated will be assessed for accuracy, precision, comparability, representativeness, completeness, and sensitivity.

Table 4-5. Quality Control Method Criteria for Volatile Organic Compounds by SW-846 8260B

Procedure	Frequency	Acceptance Criteria			Corrective Action
Initial Calibration 5-pt curve	Set-up, major maintenance, and quarterly	RRF > 0.1 for SPCCs chloromethane, 1,1-dichloroethane, and bromoform RRF > 0.3 for SPCCs 1,1,2,2-tetrachloroethane and chlorobenzene RRF > 0.05 for the other target compounds (see **Table 4-2**) RSD ≤ 30% for CCCs response factors RSD ≤ 15% for the other target compounds (see **Table 4-2**) If linear regression is used r ⟨0.990 ICV: %Rec. = 80-120%			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	RRF > 0.1 for SPCCs chloromethane, 1,1-dichloroethane, bromoform RRF > 0.3 for SPCCs 1,1,2,2-tetrachloroethane and chlorobenzene RRF > 0.05 for the other target compound (see **Table 4-2**) %D ≤ 20% for every target compound (see **Table 4-2**)			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	< MDL; 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	Every batch	Standards Every target compound (see **Table 4-2**)	Solid %Rec. 75–125% (60–140% for sporadic marginal failures – 3 allowed)	Aqueous %Rec. 80–120% (60–140% for sporadic marginal failures – 3 allowed)	Qualify associated data biased high or biased low as appropriate.
Internal Standards	Every sample	Standards Bromochloromethane 1,4-difluorobenzene chlorobenzene	Criteria 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	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	1 per 20 per matrix	Standards Every target compound (see **Table 4-2**)	Solid %Rec. %RPD 70–130% ≤30 (60–140% ≤40% for sporadic marginal failures – 3 allowed)	Aqueous %Rec. %RPD 70–130% ≤30 (60–140% ≤40% for sporadic marginal failures – 3 allowed)	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: (USEPA, 1996); (USACE, 2001, Appendix I)

Table 4-6. Quality Control Method Criteria for Semivolatile Organic Compounds and Polynuclear Aromatic Hydrocarbons by USEPA SW-846 8270C and SW-846 8270C SIM

Procedure	Frequency	Acceptance Criteria			Corrective Action
Initial calibration curve (5-pt curve)	Set-up, major maintenance	RRF > 0.05 for every target compound; RSD ≤30% for CCC compounds. RSD ≤15% for the other target compounds. If linear regression is used r ≤0.990 ICV: %Rec. = 70-130%			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 every target compound. The percent difference must be ≤20% for response factors from initial calibration.			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	< MDLs; 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	Every batch	Standards Every target compound (see **Table 4-2**)	Aqueous (%Rec.) 60–120% (~15 analytes) 45–135% (~30 analytes) 20–150% (~15 analytes) (15–150% ≤50% for sporadic marginal failures – 5 allowed)	Solid (%Rec.) 60–120% (~20 analytes) 45–135% (~25 analytes) 30–150% (~15 analytes) (20–150% ≤60% for sporadic marginal failures – 5 allowed)	Qualify associated data biased high or biased low as appropriate.
Surrogate spikes	Every sample	Standards nitrobenzene-d5 2-fluorobiphenyl p-terphenyl-d14 phenol-d5 2-fluoroprophenol-d6 2,4,6-tribromophenol 2-chlorophenol 1,2-dichlorobenzene	Aqueous (%Rec.) 45–135% 45–135% 45–135% 35–140% 35–140% 35–140% 35–140% 45–135%	Solid (%Rec.) 45–135% 45–135% 45–135% 35–140% 35–140% 35–140% 35–140% 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	1 per 20 samples per matrix	Standards Every target compound (see **Table 4-2**)	Aqueous %Rec. %RPD 45–135% ≤50 (15–150% ≤50% for sporadic marginal failures – 5 allowed)	Solid %Rec. %RPD 45–135% ≤60 (20–150% ≤60% for sporadic marginal failures – 5 allowed)	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: (USEPA, 1996); (USACE, 2001, Appendix I)

Table 4-7. Quality Control Method Criteria for Cadmium, Metals, and TCLP Metals by SW-846 6010B/7470A/7471A/GFAA (7000)

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 Low level check std. ± 20% recovery ICV 90-110% recovery If MSA performed, r> 0.995	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 Not applicable 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 standard (ICS)	Beginning and end of each sample analytical run or 2 per 8 hr.	Recovery ±20% of true value for ICP Not applicable for Hg	Terminate the analysis, correct the problem, re-calibrate, re-verify the calibration, and reanalyze the samples.
Initial and continuing calibration blank (ICB/CCB)	Every 10 samples, end of analytical run	Concentration < 3 X s of the background mean (ICP). < MDL; 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% for ICP Not applicable for Hg	Chemical or physical interference should be suspected. Investigate to identify cause.
Preparation/method blank	1 per batch per matrix	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.	Documented source of contamination.
Laboratory Control Sample	1 per 20 samples	80-120% (for sporadic marginal failure: 60-140% - 2 allowed)	Qualify associated data biased high or biased low as appropriate.
Matrix spike and duplicate and sample duplicate	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: (USEPA, 1996); (USACE, 2001, Appendix I)

Table 4-8. Quality Control Method Criteria for Pesticides and PCBs by 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 ($r \geq 0.99$) if %RSD > 20%. ICV % Rec.: 85-115%			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 for every single peak compound.			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)	Per batch	Standards Every target compound (see **Table 4-2**)	Aqueous % Rec. 50–130% (30–150% for sporadic marginal failures – 2 allowed)	Solid % Rec. 50–130% (30–150% for sporadic marginal failures – 2 allowed)	Initiate investigation and document actions taken.
Endrin/4,4-DDT Breakdown	Per batch	endrin/4,4-DDT degradation ≤15%. combined endrin/4,4-DDT degradation ≤30%.			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.	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.			Demonstrated "clean". Affected sample will be reanalyzed.
Method blanks	Per extraction batch	< MDL; No target analytes below 5% of the decision limit, 5% of the sample concentrations, whichever is higher.			Document source of contamination.
Surrogate spikes	Every sample	Surrogate Dibutylchlorendate 2,4,5,6-Tetrachloro m-xylene	Aqueous %Rec. 40-140 40-140	Solid %Rec. 40-140 40-140	Investigate to assess cause, correct the problem, and document actions taken; re-extract and re-analyze sample. If still out, qualify.
Matrix spike and duplicate	1 per 20 samples per matrix	Standards Every target compound (see **Table 4-2**)	Aqueous %Rec. %RPD 40–140% ≤50 (30–150% (60% for sporadic marginal failures – 2 allowed)	Solid %Rec. %RPD 40–140% ≤50 (30–150% ≤60% for sporadic marginal failures – 2 allowed)	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. Specific method cleanups may be used to eliminate or minimize sample matrix effects.
Target Analyte Confirmation	Every detect	RPD ≤ 40%			Qualify data as appropriate.

Sources: (USEPA, 1996); (USACE, 2001, Appendix I)

Table 4-9. 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 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	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	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; (USACE, 2001, Appendix I).

Table 4-10. Quality Control Method Criteria for Explosives by USEPA SW-846 8330 and 8332

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 for every target compound. If linear regression is used r ⟨0.990 ICV %Rec. = 85-115%			Must meet criteria prior to sample analysis
Continuing calibration standard	Daily	%D recovery ± 15% of the response factor from the initial curve for every target compound.			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	Standards Every target compound (see **Table 4-2**)	Aqueous 60–120% (40–150% for sporadic marginal failures – 2 allowed)	Solid 60–120% (40–150% for sporadic marginal failures – 2 allowed)	Qualify associated data biased high or biased low as appropriate.
Instrument Blank	12 hours, after analytical run and highly contaminated samples.	< MDL; 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	< MDL; 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	Every sample	Standards 4-nitroaniline	Aqueous %Rec. 50–150%	Solid %Rec. 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	1 per 20 samples per matrix	Standards Every target compound (see **Table 4-2**)	Aqueous %Rec. RPD 50–140% ≤50 (40–150% for sporadic marginal failures – 2 allowed	Solid %Rec. RPD 50–140% ≤50 (40–150% for sporadic marginal failures – 2 allowed)	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.
Target Analyte Confirmation	Every detect	RPD ≤ 40%			Qualify data as appropriate.

Sources: (USEPA, 1996); (USACE, 2001, Appendix I)

5.0 ENVIRONMENTAL PROTECTION PLAN

This section was developed to address environmental considerations during the performance of interim measures at Building 4343. The objective of this section is to provide adequate procedures to safeguard the environmental condition of RFAAP property in and around disturbed areas, and to mitigate and/or minimize the environmental impact of interim measures.

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants.

The Site Superintendent will coordinate all land resource management, waste management, pollution control, and abatement activities, and ensure compliance with this section by subcontractors.

For the cadmium-contaminated soil removal action at Building 4343, the Site Superintendent will coordinate all land resource management, waste management, pollution control, and abatement activities, and ensure compliance with the Environmental Protection Plan by all subcontractors.

5.1 APPLICABLE REGULATIONS

Shaw will follow all applicable regulations and obtain all necessary permits concerning environmental protection, pollution control, and abatement necessary for the proposed field operations. Applicable regulations include, but are not limited to:

- Fish and Wildlife Coordination Act (16 USC 661)
- Migratory Bird Treaty Act (16 USC 703)
- Endangered Species Act (16 USC 1531, 50 CFR 402)
- Hazardous Materials Transportation Act (49 USC 1801-1812)
- Noise Pollution and Abatement Act (42 USC 4901)
- Land Disposal Restrictions (40 CFR 268)
- Erosion and Sediment Control (4 VAC 50-30-40)
- Stormwater Management (9 VAC 25-690)
- Asbestos Handling (18 VAC 15)
- Visible Emissions and Fugitive Dust/Emissions (9 VAC 5-50)
- Asbestos Air Emissions (40CFR 61.140-156, Subpart M, 16 VAC 25-30, and 9 VAC 5-60 Subpart M incorporation by reference 40 CFR 61.140-156 Subpart 140)
- Virginia air quality standards (9 VAC 5-50 and 9 VAC 5-30)

5.2 PRE-CONSTRUCTION SURVEY OF EXISTING CONDITIONS

A survey of environmental conditions will be performed prior to performance of interim measures actions. This survey will include written records, and photographs. Specifically, the status of the trees, roadways, utilities and other site characteristics will be documented to establish a pre-interim measures record of initial site conditions. This survey record will be used to restore the site to as close to pre-interim measures conditions as possible, where applicable, as well as document pre-existing conditions for contractor liability purposes.

5.3 PREVIOUSLY USED EQUIPMENT

All previously used equipment at other sites shall be cleaned before it is brought into a new work area, ensuring that soil residuals are removed and that egg deposits from pests are not present.

5.4 PROTECTION OF LAND RESOURCES

Removal activities will be confined to areas defined in the Operations and Technical Approach Plan, *Section 2.0*. Prior to the start of removal activities, Shaw will identify the land resources to be preserved within the work areas. Except for those areas indicated in *Section 2.0*, Shaw will not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission from ATK and the RFAAP Environmental Office. No ropes, cables, or guys will be fastened to or attached to any trees for anchorage unless authorized. When such use is permitted, Shaw will provided protection for land and vegetation resources. Stone, earth, or other material displaced into uncleared areas will be removed.

5.4.1 Work Area Limits/Traffic Control

Prior to start of removal actions, Shaw will mark any areas that need not be disturbed. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Shaw personnel and subcontractors will be informed of the purpose for marking and/or protecting particular objects.

Outside of designated work areas, all personnel and subcontractor equipment and vehicles will remain on established or paved roadways in order to prevent damage of manicured lawns and green spaces as well as to limit the amount of mud transported onto base and public roadways.

5.4.2 Landscape

Trees, shrubs, vines, grasses, land forms, and other landscape features indicated in *Section 2.0* as to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved technique.

5.4.3 Unprotected Erodible Soils

All earthwork will be completed as planned. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures waste material areas, these areas will not initially be totally cleared. Clearing of such areas will progress in reasonably sized increments as needed.

5.4.4 Disturbed Areas

Erosion and sedimentation control will be effectively implemented through control of surface runoff and installation of erosion and sedimentation control devises, as needed. Runoff from the

removal site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, or other structure. Temporary erosion and sedimentation control features such as hay bales and/or silt fencing will be installed as needed. A detailed Erosion and Sedimentation Control Plan (E&SCP) is provided as *Section 6.0* to this IMWP.

5.4.5 Staging and Work Areas

Staging areas will be located as designated in the Operations and Technical Approach Plan, *Section 2.0*. Relocation of areas will be made with approval from ATK and the RFAAP Environmental Office.

5.5 WATER RESOURCES

Removal activities will be managed and controlled to avoid pollution of surface and groundwaters. Toxic or hazardous chemicals will not be applied to soil or vegetation as part of interim measures actions. The management of erosion and sedimentation is presented in the E&SCP, *Section 6.0*.

5.5.1 Waste Waters

Waste waters will be generated from decontamination operations including general equipment decontamination. Waste waters will be collected in storage tanks or drums. Sampling and analysis will be performed to determine the proper disposal requirements for the water.

5.5.2 Diversion Operations

Removal operations involving dewatering activities will be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and on water quality for downstream use.

5.5.3 Fish and Wildlife

Interferences with, disturbances to, and damage of fish and wildlife will be minimized during removal actions. No federally listed, or proposed endangered, or threatened species are known to exist in this area at RFAAP.

5.6 AIR RESOURCES

Dust particles generated from removal activities will be controlled at all times. Excavations, haul roads, work sites, and other areas will be maintained so as not to cause air pollution standards to be exceeded or which would cause a hazard or nuisance. Water sprinkling or other methods will be used to control particulates in the work areas as work proceeds and whenever a hazard or nuisance occurs. The performance of air monitoring during removal action work is described in the SSHP, *Section 8.0*.

Hydrocarbons and carbon monoxide emissions from equipment will be controlled to federal and state allowable limits.

Lastly, removal actions will be managed and controlled to minimize environment damage by noise.

5.7 WASTE DISPOSAL

Waste handling, transportation, and disposal will be performed in accordance with the Waste Transportation and Disposal Plan, *Section 7.0*, and as specified below.

5.7.1 Solid Wastes

Solid wastes (excluding demolition debris) will be direct loaded in dump trucks and transported offsite for disposal. Handling and disposal will be conducted to prevent contamination. Segregation measures will be employed so that no hazardous or toxic waste will become co-mingled with solid waste. Solid waste generated as part of interim measures actions will be transported offsite and disposed in compliance with federal, state, and local requirements.

5.7.2 Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to the ground. Periodic inspections of dispensing areas to identify leakage and initiate corrective action will be performed and documented. Chemical waste will be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Waste generated as part of removal actions will be transported offsite and disposed of in compliance with federal, state, and local requirements.

5.7.3 Hazardous Waste

Sufficient measures will be taken to prevent spillage of hazardous and toxic materials during dispensing and waste will be collected in suitable, compatible containers. Waste generated as part of removal actions will be transported offsite and disposed of in compliance with federal, state, and local requirements. Soil containing leachable cadmium at a concentration greater than the TCLP Regulatory Limit of 1 mg/L will be treated as hazardous waste. The reportable quantity (RQ) for cadmium-containing soil is 10 pounds. Spills of hazardous or toxic materials will be immediately (within 20 minutes) reported using the spill notification procedures presented in *Section 5.13.5*.

5.7.4 Burning

No burning is allowed, nor will be conducted, during interim measures actions.

5.8 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

There have not been any historical, archaeological, or cultural resources identified in the Building 4343 area. If during excavation or other interim measures activity, any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources will be temporarily suspended. These resources include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such a discovery or find, the USACE Project Officer will be immediately notified.

5.9 POST REMOVAL CLEANUP

Following interim measures actions, all areas used as part of interim measures activities will be cleaned up.

5.10 RESTORATION OF LANDSCAPE DAMAGE

Any landscape features damage or destroyed outside the limits of the approved work areas during interim measures activities will be restored.

5.11 MAINTENANCE OF CONTROL POLLUTION FACILITIES

Permanent and/or temporary pollution control facilities and devices will be maintained for the length of time interim measures activities create the particular pollutant.

5.12 TRAINING OF PERSONNEL

Shaw and subcontractor personnel will be instructed on all phases of this Environmental Protection Plan prior to starting removal work to ensure adequate and continuous environmental pollution control.

5.13 SPILL PREVENTION AND RESPONSE

The following sections describe the type/amount of potential spills that could occur during removal actions, spill prevention and control measures, spill countermeasures, spill response equipment, and spill notification procedures.

5.13.1 Potential Spill Types

Potential spill types that may occur during the Building 4343 interim measures actions include waste liquids (decontamination liquids, excavation water, etc.), waste solids (building materials, sump materials, concrete footers, soils, etc.), and materials brought onsite for interim measures work that contain hazardous constituents.

The only hazardous liquids that will be brought and stored onsite for interim measures actions will be small quantities of gasoline and diesel, motor oil, paints, and solvents. Throughout operations, these materials will be stored and transported in approved containers.

5.13.2 Spill Prevention

- Wastes collected from the interim measures actions will be properly containerized, stored, treated, and disposed in accordance with applicable federal and state regulations.
- Equipment fueling and/or lubrication will be performed utilizing drip pans to contain any spills which may occur.
- Wastes and/or chemicals will be stored in a manner to prevent contact with stormwater including the use of tarpaulins and/or storage under a roofed structure.
- All storage containers for liquid storage will be certified for aboveground use.
- The storage drums/containers will be inventoried periodically to determine if leakage is occurring and the exterior of the tanks will be examined.
- All transport drivers will be trained in Department of Transportation (DOT) and USEPA spill prevention measures.
- The transport driver will be required to remain on duty and with his truck during filling operations to protect against spills.
- The volume of waste material will be calculated prior to filling drums or containers.
- No pump operations are to continue unless attended constantly.
- Personnel training will be conducted on spill prevention, containment and retrieval methods at the start of interim measures work.

- Phone numbers will be posted regarding the report of a spill to the response agencies and the state.

5.13.3 Spill Countermeasures

- Any fuel leakage, oil drips, or hydraulic line rupture that may occur during the operation of trucks, heavy equipment, etc., will be immediately cleaned up.
- Any spill of hazardous materials will be reported through the local spill response system and addressed immediately.
- Emergency containment action will consist of placing adsorbent materials around the site of the spill.
- Accidental spills will be cleaned up immediately. The spilled medium (liquid or solid) will be collected and containerized awaiting waste characterization, transportation, and disposal.

5.13.4 Spill Mitigation Equipment

The following spill mitigation equipment will be available onsite for use during the removal actions:

- Drip pans;
- Shovels; and,
- 55-Gallon drums (for containerization).

5.13.5 Notification Procedures

If a spill occurs onsite the following notification procedure will be initiated immediately (within 20 minutes max):

1. Steve Kritak, Site Superintendent	(973) 865-8064
2. Rob Davie	(540) 239-4475 (cell)
3. Jerry Redder	(540) 659-7536
-or-	(540) 953-8663 (pager)
4. Jim McKenna	(540) 639-8641
5. RFAAP Security Dispatcher	(540) 639-7323
-or-	(540) 639-7324
-or-	(540) 639-7325
6. Brad Jennings	(540) 639-7417
7. Gretchen Miller, Shaw IM Task Manager	(410) 612-6308
8. Jeff Parks, Shaw RFAAP Project Manager	(410) 612-6326
9. Tom Meyer, USACE Project Officer	(410) 962-7677

6.0 EROSION AND SEDIMENT CONTROL PLAN

The purpose of this E&SCP is to provide a document that defines the steps which will be taken to minimize and/or eliminate erosion and sedimentation during completion of the Building 4343 IM. This plan has been developed in accordance with the guidelines provided in 4 VAC 50-30-40, the Virginia Erosion and Sediment Control Regulations. The following five basic principles along with environmental concerns should be considered when developing a E&SCP:

- Plan the development to fit the site – areas of high erosion potential should be left undisturbed whenever possible;
- Expose the smallest practical area of land for the shortest possible time – when soil disturbances occur and the natural vegetation is removed, the extent and duration of exposure should be minimized;
- Apply erosion control as a first line of defense against on-site damage – implementing practices that prevent or minimize erosion on a construction site is called "erosion control";
- Use sediment control practices as perimeter protection to prevent off-site damage – controls placed along the perimeter of a site to collect eroded sediments must be implemented; and,
- Implement a thorough maintenance and follow-up operation – a site must have thorough periodic maintenance checks of soil erosion and sediment control practices.

6.1 PLAN APPROVAL

According to 4 VAC 50-30-40, an erosion and sediment control plan is required for approval by VDEQ for all land clearing, grading or other earth disturbances, with the exception of projects involving less than one acre of grading. As discussed below, the Building 4343 IM are not anticipated to involve grading work greater than or equal to one acre; therefore, review and approval of this plan by VDEQ is not required.

6.2 EROSION AND SEDIMENT CONTROL PLANS

The scope of the Building 4343 IM was previously described in the Organization and Technical Operations Plan (*Section 2.0*) and includes cadmium-contaminated soil removal activities and removal of Building 4343, the concrete footers, and two sumps. The total area to be disturbed may be 8,900 square feet or larger (approximately 0.2 acres), however, all land-disturbing activities will be planned and conducted to minimize the size of the area to be exposed at any one time and the length of the time of exposure.

All land-disturbing activities will be planned and conducted to minimize the size of the area to be exposed at any one time and the length of the time of exposure. Surface water runoff originating upgrade of the exposed areas should be controlled to reduce erosion and sediment loss during the time of exposure. If needed, temporary sump pumps will be used in excavations to control accumulation of standing water. All surface water that contacts exposed contaminated areas will be pumped into storage tanks for subsequent characterization and disposal.

The following subsections summarize the site-specific erosion and sediment control plans for each of the planned removal actions.

6.2.1 Building 4343 IM

Building 4343 IM will consist of excavating the area to a depth of up to 4 ft bgs. Determination of whether or not removal will occur will be based on soil characterization samples. If cadmium concentrations in soil exceed the RG of 70.3 mg/kg soils will be excavated and direct loaded into trucks and disposed offsite.

Excavated areas will be immediately backfilled with clean soil following receipt of confirmation samples indicating removal to below the RG has been achieved. If sediment and erosion controls become necessary, silt fence may be installed downgradient of work areas to prevent sediment erosion and runoff. This will be a judgment made in the field by the Site Superintendent as work progresses. The proposed location of the downgradient silt fence is shown on **Figure 6-1**.

6.3 DUST CONTROL

Field operations at Building 4343 will be conducted in a manner that produces minimal dust and/or air pollution. Dust control measures such as water spray will be utilized if dusty conditions exist.

6.4 INSTALLATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROL STRUCTURES

Erosion and sediment control structures shall be installed and maintained according to minimum standards and specifications of 4 VAC 50-30-40. As indicated previously, the following erosion and sediment control standards and specifications are anticipated to be used during remedial activities:

- Silt Fence – Provides instructions for the design and installation of silt fence.
- Vegetative Stabilization – Describes vegetative stabilization methods and materials, and temporary and permanent seeding requirements.
- Erosion Control Matting – Describes use and installation of erosion control matting.
- Tree Protection – Describes applicable conditions for and use of tree protection measures.
- Material Specifications – Describes the different classifications of geotextile fabrics for silt fence.
- Dust Control – Provides temporary and permanent methods of controlling dust blowing and movement.

Erosion control measures will be established at the beginning of removal action work and maintained during the entire period of work. Erosion control measures will be repaired or replaced as needed.

All erosion and sediment control structures, disturbed areas, and areas used for storage of materials exposed to precipitation shall be inspected every seven days and within 24 hours of the end of a storm event that has rain accumulation of is 0.5 inches or greater. Clean out or replacement of structures will be performed immediately to prevent sediments from entering a live watercourse and discharging off site.

Locations where vehicles enter or exit the sites shall be inspected for evidence of sediment tracking. Construction vehicles and equipment shall be appropriately decontaminated during the course of the interim measures actions, if necessary.

Figure 6-1
Building 4343 IM Sediment Erosion Control Measures

7.0 WASTE TRANSPORTATION AND DISPOSAL PLAN

The primary objective of this Waste Transportation and Disposal Plan (WTDP) and the activities mandated by the plan is the safe handling, transportation, and disposal of contaminated materials resulting from interim measures actions at Building 4343. This objective will be achieved through compliance with local, state and federal regulations, and the requirements of this plan. The WTDP details the waste management responsibilities of Shaw and subcontractor personnel and identifies potential waste streams. It also describes the waste management practices that will be implemented for minimizing, segregating, packaging, staging, tracking, and transporting and disposing of the generated wastes.

A secondary objective of the WTDP is the handling of generated waste in a cost-effective manner. This will be accomplished by three activities:

- Waste minimization;
- Waste segregation; and,
- Waste classification.

These activities begin with the design of the individual removal actions and are integrated into the planning and execution of waste management activities associated with the overall project.

7.1 REGULATORY REQUIREMENTS

Wastes generated during interim measures actions at Building 4343 will be handled, staged, labeled, transported, and disposed in full compliance with local, state, and federal regulations. Applicable local, state, and federal regulations governing the treatment, storage, transportation, and disposal of wastes include, but are not necessarily limited to, the following:

- 40 CFR 261: Identification and Listing of Hazardous Waste;
- 40 CFR 262: Standards Applicable to Generators of Hazardous Waste;
- 40 CFR 263: Standards Applicable to Hazardous Waste Transporters;
- 40 CFR 268: Land Disposal Restrictions;
- 40 CFR 270: Regulations controlling the transportation, manifesting, and disposal of hazardous waste;
- 49 CFR 171-179: DOT regulations on the packaging and shipping of hazardous materials and samples;
- 9VAC 20-60-261: Standards Applicable to Generators of Hazardous Waste;
- COMAR 26.13.04: Standards Applicable to Transporters of Hazardous Waste;
- 9 VAC 20-60-268: Land Disposal Restrictions;
- 9 VAC 20-80-640, Disposal of asbestos-containing wastes materials;
- 9 VAC 20-60-263: Regulations Applicable to Transporters of Hazardous Waste;
- 9 VAC 20-110: Transportation of Hazardous Materials;
- 9 VAC 20-80-640: On-site Storage and Disposal of Asbestos Containing Waste Materials;

- 9 VAC 20-60-264 Subparts C, Preparedness and Prevention; and Subpart D, Contingency Plan and Emergency Procedure; and,
- 9 VAC 20-60-264 Subpart E, Manifest System, Recordkeeping, and Reporting.

7.2 ANTICIPATED WASTE STREAMS

This section presents a brief overview of the anticipated wastes that may be generated during interim measures actions at Building 4343. Waste can be divided into two primary categories which include:

- Remediation-derived wastes (RDW); and,
- Secondary waste.

A summary of anticipated wastes that will be generated from the interim measures actions are described below.

7.2.1 Remediation-Derived Wastes

RDW are those wastes that are generated through the removal of original, pre-existing contaminated material from the site. Anticipated RDW for each of the removal actions include, but, are not limited to the following:

Soil Removal

- Contaminated soil

Demolition

- Concrete;
- Wood debris;
- Metal debris; and,
- Asbestos-containing materials.

7.2.2 Secondary Wastes

Secondary wastes will be produced by the contractor during the course of the interim measures work. Examples of secondary wastes that may be produced are:

- Non-hazardous trash and potentially contaminated materials;
- IDM from sampling activities;
- Personal Protection Equipment (PPE);
- Temporary facilities (such as decon pads, and erosion and sediment control materials); and,
- Decontamination water.

Production of secondary wastes will be minimized to the fullest extent possible, typically by the segregation of hazardous and non-hazardous materials. When produced, wastes will typically be co-disposed with the RDW. Where co-disposal results in significant additional costs or is not possible due to incompatibilities with the selected disposal/treatment/recycling method, alternative means of characterization/disposal for secondary wastes will be considered.

7.3 WASTE MANAGEMENT PROCEDURES

7.3.1 Waste Minimization

Waste minimization is a primary objective during the design and implementation of the interim measures actions at Building 4343. The principal components of this program include:

- Control of waste removal to prevent over excavation;
- Segregation of waste streams;
- Reuse/recycling of wastes;
- Minimization or elimination of hazardous material that must be used; and,
- Strict inventory control of hazardous material.

Where a waste stream (such as potentially contaminated materials or soil) has the potential to exhibit differing characteristics, each waste stream will be segregated. Wastes will be segregated into the following groupings:

- Uncontaminated material;
- Potentially contaminated material; and,
- Contaminated material.

Potentially contaminated and contaminated materials may be further subdivided into different groups by contaminant types, such as:

- RCRA land disposal restricted waste;
- Other RCRA waste;
- ACM Waste;
- Toxic Substance Control Act (TSCA) waste; and,
- Non-hazardous solid waste.

Waste characterization for certain waste streams will be attempted prior to or at the beginning of interim measures activities, in order to minimize waste storage and holding time prior to transportation and disposal.

Generation of secondary waste will typically occur prior to receipt of complete analytical results. Decisions regarding waste segregation will be based on knowledge of the waste and appearance. This segregation will minimize the mixing of contaminated and uncontaminated materials.

Each of the above steps will reduce the amount of contaminated wastes being generated. Audits will be conducted by the CQC Systems Manager to monitor the waste minimization activities.

7.3.2 On-Site Waste Labeling

Following the generation of waste, each container will be clearly labeled with the following information:

- Waste generation activity and location collected;
- Identification numbers;

- Contents of the container (type of material and expected hazard level);
- Accumulation start date; and,
- Comments/special handling instructions.

This information will be augmented as needed according to applicable requirements during off-site transportation and disposal.

7.3.3 Sampling and Characterization

Each waste stream generated during the interim measures work will be characterized within 30 days of completion of waste stream generation. Waste characterization sampling and analysis will be performed by Shaw in accordance with the provisions in the FSP (*Section 3.0*) and the QAPP (*Section 4.0*). Based on the analytical results for the waste characterization samples, the wastes will be classified in accordance with Virginia and USEPA waste classification systems. The waste classification will define the waste storage, transportation, and disposal requirements that are applicable. Waste profile sheets for the disposal of each waste will then be prepared in accordance with the requirements of the disposal facility. If required by the disposal facility for acceptance of the waste, additional waste analysis will be conducted beyond that specified in **Table 3-1**.

7.3.4 Record Keeping

Shaw will maintain an inventory of waste on site. Excavated soil will be direct loaded into dump trucks for transport to the disposal facility and will not be stored onsite. An example of the waste inventory form is provided as **Figure 7-1**. This form will be updated daily.

7.3.5 Spill Response Materials

Spill response materials including, but not limited to the following will be kept onsite in case of emergencies: containers, adsorbents, shovels, and PPE. Spill response materials will be available at all times in which hazardous materials/wastes are being handled or transported, and be compatible with the wastes being handled.

7.4 OFF-SITE TRANSPORTATION AND DISPOSAL

7.4.1 Identification of Off-Site Disposal Facility

Through a competitive bidding process, one or more waste disposal subcontracts will be awarded. Each subcontract will include several permitted disposal facilities that offer a range of disposal options (e.g., landfilling, incineration, recycling) for a variety of waste types (e.g., construction debris, non-hazardous waste, hazardous waste). Based on the waste characterization results, and subsequent waste classification, an appropriate waste disposal facility will be identified. Shaw will then prepare a two-way memo, including the analytical results, estimated quantity of waste, waste profile sheet(s), and proposed method of disposition and disposal facility, to gain approval from USACE to dispose of the waste. Advanced planning and coordination by Shaw, USACE, and RFAAP/ATK will be necessary to minimize the staging of waste (non-hazardous debris only, as soil will not be staged) on site.

Figure 7-1 Waste Inventory Form
Building 4343 IM Action

Waste Container ID	Container Type	Waste Description	Quantity	Date Packaged	Waste Profile	Date Shipped	Disposal Facility	Disposal Method	Disposal/ Destruction Date

Notes:

7.4.2 Transportation of the Waste

The transport documentation and transport vehicle will be inspected prior to shipment of the hazardous wastes to ensure that the packaging, marking, labeling, handling, and placarding of waste complies with federal, state, and local laws and regulations. Shaw will supervise all loading activities, and monitor all stages of waste handling by the disposal subcontractor.

7.5 DOCUMENTATION AND REPORTING

7.5.1 Complete Manifest Package

Shaw will prepare manifests for the transportation and disposal of hazardous wastes in accordance with USEPA and DOT requirements. The principal components of the completed manifest package include:

- Waste profile sheets (signed by an ATK representative);
- Waste disposal characterization;
- Hazardous waste manifests;
- ACM manifests (if applicable);
- Hazardous material shipping papers; and,
- Land disposal restriction notification and certification form.

Hazardous waste manifests, waste profile sheets, and land disposal restriction notification and certification forms will list RFAAP as the generator and will be signed by an appointed representative of RFAAP. The manifests will include the shipper's license number, address and contact information, and the permit number for the disposal facility. Shaw will provide 3 days notice of shipping to the appointed representative of RFAAP and provide manifest blanks at that time. Final weight for each load will be calculated using an excavator bucket scale during truck loading. Final weights will be filled in on the manifest for signature at that time. Close coordination will be required to minimize demurrage charges.

The supporting information will contain at a minimum the following information:

- Date of initial waste generation;
- Description of process that generated the waste;
- All analytical data and/or process knowledge used to characterize the wastes, including quality control data;
- Dates samples were collected;
- Description of the sampling location(s), and sampling methods and equipment utilized;
- Description of sample handling techniques, including containerization, preservation, and COC;
- Any correspondence supporting waste classification determination;
- Specific type of inner and outer packaging; and,
- Markings, labeling, and placards offered by the transporter.

7.5.2 Transportation and Disposal Reporting Requirements

7.5.2.1 Tabulated Waste Handling Information

Shaw will maintain a list of all waste materials going off site on the Waste Inventory Form (**Figure 7-1**). Where applicable, this list will include the description, quantity, hazardous waste classification, date the waste was shipped, disposal facility, method of disposal, and date of disposal. Copies of the Waste Inventory Form as well as other supporting documentation related to the disposal operation audit trail will be included in the Building 4343 IM Summary Report following completion of the IM.

7.5.2.2 Transportation and Disposal Procedures

After the waste leaves RFAAP, Shaw will maintain a clear audit trail of the entire disposal operation including, but not limited to, the following:

- Manifest copy(s);
- Driver information and truck numbers;
- Profile sheet(s);
- Certificate of Transfer; and,
- Certificate of Disposal.

7.5.2.3 Discrepancies

Any discrepancies due to differences between the quantities or types of wastes designated on the manifest or shipping papers, and the quantity or type of wastes a facility actually receives must be reported. Shaw will investigate these discrepancies and rectify the identified discrepancy.

7.5.2.4 Exception Reports

The following procedures will be used for determining if an exception report is needed. On or before the 35th day after the transporter signs the manifest, it will be verified that the generator or the generator's representative has received a copy of the signed manifest from the TSD facility. If the generator's representative has failed to receive a signed copy of the manifest by the 44th day, an exception report will be prepared and submitted to USACE and RFAAP no later than day 45.

8.0 SITE SAFETY AND HEALTH PLAN

This section discusses safety and health concerns for the Building 4343 IM actions, and serves as the SSHP. The safety and health policies and procedures that will be followed during the removal actions are defined within this section.

This SSHP was prepared for use at Building 4343 by Shaw personnel and subcontractors performing a specific scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known, or suspected, to be present on the project site. It is not possible in advance to discover, evaluate, and protect against all possible hazards which may be encountered during the duration of this project. Adherence to the requirements of this Plan will significantly reduce, but not eliminate, the potential for occupational injury or illness at the project site. The guidelines contained in this SSHP were developed specifically for the project site described herein, and should not be used at any other site without the review and approval of a qualified health and safety professional.

8.1 INTRODUCTION

This SSHP was developed to provide the field team/visitors with safe working conditions during field activities to ensure protection of all personnel during the excavation, removal, demolition, waste handling, and restoration activities at Building 4343. In addition, an objective of this SSHP is to provide site-specific safety and health controls that will prevent and minimize personal injuries, illnesses, and physical damage to equipment and property. The plan stresses management responsibilities, pre-planning for all new activities, medical surveillance, training, periodic work site evaluations and audits, accident prevention and investigation recordkeeping, PPE, air monitoring requirements, site controls, decontamination procedures, and general safety requirements.

All Shaw and subcontractor personnel performing field activities are responsible for the adherence to the SSHP procedures and policies during the performance of all work. Site personnel and visitors will be required to read this SSHP and to sign the acknowledgment form (located in **Appendix D**) to document their understanding of the contents. Shaw will not, however, accept responsibility for the use of the plan by others.

All site personnel will exercise caution at all times and immediately report any site conditions to supervisory personnel which may pose safety or health hazards to workers or the public.

8.1.1 Site Removal Activities

Site interim measures activities to be completed as part of this scope of work at Building 4343 include excavation and disposal of cadmium-contaminated soil and removal of Building 4343, 2 sumps, and the concrete footers located outside of Building 4343. Background site information and details on the approach and components for each of the removal actions are provided in the Organization and Technical Approach Plan (*Section 2.0*).

8.1.2 Applicable Standards and Regulations

All site activities covered by this SSHP must comply with the requirements of the following regulations and appropriate guidance including, but not limited to:

- Title 29, Code of Federal Regulations Part 1910 (29 CFR 1910) Occupational Safety and Health Standards, General Industry;

- Title 29, Code of Federal Regulations Part 1926 (29 CFR 1926), Safety and Health Regulations, Construction Industry;
- FAR, Clause 52.236-13, Accident Prevention;
- USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01;
- USACE Safety and Health Requirements Manual EM 385-1-1;
- USACE Safety and Occupational Health Document Requirements for HTRW and OE Activities, ER 385-1-92;
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (National Institute for Occupational Safety and Health [NIOSH] 85-115);
- Title 40, Code of Federal Regulations Parts 260-276 (40 CFR 260-276), Hazardous Waste Management;
- Title 40, Code of Federal Regulations Subchapter C, Air Programs;
- Occupational Safety and Health Guidance for Hazardous Waste Site Activities, U.S. Department of Health and Human Services, October 1985;
- Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH); and,
- Shaw Safety and Health Requirements Program Manual.

All Shaw and subcontractor field staff will be required to follow these and other applicable Federal and/or State safety and health standards, regulations, and guidance manuals.

8.1.3 Site Safety and Health Documentation

Recordkeeping requirements for safety and health are necessary to ensure accurate and complete monitoring of all personnel. Any changes to the approved SSHP will be documented using the Shaw Revision Form presented in **Appendix D**, and reviewed and approved by the USACE prior to implementation. All on-site personnel shall read this SSHP and sign the acknowledgment form (located in **Appendix D**) to document their understanding of the contents. The SSHO will keep this form on file.

8.1.4 Safety Statement

It is Shaw's plan to provide a safe work environment for all personnel involved in the interim measures activities at Building 4343. Shaw considers no phase of operations or administration to be of greater importance than the prevention of personnel injury and illness at the work site.

Any authorized USACE representative has the right to notify Shaw and/or any EMARC subcontractor of any condition that poses a serious or imminent danger to health and safety. Upon such notification, Shaw and/or any EMARC subcontractor shall immediately take corrective action. Furthermore, any authorized USACE representative may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

This SSHP prescribes the procedures that must be followed by all site personnel. Operational changes which could affect the health and safety of personnel, the community or the

environment will not be made without prior approval of the USACE, Shaw Project Manager, Shaw EMARC Health and Safety Manager, and SSHO.

The following is Shaw's corporate policy as it pertains to safety:

The Shaw Group is firmly committed to operating all of its facilities and projects in a safe, efficient manner and in compliance with all applicable safety, health and environmental regulations. Its goal is to provide an injury free work environment where facilities and projects are free of recognized hazards; and people, equipment and the environment are not placed at unreasonable risk of injury or damage.

The most valuable resource Shaw has is its people. While quality and productivity are critical to operations, they will never take precedence over the safety of personnel or protection of the environment.

Accomplishing these goals requires a unified team effort from all levels of the organization. Safety must be planned into all of our activities and receive the same level of attention as quality and productivity.

This project will be conducted under the guidance of all applicable federal, state, and local requirements. It is the policy of Shaw to adhere to or exceed the minimum requirements of each governing document (see References, Section 1.7). When any conflict exists between referenced documents, the most stringent position of the standard will apply.

The Shaw Group believes in two fundamental principles of safety:

- All accidents, injuries and occupational illnesses are preventable; and,
- If an operation cannot be done safely, it will not be done.

To put these principles into practice, all Shaw personnel and subcontractor employees will receive the appropriate training, equipment, and other resources necessary to complete their assigned tasks in a safe and efficient manner. Subcontractors must also be appropriately trained, participate in the necessary medical surveillance programs, and comply with the required policies, procedures, and regulations.

Safety, industrial hygiene, and loss prevention are the direct responsibility of all members of management, who must create an environment in which everyone shares a concern for their own safety and the safety of their associates. Safety will take precedence over expediency. It is a condition of employment that all employees work safely.

8.2 PROJECT ORGANIZATION AND PERSONNEL QUALIFICATIONS AND RESPONSIBILITIES

The project organization and reporting structure is presented in *Section 2.0* of this Work Plan. Qualifications for key individuals are as follows:

The Health and Safety Manager must be a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP) with experience in hazardous waste site operations.

The SSHO must be fully trained and experienced and able to implement and continually enforce the SSHP.

At least two site workers will be certified in First Aid/CPR by the Red Cross, or equivalent agency.

All personnel are responsible for the adherence to the SSHP procedures and policies during the performance of all work. Site personnel and visitors will be required to read this SSHP and to sign the acknowledgment form (located in **Appendix D**) to document their understanding of the contents. Failure to comply with the provisions of this Plan may lead to disciplinary action and/or dismissal from the work site. Ensuring the safe and healthful conduct of site operations is the responsibility of everyone assigned to the site, therefore, all personnel are responsible for the following:

- Complying with the SSHP and all other required safety and health guidelines;
- Taking all necessary precautions to prevent injury to themselves and to their fellow employees;
- Continually being alert to any potentially harmful situation and immediately informing the SSHO of any such conditions;
- Performing only those tasks that they believe they can do safely and have been trained to do;
- Notifying the SSHO of any special medical conditions (i.e., allergies, contact lenses, diabetes, etc.) which could affect their ability to safely perform site operations;
- Notifying the SSHO of any prescription and/or over-the-counter medication which they are taking that might cause drowsiness, anxiety, or other unfavorable side effects;
- Preventing spillage and splashing of materials to the greatest extent possible;
- Practicing good housekeeping by keeping the work area neat, clean, and orderly;
- Immediately reporting all injuries, no matter how minor, to the SSHO;
- Maintaining site equipment in good working order, and reporting defective equipment to the SSHO; and,
- Properly inspecting and using the PPE required by the SSHP or the SSHO.

8.2.1 Subcontractor Responsibilities

In conformance with the Department of Labor, OSHA Hazardous Waste Operations (29 CFR 1910.120), each subcontractor employee proposed for on-site activities must participate in a medical monitoring program, must be certified for hazardous waste field work by a licensed physician, and must have successfully completed the required safety and health training. The subcontractor shall also be responsible for providing equipment that is safe for operations and free from any hazards.

The asbestos abatement contractor will remove any asbestos and/or ACM from the facilities and will be responsible for completing their own site-specific work plan and safety plan. Shaw will review and approve the contractors safety plan prior to mobilization. The abatement contractor will be required to follow the USEPA asbestos regulations (Asbestos Hazardous Emergency Response Act (AHERA), Title 40 of the Code of Federal Regulations, Part 763) as well as the State of Virginia's asbestos regulations including site surveys, job type classification, training, containment construction, control and air sampling. In addition, all asbestos subcontractors must

be AHERA and State of Virginia licensed and at least one of the subcontractors onsite must have an AHERA and State of Virginia asbestos supervisor license. Workers not involved in asbestos removal work but, who may be working in adjacent tasks or those in proximity of asbestos abatement tasks, will receive asbestos awareness training. The Shaw E&I HASP will include an Activity Hazard Analysis as a guideline for the subcontractor. Air sampling will be conducted in accordance with State and Federal regulations.

8.2.2 Visitor Responsibilities

Authorized visitors to investigation areas on site will be briefed on the hazards present at that location by the SSHO. Visitors will be responsible for compliance with the requirements specified in this SSHP. Visitors will not be permitted to enter potentially contaminated work zones unless they have completed the appropriate training and medical surveillance requirements, and have the proper personal protective equipment. All visitors will be escorted.

8.3 HAZARD ANALYSIS

8.3.1 Activity Hazard Analysis

Activity Hazard Analyses define the activities being performed and identify the sequences of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level.

8.3.1.1 Soil Removal

An activity hazard analysis for the Building 4343 soil removal is included as **Tables 8-1a through 8-1c**. This activity will be performed subject to the safety provisions of 29 CFR Parts 1910 and 1926, and USACE EM 385-1-1.

8.3.1.2 Asbestos Abatement

An activity hazard analysis for the Building 4343 asbestos abatement is included as **Table 8-2a**. This activity will be performed subject to the safety provisions of 29 CFR Parts 1910 and 1926, and USACE EM 385-1-1.

8.3.1.3 Building/Sump/Footer Demolition

An activity hazard analysis for demolition of Building 4343, the two sumps, and the concrete footers is included as **Table 8-2b**. This activity will be performed subject to the safety provisions of 29 CFR Parts 1910 and 1926, and USACE EM 385-1-1.

8.3.2 Physical Hazards

This section discusses specific physical hazards that may be encountered at RFAAP during the removal actions. If additional hazards other than the ones listed in this section are encountered, this SSHP will be revised to address these hazards.

Table 8-1. Activity Hazard Analysis –Soil Removal
a. Pre-Removal Soil Characterization Sampling

Activity: Pre-Removal Soil Characterization Sampling **Analyzed by/date: _____**
Reviewed by/date: _____ (/ /) **Approved by/date: _____ (/ /)**

PRINCIPLE STEPS	POTENTIAL SAFETY/ HEALTH HAZARDS	RECOMMENDED CONTROLS
• Soil Sampling ***Stop work and notify your supervisor if you are not sure how to perform your task!***	Physical Hazards	
	• Cold or heat stress	• Wear appropriate clothing and follow recommended work schedules and monitoring controls as stated in *Sections 8.3.2.10 or 8.3.2.11*
	• Manual lifting of coolers	• Use proper lifting techniques as discussed in See *Section 8.3.2.14*
	• Slip, trip, and fall hazards	• Safety training and personal awareness • See *Section 8.3.2.15* for general slip, trip, and fall controls
	• Electrical storm	• Shut down operations, see *Section 8.3.2.16*
	Chemical Hazards	
	• Exposure to contaminants in soil, primarily cadmium.	• Minimize dust generation, wash hands and face, see *Section 8.3.3* for chemical hazard controls • Use appropriate PPE
	Biological Hazards	
	• Ticks	• Tape pant legs to boots, avoid tall grass and bushes if possible, check for ticks frequently, see *Section 8.3.4.1*
	• Stinging insects	• Watch out for and avoid stinging insects, see *Section 8.3.4.2*
	• Spiders	• Watch out for and avoid black widow and brown recluse spiders, see *Section 8.3.4.3*
	• Poisonous Plants ***Stop work and notify your supervisor if you are not sure how to perform your task!***	• Watch out for and avoid poisonous plants likely to grow near sampling locations, avoid contact with plant oils that may be present on clothes or equipment, wash hands to prevent spreading oils, see *Section 8.3.4.6* ***Stop work and notify your supervisor if you are not sure how to perform your task!***
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Stainless steel trowels, Hand augers	• None	• All site workers must have OSHA Training in accordance with 29 CFR 1910.120. • All site workers must attend the Daily Safety Meetings. • Hazard Communication for all site workers.

Table 8-1. Activity Hazard Analysis –Soil Removal
b. Soil Removal

Activity: Soil Removal **Analyzed by/date: (/ /)**
Reviewed by/date: (/ /) **Approved by/date: (/ /)**

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Shovel soil from sumps into 55-gallon drums • Excavate soil and direct load into dump trucks • Collect waste characterization samples ***Stop work and notify your supervisor if you are not sure how to perform your task!***	Physical Hazards	
	• General heavy equipment hazards	• Safety training, personal awareness, and safety devices • Maintain a safe exclusion zone • Use hand signals • See *Section 8.3.2.3* for general heavy equipment controls
	• Electrical shock	• Locate and shut down all utilities in work zone, obtain dig permit, watch out for overhead power lines
	• Noise	• Use hearing protection if noise exceeds 85 dBA, see *Section 8.3.2.12*
	• Cold or heat stress	• Wear appropriate clothing and follow recommended work schedules and monitoring controls as stated in *Sections 8.3.2.10 or 8.3.2.11*
	• Manual lifting	• Use proper lifting techniques as discussed in See *Section 8.3.2.14*
	• Slip, trip, and fall hazards	• Safety training and personal awareness • See *Section 8.3.2.15* for general slip, trip, and fall controls
	• Electrical storm	• Shut down operations, see *Section 8.3.2.16*
	Chemical Hazards	
	• Exposure to contaminants in soil, primarily cadmium.	• Minimize dust generation, wash hands and face, see *Section 8.3.3* for chemical hazard controls • Use appropriate PPE
	Biological Hazards	
	• Ticks	• Tape pant legs to boots, avoid tall grass and bushes if possible, check for ticks frequently, see *Section 8.3.4.1*
	• Stinging insects	• Watch out for and avoid stinging insects, see *Section 8.3.4.2*
	• Spiders	• Watch out for and avoid black widow and brown recluse spiders, see *Section 8.3.4.3*
	• Poisonous Plants ***Stop work and notify your supervisor if you are not sure how to perform your task!***	• Watch out for and avoid poisonous plants, avoid contact with plant oils that may be present on clothes or equipment, wash hands to prevent spreading oils, see *Section 8.3.4.6* ***Stop work and notify your supervisor if you are not sure how to perform your task!***
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Excavator, shovels	• Daily inspection and maintenance of equipment	• All site workers must have OSHA Training in accordance with 29 CFR 1910.120 • All site workers must attend the Daily Safety Meetings • Hazard Communication for all site workers • Appropriate heavy equipment training

Table 8-1. Activity Hazard Analysis –Soil Removal
c. Backfill and Site Restoration

Activity: Backfill and Site Restoration **Analyzed by/date: _____**
Reviewed by/date: _____ (/ /) **Approved by/date: _____ (/ /)**

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Backfill excavation • Re-seed ***Stop work and notify your supervisor if you are not sure how to perform your task!***	Physical Hazards	
	• General heavy equipment hazards	• Safety training, personal awareness, and safety devices • Maintain a safe exclusion zone • Use hand signals • See *Section 8.3.2.3* for general heavy equipment controls
	• Electrical shock	• Watch for overhead power lines
	• Cold or heat stress	• Wear appropriate clothing and follow recommended work schedules and monitoring controls as stated in *Sections 8.3.2.10 or 8.3.2.11*
	• Manual lifting	• Use proper lifting techniques as discussed in *Section 8.3.2.14*
	• Slip, trip, and fall hazards	• Safety training and personal awareness • *See Section 8.3.2.15* for general slip, trip, and fall controls
	• Electrical storm	• Shut down operations, see *Section 8.3.2.16*
	Chemical Hazards – The potential for exposure to chemical hazards will be minimal	
	Biological Hazards	
	• Ticks	• Tape pant legs to boots, avoid tall grass and bushes if possible, check for ticks frequently, see *Section 8.3.4.1*
	• Stinging insects	• Watch out for and avoid stinging insects, see *Section 8.3.4.2*
	• Spiders	• Watch out for and avoid black widow and brown recluse spiders, see *Section 8.3.4.3*
	• Poisonous Plants ***Stop work and notify your supervisor if you are not sure how to perform your task!***	• Watch out for and avoid poisonous plants, avoid contact with plant oils that may be present on clothes or equipment, wash hands to prevent spreading oils, see *Section 8.3.4.6* ***Stop work and notify your supervisor if you are not sure how to perform your task!***
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Excavator, shovels	• Daily inspection and maintenance of equipment	• All site workers must have OSHA Training in accordance with 29 CFR 1910.120 • All site workers must attend the Daily Safety Meetings • Hazard Communication for all site workers • Appropriate heavy equipment training

Table 8-2. Activity Hazard Analysis – Building 4343/Sump/Footer Demolition
a. Asbestos Abatement of Building Materials

Activity: Asbestos Abatement of Building Materials **Analyzed by/date:** _____
Reviewed by/date: _____ (/ /) **Approved by/date:** _____ (/ /)

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
• Establish Safe Work Zone and Regulated Area(s) around Building Perimeter • Establish laydown area for equipment, materials, and waste • Establish a decon area for removing PPE prior to exiting the Regulated Area(s) • Ensure all utilities have been disconnected to structure • Establish fall protection system • Perform personal & perimeter air monitoring • Remove built-up roofing materials using wet removal methods • Place asbestos-containing waste into roll-off containers ***Stop work and notify your supervisor if you are not sure how to perform your task!***	▪ Personal injury ▪ Slips & Trips ▪ Falls (>6-feet) including open holes in roof ▪ Lifting Strains & Sprains ▪ Cuts and abrasions ▪ Electrocution ▪ Exposure to Asbestos ▪ Improper Use or Damaged Hand or Power Tools ▪ Improper material handling ▪ Fire ▪ Working in hot environments ***Stop work and notify your supervisor if you are not sure how to perform your task!***	▪ General Safety: To minimize potential hazards all personnel shall attend site orientation prior to start of work activities in addition to daily safety tailgate meetings to familiarize themselves to hazards, emergency procedures and equipment, operational aspects & heavy equipment use, and change(s) in site/work conditions. Daily housekeeping will be implemented at the end of each workday. A Regulated Area(s) must be established and clearly identified, with signage, prior to initiating any asbestos abatement activities. ▪ Fall Protection: Prior to performing any work on the roof an approved fall protection system must be installed. The fall protection system selected must meet the minimum requirements specified in 29 CFR 1926 Subpart M – Fall Protection and consistent with USACE EM385 1-1 and Shaw E&I Policy HS301. All roof openings must be covered with secured material. All extension ladders must be rated Class I (heavy duty) and must be secured/tied-off with a minimum of 3-foot extension beyond the working surface. ▪ Asbestos Exposure: All personnel assigned to abatement activities must be trained and licensed as asbestos abatement workers. All workers must be assigned and wear proper respiratory protection with HEPA (P100) filter cartridges. All personnel must properly don and doff tyke coveralls and hand protection prior to entering and exiting the established regulated Area(s). Personal air monitoring must be performed on a daily basis in accordance with 29 CFR 1926.1101 ▪ Utilities: Prior to demolition activities, including asbestos abatement, all utilities will be contacted and all electrical, water, sewer and gas lines will be identified and disconnected and rendered safe. ▪ Hand & Power Tool Use: Prior to use all tools must be inspected. Any damaged or defective tools will tagged and removed from service for repair and/or discarded. Portable generators must have GFCI outlets when using portable hand tools.

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
		▪ PPE: Level-D PPE will be worn outside the established Regulated Area(s). Level "C" PPE must be worn inside the Regulated Area(s). ▪ Material Handling & Storage: No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting are for lifting objects over the 60-pound limit. Asbestos-containing waste materials must not be placed into approved containers that are clearly marked as containing asbestos. ▪ Heat Stress: Monitor for Heat stress in accordance with the Shaw Policy HS400; Provide appropriate fluids to prevent worker dehydration, and The work area shall provide potable water supply. ***Stop work and notify your supervisor if you are not sure how to perform your task!***
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
Hand/power tools, ladders, portable electric hand tools, personal fall arrest system, amended water, air monitoring pumps	Daily safety Inspections (hand/power tools, ladders, personal fall arrest system)	Site orientation; asbestos abatement training/license; fall protection Lifting/back safety.

Table 8-2. Activity Hazard Analysis – Building 4343/Sump/Footer Demolition
b. Demolition

Activity: Building Demolition **Analyzed by/date: (/ /)**
Reviewed by/date: (/ /) **Approved by/date: (/ /)**

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Collection of wood, metal, and stone waste characterization samples • Demolition of structures • Segregation and disposal of materials • Site restoration ***Stop work and notify your supervisor if you are not sure how to perform your task!***	Physical Hazards	
	• Flying/falling debris during demolition of structure	• Maintain a safe exclusion zone of 100 feet during removal operations, use appropriate safety equipment including hard hat and safety glasses
	• Collapse of walls	• Do not allow walls in excess of 10 feet in height to remain standing without lateral bracing, see *Section 8.3.2.2* for demolition controls
	• General heavy equipment hazards	• Safety training, personal awareness, and safety devices • Maintain a safe exclusion zone, use hand signals • See *Section 8.3.2.3* for general heavy equipment controls
	• Contacting overhead or underground utilities	• Maintain safe distance of at least 15 feet from overhead power lines • Perform utility clearance and obtain dig permit
	• Noise	• Use hearing protection if noise exceeds 85 dBA, see *Section 8.3.2.12*
	• Cold or heat stress	• Wear appropriate clothing and follow recommended work schedules and monitoring controls as stated in *Sections 8.3.2.10 or 8.3.2.11*
	• Manual Lifting	• Use proper lifting techniques as discussed in *Section 8.3.2.14*
	• Slip, trip, and fall hazards	• Safety training and personal awareness • See *Section 8.3.2.15* for general slip, trip, and fall controls
	• Electrical storm	• Shut down operations, see *Section 8.3.2.16*
	Chemical Hazards	
	• Exposure to contaminants in soil, primarily cadmium	• Minimize dust generation, wash hands and face, use appropriate PPE, see *Section 8.3.3* for chemical hazard controls
	Biological Hazards	
	• Ticks	• Tape pant legs to boots, avoid tall grass and bushes if possible, check for ticks frequently, see *Section 8.3.4.1*
	• Stinging insects	• Watch out for and avoid stinging insects, see *Section 8.3.4.2*
	• Spiders	• Watch out for and avoid black widow and brown recluse spiders, see *Section 8.3.4.3*
	• Poisonous Plants ***Stop work and notify your supervisor if you are not sure how to perform your task!***	• Watch out for and avoid poisonous plants, avoid contact with plant oils that may be present on clothes or equipment, wash hands to prevent spreading oils, see *Section 8.3.4.6* ***Stop work and notify your supervisor if you are not sure how to perform your task!***

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Excavator with breaker attachment, front end loader	• Daily inspection and maintenance of equipment	• All site workers must have OSHA Training in accordance with 29 CFR 1910.120. • All site workers must attend the Daily Safety Meetings. • Hazard Communication for all site workers. • Appropriate heavy equipment training.

8.3.2.1 Demolition

In addition to hazards due to heavy equipment, demolition of structures may pose a hazard to workers resulting from weakening of structural members and unexpected collapse, or from flying or falling debris. Demolition activities shall comply with EM-385-1-1, Section 23, Demolition, and 29 CFR 1926.850, Demolition. The following is a list of requirements that are pertinent to Building 4343 IM Actions, and shall be complied with during demolition activities:

- All electric, gas, water, steam, sewer, and other service lines shall be shut off, capped, or otherwise controlled outside the building before demolition is started;
- If hazardous building materials, hazardous chemicals, gases, explosives, flammable materials, or dangerous substances are present, such hazards should be controlled or eliminated before demolition is started;
- All asbestos-containing building materials will be removed prior to demolition;
- A safe zone shall be established around the perimeter of the structure prior to demolition activities commencing. This safe zone shall be established, at a minimum, a distance of twice the height of the structure.
- Demolition of floors and exterior walls shall begin at the top and work downward; and,
- No wall section which is more than ten feet in height shall be permitted to stand without lateral bracing, unless such wall was designed and constructed to stand without such lateral support and is in a condition safe enough to be self-supporting. No wall section shall be left standing without lateral bracing any longer than necessary for removal of adjacent debris interfering with demolition of the wall. Exception to this requirement will be allowed for such wall sections which are designed and constructed to stand without lateral support.

8.3.2.2 Heavy Equipment

Tests shall be made at the beginning of each day during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition and that all required safety devices are in place. Whenever any machinery or equipment is found to be unsafe or a deficiency which affects the safe operation of equipment is observed, the equipment shall be immediately taken out of service and shall not be used until all of the unsafe conditions are corrected. Machinery and mechanized equipment shall be operated by designated qualified personnel. Equipment safety requirements must be in accordance with 29 CFR 1926 and EM 385-1-1, Section 16 and the guidelines listed below:

- Operation of heavy equipment will be limited to properly trained personnel;
- Operator's certifications, qualification letters, and necessary Standard Operating Procedures (SOPs) will be maintained on site;
- Operator shall use the safety devices provided with the equipment (i.e., seatbelts, backup warning indicators and horns);
- Visually inspect equipment daily, prior to operation, and report any deficiencies. Document observations;
- Good housekeeping practices will be maintained in the cab area of heavy equipment; and,

- Additional riders shall not be allowed on equipment, unless it is specifically designed for that purpose.

As presented in **Appendix E**, Shaw Procedure HS810, Commercial Motor Vehicle Operation and Maintenance, will be implemented.

8.3.2.3 Power and Hand Tools

By their very nature, power tools have great capability for inflicting serious injury upon site personnel if they are not used and maintained properly. Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. To control the hazards associated with power and hand tool operation, the requirements outlined in EM 385-1-1, and the safe work practices listed below shall be observed when using these tools:

- Operation/use will be conducted by authorized and experienced personnel;
- Tools will be inspected prior to use, and defective equipment will be removed from service until repaired;
- Tools will be selected and used in the manner for which they were designed;
- Be sure of footing and grip before using any tool;
- Power tools designed to accommodate guards will have such guards properly in place prior to use;
- Do not use tools that have split handles, mushroom heads, and worn parts;
- Safety glasses or a face shield will be used if use of tools presents an eye or face hazard;
- Do not use makeshift tools or other improper tools;
- Use non-sparking tools in the presence of explosive vapors, gases, or residue;
- Loose fitting clothing or long hair will not be permitted around moving parts;
- Hands, feet, etc. will be kept away from moving parts;
- Maintenance and adjustments to equipment will not be made while equipment is in operation. Power will be disconnected prior to maintenance;
- An adequate operating area will be provided, allowing sufficient clearance and access for operation; and,
- Proper PPE in accordance with equipment operating manual will be used (i.e., chain saw chaps, leather gloves, hard hats, hearing protection, shin guards, face shield, safety glasses, etc.).

8.3.2.4 Fire and Explosion Hazards

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during the conduct of site activities, such as moving drums, mixing/bulking of site chemicals and during refueling of heavy or hand held equipment. Some potential causes of explosions and fires include:

- Mixing of incompatible chemicals, which cause reactions that spontaneously ignite due to the production of both flammable vapors and heat;

- Ignition of explosive or flammable chemical gases or vapors by external ignition sources;
- Ignition of materials due to oxygen enrichment;
- Agitation of shock or friction-sensitive compounds; and,
- Sudden release of materials under pressure.

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on site and members of the general public living or working nearby. Site personnel involved with potentially flammable material or operations will follow the guidelines listed below and EM 385-1-1, Section 9, to prevent fires and explosions:

- Potentially explosive/flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator/oxygen (CGI/O_2) meter;
- Prior to initiation of site activities involving explosive/flammable materials, all potential ignition sources will be removed or extinguished;
- Non-sparking and explosion-proof equipment will be used whenever the potential for ignition of flammable/explosive gases/vapors/liquids exists;
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive/flammable atmospheres;
- Smoking will be prohibited in the vicinity of operations which may present a fire hazard;
- Flammable and/or combustible liquids must be handled only in approved, properly labeled metal safety cans equipped with flash arresters and self-closing lids;
- Transfer of flammable liquids from one metal container to another will be done only when the containers are electrically interconnected (bonded); and,
- The motors of all equipment being fueled will be shut off during the fueling operations.

8.3.2.5 Electrical

While it is anticipated that all electrical hookup at Building 4343 have been terminated, this section is included as this will be verified prior to demolition of Building 4343. All electrical work performed shall comply with applicable National Electric Safety Code (NESC), National Electronics Council (NEC), and U.S. Coast Guard (USCG) regulations. All electrical work shall be performed by qualified personnel familiar with applicable code requirements. All safe guarding of hazardous energy sources will comply with Shaw safety policy HS 315.

Above or below ground utilities may pose a hazard to team members during field activities. Below ground utilities will need to be located by Department of Public Works (DPW) personnel prior to excavation activities. As presented in **Appendix E**, Shaw safety procedure HS308, Underground and Overhead Utilities will be followed to prevent utility damage. A safe distance between all equipment and overhead power lines must be maintained at all times. Minimum safe clearances are as follows:

Nominal System Voltage	Minimum Rated Clearance
0 to 50 kV	3 meters
51 to 200 kV	4.5 meters
201 to 300 kV	6 meters
301 to 500 kV	7.5 meters
501 to 750 kV	105 meters
751 to 1000 kV	135 meters

8.3.2.6 Excavations and Trenching

Excavation activities will be conducted in accordance with EM 385-1-1, Section 25 and Subpart P of 29 CFR 1926. As presented in **Appendix E**, Shaw Procedure HS307, Excavation and Trenching, will be implemented during excavation and trenching operations. The guidelines below are intended to reflect minimum requirements to be followed on this site.

- Prior to initiation of any excavation or trenching activity, the location of underground installations will be determined in accordance with Shaw safety policy HS308;
- The excavation(s) will be inspected and documented daily by the SSHO or by the Competent Excavation and Trenching person prior to commencement of work activities;
- Evidence of cave-ins, slides, sloughing, or surface cracks will be cause for work to cease until necessary precautions are taken to safeguard workers;
- Excavations five feet or deeper, which cannot be sloped will require a registered civil engineer or soils excavations specialist, to design and install a protective system;
- Protective systems shall be selected from OSHA 29 CFR 1926 Subpart P and/or designed by a registered professional civil engineer;
- Spoils and other materials will be placed two feet or more from the edge of the excavation;
- Materials used for sheeting, shoring, or bracing will be in good condition;
- Timbers will be sound, free of large or loose knots, and of appropriate dimensions for the excavation;
- Safe access will be provided into the excavation(s) by means of a gradually sloped personnel access/egress ramp; and,
- Excavations four feet or more in depth will have a means of egress at a frequency such that lateral travel to the egress point does not exceed 25 feet.

8.3.2.7 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common illnesses at a site, regular monitoring and other preventive measures are vital.

Heat stress manifests itself in progressive stages (listed below), each increasing in severity, and if not remedied, can threaten life or health. Factors which may predispose a worker to heat stress

include: lack of physical fitness, lack of acclimatization to hot weather, degree of hydration, current health status, alcohol or drug use, and the worker's age and sex. Therefore, it is important that all workers be able to recognize symptoms of these conditions and be capable of arresting the problem as quickly as possible.

As with any illness, the best cure for heat stress is avoidance/prevention. Heat stress is most likely to occur early in the summer, prior to acclimatization. Full acclimatization takes five to seven days of consecutive controlled exertion in heat. Individual physical conditioning, pre-existing illnesses and use of alcohol contribute significantly to the potential for heat stress. Avoidance includes drinking plenty of fluids, taking frequent breaks, revise work schedule around hot periods of the day, and assure that worker are acclimated before allowing them to work for extended periods of time. **Table 8-3** shows an example work/rest schedule to be implemented as it relates to the work load and regimen. The SSHO will determine when work/rest schedules will be implemented based on temperature and work load.

As presented in **Appendix E**, Shaw Procedure HS400, Working in Hot Environments, will be implemented to control heat-related illness. The SSHO will determine the potential for heat stress based on planned activities and weather forecasts.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

Symptoms – Symptoms of heat rash include a mild red rash, especially in areas of the body which sweat heavily.

Treatment – Treatment includes decreasing the amount of time in protective gear and providing powder (such as corn starch or baby powder) to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

Table 8-3
Examples of Permissible Heat Exposure Threshold Limit Values

Work – Rest Regimen	*Work Load Light	Moderate	Heavy
Continuous work	30.0 (86)	26.7 (80)	25.0 (77)
75% Work - 25% Rest, each hour	30.6 (87)	28.0 (82)	25.9 (78)
50% Work - 50% Rest, each hour	31.4 (89)	29.4 (85)	27.9 (82)
25% Work - 75% Rest, each hour	32.2 (90)	31.1 (88)	30.0 (86)

*Consult the ACGIH TLV booklet for definitions of Light, Moderate and Heavy work loads. Values are given in °C and (°F) WBGT, and are intended for workers wearing single layer summer type clothing. As workload increases, the heat stress impact on an unacclimatized worker is exacerbated. For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5°C.

Source: ACGIH. 1995-1996 Threshold Limit Values and Biological Exposure Indices. Cincinnati, OH.

Heat Fatigue

Heat fatigue is characterized by discomfort and reduced mental awareness, with a greater effect in unacclimated workers. Medical treatment is usually not needed. Heat fatigue usually effect people who work in hot environments and perspire a great deal. Loss of salt from the body causes very painful cramps of the leg and abdominal muscles. Heat fatigue also may result from drinking iced water or other drinks too quickly or in too large a quantity.

Symptoms – Heat fatigue symptoms include muscle cramps in legs and abdomen, pain accompanying the cramps, faintness, and profuse perspiration.

Treatment – Treatment includes removing a victim to a cool area and loosening clothing, stretching and massaging affected muscle, drinking one to two cups of water immediately, and every twenty minutes thereafter.

Heat Exhaustion

Heat exhaustion results from sustained exertion in heat, combined with failure to replace water and salts lost in sweat. Heat syncope results in fainting and can occur when standing immobile in heat. It is caused by the pooling of venous blood in the dilated vessels of the skin and lower body.

Symptoms – Symptoms include weak pulse, rapid and shallow breathing, fatigue, nausea, headache, profuse perspiration, dizziness, unconsciousness, and clammy, moist skin which may be flushed or pale.

Treatment – Replacement of water and salts is required to recover. Electrolyte replacement fluids should be taken until urine volume increases. Recovery is complete and rapid following rest in a recumbent position at a cool location. Treat the person for shock if necessary, and remove him/her to a medical facility if there is any indication of a more serious problem.

Heat Stroke

The most serious heat injury is *heat stroke*. Heat stroke is a medical emergency, treatment must be immediate and professional medical attention must be obtained. Heat stroke is caused by a combination of factors including heavy exertion heat, inadequate replacement of fluids, poor physical condition, and individual susceptibility.

Symptoms – Failure of sweat response occurs, leading to a rapidly accelerated increase in core temperature. The victim usually has hot, dry red skin and if conscious, is confused; convulsions may be present. Additional symptoms include dilated pupils, and a full and fast pulse.

Treatment – The victim must be cooled immediately; heat stroke is fatal if treatment is incomplete or delayed. Emergency care includes transportation to a medical facility, placing person in a cool environment, assure an open airway, reduce the body temperature (wrap in wet sheet or douse body with water), and if available, place cold packs under arms, around neck, at the ankles, or any place where blood vessel lie close to skin.

8.3.2.8 Cold Stress

As with high temperatures, outdoor work in low temperatures can result in risks to the health of employees exposed without adequate preparation. The combined temperature/wind chill affect is shown in **Table 8-4**. To minimize impacts from cold stress, the information and precautions given below shall be observed.

Table 8-4
Wind Chill

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	***LITTLE DANGER*** In<hr with dry skin. Maximum danger of false sense of security.				***INCREASING DANGER*** Danger from freezing of Exposed flesh within One minute.				***GREAT DANGER*** Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

Cold-related worker fatalities have resulted from failure to escape low environmental air temperatures, or from immersion in low temperature water. Most hypothermia cases develop in air temperatures between 30 - 50°F. The single most important aspect of life-threatening hypothermia is a fall in the deep core temperature of the body. Lower body temperature will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body that have high surface-area-to-volume ratio such as fingers, toes, and ears are the most susceptible.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost Nip or Initial Frostbite: Characterized by sudden blanching or whitening of skin.
- Superficial Frostbite: Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep Frostbite: Tissues are cold, pale, and solid; extremely serious injury.
- Systemic Hypothermia: This condition is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and sometimes rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and finally 5) death.

Treatment of cold stress includes bringing the body core temperature back to its normal temperature of 98.6°F. Personnel exhibiting symptoms of cold stress should be brought in to a warm area and allowed to rest and warm up. Warm, non-alcoholic, decaffeinated drinks (not coffee) or soup should be given to increase body temperature, and rewarming should be gradual.

For frostbite emergency treatment, the victim should be sheltered from the wind and cold and given warm drinks. If superficial, the frozen area should be covered with extra clothing or warmed against the body. Do not use direct heat, and do not pour hot water over or rub the effected area. Warming should be gentle and gradual. If the frostbite is deep (area is frozen and hard to the touch), immediate medical attention should be obtained.

For hypothermia emergency treatment, all stages are treated by either passive or active rewarming. This is accomplished by better conservation of the patient's body heat. It is important to note that if a victim is found in a remote area, despite the death-like appearance, the person may be saved. All attempts should be made to revive the victim. Active rewarming means heat is applied to the victim by an external source, either to the skin surface and/or through the core. Treatment includes:

- Preventing further heat loss. Remove the victim to a warm, dry place.
- Remove wet clothing piece-by-piece and dry underlying skin.
- Dress in several layers of warm, dry clothing, giving preference to the central body core rather than the extremities.
- Cover the victims head, then wrap the victim in blankets.
- If the victim is conscious, all him/her to drink hot fluids.
- Monitor oral body temperature every 15 minutes. If the body temperature falls below 98.6°F, the team member should not be allowed outside until the body temperature returns to normal.
- In more severe cases of hypothermia, implement the above actions, but also institute some type of active rewarming, including:
    - Electric pads or blankets;

- Hot-air blowers or heaters;
- Heated blankets or clothes; and,
- Use of human body heat.

- It is important to watch for signs of return of the normal thermoregulatory mechanisms (shivering, teeth chattering, etc.) and to monitor mental status.
- The victim should be transferred to a medical facility after the emergency care steps have been initiated and should not be allowed to return to work for at least 48 hours.
- Perform CPR if the victim is pulseless and not breathing.
- Avoidance of cold stress emergencies can be performed by the general practices stated below:
  - Wear layered clothing, including a water-repellent outer layer.
  - Wear gloves, socks, and a hat that are synthetic or wool insulated.
  - Remove outer layers of clothing during breaks to prevent inner layer from getting wet from perspiration.
  - Eat well balance meals and maintain an adequate intake of fluids.
  - Seek shelter in a warm protected area when signs and symptoms of cold stress become evident.

Table 8-5 provides a work/warm-up schedule for a four hour shift as it relates to temperature and wind speed. This schedule will be applied during all field work.

Table 8-5
Threshold Limit Values Work/Warm-Up Schedule For 4-Hour Shift*

Air Temperature-Sunny Sky		No Wind		5 MPH Wind		10 MPH Wind		15 MPH Wind		20 MPH Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	Normal	1	75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to 34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5		
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5				
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5						
-40° to -42°	-40° to -44°	30 min.	5								
-43° to below	-45° & Below	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	

Notes for Table:

1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:

3. mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

4. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:

5. special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

6. TLVs apply only for workers in dry clothing.

* Adapted from the "1995-1996 Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienist. Cincinnati, OH.

As presented in **Appendix E**, Shaw Procedure HS401, Cold Stress, will be implemented to control cold related illness.

8.3.2.9 Noise

Hearing protection may be required during certain noisy activities. Hearing protection will be required when sound pressure levels in work areas or on equipment exceed 85 dBA, the threshold limit value for noise. Permissible noise exposure levels for different durations are shown in **Table 8-6**. A field guideline for knowing when hearing protection is recommended is if people three feet apart must raise their voices to be heard in normal conversation.

Table 8-6
Permissible Noise Exposure

A-Weighted Sound Level (dB)	Permitted Duration Per Workday (Hours)	A-Weighted Sound Level (dB)	Permitted Duration Per Workday (Hours)
80	32.0	106	0.87
81	27.9	107	0.76
82	24.3	108	0.66
83	21.1	109	0.57
84	18.4	110	0.50
85	16.0	111	0.44
86	13.9	112	0.38
87	12.1	113	0.33
88	10.6	114	0.29
89	9.2	115	0.25
90	8.0	116	0.22
91	7.0	117	0.19

A-Weighted Sound Level (dB)	Permitted Duration Per Workday (Hours)	A-Weighted Sound Level (dB)	Permitted Duration Per Workday (Hours)
92	6.2	118	0.16
93	5.3	119	0.14
94	4.6	120	0.125
95	4.0	121	0.11
96	3.5	122	0.095
97	3.0	123	0.082
98	2.6	124	0.072
99	2.3	125	0.063
100	2.0	126	0.054
101	1.7	127	0.047
102	1.5	128	0.041
103	1.3	129	0.038
104	1.1	130	0.031
105	1.0		

Source: Shaw Procedure HS402

As presented in **Appendix E**, Shaw Procedure HS402, Hearing Conservation Program, will be implemented when elevated noise levels exist. The SSHO will provide training on the proper use of hearing protection in accordance with 29 CFR 1910.95. The training will be conducted as a part of the pre-work safety and health briefing and documented in the safety files.

8.3.2.10 Dust

It is possible that dust could be generated during demolition operations. In such cases, a water spray will be used to minimize dust generation. Real-time dust monitors may be used if necessary to protect site personnel (*Section 8.6*).

8.3.2.11 Manual Lifting

Investigation activities may require personnel to move large, heavy objects by hand. The human body is subject to severe damage in the forms of back injury and hernia if caution is not observed when handling, lifting, or moving these large, heavy objects.

The following fundamentals should be followed while manual lifting objects:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably. No individual employee is permitted to lift any object that weighs over 60 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 60-pound limit.
- A firm grip on the object is essential, therefore, the hands and objects shall be free of oil, grease, and water.

- The hands and fingers shall be kept away from any points that could cause them to be pinched or crushed, especially when setting the object down.
- The item shall be inspected for metal slivers, jagged edges, burrs, and pinch points, and gloves shall be used to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that you cannot see around.
- When placing an object down, the stance and position are identical to that for lifting.
- If needed, back support devices will be provided to aid in preventing back injury.

The following steps will be followed during manual lifting:

- Get a good footing;
- Place feet about one shoulder width apart;
- Bend at knees to grasp weight;
- Keep the back straight;
- Get a firm hold;
- Lift gradually by straightening the legs; and,
- If weight is uncomfortable to lift, get help.

8.3.2.12 Slips, Trips, Falls

Field operations may place personnel in situations where they may be exposed to slip, trip, and fall hazards. Slipping hazards will exist when the ground is wet, or on steep slopes. Tripping hazards will exist on rough, uneven terrain, or if the work area is cluttered with tools, equipment, debris, soil piles, etc. Falling hazards will exist as a result of slip or trip hazards, or in elevated work areas with inadequate railing.

The following precautions should be followed by all site personnel:

- Field personnel shall become familiar with the general terrain of the site and potential physical hazards (i.e., rocky conditions, uneven terrain) which would be associated with accidental slips, trips, and falls;
- Be cautious after periods of heavy rainfall, which may cause earth movement and slides;
- Be attentive where you walk since pits, holes, or similar hazards may be partially covered or visually obstructed;
- Be cautious around soil or terrain which recently may have been disturbed, relocated, or otherwise made less stable; and,
- Avoid the top edges of drop-off areas whether they have been disturbed or not.

8.3.2.13 Lightning

Electrical storms commonly occur during Spring and Fall. The resulting lightning poses a safety hazard to field personnel. Since the storms are sometimes fast moving, field personnel should watch for indications of electrical storms. The distance to an electrical storm can be estimated by observing the interval between the lightning flash and the sound of thunder. Since sound travels approximately 1,100 feet per second, an interval of 5 seconds corresponds to a storm distance of approximately 1 mile.

If an electrical storm is observed within five miles of the site, field personnel shall cease outside activities and proceed to the site office for further instructions and all heavy equipment will be shut down. If caught in the open by an electrical storm, all personnel will immediately seek shelter in their vehicle and proceed as above. In the event that their vehicle is inaccessible, they will move to a topographically low area away from tall objects and conductors (e.g., transformer, power lines, metal sheds) and wait for the storm to leave the area.

8.3.2.14 Drum Handling

Hazardous materials are often shipped, stored, or disposed in 55-gallon drums. If a drum or other container is encountered with unknown contents, caution should be exercised to avoid explosion or chemical hazards.

8.3.3 Chemical Hazards

This section discusses chemical hazards that may be encountered at RFAAP during the interim measures at Building 4343. Chemical hazards can be encountered either from chemicals brought on site by the contractor for use during activities, chemicals stored at the site, or chemicals that have been released to the environment and are present in various media such as air, soil, or water.

8.3.3.1 Site-Related Chemicals

Cadmium was identified equal to or above the calculated residential remedial goal of 70.3 mg/kg during the RFI investigation at Building 4343 (USACE, 2004) as presented on **Figures 2-2 and 2-3**. As presented in **Appendix E**, Shaw Procedure HS501, Cadmium Compliance Plan, will be implemented to control cadmium-related chemical exposures.

Asbestos has been identified in the building materials of Building 4343. Prior to any demolition of the structure all asbestos-containing building materials will be removed by a qualified and licensed subcontractor.

Lead-based paints have been quantitatively confirmed in several building components of Building 4343. This WP does not require the separate abatement of LBP inside the structure prior to demolition. However, all safety precautions will be taken to ensure that worker exposures are kept to a minimum. This will be accomplished through engineering controls (i.e., water misting) and establishment of safety zones.

Silica dust will be generated during the demolition of the structure and footings. To reduce the potential for airborne silica generation demolition using tractor hoe w/ grappler and/or hoe-ram will be employed as well as engineering controls (i.e., water misting).

8.3.3.2 Exposure Pathways

Chemicals may pose a hazard to humans when inhaled, ingested, or through dermal absorption. Inhalation can occur when chemicals are present as vapors, aerosols, or attached to airborne dust particles. Ingestion usually occurs incidentally, as chemicals present in the air enter the mouth or nose, or from hand to mouth activities such as eating, drinking, and smoking. Dermal absorption occurs when chemicals contact unprotected skin.

8.3.3.3 Exposure Assessment

The toxic hazards to site personnel associated with chemicals can be assessed through comparison of actual exposures with several established occupational exposure limits using quantitative collection and analysis through real-time and/or time-integrated personal air sampling.

Permissible Exposure Limits (PELs) are established by the OSHA. TLVs are established by the ACGIH. Immediately Dangerous to Life or Health (IDLH) values are established by NIOSH. **Table 8-7** presents occupational exposure limits (if available) for potential chemicals, including OSHA PELs, ACGIH TLVs, and NIOSH IDLH values. The table also indicates if there are potential significant contributions to the overall exposure for the chemical of concern through dermal contact, and identifies the acute symptoms resulting from exposure.

The occupational exposure limits are described as follows:

PELs may be expressed as an 8-hour Time-Weighted Average (TWA), a Short-Term Exposure Limit (STEL), or a ceiling limit. Ceiling limits may not be exceeded at any time. PELs are enforceable by law. STELs are allowable exposure limits for durations ranging from 5 to 15 minutes, without causing the 8-hour TWA to be exceeded.

Table 8-7
Occupational Health Exposure Guidelines for Potential Contaminants

Contaminant	Acute Symptoms of Exposure	PEL (TWA unless otherwise noted)	TLV-TWA	Skin Notation (Yes/No)	IDLH
Cadmium	Pulmonary edema, difficulty breathing, cough, chest tight, substernal (below the sternum) pain, headache, chills, muscular aches, nausea, vomiting, diarrhea, loss of sense of smells, emphysema, proteinuria, mild anemia	0.005 mg/m^3	0.01 mg/m^3	N	9 mg/m^3
Lead	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension	0.05 mg/m^3	0.05 mg/m^3	N	100 mg/m^3

Contaminant	Acute Symptoms of Exposure	PEL (TWA unless otherwise noted)	TLV-TWA	Skin Notation (Yes/No)	IDLH
Asbestos	Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing; irritation eyes; [potential occupational carcinogen]	0.1 fiber/cm^3	0.1 fiber/cm^3	N	1 fiber/cm^3 (Excursion Limit – 30 minutes)
Silica	Cough, dyspnea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen]	30 mg/m^3 divided by the value "%SiO_2 + 2	0.05 mg/m^3	N	50 mg/m^3

The ACGIH TLV is defined as the TWA concentrations for a substance to which nearly all workers (8 hours/day, 40 hours/week) may be repeatedly exposed, day after day, without experiencing adverse health effects. For some substances, the overall exposure to a substance is enhanced by skin, mucous membrane, or eye contact. These substances are identified by "yes" in the skin notation column.

The IDLH values represent the maximum concentrations from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing symptoms or any irreversible health effects.

8.3.3.4 Chemical Hazard Communication

In order to comply with the OSHA Hazard Communication Standard 29 CFR 1910.1200 and to ensure that site personnel are informed of the hazards associated with the materials with which they work, the following requirements will apply to all commercial products containing hazardous substances which are brought on site.

- Material Safety Data Sheets (MSDSs) will be maintained for each product containing a hazardous substance that will be used on site. MSDSs for chemicals being used or stored on site during investigation activities are included in **Appendix F**.
- All containers not supplied with adequate hazard labeling will have a hazard communication label affixed to the container providing the health and physical hazards associated with the material.
- All personnel, including subcontractors who work with products containing hazardous substances, will be trained in accordance with the requirements of 29 CFR 1910.1200. This training will be performed and document by the SSHO and maintained on-site in the safety files.
- An inventory of all products containing hazardous substances used on site will be maintained using a site-specific Chemical Inventory.

8.3.4 Biological Hazards

Biological hazards that may be found at Building 4343 include ticks, spiders, snakes, and poisonous plants. The following sections discuss the potential biological hazards that may be encountered at Building 4343 during removal actions.

8.3.4.1 Ticks

From April through October, particular caution will be exercised to prevent site workers from being bitten by deer ticks and potentially contracting Lyme Disease. The Center for Disease Control (CDC) has noted an increase of Lyme Disease and Rocky Mountain Spotted Fever (RMSF) which are caused by tick bites. Ticks are small, ranging from the size of a comma up to about one quarter-inch; when embedded in the skin, they may look like a freckle. Ticks live in and near wooded areas, tall grass, and brush.

Lyme Disease – Lyme Disease is caused by deer ticks and lone star ticks that have become infected with spirochetes. Female deer ticks are about one quarter-inch in size, and are black and brick red in color. Male deer ticks are smaller, and completely black. Lone star ticks are larger and chestnut brown in color. The illness typically occurs in the summer and is characterized by a slowly expanding red rash that develops in a few days to a few weeks after the bite of an infected tick. This may be accompanied by flu-like symptoms along with headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage, treatment by a physician usually is effective. If left alone, these early symptoms may disappear, but more serious problems may follow. The most common late symptom of the untreated disease is arthritis. Other problems which may occur include meningitis, neurological abnormalities, and cardiac abnormalities. It is important to note that some people do not get the characteristic rash and may have diminished progress to the later manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

Rocky Mountain Spotted Fever – RMSF has occurred in this area of the country. It is caused by Rocky Mountain wood ticks and dog ticks which have become infected with rickettsia. Both are black in color.

RMSF disease is transmitted by the infected dog tick, *Dermacentor variabilis* and is common in the western U.S. It is important to note that the dog tick is significantly larger than the deer tick, previously discussed. Nearly all cases of Rock Mountain spotted fever occur in the Spring and Summer, generally several days after exposure to infected ticks. The onset of illness is abrupt, often with high fever, headache, chills, and severe weakness. After the fourth day of fever, victims develop a spotted pink rash, which usually starts at the hands and feet and gradually extends to most of the body.

The first symptoms of either disease are flu like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur.

If a site employee believes they have been bitten by a tick, or if any of the signs and symptoms noted above appear, the employee will contact the SSHO, who will authorize the employee to visit a physician for an examination and possible treatment.

The following precautions should be taken when working in areas that might be infested with ticks:

- Cover your body as much as possible. Wear long pants and long-sleeved shirts. Light color clothing makes spotting of ticks easier.
- Try to eliminate possible paths by which the deer tick may reach unprotected skin. For example, tuck bottoms of pants into socks or boots and sleeves into gloves. (Duct tape may be used to help seal cuffs and ankles.) If heavy concentrations of ticks or insects are anticipated or encountered, Tyvek® coveralls may be used for added protection.
- Conduct periodic and frequent (e.g., hourly) surveys of your clothing for the presence of ticks. Remove any ticks and insects that become attached to clothing.
- Spray outer clothing, particularly your pant legs and socks, but not your skin, with an insect repellent that contains permethrin or permanone, or use a repellent with DEET, which can be applied to the skin.
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible;
- Tuck pant legs into boot tops or tape pants to boot tops to prevent ticks from crawling up the pant leg (this may not be an option at sites where extreme heat stress is anticipated); and,
- If dressed in Level D or Modified Level D and no other head protection is required, wear a hat to prevent ticks from getting into the hair.

The following actions should be taken if a tick is found:

- If you find a tick, remove it by pulling on it gently with tweezers;
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers;
- Do not use matches, a lit cigarette, nail polish or any other type of chemical to "coax" the tick out;
- Be sure to remove all parts of the tick's body and disinfect the area with alcohol or a similar antiseptic after removal;
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area; and,
- Look for the signs of the onset of RMSF, such as a rash-like inflammation consisting of red spots under the skin that appear 3 to 10 days after the tick bite.

Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, but firmly, until it releases its hold on the skin. Save the tick in a jar labeled with a date, body location of the bite, and place it where it may have been acquired.

Wipe the bite thoroughly with an antiseptic and notify the safety officer as soon as possible. The various stages and symptoms are well recognized and if detected can be treated with antibiotics. Early detection and treatment with antibiotics significantly reduces the severity of Lyme disease and Rocky Mountain spotted fever. If necessary, seek medical attention.

8.3.4.2 Ants, Bees, Wasps, Hornets, and Yellow Jackets

Contact with stinging insects like bees, hornets, and wasps may result in site personnel experiencing adverse health affects that range from being mild discomfort to life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects.

Nests and hives for bees, wasps, hornets, and yellow jackets often occur in ground, trees, and brush. The area will be checked for obvious nests and hives before it is cleared. If a nest or hive is found, the SSHO will be contacted before the nest is disturbed or removed; and, if possible, an alternate sampling location will be selected. Bites and stings can be painful and may elicit an allergic reaction. Medical surveillance will identify any individuals with life threatening allergies. These individuals will not work in areas where there is a great potential for insect stings. If simple first-aid measures do not alleviate the symptoms, the victim will be taken to the nearest medical center. An attempt will be made to kill the offending insect and take it to the emergency room with the victim if this can be done quickly and without endangering personnel.

Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote, wooded, grassy areas;
- The nests can be situated in trees, rocks, bushes, or in the ground, and are usually difficult to see;
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active;
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention;
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock;
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages; and,
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure; therefore, even if someone has been stung previously, and has not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction upon receipt of another sting.

With these things in mind and with the high probability of contact with stinging insects, all site personnel shall comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp, or hornet stings, they must inform the SSHO of this condition prior to participation in site activities. The SSHO will question all site personnel concerning allergies or sensitivities prior to initiating work on site;

- All site personnel will be watchful for the presence of stinging insects and their nests, and shall advise the SSHO if a stinging insect nest is located or suspected in the area;
- Any nests located on site shall be flagged off and site personnel shall be notified of its presence;
- If stung, site personnel shall immediately notify the SSHO to obtain treatment and allow the SSHO to observe them for signs of allergic reaction; and,
- Site personnel with a known hypersensitivity to stinging insects shall keep required emergency medication on or near their person at all times.

Stings of these insects are responsible for more deaths in the U.S. than bites and stings of all venomous creatures. This is due to the sensitization by the victim to the venom from repeated stings, which can result in anaphylactic reactions. The stinger may remain in the skin and should be removed by teasing or scraping rather than pulling. An ice cube placed over the sting will reduce pain. An analgesic-corticosteroid lotion is often used. People with known hypersensitivity to such stings should carry a kit containing antihistamine and epinephrine.

8.3.4.3 Spiders

The biting insects of greatest concern are spiders, especially the black widow and the brown recluse. These spiders are of special concern due to the significant adverse health effects that can be caused by their bite.

Black Widow – The black widow is a coal-black, bulbous spider 3/4 to 1-1/2 inches in length, with a bright red hourglass on the underside of the abdomen. The black widow is usually found in dark moist locations, especially under rocks and rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite;
- Appearance of small punctures (sometimes none are visible); and,
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of face and extremities.

Brown Recluse – The brown recluse is brownish to tan in color, rather flat, 1/2 to 5/8 inches long with a dark brown "violin" shape on the underside. It may be found in trees or in dark locations. Victims of a brown recluse bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite;
- Formation of a large, red, swollen, pustulating lesion with a bull's-eye appearance;
- Systemic effects may include a generalized rash, joint pain, chills, fever, nausea, and vomiting; and,
- Pain may become severe after 8 hours with the onset of tissue necrosis.

There is no effective first aid treatment for either of these bites. Except for very young, very old, or weak victims, these spider bites are not considered to be life threatening; however, medical treatment must be sought to reduce the extent of damage caused by the injected toxins. If either of these spiders are suspected or known to be on site, the SSHO shall brief the site personnel as to the identification and avoidance of the spiders. Site personnel should notify the SSHO if they locate either of these spiders.

8.3.4.4 Snakes

The possibility for encountering snakes exists. Although rare in the southwestern Virginia area, the species of greatest concern is the copperhead *(Agkistrodon contortix)*. Copperheads grow to 36 inches and can be recognized by the copper-color head and a reddish-brown hourglass pattern on the body. Copperheads are normally lethargic; once aroused, however, they strike vigorously and may rapidly vibrate their tails. Rocky hillsides are favorite habitats.

To minimize the threat of snake bites, all personnel walking through the brush will be aware of the potential for encountering snakes and will avoid actions that increase the likelihood of encounters (e.g., turning over logs). Additional caution will be exercised around sawdust or rock piles, which are known to support copperheads. In the event of a snake bite, the following rules should be followed:

- Do no cut "X's" over the bite area as this will intensify the effect of the venom;
- Do not apply suction to the wound since this has a minimal effect in removing venom;
- Do no apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area;
- If possible, kill the snake, bag it, and transport it with the victim. Try to identify the snake for proper selection of anti-venom;
- Do not allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body;
- Keep the victim calm and immobile;
- Have the victim hold the affected extremity lower than the body while waiting for medical assistance; and,
- Transport the victim to a medical facility immediately.

8.3.4.5 Animals

Normally wildlife avoid people and areas where activities are ongoing. Small animals, such as raccoons, infected with rabies or when cornered, may become aggressive. When working remain alert for likely locations that animals inhabit. Avoid nests, dens, and holes in the ground that may be the animal's home.

The only effective measure to preclude animal bites is avoidance. Contact with all wild animals at Building 4343 will be avoided at all times. Persons bitten by an animal should seek medical assistance immediately, especially if it is suspected that the animal is rabid. Aggressive or disoriented behavior, as well as foaming of the mouth can be signs of rabid animals. Until medical assistance can be reached, persons should watch for symptoms of severe swelling, nausea, and shock.

8.3.4.6 Poison Ivy, Poison Oak, Poison Sumac

Poison ivy thrives in all types of light and usually grows in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has shiny, pointed leaves that grow in clusters of three. Poison sumac is a tall shrub or slender tree that usually grows along swampy areas or ponds in wooded areas. Each poison sumac leaf stalk has 7 to 13 leaflets which have smooth edges. Poison oak is mostly found in the southeast and west. Poison oak resembles poison ivy, with one important difference. Poison oak leaves are more rounded than jagged like poison ivy and the underside of poison oak leaves are covered with hair.

All personnel should become familiar with and be able to recognize poison ivy, poison oak, and poison sumac in the field. All personnel that know they are over sensitive to poison ivy or poison sumac will notify their SS or the SSHO. They will not be allowed to work in the area until the poison ivy/sumac has been removed. This information will be noted on their medical data sheet. Reaction to poison ivy can be prevented if the exposed skin is washed with mild soap and water within 10 minutes of contact. Contact can be prevented by site workers wearing appropriate clothing. Preventive measures which can prove effective for most site personnel are:

- Avoid contact with any poisonous plants on site and keep a steady watch to identify, report, and mark poisonous plants found outside;
- Wash hands, face, or other exposed areas at the beginning of each break period and at the end of each work day;
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment, and clothing;
- Barrier creams, detoxification/wash solutions, and orally administered desensitization may prove effective and should be tried to find the best preventive solution; and,
- Avoid spreading oils from these plants to hands and other parts of the body.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in the oils produced by the plant. Contamination from the oils of these plants may occur through contact with leaves, branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact;
- Reddening, swelling, itching, and burning at the site of contact;
- Pain, if the reaction is severe; and,
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

Blisters form during the subsequent 24 to 36 hours. Crusting and scaling occurs within a few days. Signs and symptoms included redness, swelling, and sometimes intense itching. Symptoms usually disappear in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe.

8.3.4.7 Biological Agents

Microbial hazards can potentially occur when workers handle materials with biological contamination. One source of infection for response workers is poor sanitation. Waterborne and foodborne diseases can be a problem if adequate precautions are not taken to keep food and drinking water properly stored and isolated. An example of such a disease is salmonellosis. Workers must also avoid creating any sanitation problems by making sure that properly designed lavatory facilities are available at the work site.

Tetanus is another biological hazard encountered on hazardous materials sites. Workers must avoid puncture hazards, wear appropriate protective clothing, and be current in Tetanus Inoculations.

8.3.4.8 Bloodborne Pathogens

In July of 1992, OSHA issued a final Standard for Protection of Workers Potentially Exposed to Bloodborne Pathogens (29 CFR 1910.1030). This primarily involves medical and research personnel. Bloodborne pathogens are pathogenic microorganisms which may be present in human blood and can cause disease in humans. These pathogens include, but are not limited to hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

Potential exposure during site activities results from workers who are infected. The OSHA Standard specifically includes first aid providers and is enforceable on site subject to the Hazardous Waste Site Work and Emergency Response Standard (29 CFR 1910.120). The basic concept of this standard is that medical care workers and first aiders must take the "Universal Precaution" of assuming that any blood containing fluid or person bleeding or contaminated with blood containing fluid is positive (infected) with both viruses.

Protection involves the use of personal protection such as gloves, eye shields, one-way valve rescue breather devices, and training. In order to effectively protect against any hazards, workers must have a basic understanding of the hazard. This is particularly true of Site Supervisors and SSHOs and others expected to administer first aid if necessary.

8.4 SITE CONTROL PROCEDURES

8.4.1 Site Control

To protect the public and maintain security at Building 4343 during working hours, the site will be controlled as follows:

- Work areas and support areas will be established prior to the start of activities;
- Only authorized workers will be permitted in work areas;
- Work will cease if unauthorized personnel enter work areas; and,
- Temporary fencing will be utilized around excavations to protect site visitors.

8.4.2 Site Work Zones

If site conditions dictate an upgrade in PPE due to the presence of contaminants at high concentrations, work zones will be established to ensure against the accidental spread of hazardous substances by workers from contaminated areas to clean areas. Zones will be delineated on site where removal activities occur, and the flow of personnel in these zones will be controlled. The establishment of site work zones will help ensure that personnel are properly

protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency. The site work zones that will be used during site activities, as deemed necessary by the SSHO, will include:

- Exclusion Zone (EZ) – the contaminated area;
- Contamination Reduction Zone (CRZ) – the area where decontamination of PPE takes place; and,
- Support Zone (SZ) – the uncontaminated area where workers should not be exposed to hazardous conditions.

A "hotline" where personnel routinely enter or exit the EZ will be located upwind of the work activities. Site work zones, including hotlines, will be established as deemed necessary by the SSHO during field activities. All site work zones will be adequately marked using traffic cones or banner guard.

Access to the EZ and CRZ will be strictly limited to individuals who meet all medical monitoring, training, and PPE requirements of the site. Visitors who have received the appropriate training, are medically qualified, and are wearing the appropriate level of protection must receive a site safety briefing and will be escorted within these zones by the SSHO. Visitors who do not meet the specified requirements will remain in the SZ.

Asbestos Abatement

Prior to demolition of the building all known asbestos-containing building materials (ACBM) will be removed in accordance with regulations codified by the State of Virginia. Prior to asbestos abatement activities taking place the contractor will establish a "Regulated Area". This Regulated Area will be identified by the appropriate asbestos warning signage (English and Spanish). Only trained and licensed personnel will be permitted inside this area during abatement activities. The asbestos abatement contractor must submit a abatement plan for approval prior to abatement activities being initiated.

Building Demolition (Lead/Silica)

In addition to the ACBM found in the building materials, lead-based paint has been confirmed, via quantitative testing method, in the painted surfaces on both exterior and interior masonry walls. If structural steel exits inside the building the steel may need to be cut for debris sizing purposes. If cutting of the beam is to be performed the individual assigned to the task (which could be done using a demo saw or an oxy-acet torch) will be offered respiratory protection and the area will be ventilated.

Demolition of the single story building is anticipated to potentially generate significant levels of nuisance dust and/or silica that could adversely impact site personnel and the public. In order to reduce the levels of nuisance dust and/or silica to below the OSHA PEL an adequate water supply will be available and water will be constantly applied to the structure and debris pile during disturbance.

A Demolition Plan will be prepared in accordance with EM385 1-1, Section 23 and reviewed with the crew prior to field activities. A safe work zone will be established around the perimeter

of the building and will extend, at a minimum, twice the height of the building. Personnel will not be permitted to operate inside the established safe zone during demolition activities.

8.4.3 Buddy System

The buddy system will be employed by all personnel entering a hazardous waste operation. This system requires that a partner, or buddy, accompany each worker. The buddy provides the co-worker/partner with assistance, observes the partner for signs of exposure, periodically checks the integrity of the partner's PPE, and notifies the SSHO if help is needed. The buddy must be in a line of sight or hearing of the partner and be prepared to enter any area the partner enters. The buddy must be fully certified to work in the level of protection that the employee is working in, and must have the appropriate PPE available.

8.4.4 Communications

This section describes the on and off-site communications that are required during operations at Building 4343. At Building 4343, at least one cellular telephone will be available at each work site for off-site transmissions and emergency response.

8.5 PERSONAL PROTECTIVE EQUIPMENT

PPE consistent with Shaw Procedure HS600 (**Appendix E**) will be required during field work at Building 4343. **Table 8-8** presents the PPE requirements for the interim measures actions planned at Building 4343. The SSHO will review the required level of protection and safety equipment with each work crew. The ultimate decision on which protective level is most appropriate will be made by the SSHO. The level of protection selected will be based on:

- The type and measured concentration of the chemical substance having the lowest PEL, TLV, and/or IDLH concentration in the ambient atmosphere, its range of toxic properties and lower explosive limit (LEL), and the evaluated degree of hazard.
- Potential for exposure to substances in the air, liquid splashes, or other direct contact with hazardous materials.

Table 8-8
Personal Protective Equipment Requirements

Activity/Location	PPE Level	Comment
Cadmium-Contaminated Soil Removal	Level D/ Modified D	Modified Level D for personnel contact with contaminated material. Upgrade to Level C if action levels warrant
Asbestos Abatement	Level C	SSHO will determine, based on removal method selected, whether an APR or PAPR will be utilized
Demolition of Building 4343	D	Upgrade to Modified Level D or Level C if warranted
Demolition of Sumps	D	Upgrade to Modified Level D or Level C if warranted
Demolition of Concrete Footers	D	Upgrade to Modified Level D or Level C if warranted

In situations where the chemical identity, concentrations, and possibility of contact are not well-characterized, the appropriate level of protection will be one level higher than the suspected level of protection, based on professional experience and judgment, until the hazards can be better identified.

PPE shields the body against contact with a known or suspected chemical. OSHA specifies four PPE levels: A, B, C, and D. It is not expected that the type and level of contaminant exposure during activities performed under this task will require either Level A or B protection. If unforeseen conditions arise which would require level A or B, work will halt so that the task can be reevaluated and this SSHP can be revised or replaced.

8.5.1 Level D

Level D protection will be worn only as a work uniform and not on any site with respiratory or skin hazards. It provides minimal protection and consists of:

- Coveralls or work clothes (dictated by weather);
- Leather safety boots/shoes with chemical-resistant soles, steel toes, and shanks;
- Surgical gloves: non-latex or non-powdered, low-protein latex gloves (when necessary);
- Work gloves: cotton or leather (when necessary);
- Eye protection (safety glasses or goggles); and,
- Hearing protection (when necessary).

8.5.2 Modified Level D

- Cotton, Saranex, Chemrel (or equivalent), or polycoated Tyvek® or regular Tyvek® coveralls (dependent upon location and splash potential);
- Rain suit or Saranex apron, and face shield (when there is a splash hazard);
- Leather safety boots/shoes with chemical-resistant soles, steel toes, and shanks with chemical resistant (disposable latex) boot covers (outer);
- Inner gloves: non-latex or non-powdered, low-protein latex gloves;
- Outer gloves: chemical-resistant butyl/neoprene or Viton/neoprene gloves;
- Eye protection (safety glasses or goggles); and,
- Hearing protection (when necessary).

8.5.3 Level C

Level C protection will be worn when the criteria for using air-purifying respirators are met. Level C consists of:

- Tyvek® or Saranex coveralls (dependent upon location and splash potential);
- Full-face air-purifying respirator (NIOSH-approved) or Powered air-purifying respirator w/ HEPA cartridge;
- Prescription insert for workers who require corrective lenses (individuals will not be permitted to wear contact lenses);

- Leather safety boots/shoes with chemical-resistant soles, steel toes, and shanks;
- Latex boot covers or pullover slush boots (dependent upon location and splash potential);
- Inner gloves: chemical-resistant nitrile or non-latex surgical gloves;
- Outer gloves: chemical-resistant butyl or neoprene gloves; and,
- Other PPE such as hearing protection (dependent upon the activities performed).

8.5.4 Respirator Selection and Fit Test

Shaw's Safety and Health Program Requirements Manual requires that all personnel who work on potentially hazardous sites participate in Shaw's Respiratory Protection Program (Shaw Procedure HS600 provided in **Appendix E**). A qualitative fit test will be performed on each individual slated for field work at least once per year. Training on use, maintenance and cleaning of respiratory protective equipment is included as part of the employee's 8-hour annual refresher training course. Each person receives documentation of the size, brand, and model number of the air purifying respirator that he or she is approved to use. This information is retained in Shaw's corporate safety and health files and also in the site safety files.

8.6 AIR MONITORING REQUIREMENTS

Environmental monitoring equipment to be used at Building 4343 is discussed in this section, along with action levels for each monitoring instrument. Based on these action levels, the SSHO, or designated alternate, will authorize downgrades or upgrades in the level of PPE, as appropriate. One or more of the following instruments may be used as directed/needed by task:

- A CGI/O_2 Meter; and,
- A Real-Time Dust Monitor.

Proposed initial air monitoring instruments for the interim measures activity are presented in **Table 8-9**

Air monitoring data from these instruments will be recorded in field logbooks. The use of this equipment is intended to provide warning and allow appropriate action to be taken to prevent exposure to contaminants released into the atmosphere. Instruments are calibrated annually by the manufacturers. In addition, calibration and maintenance checks of monitoring equipment will be performed daily prior to each use according to the manufacturer's specifications.

Table 8-9
Air Monitoring Requirements

Activity/Location	Air Monitoring Instrument Required
Soil Removal	CGI/O_2; Real-Time Dust Monitor
Demolition of Building/Footers/Sumps	Real –Time Dust Monitor

8.6.1 Real-Time Particulate Monitor

A real-time particulate monitoring instrument is used to determine the concentration of total particulate in the breathing zone. Dust monitoring will not initially be required during Building 4343 Removal Actions, as justified in this section. This instrument will be employed during ground intrusive activities where heavy metals are the POC and during building demolition activities due to the presence of lead-based paint. A water spray will be used to minimize dust generation during the above activities.

The following calculation represents the total particulate in mg/m^3 which must be detected in the breathing zone of site workers to potentially exceed the PEL for inorganic chemicals:

$$\frac{10^6 \text{ mg/kg} \quad X \quad \text{PEL in mg/m}^3}{\text{maximum soil concentration (mg/kg)}} = \text{Calculated Action Level}$$

Using this equation and sampling results for soil from Building 4343, action levels were calculated for cadmium. The calculated action levels are as follows:

	PEL	Max. Concentration in Soil	Calculated Action Level
Cadmium	0.005 mg/m^3	24,300 mg/kg	0.21 mg/m^3

In addition to this concentration, the 15 mg/m^3 OSHA PEL for "particulates not otherwise regulated" applies to this site. This action level is shown in **Table 8-10**.

Since the calculated dust action level for cadmium is lower than the OSHA PEL, it will be considered the dust action level for cadmium.

Table 8-10
Air Monitoring Action Levels for PNOR

Readings	Level of Protection/Action
Real-Time Particulate Monitor	
≤ 15 mg/m^3	Normal Operations
> 15 mg/m^3	Use engineering controls to reduce dust levels or use respirators.

8.6.2 Time-Integrated Air Sampling

Time-integrated air sampling may be performed during activities when site characterization data and real-time instrumentation indicate that chemical and/or dust exposures to personnel are suspected to be approaching established limits (PEL/TLV) for target compounds, such as cadmium or silica. Initially, personal air samples will be collected for each craft job classification to determine if an employee may be exposed to these chemicals/materials at or above the action levels. Additional periodic monitoring may be performed based on the results of the initial monitoring. Samples will be collected and analyzed following OSHA or NIOSH methods. All time-integrated, personal air samples for chemical constituents will be analyzed

using a laboratory accredited by the American Industrial Hygiene Association. Employees who are subject to time-integrated air sampling will be informed of the results in accordance with Shaw E&I safety procedure (HS104).

8.7 DECONTAMINATION PROCEDURES

Decontamination procedures are necessary to protect field personnel and control the spread of contamination by either personnel or equipment. Decontamination procedures to be followed are discussed below and additional information is provided in Shaw SOP 80.1 (**Appendix B**).

8.7.1 Personnel Decontamination Procedures

During all site activities, personnel will attempt to minimize the degree of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel will minimize physical contact with contamination (when possible). This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

A step-by-step description of decontamination procedures for contaminated personnel for Levels C and Modified D is as follows:

- Segregated equipment drop - All monitoring instruments, samples, hand tools, and notebooks are dropped in this area to be decontaminated by one of the decontamination team members. To aid in decontamination, instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants.
- Outer boot cover and outer glove wash and rinse - Scrub the outer disposable boot covers and outer gloves with a brush, soap, and water. Rinse the boot covers and glove covers.
- Tape removal - Remove all sealing tape from around boots, gloves, zippers, etc. Place in the disposable clothing drum.
- Outer boot cover and outer glove cover removal - Remove the outer boots and gloves by pulling down the items and exposing the clean inner lining. Place the boots and gloves in the disposable equipment drum.
- Outer coverall removal - Unzip and remove the outer coverall. Remove protective clothing in an “inside out” manner. Do not remove contaminants from clothing by blowing, shaking, or any other means that may disperse material into the air. Secure disposable PPE in plastic bags placed in 55-gallon drums designated for PPE.
- Facepiece removal - Remove facepiece and place in a designated area for further cleaning.
- Inner glove removal - Remove inner gloves and place in the disposable clothing drum. Remove inner coverall, if one is used, and wash hands and face.

The decontamination line will be oriented so that the SZ and CRZ exit is upwind from the EZ and the first stages of decontamination. The decontamination line will be assembled so that it can be easily moved in case of a significant change in wind direction. All receptacles for contaminated protective clothing will be equipped with a lid that can be closed to prevent the release of contaminants.

The SSHO will determine whether conditions warrant wet or dry personnel decontamination procedures based on weather conditions, contaminant risk, and experience.

8.7.1.1 Decontamination During Medical Emergencies

If immediate life-saving first aid or medical treatment is required, decontamination procedures will be omitted. Outer garments can be removed as long as it does not delay giving the proper care or aggravate the condition. Grossly contaminated clothing should be removed carefully, because clothing can transfer contaminants to people administering first aid. If the outer contaminated garments cannot be safely removed, the individual will be wrapped in plastic, rubber, or blankets to help prevent the spread of contamination to emergency personnel. On-site personnel will accompany contaminated victims to the medical facility to advise on matters involving decontamination.

8.7.2 Equipment Decontamination Procedures

Equipment used to excavate contaminated soil will be decontaminated after use to minimize the spread of contaminants. Decontamination procedures will vary depending upon the contaminant involved, but may include sweeping, wiping, scraping, hosing, or steaming the exterior of the equipment. Personnel performing this task will wear the proper PPE as prescribed by the SSHO.

8.8 EMERGENCY RESPONSE PLAN

8.8.1 General

The frequency and severity of emergency situations can be dramatically reduced through proper implementation of the SSHP Emergency Response Plan. If an emergency does occur, quick, decisive action is required since delays in minutes can create or escalate life-threatening situations. In an emergency situation, site personnel involved in emergency response and rescue must be prepared to respond immediately and all required equipment must be on hand, in proper working order, and ready to use. To ensure rapid, effective response to a site emergency, the procedures and contingency plans outlined in this section are implemented prior to and during the conduct of any site activities involving exposure to safety and health hazards.

8.8.2 Pre-Emergency Planning

8.8.2.1 Identification of Local Emergency Services

Prior to the conduct of site operations, Shaw contacted and/or gathered information/phone numbers of the local and site emergency response authorities. The authorities contacted were informed of the nature of the site activities to be performed under this SSHP, and the potential hazards that the conduct of these activities pose to investigation personnel, the environment and the general public. Shaw personnel were informed as to the type of emergency services available through the local authorities and were given the contact phone numbers for these services. In the event that evacuation of the general public is required due to either normal site operations or an emergency event, the SSHO is responsible for contacting the appropriate local authorities who execute and coordinate an evacuation. The phone numbers for local and site emergency services, as well as key personnel involved with the investigation, are listed in the **Table 8-11**.

Table 8-11
Emergency Assistance Information
Radford AAP, Radford, Virginia

Contact	Phone Number
Tom Meyer (USACE)	(410) 962-7677 (office)
Steve Bowers, C.C.M. (USACE ERRO Project Officer)	(410) 671-6003 (office)
Jim McKenna (Environmental Coordinator and Site Contact)	(540) 639-8641 (office)
Jerry Redder, P.E. (ATK Environmental Manager)	(540) 639-7536 (office)
Jeff Parks, P.G. (Shaw RFAAP Project Manager)	(410) 612-6326 (office)
RFAAP Field Office (Site Superintendent/SSHO)	(609) 584-8900 (Cellular)
Joe Hoyt, C.H.S.T. (EMARC Health and Safety Manager)	(804) 337-6982 (Cellular)
Shaw Help Desk	(866) 299-3445
Health Resources	800-350-4511
Emergency Response Services	
Installation Fire Department	7457 (On Post)
Installation Security Police	7325 (On Post) (540) 639-7325 (Off Post)
Installation Safety Department	7294 (On Post) (540) 639-7294 (Off Post)
Installation Spill Response	7323, 7324 or 7325 (On Post) (540) 639-7323, 7324, or 7325 (Off Post)
Installation Medical Facility (Occupational Medicine Services)	7123 (On Post) (540) 639-7123 (Off Post)
Installation Ambulatory Services	7323 (On Post) (540) 639-7323 (Off Post)
Local Non-Emergency Clinic (Occupational Medical Services)	540-961-4675
Local Police Department	911
National Poison Control Center	(800) 492-2414
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(215) 597-9800
Chemical Manufacturers Association Chemical Referral Center	(800) 262-8200

Non-Emergency Services:
Occupational Medical Services
3700 South Main Street
Blacksburg, VA 24060
Hours of Operation: M-F 8:30-3:30 pm; closed 12-1 pm for lunch

Directions to Occupational Medical Services From RFAAP (see Figure 8-1):

Turn Left out of RFAAP onto Route 114 (Pepper's Ferry Road), go 6.5 miles
Turn Left onto Route 460 Business (Franklin Street), go 1.0 miles
Make a U-turn at Yellow Sulphur Rd, Hightop Rd onto S Main St[US-460-Business], go 0.2 mi
Arrive at 3700 S Main Street, on the Right

- Comfort Inn and Cinco de Mayo restaurant will be on the right

Emergency Services:
RFAAP Installation Hospital
Alliant Techsystems, Inc.
Rt. 114
PO Box 1
Radford, VA 24141

Contact	Phone Number
Directions from the Main Gate to the Radford Army Ammunition Plant Hospital: Enter through Main Gate Turn Left at Building 220, Administrative Building Proceed down hill to gate house at Gate 1 White building on right through gate house (Building 205) **Directions from Building 4343 to the Radford Army Ammunition Plant Hospital (see Figure 8-2)**: Follow Contractor Route back across bridge to Gate No 1. Hospital is white building on left just inside of the gate (Building 205)	

Figure 8-1
Directions to Occupational Medical Services

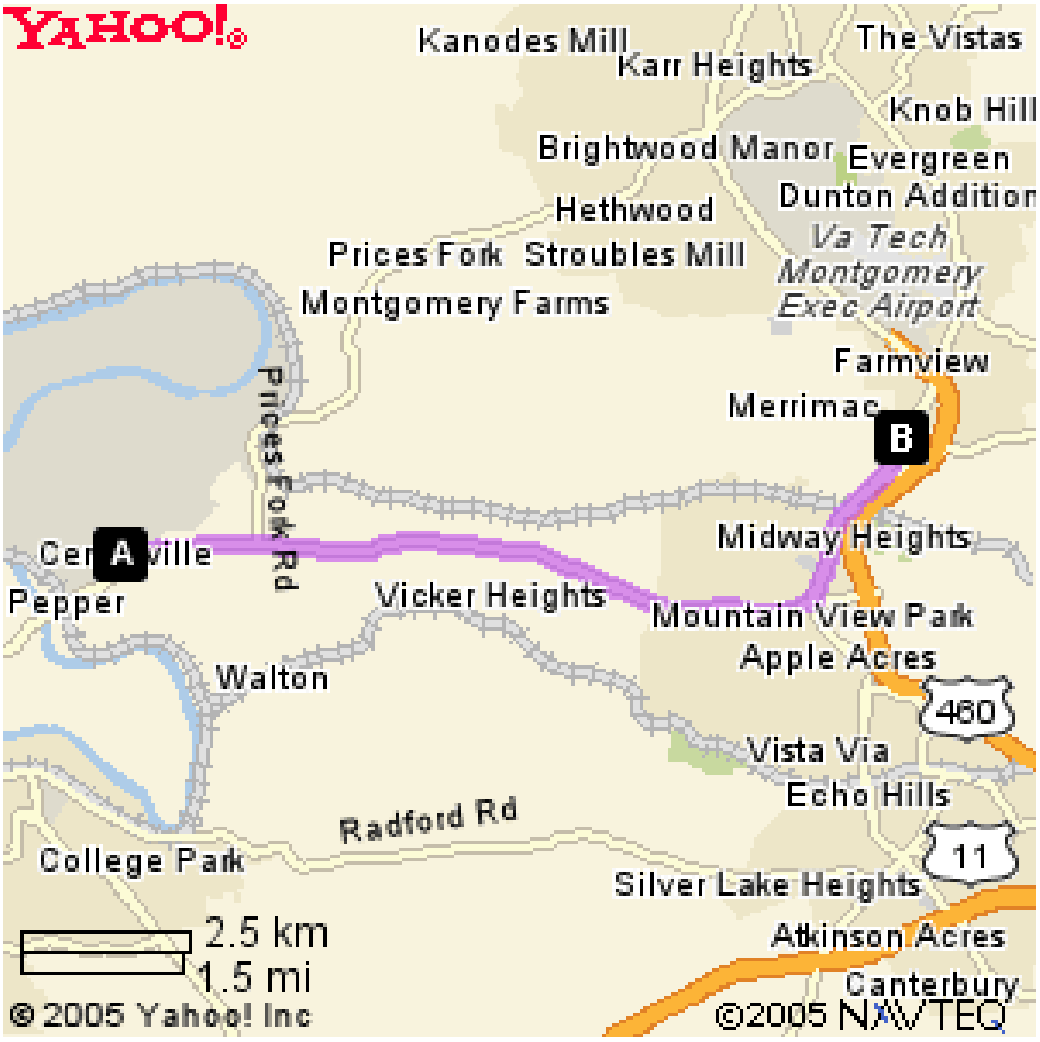
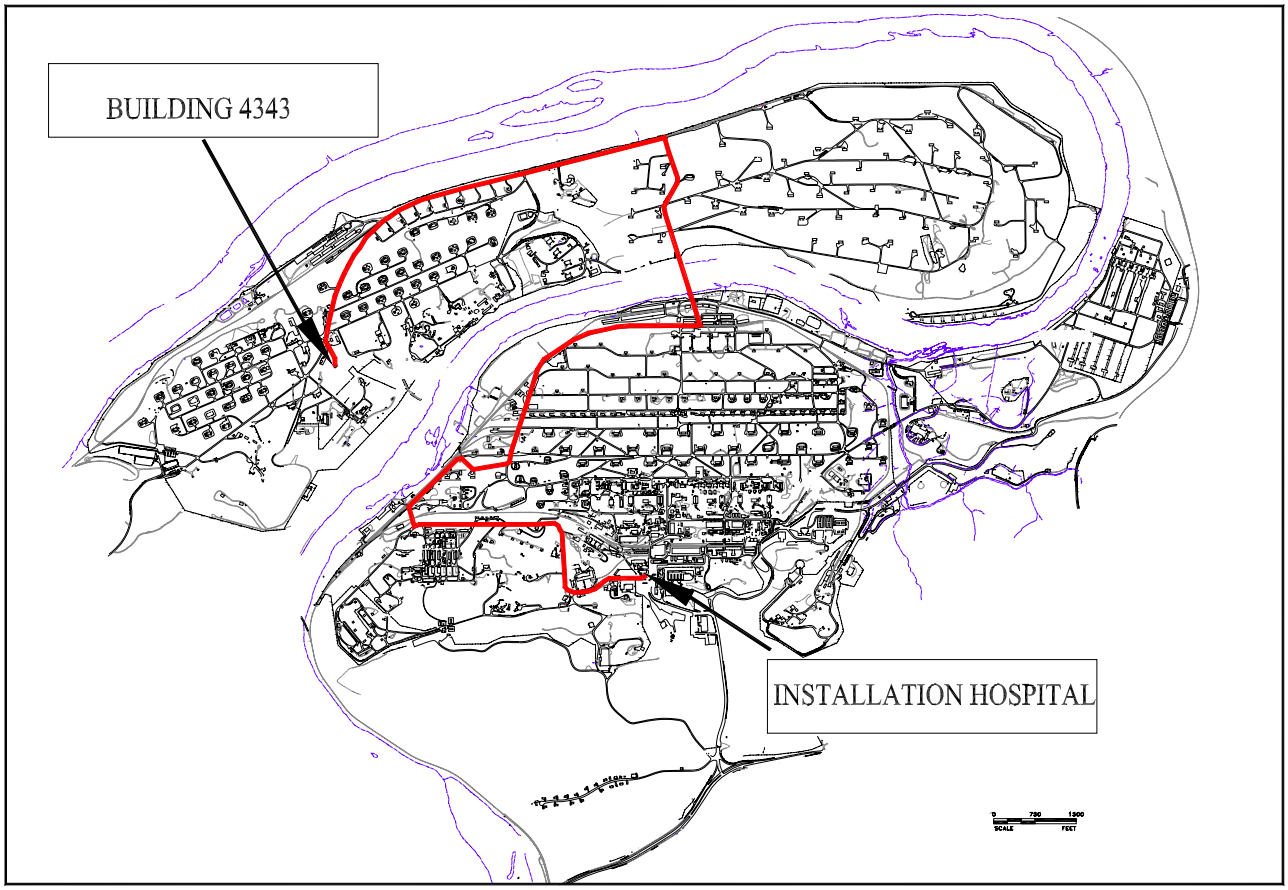


Figure 8-2
Directions to Radford Army Ammunition Plant Hospital



8.8.2.2 Identification of Potential Emergencies

During the development of this SSHP, great attention has been given to identifying potential health and safety hazards associated with the conduct of site activities. Once identified, these hazards were assessed to determine the risk that these hazards could result in an emergency situation. Contingency plans for responding to the potential emergency situations have been developed and are included in this section. The potential emergencies which may result during the conduct of site activities are as follows:

- Injury or illness;
- Fire/explosion; and,
- Adverse weather conditions.

8.8.2.3 Other Hazard Information

In the event that additional site or task hazard information becomes available during the conduct of site investigation activities, this information will be assessed by the SSHO to determine if the contingency plans in this section need to be updated.

8.8.3 Personnel Responsibilities

8.8.3.1 On-Scene Incident Commander

In the event of an emergency, the SSHO assumes the responsibility of On-Scene Incident Commander (OSIC). The alternate person to assume this role, in the event that the SSHO is unavailable or incapacitated, is the task supervisor. The OSIC has responsibility for directing all on-site and off-site response personnel.

8.8.3.2 On-Site Emergency Response Services

Shaw personnel/subcontractor personnel are trained to provide first aid treatment for minor injuries. At least two persons on site at all times are first aid and CPR certified.

The SSHO will determine if the injury requires further treatment. If emergency response is needed, the SSHO, or other designee, will call emergency response personnel by dialing 911.

8.8.3.3 Off-Site Emergency Response Services

Off-site emergency response services that may be needed in the event of a site emergency such as fire, medical, and police personnel, are listed in **Table 8-11**.

8.8.3.4 Medical Evacuation

Medical evacuation (MedEvac) requirements are determined by the emergency first responder. Personnel requiring additional treatment are evacuated to the New River Valley Medical Center by ambulance. Helicopter MedEvac will be initiated by the emergency first responder if necessary.

8.8.4 Emergency Site Control and Security

In an emergency, it is imperative that site control and security be maintained. To control site personnel, the OSIC will utilize the Site Entry/Exit Log to ensure all personnel are present or accounted for at the assembly point(s). Depending upon site size and configuration, weather and

wind conditions and the nature of the emergency, the following will, as applicable, be used to maintain site security:

- Close, but do no lock, gates as evacuation occurs;
- Erect flagging or barrier tape to prevent accidental entry;
- Use a megaphone, walkie-talkies, and/or cell phones to alert personnel to stay clear of the site; and,
- Use vehicles to block access routes to the site, but ensure they can be moved rapidly if emergency vehicles must use the access route.

8.8.5 Medical Facilities

The directions to the Occupational Medical Facilities are presented in **Figure 8-1**. Directions for emergency services at the RFAAP Installation Hospital are presented in **Table 8-11**.

8.8.6 General Emergency Procedures

Emergency response procedures include all steps to be taken for notifying, evaluating, reacting to, documenting, and following-up on a given emergency situation. To ensure all necessary elements are covered, the procedural steps outlined in this paragraph are implemented for each emergency, regardless of its nature.

8.8.6.1 Notification

Once the OSIC has been informed of the emergency, the OSIC alerts site personnel to the presence of the emergency by radios. This is done to:

- Notify personnel and get their attention;
- Stop all work activity as required;
- Lower noise levels in order to speed and simplify communication; and,
- Begin emergency and/or evacuation procedures.

If on-site Shaw personnel/subcontractors or off-site emergency personnel are to enter the site in response to the emergency, the OSIC, to the extent possible, will notify response personnel about the nature of the emergency, to include:

- What happened and when it happened;
- Where on site the emergency situation occurred;
- Who is involved and, if possible, the cause of the emergency;
- The extent of damage and what hazards may be involved; and,
- What actions should be taken.

8.8.6.2 Assessing the Emergency

Available information related to the emergency and the on-site response capabilities should be evaluated and the information listed below obtained to the extent possible:

- What happened;

- Type of incident;
- Casualties involved;
- Victims (number, location, and condition);
- Treatment required;
- Missing personnel;
- Cause of incident;
- Extent of damage to structures, equipment, and terrain;
- What could happen from this point;
- Potential for fire or explosion;
- Location of all personnel in relation to hazardous areas;
- Potential for emergency affecting the general public or the environment;
- What can be done to remediate the situation;
- Equipment and personnel needed for rescue and hazard mitigation;
- Number of uninjured personnel available for response;
- Resources available on site;
- Resources available from off-site response groups and agencies;
- Time needed for off-site response to reach the site; and,
- Hazards involved in rescue and response.

8.8.6.3 Rescue and Response Actions

Based on the information collected during the emergency assessment, the general actions listed below are taken, with some actions being conducted concurrently. No one is to attempt emergency response/rescue until the situation has been assessed and the appropriate response outlined by the OSIC.

- Enforce the Buddy System;
- Allow no one to enter a hazardous area without a partner;
- Personnel in the EZ should be in line-of-sight or in communication with the OSIC or his designee;
- Survey Casualties;
- Locate all victims and assess their condition;
- Determine resources needed for stabilization and transport;
- Assess Existing and Potential Hazards and Determine;
- Whether and how to respond;
- The need for evacuation of site personnel and off-site population;

- The resources needed for evacuation and response;
- Request Aid;
- Contact the required off-site and on-site personnel or facilities, such as ambulance, fire department, police, etc.;
- Allocate Resources;
- Allocate on-site personnel and equipment to rescue and initiate incident response operations;
- Control;
- Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency (i.e., control fire, secure site, etc.);
- Extricate;
- Remove or assist victims from the area;
- Stabilize;
- Administer any medical procedures that are necessary before the victims can be moved;
- Stabilize or permanently fix the hazardous condition;
- Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks, etc.);
- Transport;
- Using either on-site or off-site assets;
- Casualty Logging;
- Record who, time, destination and condition upon transport;
- Evacuate;
- Move site personnel to the rally point, a safe distance upwind of the incident;
- Monitor the incident for significant changes; the hazards may diminish, permitting personnel to re-enter the site, or hazards may increase and require public evacuation;
- Casualty Tracking; and,
- Record disposition, condition and location.

8.8.6.4 Post Emergency Follow-Up

Immediately following an emergency, it is imperative that all Federal, State and local regulatory agencies be notified of the emergency. The following activities will be conducted:

- Notify all appropriate governmental agencies as required. Accidents will be reported immediately by telephone to USACE and in writing within 2 working days of occurrence. Complete the USACE Accident Investigation Report (Eng Form 3394-see **Appendix D**). Any chemical exposure or occupational injuries and illnesses also will be reported and recorded, if recordable per 29 CFR 1904, on an OSHA Form No. 300 Log (see **Appendix D**). Any incident will be reported to OSHA by Shaw's Health and Safety Manager as soon as

possible. Any incident or accident will be reported to the EMARC Safety Manager and the Shaw Corporate Help Desk. If a person is injured, Health Resources need to be notified prior to/during transportation of the injured party to the emergency room or the Health Clinic. Any damage to government or contractor property (which occurs during the performance of the contract at the project site) in excess of $2,000 will be reported to USACE within 8 hours of occurrence;

- Complete a Shaw Accident Report (see **Appendix D**). Any recommended hazard control will be discussed with the Shaw Health and Safety Manager for approval prior to implementing the control. The SSHO will maintain records of all site accidents and first aid treatments. Accident investigation and injury/illness record-keeping procedures are outlined in Shaw Procedure HS020 (**Appendix E**);
- Conduct an accident investigation to determine the cause of the emergency and what preventive measures could be taken to ensure the emergency does not occur again;
- Review and revise, as needed, the site operational procedures, and if necessary, update the SSHP to reflect the new procedures; and,
- Restock and clean all equipment and supplies utilized or damaged in the emergency.

8.8.6.5 Documentation

Documentation related to the emergency will be recorded in an accurate, authentic and complete fashion. Documentation shall be recorded as soon as possible after the emergency to ensure it is recorded while the events are vivid in the minds of the personnel involved. The information recorded will include:

- A chronological record of events;
- A listing of the personnel involved, including personnel on site, site personnel who responded, personnel in charge, and off-site groups or agencies that responded;
- A listing of the actions taken to minimize the effects of or mitigate the emergency;
- An assessment of the potential exposures received by site personnel and the surrounding public; and,
- A recording of the injuries or illnesses which occurred as a result of the emergency. All information gathered will be forwarded to the EMARC Safety Manager and to the Corporate Safety Group in Louisiana.

8.8.7 On Site Emergency Equipment

The emergency equipment listed in **Table 8-12** below will be available at each work site. The team support vehicle is designated as an emergency vehicle. All emergency equipment will be maintained in proper working order and inspected by the SSHO to ensure completeness and proper working order. The results of the inspection will be documented in the safety log. In the event that any of the disposable items are utilized, the SSHO will ensure they are replaced immediately. Site operations will not be conducted if the required emergency equipment is not available on site.

Table 8-12
Emergency Response Equipment

Emergency Equipment	Number per Location	Location where Emergency Equipment is Stored
First Aid/Burn Kit	1 each	Team Support Vehicle
Eye Wash	1 each	All First Aid Kits
CPR Pocket Mask	1 each	All First Aid Kits
Disposable Latex Gloves	5 each	All First Aid Kits
Fire Extinguisher 10 BC Rated	1 each	Team Support Vehicle

8.8.8 Contingency Plans

The following paragraphs contain emergency specific contingency plans. These plans outline the procedures for mitigating each of the potential emergency situations that were identified in the pre-emergency planning. These contingency plans specify the minimum emergency procedures and may be subject to alteration by the SSHO, based on actual or changing site conditions.

8.8.8.1 Injury or Illness

In the event of an emergency involving personal injury or illness, immediate response is key in preventing further injury/illness and providing comfort to the affect party. When personnel are injured or overcome by illness, the following procedure is followed:

- Upon notification of the occurrence and nature of the injury/illness the OSIC, if deemed necessary, summon emergency personnel; and,
- Administer life support if necessary until emergency response personnel arrive.

8.8.8.2 Fires and Explosions

The occurrence of a fire on site presents a serious threat to all site personnel, the environment, and the general public. To ensure immediate, aggressive response to emergencies dry-chemical-type fire extinguishers will be available at each individual work site. Dry chemical fire extinguishers are also provided at any other site location where flammable materials may present a fire risk. Additionally, a fire extinguisher rated at least 2A:10B:C will be located with each piece of heavy equipment and in each site vehicle.

Small Fires

A small fire is defined as a fire that can be extinguished with a 4A:20B:C type fire extinguisher. In the event of a small fire, site personnel take the following actions:

- All unnecessary personnel are evacuated from the immediate area, to an upwind location;
- Extinguish the fire using portable fire extinguishers or by smothering from an upwind location;
- Request emergency response assistance (ambulance, fire, police) as needed;
- Do not attempt to extinguish a fire, even a small one, involving explosives; and,

- Notify the SSHO and site supervisor.

Large Fires

In the event of a large fire or small fire which cannot be extinguished, the following actions are taken:

- All unnecessary personnel will be evacuated from the site, to an upwind location;
- The 911 emergency response services (police, ambulance, hospital, etc.) will be notified by the OSIC as needed;
- If it can be conducted safely, the OSIC will direct personnel to move vital equipment/supplies from the fire path;
- The OSIC will determine the appropriate level of protective clothing to be worn by personnel fighting the fire;
- To the extent possible, and with available resources, fight the fire from an upwind location;
- Do not attempt to extinguish a fire involving explosives; and,
- Notify the SSHO and site supervisor.

Explosion

In the event of an explosion, all nonessential personnel evacuate and help secure the site, the OSIC requests the required support equipment and personnel, and the USACE representative are notified. It is essential that the site be evacuated and no one allowed to re-enter until at least 30 minutes after the explosion. The OSIC determines what actions are appropriate.

8.8.8.3 Inclement Weather

In the event of inclement weather (i.e., high winds, electrical storms, tornadoes, extremely hot weather [>100°F], or extremely cold weather [<0°F]) it may be necessary to cease operations and evacuate the site.

8.8.8.4 Spill Containment

A spill containment program will be implemented during all site activities that meet drum and container handling requirements in accordance with 29 CFR 1910.120. Hazardous substances and contaminated soils, liquids, and other residues also will be handled, transported, labeled, and disposed of in accordance with this regulation. If a spill occurs, Shaw will follow the *Spill Notification Procedures* in *Section 5.13.5* of this Work Plan and, if possible, implement controls to contain and isolate the spilled substance.

8.9 PERSONNEL TRAINING AND MEDICAL SURVEILLANCE PROGRAM

8.9.1 General

Work at RFAAP will be performed in accordance with the RFAAP MWP (URS, 2003). Section 8 of the MWP details the security and entry requirements for the installation. All Shaw employees, managers, supervisors, consultants, and subcontractors who perform field activities at RFAAP are required to have received the following:

- OSHA 1910.120 initial 40-hour training or OSHA 1910.120 annual 8-hour refresher training within the last year. In addition, three days of documented field experience under the direct supervision of a trained, experienced supervisor is required.
- Managers and supervisors directly responsible for site activities must complete an 8-hour supervisor training course in addition to the 40-hour training and 8-hour refresher course. Training certificates for all personnel (including subcontractor personnel) conducting site activities will be maintained in the Project File or Shaw's corporate safety and health file.
- An occupational medical surveillance examination (in compliance with OSHA 1910.120) within the last year, which demonstrates no restrictions for hazardous waste site work, and ability to wear a respirator.
- Site-specific safety and health training that specifically addresses the activities, procedures, monitoring, and equipment applicable to ongoing field activities.
- At least two members of the team are required to have first aid and CPR certification. These personnel will be on site with the team at all times.

8.9.2 Site Specific Training

To ensure that all personnel understand the hazards associated with this specific project, the SSHO will conduct initial site-specific training for personnel before participating in the field activities. The SSHO will use the following outline for the initial training of personnel:

- Names of personnel and alternates responsible for site safety and health;
- Safety, health, and hazards present at the site;
- Contingency Plans Training;
- Hazard Communications Training;
- Use of PPE;
- Work practices by which the employee can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Decontamination procedures;
- Emergency response plan; and,
- Spill containment.

8.9.2.1 Activity/Hazard Specific Training

Prior to initiating abatement, demolition, and soil remediation activities all personnel will receive additional training in asbestos awareness, lead awareness, silica awareness, and cadmium awareness.

8.9.3 Daily Safety Meetings

Safety meetings/training will be held each morning on-site at the daily safety meeting. This meeting will be conducted by the SSHO. Attendance is mandatory for all site personnel and will

be documented in a log book. The safety and health considerations for the day's activities will be reviewed at this meeting. Additional training, JSA creation, and review of safety concerns will be conducted when circumstances dictate. The meeting will re-affirm safety issues, specific hazards, and emergency procedures including:

- Notification procedures and phone numbers;
- Rally points, and safe areas;
- Hospital and evacuation routes; and,
- Emergency equipment.

The SSHO will conduct tailgate safety meetings and new employee orientation at the beginning of each shift, whenever new personnel arrive at the site, as site conditions change, or as needed.

8.9.4 Medical Monitoring Program

Shaw employees who conduct field activities at Building 4343 must participate in Shaw's medical surveillance program. Personnel performing site work must have received a medical baseline or follow-up examination within the past 12 months. A physician's statement declaring that each Shaw field team member is medically qualified to perform hazardous waste related activities, including medical qualification to wear a respirator, will be maintained on site and in the Shaw corporate safety and health files.

Subcontractor employees must participate in their employer's medical monitoring program consistent with 29 CFR 1910.120. The SSHO must ensure that all subcontractors participate in a medical monitoring program and that subcontractors provide appropriate documentation. Documentation will be maintained on site and should include a statement declaring that each subcontractor employee is medically qualified to perform hazardous waste site work, including medical qualification to wear a respirator.

8.10 GENERAL SAFETY ITEMS

Additional safety items include the following:

- Safety and health audits will be conducted by the SSHO to ensure that all site activities are being performed in accordance with the SSHP, USACE requirements, OSHA regulations, Shaw procedures, and contract requirements.
- The SSHO will ensure that appropriate PPE is available for personnel and is used as directed in this SSHP. The SSHO will be responsible for ensuring that job site hazards are properly controlled to provide safe ingress and egress from the sites. Cones and high-visibility banner guard (when deemed necessary by the SSHO) will be used to control traffic and limit access to hazardous and restricted areas.
- A tailgate safety meeting will be conducted to discuss pertinent site safety topics at the beginning of each shift, whenever new personnel arrive at the job site, as site conditions change, and whenever otherwise deemed necessary. These meetings will be conducted by the SSHO, and all relevant information will be recorded in the site logbooks. Site personnel and visitors are required to attend these meetings. Proof of attendance will be documented. Necessary information from these meetings will be forwarded to the SSHO.

- Shaw and its subcontractors will emphasize compliance with state, local, and Installation motor vehicle laws, regulations, and safety guidelines as part of each daily safety briefing. Special considerations, such as current or anticipated hazardous road conditions, will be addressed at the daily safety briefings.
- Emergency telephone numbers will be posted for the fire department, emergency medical response, and the nearest emergency medical clinic/hospital. These numbers are listed in this SSHP.
- At least one copy of this SSHP shall be available at each work site.
- Horseplay, practical joking, or any other actions that jeopardize safety will not be tolerated.
- Running is not permitted.
- Alcoholic beverages and non-medicinal drugs are not permitted at the project site. Personnel suspected of being under the influence of alcohol or drugs will be removed from the site.
- Radios (excepting two-way radios), tape players or other forms of entertainment devices are prohibited during work.
- Legible and understandable precautionary labels shall be affixed prominently to containers of contaminated scrap, waste, debris, and clothing.
- Removal of contaminated soil from protective clothing or equipment by blowing, shaking or any other means which disperse contaminants into the air is prohibited.
- Transportation and disposal of contaminated materials shall comply with all applicable local, State, and Federal regulations. These items will be addressed by the generator, transporter and disposer.
- Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.
- Emergency equipment (including first aid equipment, emergency-use respirators, spill control materials, and fire extinguishers) shall be located in readily accessible locations.
- All trenching, shoring, and excavation work must comply with all federal OSHA rules and Shaw safety policy HS307.
- No food or beverages shall be present or consumed in the EZ. No tobacco products shall be present or used and cosmetics shall not be applied in the EZ.
- All personnel shall avoid contact with potentially contaminated substances. Walking through puddles or mud, kneeling on the ground, or leaning against drums shall be avoided.
- Monitoring equipment shall not be placed on potentially contaminated surfaces.

Field personnel must observe each other for signs of toxic exposure. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin discoloration;
- Changes in coordination;
- Changed in demeanor;

- Excessive salivation and papillary response; and,
- Changes in speech pattern.

Field personnel shall be cautioned to inform each other of non-visual effects of toxic exposure such as:

- Headaches or dizziness;
- Nausea;
- Blurred vision;
- Cramps; and,
- Irritation of eyes, skin, or respiratory tract.

9.0 CONTRACTOR QUALITY CONTROL PLAN

This Contractor Quality Control Plan (CQCP) describes the QC organization and program for interim measures actions at Building 4343. The requirements and systems herein, are relevant and applicable to project work performed by Shaw and its subcontractors and suppliers. Chemical quality management aspects of this QC program are addressed in the Quality Assurance Project Plan (QAPP).

The objective of this CQCP is to establish procedures to verify that the quality of work meets the applicable requirements of the contract, and is suitably well documented. Specifically, this plan:

- Identifies the qualifications, authority, duty and responsibility of the CQC System Manager and staff;
- Establishes QC procedures for inspection and test activities, including the performance of three phase control, deficiency and daily QC reporting; and,
- Defines project communication, documentation, and record keeping procedures.

References used for the development of this plan include USACE ER 1180-1-6: *Construction Quality Management* (30 September 95); USACE ER 1110-1-12: *Engineering and Design Quality Management* (1 June 93); and USACE ER 415-1-10: *Contractor Submittal Procedures* (15 April 97).

The sponsoring/monitoring agency for this project is the USACE, Baltimore District. Therefore, USACE's acceptance of this CQCP is required prior to the start of on-site operations under definable features of work listed in *Section 9.510* of this CQCP. Work outside these definable features is not to be performed without USACE documented approval.

Once accepted by the USACE, the distribution of plans, drawings, procedures and instructions shall be controlled to ensure that the most recent revision is available for use at all locations where work is to be performed. Within the Shaw's project team, initial distribution will include the EMARC Program Manager, RFAAP Project Manager, Building 4343 IM Task Manager, EMARC QC Manager, CQC System Manager, Site Superintendent and subcontractors.

The USACE is to be notified by the CQC System Manager in writing a minimum of seven calendar days prior to any proposed changes to a USACE-accepted CQCP. Any revisions or changes to the accepted CQCP, CQC staff, or their responsibilities must be approved by the USACE prior to being implemented by the CQC System Manager or other project personnel.

Revisions to this plan will require the same level of review and approval as the original document.

9.1 PROJECT BACKGROUND

A detailed discussion of the project background was presented in the Organization and Technical Approach Plan (*Section 2.0*).

9.1.1 Project Scope of Work

The project scope of work and detailed approach for completion of the Building 4343 IM is provided in the Organization and Technical Approach Plan (*Section 2.0*).

9.2 PROJECT ORGANIZATION

The quality related responsibilities and authority of the key members of the organization are outlined below. Additional QC staff may be added as necessary to meet QC requirements to complete the definable features of work. Changes in project management and QC personnel require USACE approval.

9.2.1 Project Manager

Mr. Jeff Parks, P.G., the Project Manager, reports to the EMARC Program Manager, Mr. Mike Vollo. Mr. Parks is responsible for coordinating all activities performed by Shaw at RFAAP and for communicating with the USACE.

9.2.2 Building 4343 IM Task Manager

Ms. Gretchen Miller, P.E., the Building 4343 IM Task Manager, reports to the RFAAP Project Manager, Mr. Jeff Parks. Ms. Miller is responsible for the quality and timeliness of all project activities, including those performed by subcontractors. Essentially the Task Order Manager is responsible for task accomplishment, administration of all instructions and on-site customer interface.

9.2.3 CQC System Manager

Mr. Erik Zimmers is the designated CQC System Manager for this project. Mr. Zimmers will report to Mr. Charles Hunter, EMARC QC Manager, and will coordinate activities with the Building 4343 IM Task Manager and Site Superintendent. As CQC System Manager, Mr. Zimmers has authority to enforce the procedures defined in this CQCP. In alignment with this authority, Mr. Zimmers has the authority to stop work, if necessary to ensure that project activities comply with the requirements of this CQCP, the contract, and the Task Order. This authority applies equally to all project activities, whether performed by Shaw or its subcontractors and suppliers.

The CQC System Manager is responsible for planning and executing QC monitoring, inspection and oversight of project operations to verify compliance with applicable requirements.

Specifically, the CQC System Manager is responsible for: (1) developing, implementing and maintaining this CQCP and its related procedures; (2) planning and conducting preparatory, initial, follow-up, and final/completion inspections for each definable feature of work; (3) identifying quality deficiencies and verifying that appropriate corrective actions are implemented; (4) verifying that the requisite QC records including submittals are generated and retained as prescribed in this CQCP ; and (5) verifying that subcontracted laboratories have appropriate USACE certifications and a documented QC program that complies with the applicable requirements of the contract and Task Order.

The CQC System Manager is to be physically onsite whenever project-related fieldwork is in progress. If the CQC System Manager is to be absent from the site, with USACE approval, an alternately qualified CQC System Manager will be provided for USACE acceptance and assigned during the absence.

Mr. Zimmers has successfully completed the USACE Quality Management Training Course for Contractors. Any alternate CQC System Manager must also complete this training prior to assignment.

9.2.4 Site Superintendent

The Site Superintendent, Mr. Steve Kritak, reports to the Building 4343 IM Task Manager regarding all daily site operations. The Site Superintendent is responsible for supporting the implementation of the CQCP and efforts of the CQC System Manager and his staff.

9.2.5 Project Chemist

Eric Malarek, the Project Chemist, will be responsible for analytical sampling, reviewing results for acceptance and ensuring analytical data is validated at the level required by the DQOs. The Project Chemist will be responsible for coordinating analysis and data package production with the laboratory. The Project Chemist will report to the Building 4343 IM Task Manager and assist the CQC System Manager, as needed.

9.2.6 Subcontractors

Shaw will procure subcontractors for asbestos abatement, waste transportation and disposal, and laboratory services from USACE certified laboratories.

9.3 PERSONNEL QUALIFICATION AND TRAINING

Project staff shall be qualified to perform their assigned jobs in accordance with terms outlined by the EMARC contract. This will be accomplished by establishing and enforcing minimum qualification requirements for key positions, verifying initial and continued personnel proficiency, and implementing on-the-job training, as necessary.

9.3.1 Project Personnel

Shaw has established minimum qualification requirements for key positions on this project through review of contractual and other project-related requirements. The Building 4343 IM Task Manger is responsible for reviewing personnel qualifications, and providing for any additional training required for this site. In the event that additional assignments are made for this project, the qualifications of assigned personnel are to be evaluated and documented. Project personnel are not to be assigned a position or job for which they do not meet the minimum qualifications.

Senior technical staff shall provide on-the-job training to newly assigned technical staff related to their job requirements and techniques and with particular emphasis on problem prevention. Work performed by newly assigned staff is to be monitored by senior staff. When newly assigned personnel arrive, the individual's demonstrated proficiency to perform his or her assigned duties must be thoroughly documented prior to his or her release from senior staff monitoring. Training will be documented with training records maintained on file.

9.3.2 QC Personnel

QC personnel will be qualified to perform their assigned jobs. Minimum education and experience standards shall be in compliance with Shaw policies and procedures. Qualifications for key technical, management, and additional QC staff (if required) will be documented as outlined in the EMARC contract vehicle.

9.3.3 Subcontractors

Anticipated subcontractor organizations are identified in *Section 9.2.6* of this CQCP. The Project Manager is responsible for ensuring that subcontractors possess the requisite

qualifications prior to procurement. Subcontractors to Shaw shall not subcontract their responsibilities on this project to a third party or organization without prior and written approval of the Shaw Project Manager. The Shaw Project Manager will ensure that each subcontractor agrees to comply with this CQCP or develops and implements a QC program that meets all contract requirements and is reviewed and accepted by Shaw and the USACE, prior to performing work.

9.3.4 Health and Safety Training

Health and Safety training requirements for on-site project personnel have been established in accordance with OSHA requirements for hazardous site workers (29 CFR 1910.120) and Shaw policies and procedures. These training requirements are specified in the SSHP and are to be met before project personnel can begin site work. As a minimum, site workers and visitors, who may encounter hazardous substances are to have completed the OSHA Hazardous Material Site Worker Training (40-hour initial training and 8-hour annual refreshers). Site managers are to have completed the 8-hour Supervisor Training also.

9.4 LETTER OF AUTHORITY

The letter of authority describes responsibilities and delegates the authority of the CQC System Manager. A copy of this letter will be furnished to the USACE and provided in **Appendix G**.

9.4.1 CQC System Manager

A letter of authority has been signed by the Shaw EMARC QC Manager and acknowledged by the designated CQC System Manager for this project. This letter describes the responsibilities of, and delegates authority to, this function, including the authority to stop work that is not in compliance with project requirements.

9.5 SUBMITTAL MANAGEMENT

The Project Manager has the sole responsibility for ensuring submittals fully comply with project requirements and shall establish and designate an individual to maintain the project Submittal Register. Submittal control is required to regulate the timely flow of materials and work, to ensure problem prevention and to demonstrate that materials and work are in compliance with applicable requirements. Project submittal procedures are to be implemented as prescribed herein and in accordance with the project Submittal Register.

9.5.1 General Requirements

The Site Superintendent is responsible for submittal scheduling and tracking. The CQC System Manager is responsible for ensuring, through detailed review, that submittals, as well as the materials and the work they represent, are verified in full compliance with applicable requirements.

9.5.1.1 Project Submittals

Submittals are to be listed and tracked using USACE Engineering Form (ENG) 4288, Submittal Register. Submittals include deliverables generated on site or off site by Shaw, subcontractors, fabricators, manufacturers, suppliers, or purchasing agents. Procurement documents for subcontracted services and materials are to list the submittals required of the subcontractor. The CQC System Manager is to review the list to verify its completeness. The approved ENG 4288 becomes the scheduling document used to track and control submittals throughout the project.

Submittals will be transmitted using form ENG 4025 with a unique tracking number assigned from the Submittal Register.

9.5.1.2 Project Records

The CQC System Manager is to establish and maintain an on-site project file in accordance with contract requirements. The purpose of this file is to maintain a complete set of all documents, reports, certifications, and other records that provide information on project plans, contract agreements, and project activities. The initial file will be structured to include a record copy of the following documents:

- Construction schedule and progress reports;
- Technical specifications, including addenda and modifications thereof;
- Change orders and other contract modifications;
- Engineer Field Orders;
- Manufacturer's certificates;
- Daily work activity summary reports, including:
  - ⇒ Daily QC report (including QC log);
  - ⇒ Daily Health and Safety Report;
  - ⇒ Daily Superintendent Report (including activity log);
  - ⇒ Reports on any emergency response actions;
  - ⇒ Test records;
  - ⇒ Records of site work;
  - ⇒ Chain-of-custody records;
  - ⇒ Reports on any spill incidents;
  - ⇒ Truck load tickets and shipping papers;
  - ⇒ Laboratory results;
  - ⇒ Records on quantities of soil treated; and,
  - ⇒ Other items as required by the Contracting Officer Representative;
- Conversation logs;
- Meeting minutes and agenda;
- Inspection logs and schedules;
- Photo documentation;
- Site maps; and,
- As built drawings.

9.5.2 Submittal Scheduling

The Site Superintendent is to establish and maintain a project submittal schedule that reflects the status on ENG 4288. Submittal activities are to be incorporated into the construction schedule so that submittal progress can be tracked in conjunction with overall progress. Submittal schedules are to allow for evaluation, approval, procurement, and delivery prior to the preparatory phase and before the item is needed. The Site Superintendent is responsible for monitoring the progress of project submittals and keeping the Project Manager and CQC System Manager apprised. The submittal schedule is to be updated by the Site Superintendent and reviewed by the CQC System Manager on a weekly basis. Submittals covering component items that form a system or items that are interrelated are to be scheduled and submitted concurrently. Adequate time is to be allowed for required reviews and approvals.

9.5.3 Review of Plans and Specifications

During the preparatory phase for a construction feature of work, the Project Manager or his designee is responsible for reviewing the construction drawings and specifications and requesting clarification from USACE, where necessary. The primary purposes of this review are to identify and resolve potential conflicts prior to initiating work operations. In the interest of minimizing adverse impacts on project schedules this review is to be performed as early in the process as practical to allow sufficient time for evaluation and response. The Project Manager is responsible for ensuring that construction plans, drawings, and specifications (1) have been approved by USACE for implementation on the particular feature of work; (2) are clear and complete; and (3) are executable, cost-effective, and practical. The review should include items such as identifying discrepancies between plans and specifications, assessing and verifying site conditions and restraints, verifying that proper allowances are made for maintenance space and access, etc.

9.5.4 Review and Approval of Submittals

Prior to client delivery or use, project submittals are to be reviewed and accepted by Shaw. The CQC System Manager certification and signature are required on each submittal. He is to review submittals prepared by Shaw, subcontractors, and suppliers for completeness and compliance with the specifications of the Task Order and contract. Submittals related to construction equipment or materials are to be reviewed for contractual compliance, including compliance with the *Buy American Act* (FAR 52.225-0005 and 52.225-15). Noncompliant submittals are to be returned to the originator for corrective action and re-submittal to the CQC System Manager.

Prior to submittal to the CQC System Manager for certification, technical documents (e.g., reports, plans, and engineering drawings) are to be reviewed by qualified staff. Although part of the QC process, technical reviewers may include but are not limited to the QC staff.

9.5.5 Documentation

In addition to the documentation requirements specified above, the following requirements apply to this project. The QC file is to be maintained by the CQC System Manager and is to be controlled as an integral component of the project files. Shop drawings, work orders, and change orders issued for remedial actions are to be provided to the CQC System Manager. It is the responsibility of the CQC System Manager to maintain this technical information and keep it current and recorded as it is revised. Technical information is not to be replaced or revised without receipt of a properly authorized change order or revision. Copies of purchase orders or

subcontracts requiring inspection are to be provided to the CQC System Manager for receiving and recording purposes. Copies of required certifications received are to be maintained in the QC file and are to be submitted to the client in accordance with agreements made at the coordination meeting. Changes in submittal progress and QC activities related to submittals are to be summarized in the Daily QC Report.

9.6 INSPECTION PHASES

The CQC System Manager is responsible for verifying compliance with this CQCP through implementation of the 3-phase control process. This process ensures that project activities comply with the approved plans and procedures. The specific QC monitoring requirements for the definable features of work for the Building 4343 removal actions are discussed below. This section specifies the minimum requirements that must be met and to what extent QC monitoring must be conducted by the CQC System Manager.

9.6.1 Implementation of the 3-Phase Inspection Process

The CQC System Manager is to ensure that the 3-phase control process is implemented for each definable feature of work listed in *Section 9.10* of this CQCP, regardless of whether they are performed by Shaw or its subcontractors. Each control phase is important for obtaining a quality product. However, the preparatory and initial inspections are particularly invaluable in preventing problems. Production work is not to be performed on a definable feature of work until a successful preparatory and initial phase inspection, have been completed.

9.6.1.1 Preparatory Phase Inspection

The CQC System Manager or designee will perform a Preparatory Phase Inspection prior to beginning each definable feature of work. The purposes of this inspection are to review applicable specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities. To conduct and document the inspection, the CQC System Manager shall use the Preparatory Inspection Checklist provided in **Appendix H**.

The CQC System Manager or designee will review work plans and operating procedures to ensure that they describe pre-qualifying requirements or conditions, equipment and materials, appropriate sequence, methodology, hold/witness points, and QC provisions. He is to verify that the required plans and procedures have been prepared and approved and are available to the field staff; field equipment is appropriate for its intended use, available, functional, and properly calibrated; staff responsibilities have been assigned and communicated; staff have the necessary knowledge, expertise, and information to perform their jobs; arrangements for support services (such as asbestos abatement contractors and test laboratories) have been made; and prerequisite site work has been completed. As part of the Preparatory Phase Inspection, the CQC System Manager is to verify that lessons learned during previous similar work have been incorporated as appropriate into the project procedures to prevent recurrence of past problems.

Project staff must correct or resolve discrepancies between existing conditions and the approved plans/procedures identified by the CQC System Manager during a Preparatory Inspection. The CQC System Manager or designee must then verify that unsatisfactory and nonconforming conditions have been corrected prior to granting approval to begin work. Client notification is required at least 24 hours in advance. Results are to be documented in the preparatory inspection checklist and summarized in the Daily QC Report, which is provided in **Appendix H**.

9.6.1.2 Initial Phase Inspection

The CQC System Manager is to perform an Initial Phase Inspection the first time a definable feature of work is performed. To conduct and document the inspection, the CQC System Manager shall use the Initial Phase Inspection Checklist provided in **Appendix H**. The purposes of this inspection is to check preliminary work for compliance with procedures and specifications, establish the acceptable level of workmanship, and check for omissions and resolve differences of interpretation. The CQC System Manager, or his designee, is responsible for ensuring that discrepancies between site practices and approved specifications are identified and resolved. Initial inspection results are to be documented by the CQC System Manager and summarized in the Daily QC Report. Discrepancies between site practices and approved plans/procedures are to be resolved and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the CQC System Manager or his designee, prior to granting approval to proceed. Client notification is required at least 24 hours in advance.

9.6.1.3 Follow-up Phase Inspection

The CQC System Manager or designee will perform a Follow-up Phase Inspection each day a definable feature of work is performed. The purpose is to ensure continuous compliance and the level of workmanship. To conduct and document these inspections, the CQC System Manager is shall develop inspection checklists to accommodate the inspection of both routine and complex inspection activities. The CQC System Manager is responsible for on-site monitoring of the practices and operations taking place and verifying continued compliance with the specifications and requirements of the contract, Task Order, and approved project plans and procedures. He is also responsible for verifying that a daily health and safety inspection is performed and documented as prescribed in the project SSHP. Discrepancies between site practices and approved plans/procedures are to be reported, and corrective actions for unsatisfactory and nonconforming conditions or practices are to be verified by the CQC System Manager or his designee prior to granting approval to continue work. Follow-up inspection results are to be documented using a suitable checklist, as necessary, and summarized in the Daily QC Report.

9.6.1.4 Additional Inspections

Additional inspections performed on the same definable feature of work may be required at the discretion of the client or the CQC System Manager with approval by the client. Additional preparatory and initial inspections are generally warranted under any of the following conditions: unsatisfactory work, as determined by Shaw or the client; changes in key personnel; resumption of work after a substantial period of inactivity (e.g., 2 weeks or more); or changes to the project scope of work/specifications.

9.6.1.5 Completion/Acceptance Inspection

A Completion/Acceptance Inspection shall be performed, upon conclusion of the feature of work and prior to closeout, to verify that project requirements relevant to the particular feature of work are satisfied. Outstanding and nonconforming items are to be identified and documented on a punch list. As each item is resolved, it is to be so noted on the punch list. Client acceptance and closeout of each definable feature of work is a prerequisite to project closeout.

9.6.2 Inspection Procedures

9.6.2.1 Receiving and Storage

The CQC System Manager or designee is to inspect construction materials upon receipt and prior to use. Visual inspection criteria include identification, signs of damage or distortion, completeness, evidence of compliance with specifications, and associated documentation. Results of receiving inspections are to be documented and summarized in the Daily QC Report.

9.6.2.2 Off-Site Control

Source inspections at supplier facilities, if necessary, shall be performed to verify compliance with contract and Task Order requirements.

9.6.2.3 Material Certification

Copies of purchase orders or subcontracts requiring receiving inspection are to be provided to the CQC System Manager for scheduling inspection and record-keeping purposes. Copies of supplier certifications are to be maintained in the project QC file and made available to the USACE upon request or submitted in accordance with contract requirements.

9.6.2.4 Inspection of Workmanship

Standards for good workmanship shall be established and documented. The CQC System Manager shall discuss these standards during the preparatory phase meeting for each definable feature of work and verify the presence of good workmanship during each initial phase inspection, and follow-up phase inspection thereafter. Identified deficiencies are to be reported to the responsible organization and documented. Corrective actions are to be verified by the CQC System Manager and documented.

9.6.2.5 Surveillance of Subcontractor Operations

The CQC System Manager is responsible for performing monitoring, inspection and oversight of project activities conducted by Shaw and its subcontractors. Deficiencies associated with subcontractor work are to be reported to the appropriate level of management for resolution.

9.6.3 Documentation of Inspections

The Shaw Inspection Schedule & Tracking Form (**Appendix H**) is to be used by the CQC System Manager for planning, scheduling and tracking the progress of inspections for this project. The information on the form is to be kept up to date.

9.7 TESTING

Testing will be performed as required to confirm that specifications are met. Testing in support of remediation activities generally includes on-site tests of items and materials, and off-site testing by laboratories, manufacturers and suppliers.

9.7.1 Test Plan Application

Testing will be conducted and reported in accordance with project specifications, drawings, codes, standards, and procedures. The CQC System Manager and the subcontract laboratory will use this plan as a guide and checklist throughout the project. A preparatory meeting will be held for each definable feature of work where the testing and frequency of tests are to be reviewed. The QC staff is responsible for verifying that the tests are performed and that the results are summarized in and provided with the Daily QC report. Test failures will be documented on a

nonconformance report and tracked until such time as rework and re-testing can be performed and corrective action is verified.

9.7.2 Testing Procedures

The QC staff shall verify the proper selection of measuring and test equipment (M&TE) and verify that approved procedures and protocols are identified and available for use. QC shall also confirm that test personnel have a working knowledge of the test and instruments to be used. Upon satisfactory verification of the stated requirements, the test may proceed. Each reading is to be verified and documented by a member of the QC staff. As a minimum, test reports will reflect the date of performance, type of test conducted, the item tested, the procedure/protocol used (including revision), actual test results, identification of any measuring and test equipment used (including calibration status), identification and signature of the individual performing the test. Copies of test reports will be maintained in the project files and submitted to the USACE, as required.

9.7.3 Test Organizations

For environmental testing the selected laboratory will be certified by the USACE Missouri River Division (MRD) for environmental analysis for toxic materials using standard methods.

The CQC System Manager will verify the performance of sampling, sample handling and shipping in accordance with the applicable sections of this plan. The sampling technicians will perform the required sampling. The Project Chemist will be responsible for ensuring analytical data is validated at the level required by the DQOs.

Data reports are to include sufficient information to verify the effectiveness and implementation of laboratory QC systems. Requisite information includes raw data, instrument printouts, preparation logs, calibration records, test results for associated QC samples, dilution factors, instrument settings, equations used in data reduction, and any observed deviations or problems.

9.7.4 M&TE Calibration and Maintenance

The selection, control and use of M&TE shall be as specified within procedures and specifications. M&TE shall be calibrated or verified at specific intervals or prior to use, against measurement standards traceable to nationally recognized standards. M&TE shall be stored, handled and maintained in accordance with the manufacturer's instructions. Records of these activities are to be generated by the individual performing the activity with copies provided to the CQC System Manager for retention in the project QC file. The Work Plan lists the M&TE for this project and provides calibration and maintenance responsibilities, schedules, and procedures.

9.7.5 Validation of Test Results

Prior to their use in decision-making, test data are to be reviewed and validated by the Project Chemist or his designee. Validation is to include:

- verification that all required documentation was submitted;
- verification that specified test procedures and conditions were followed; and,
- review of QC data and comparison of achieved results against specified limits of acceptability.

9.7.6 Documentation of Testing

Test results are to be documented by the individual performing the test. Calibration and maintenance records associated with the M&TE are to be generated by the individual performing the activity. Documentation for calibration and maintenance of M&TE is to be made available to the USACE upon request.

Test results are to be retained in the project file and summarized in the Daily QC Report. These results will additionally be compiled into a report to the CQC System Manager that includes the name of the test, the items tested, test conditions and procedures, units of measurement, the resulting test data for all submitted samples (both passing and failing), and associated QC information (e.g., equipment calibration and maintenance, duplicate measurements, and use of certified reference standards). A copy of each test report is to be attached to the Daily QC Report.

9.8 NONCONFORMANCE REPORTING & CORRECTIVE ACTION

The Shaw system for reporting deficiencies and implementing effective corrective action provides for two distinct reporting mechanisms which are procedurally addressed. The Nonconformance Report (NCR) shall be used for reporting and correcting deficient items and materials, and the Corrective Action Request (CAR) shall be used to report and correct programmatic deficiencies, negative quality trends, breakdowns in the quality program, and/or the more serious or significant deficiencies requiring management attention and action.

9.8.1 Identification and Control of Nonconforming Conditions

Any deficiency in characteristic, documentation, or procedure, which renders an item or material unsatisfactory or unacceptable, is required to be identified, reported, and corrected. The CQC System Manager will document item and material deficiencies using a NCR, following form instructions and those instructions delineated within Shaw SOP–Q-007; Nonconformance Reporting. The NCR form is provided in **Appendix H**. Each NCR will be logged within the NCR Tracking Log, and issued to the responsible organization for timely disposition and corrective action. Each NCR response shall identify one of the following four (4) categories for disposition:

- Rework – The act of bringing the item into compliance with the original requirements;
- Repair – The act of making the item perform to its original requirements and function;
- Scrap – Removing the item from the project site for disposal; and,
- Use-As-Is – Permits the item to be utilized based on a documented and acceptable technical justification.

When possible, each NCR disposition will include the following within its corrective action:

- Identification of the cause;
- Steps taken to preclude recurrence; and,
- Date of disposition performance and corrective action completion.

Each NCR disposition and its corrective action will be verified by the CQC System Manager and documented by signature and date. This will include all re-inspection and re-testing, as appropriate.

NCR forms may be supplemented by completed checklists, photographs, sketches, drawings or other renderings to assist in identifying the deficiency. All such data will become a part of the NCR and shall be maintained with the NCR on file.

9.8.2 Corrective Action Requests

In the case of a programmatic deficiency, or recurrence of a nonconforming condition (attributed to ineffective corrective action), the CQC System Manager will issue a CAR to the responsible organization. A CAR form is provided in **Appendix H**. The CAR will be processed in accordance with Shaw SOP-Q-008; Corrective Action Requests. The CAR is a document used to report deficiencies of a significant nature and shall be distributed to upper management for their attention and any subsequent action. The CAR is generally reserved for serious or major deficiencies and requires the responsible organization to:

- take immediate corrective action to remedy the condition;
- investigate and identify the root cause through analysis;
- identify steps taken to preclude recurrence; and,
- implement effective corrective action in a timely manner.

For each CAR, the responsible organization shall prepare and submit a formal response to the CQC System Manager for evaluation and acceptance, prior to the established due date. Failure to respond and/or provide effective corrective action will generally result in the issuance of a stop work order.

Each CAR corrective action will be verified by the CQC System Manager and documented. The completed CAR and any related documentation will be maintained in the project quality files.

9.9 REPORTS

The CQC System Manager is responsible for the preparing and submitting the Daily QC Report to the USACE, the Site Superintendent for the project file, and providing concurrent courtesy copies to the Project Manager. The original and one copy of the Daily QC Report with attachments are to be submitted to the USACE on the first work day following the date covered by the report. All calendar days, including weekends and holidays, are to be accounted for throughout this project. As a minimum, one report is to be prepared and submitted for every continuous seven days of no work.

As a primary component of the Daily Activity Summary Report, the Daily QC Report is to provide an overview of QC activities performed each day, including those performed for subcontractor and supplier activities. The QC reports are to present an accurate and complete picture of QC activities. They are to report both conforming and deficient conditions, and should be precise, factual, legible, and objective. Copies of supporting documentation, such as checklists and surveillance reports are to be attached. The format to be used is provided in **Appendix H**.

A field QC log is to be maintained by the CQC System Manager and assigned to each member of the QC staff for use in documenting details of field activities during QC monitoring activities. At the end of each day, a copy of the log entries is to be attached to the Daily QC Report. The information in the QC log provides backup information and is intended to serve as a phone log

and memory aide in the preparation of the Daily QC Report and in addressing follow-up questions that may arise.

QC and H&S staff input for the Daily QC Report is to be provided in writing to the CQC System Manager at a previously agreed upon time and place, generally no later than about 1 hour before normal close of business. For the sake of simplicity and completeness, the format for QC staff input should follow the same as for the Daily QC report with only the relevant sections completed.

Each Daily QC Report is to be assigned and tracked by a unique number comprised of the Delivery Order number followed by the date expressed as DDMMYY. In the case of "no work day" reports, the report number is to comprise the Delivery Order, the last date covered, the number of days covered, and the initials "NW." For example, DO #0025-110499 is the report for this delivery order related to site work performed on 11 April 1999, and DO #0025-290599-3NW is the report for this delivery order related to three no work days from 27 May 1999 through 29 May 1999. Copies of Daily QC Reports with attachments and QC logs no longer in use are to be maintained in the project QC file. Upon project closeout, all QC logs are to be included in the project QC file.

9.10 DEFINABLE FEATURES OF WORK

Below, the definable features of work are identified and briefly described for the Building 4343 IM action.

9.10.1 Soil Removal

9.10.1.1 Mobilization

This definable feature of work includes all pre-mobilization activities such as notifications and preparation of manifests; mobilization activities such as establishment of a field office, mobilization of personnel, and mobilization of materials and equipment; and a kick-off/safety meeting to include a walk-through orientation of the removal action site, review of the work plan and removal action tasks, and review and acknowledgement of the SSHP (*Section 8.0*) by all site personnel.

9.10.1.2 Site Preparation

This definable feature of work includes all required activities associated with preparing the site for cadmium-contaminated soil removal activities. This includes delineation of work and support zones, and installation of sediment and erosion control measures, if necessary.

9.10.1.3 Soil Characterization Sampling

This definable feature of work includes all required activities associated with establishing excavation area boundaries at Building 4343, and collecting discrete soil samples to determine the area where elevated levels of cadmium is present.

9.10.1.4 Soil Removal and Confirmation Sampling

This definable feature of work includes all required activities associated with: 1) the excavation, transport, and disposal of cadmium-contaminated soil from Building 4343; and 2) the collection of confirmation soil samples to ensure all contaminated soil has been removed.

9.10.1.5 Backfill and Site Restoration

This definable feature of work includes all required activities associated with backfilling the site and restoring vegetation at Building 4343.

9.10.1.6 Demobilization

This definable feature of work includes the removal of all equipment and materials from the jobsite and staging areas that were utilized during, or generated as a result of the soil removal activities at Building 4343.

9.11 DEMOLITION OF BUILDING 4343/SUMPS/FOOTERS

This section discusses the addition definable features of work not included in *Section 9.10.1*, Soil Removal, above.

9.11.1.1 Waste Characterization Samples

This definable feature of work includes all required activities associated with sampling the building materials, concrete footers, and sumps.

9.11.1.2 Site Preparation

This definable feature of work includes all required activities associated with preparing the site for demolition of Building 4343, the 2 sumps, and the concrete footers. This includes establishing a staging area, delineation of work and support zones, and installation of sediment and erosion control measures if necessary.

9.11.1.3 Demolition of Structure

This definable feature of work includes all required activities associated with razing Building 4343, as well as the concrete footers and two sumps.

9.11.1.4 Segregation and Disposal of Materials

This definable feature of work includes all required activities associated with segregating concrete, metal, and wood materials as separate waste streams, if necessary.

10.0 REFERENCES

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Appendix A
Statement of Qualifications

STATEMENT OF QUALIFICATIONS

Mr. Mike Vollo has over 19 years of diverse experience involving the management of projects requiring air quality support, meteorological studies, air permitting, emergency response remediation, asbestos and lead-based paint consulting services and indoor air quality assessments. Mr. Vollo has managed more then $300 million of environmental projects for both government and commercial clientele. This would include emergency response contracts for the U.S. Postal Service Anthrax Remediation Projects, and Environmental Management and Remediation Contract (EMARC) for the U.S. Army Corps of Engineers. Additional management included air permitting, development of emission rates, air quality dispersion modeling, air quality impact analysis risk assessment, environmental work plans, waste disposal, and soil and drum removal operations. Some computer models which Mr. Vollo is familiar with include: ISCLT, ISCST, SCREEN, WINPROSE, and CHEMDAT-7. Mr. Vollo has extensive knowledge and experience in the performance of NEPA Baseline Assessment and ASTM Due Diligence Compliance. As a meteorologist, Mr. Vollo is responsible for Meteorological/Climatological Studies, data evaluation, and the operation and maintenance of meteorological stations. Mr. Vollo also has extensive experience and certifications in asbestos relative projects and is considered Shaw's Lead Technical Expert for asbestos consulting projects. Experience includes project management of asbestos abatement project, specification design, asbestos investigation, bulk and air sampling and the development of operation and maintenance (O&M) costs and plans. Because of his professional achievements, Mr. Vollo has been named a Technical Associate and emergency response manager by the U.S. Environmental Protection Agency (EPA) for the emergency response cleanup services (ERCS) contract. Mr. Vollo also has managed and performed indoor air quality assessments and is a certified Indoor Air Quality Investigator.

Mr. Jeffrey Parks is a registered, professional geologist with 20 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 (USACE) groundwater study, remedial investigation, and remediation projects, including projects at Radford Army Ammunition Plant, VA. He has been the senior hydrogeologist and project manager for USEPA-funded investigations of uncontrolled hazardous waste sites and a technical lead for the Federal Aviation Authority-expedited response action group. Mr. Parks is also the Edgewood Office Technical Services Manager Northern Division. Responsibilities in this role include guidance for scientists in addition to project staffing, mentoring, and yearly progress evaluations.

As a Project Manager for Radford Army Ammunition Plant, Radford, VA. Mr. Parks is responsible for budgetary and technical management of a variety of tasks including RCRA Facility Investigations and Corrective Measures Studies in support of Radford's RCRA Permit, contract compliance and administration, preparation and review of daily production and usage rates, tracking and reviewing project finances, and client and regulatory interface. Also conducting Remedial Investigations/Feasibility Studies, expedited removal actions, and a facility-wide groundwater study in karst terrain.

Ms. Gretchen Miller has over nine years of experience as a task manager/project engineer involved in HTRW investigations and cleanup of a wide variety of DoD sites. Her experience includes the completion of site investigations, EE/CA preparation involving the removal and/or avoidance of ordnance as part of the process, the excavation and disposal of lead-contaminated range soils, pits of unknown chemical/biological wastes, and landfills including municipal, industrial, medical, and UXO wastes and RI/FS for VOC, TPH, and explosive contamination in soil and groundwater and pits of UXO/CWM. Ms. Miller is knowledgeable in Base Realignment and Closure (BRAC) site investigation and remediation. Ms. Miller has worked at DOD sites located in Virginia, New Jersey, Maryland, Alabama, Tennessee, California, and Nebraska.

Mr. Joe Hoyt has been responding to emergency environmental actions, time critical remediation projects, unique demolition scenarios, RCRA landfill closures, and safety troubleshooting at hazardous remediation jobs over the course of 16 years. In the past 9 years Mr. Hoyt has worked mainly in the Department of Defense Program working on programs such as the LANTDIV, and the Baltimore TERC Programs and has completed with great success some of the largest and safest projects under these contracts.

Mr. Hoyt has experience in the environmental remediation and construction industry as a site safety officer. He has worked on EPA, DoD, AFCEE, USACE and multiple state governmental agencies sites. He has experience in managing a variety of clean up scenarios including wastewater and ground water recovery and treatment, labpack operations, drum removal, large asbestos and lead projects, Superfund ERCS removal projects, RCRA closures and large soil excavation projects. He has worked with anthrax, bio-hazards, PCBs, dioxin, biomedical waste, pesticides, cyanide, flammables, radiation, lead, asbestos, unexploded ordinance, corrosives and petroleum products. Mr. Hoyt ensures that the highest safety standards are always met.

Mr. Charles Pete Hunter has successfully served the energy and environment industries for thirty years. During his career he has held responsible positions in quality management supporting the U.S. Department of Energy, as well as major architectural engineering, construction, and environmental management firms. His experience in quality systems, management of personnel, business development, and program assessment has encompassed commercial nuclear power plant construction, startup, and operations; defense reactor program support; environmental restoration; hazardous waste management and remedial construction projects. As a quality assurance professional he has extensive experience in quality programs meeting the requirements of 10CFR-830.120, DOE/RW-0333P, 10CFR-50, Appendix B, ANSI/ASME NQA-1, ANSI/ASQC-E4, ISO-9000 and other quality standards. He is a committee member of the U. S. Sub TAG to ISO/TC207 for the development of ISO 14000 Environmental Management Standards, and member of the ANSI ASQ Z1 Environmental Management Subcommittee to the U.S. Technical Advisory Group to ISO.

Mr. Steve Kritak has gained over 14 years of experience managing multi-disciplinary project personnel on both emergency response and planned remediation projects for a wide variety of government (e.g., USACE and USEPA) and commercial clients. He has managed field crews ranging in size from a few cleanup technicians to over 50 equipment operators, sample technicians, cleanup technicians, and laborers, as well as subcontractor personnel (e.g., asbestos and lead-based paint abatement, demolition, and T&D subcontractors). Types of projects he has

successfully managed include landfill capping, soil and sediment excavation, facility decontamination and demolition, stabilization/solidification, UST/AST cleaning/removal, drum handling, slurry wall construction and Transportation and disposal coordination. Mr. Kritak has worked on Radford AAP previously and is well aware of the intricacies with the project.

Mr. Eric Zimmers is a Health and Safety Coordinator with experience in identification, recognition, and control of industrial hygiene and safety hazards. He has responsibility for implementing and managing health and safety programs for emergency response and remediation efforts. His experience includes coordination of the health and safety activities with regulatory agencies at the local, state, and federal levels, provided health and safety trainings, proactive accident prevention programs, accident/incident investigations, auditing, reporting requirements, industrial sampling protocols, and coordinating medical programs. Mr. Zimmers in addition to his duties of a Health and Safety Coordinator, he has performed multi-role functions such as quality control, quality assurance, environmental compliance permitting, and operations management. His responsibilities have included both financial aspects of project health and safety and technical considerations for comprehensive project administration.

Mr. Eric Malarek is a chemist with 19 years hands-on experience overseeing and providing broad range of environmental project consulting, quality assurance oversight and training, data validation and management, field sampling, and technical support. Overall experience with public and commercial accounts with special strengths gleaned from key project positions on large federal site/remedial investigations, feasibility studies, corrective actions, and long-term monitoring programs. Strong familiarity with relevant laboratory operations, procedures, regulatory requirements, QA/QC protocols, scheduling, data packages and other factors critical to meeting external (and internal) client needs. Practical foundation rooted in commercial and USEPA laboratory positions complimented by business, technical and project management skills enhanced in the consulting industry.

Appendix B
Standard Operating Procedures (SOPs)

Standard Operating Procedures

SOP SERIES	TITLE
10.0	**DOCUMENTATION**
10.1	Field Logbook
10.2	Surface Water, Groundwater, and Soil/Sediment Field Logbooks
10.3	Boring Logs
10.4	Chain-of-Custody Forms
30.0	**SAMPLING**
30.1	Soil Sampling
30.6	Containerized Material
30.7	Sampling Strategies
50.0	**SAMPLE MANAGEMENT**
50.1	Sample Labels
50.2	Sample Packaging
70.0	**INVESTIGATION-DERIVED MATERIAL**
70.1	Investigation-Derived Material
80.0	**DECONTAMINATION**
80.1	Decontamination

STANDARD OPERATING PROCEDURE 10.1
FIELD LOGBOOK

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording daily site investigation activities.

Records should contain sufficient information so that anyone can reconstruct the sampling activity without relying on the collector's memory.

2.0 MATERIALS

- Field Logbook;
- Indelible ink pen; and
- Clear tape.

3.0 PROCEDURE

Information pertinent to site investigations will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line out deletions that are initialed and dated. If only part of a page is used, the remainder of the page should have an "X" drawn across it. At a minimum, entries in the logbook will include but not be limited to the following:

- Project name (cover);
- Name and affiliation of personnel on site;
- Weather conditions;
- General description of the field activity;
- Sample location;
- Sample identification number;
- Time and date of sample collection;
- Specific sample attributes (e.g., sample collection depth flow conditions or matrix);
- Sampling methodology (grab or composite sample);
- Sample preservation, as applicable;
- Analytical request/methods;
- Associated quality assurance/quality control (QA/QC) samples;
- Field measurements/observations, as applicable; and
- Signature and date of personnel responsible for documentation.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program*. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, DC.

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

STANDARD OPERATING PROCEDURE 10.2
SURFACE WATER, GROUNDWATER, AND SOIL/SEDIMENT FIELD LOGBOOKS

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording surface water, groundwater, and soil/sediment sampling information, as well as instrument calibration data in field logbooks.

2.0 MATERIAL

- Applicable field logbook (see attached forms); and
- Indelible ink pen.

3.0 PROCEDURE

All information pertinent to surface water, groundwater, or soil/sediment sampling will be recorded in the appropriate logbook. Each page/form of the logbook will be consecutively numbered. All entries will be made with an indelible ink pen. All corrections will consist of line out deletions that are initialed and dated.

3.1 SOIL/SEDIMENT

3.1.1. Field Parameters/Logbook (Form 10.2-a)

1. HIGH CONCENTRATION EXPECTED?: Answer "Yes" or "No.";
2. HIGH HAZARD?: Answer "Yes" or "No.";
3. INSTALLATION/SITE: Record the complete name of the Installation or site;
4. AREA: Record the area designation of the sample site;
5. INST. NAME: Record the two-letter installation name for Radford Army Ammunition Plant – "RD";
6. SAMPLE MATRIX CODE: Record the appropriate sample matrix code. Common codes are "SD" for solid - sediment, "SI" for soil - gas, "SL for solid sludge, "SO" for surface other, "SS" for solid – soil, "SW" for surface wipe, "WD" for water – potable, "WG" for water – ground, "WS" water – surface, "WT" – water treated and "WW" water -waste;
7. SITE ID: Record a code up to 20 characters or numbers that is unique to the site;
8. ENV. FIELD SAMPLE IDENTIFIER: Record a code up to 20 characters specific for the sample;
9. DATE: Enter the date the sample was taken;
10. TIME: Enter the time (12-hour or 24-hour clock acceptable as long as internally consistent) the sample was taken;

11. AM PM: Circle “AM” or “PM” to designate morning or afternoon (12-hour clock);
12. SAMPLE PROG: Record “RFI” (RCRA Facility Investigation) or other appropriate sample program;
13. DEPTH (TOP): Record the total depth sampled;
14. DEPTH INTERVAL: Record the intervals at which the plug will be sampled;
15. UNITS: Record the units of depth (feet, meters);
16. SAMPLE MEASUREMENTS: Check the appropriate sampling method;
17. CHK: Check off each container released to a laboratory;
18. ANALYSIS: Record the type of analysis to be performed on each sample container;
19. SAMPLE CONTAINER: Record the sample container type and size;
20. NO.: Record the number of containers;
21. REMARKS: Record any remarks about the sample;
22. TOTAL NUMBER OF CONTAINERS FOR SAMPLE: Record the total number of containers;
23. SITE DESCRIPTION: Describe the location where the sample was collected;
24. SAMPLE FORM: Record the form of the sample (i.e., clay, loam, etc.) using The Unified Soil Classification System (USCS);
25. COLOR: Record the color of the sample as determined from standard Munsell Color Charts;
26. ODOR: Record the odor of the sample or “none”;
27. PID: Record the measured PID values or other similar measurement instrument value;
28. UNUSUAL FEATURES: Record anything unusual about the site or sample;
29. WEATHER/TEMPERATURE: Record the weather and temperature; and
30. SAMPLER: Record your name.

3.1.2 Map File Form (refer to form 10.2-c)

- SITE ID: Record the Site ID from the field parameter form;
- POINTER: Record the field sample number for the sample being pointed to;
- DESCRIPTION/MEASUREMENTS: Describe the location where the sample was taken, along with distances to landmarks;
- SKETCH/DIMENSIONS: Diagram the surroundings and record the distances to landmarks;
- MAP REFERENCE: Record which U.S.G.S. Quad Map references the site;
- COORDINATE DEFINITION: Write the compass directions and the X- and Y-coordinates of the map run;
- COORDINATE SYSTEM: Write “UTM” (Universal Transverse Mercator);
- SOURCE: Record the 1-digit code representing the Map Reference;

- ACCURACY: Give units (e.g., write “1-M” for 1 meter);
- X-COORDINATE: Record the X-coordinate of the sample site location;
- Y-COORDINATE: Record the Y-coordinate of the sample site location;
- UNITS: Record the units used to measure the map sections;
- ELEVATION REFERENCE: Record whether topography was determined from a map or a topographical survey;
- ELEVATION SOURCE: Record the 1-digit code representing the elevation reference;
- ACCURACY: Record the accuracy of the map or survey providing the topographical information;
- ELEVATION: Record the elevation of the sampling site;
- UNITS: Write the units in which the elevation is recorded; and
- SAMPLER: Write your name.

4.2 SURFACE WATER

4.2.1 Field Parameter Logbook (Forms 10.2-b and 10.2-c)

- CAL REF: Record the calibration reference for the pH meter;
- pH: Record the pH of the sample;
- TEMP: Record the temperature of the sample in degrees Celsius;
- COND: Record the conductivity of the water;
- Description of site and sample conditions (refer to 10.2-b);
- Map File Form (refer to Section 3.1.2).

4.3 GROUNDWATER (FORMS 10.2- D)

4.3.1 Field Parameter Logbook (Forms 10.2-b)

Refer to Section 3.2.1.

4.3.1 Map File and Purging Forms

- WELL NO. OR ID: Record the abbreviation appropriate for where the sample was taken. Correct abbreviations can be found on pages 18-21 of the IRDMIS User's Guide for chemical data entry;
- SAMPLE NO.: Record the reference number of the sample;
- WELL/SITE DESCRIPTION: Describe the location where the sample was taken, along with distances to landmarks;
- X-COORD AND Y-COORD: Record the survey coordinates for the sampling site;
- ELEV: Record the elevation where the sample was taken;
- UNITS: Record the units the elevation was recorded in;

- DATE: Record the date in the form MM/DD/YY;
- TIME: Record the time, including a designation of AM or PM;
- AIR TEMP.: Record the air temperature, including a designation of C or F (Celsius or Fahrenheit);
- WELL DEPTH: Record the depth of the well in feet and inches;
- CASING HEIGHT: Record the height of the casing in feet and inches;
- WATER DEPTH: Record the depth (underground) of the water in feet and inches;
- WELL DIAMETER: Record the diameter of the well in inches;
- WATER COLUMN HEIGHT: Record the height of the water column in feet and inches;
- SANDPACK DIAM.: Record the diameter of the sandpack. Generally, this will be the same as the bore diameter;
- EQUIVALENT VOLUME OF STANDING WATER: Use one of the following equations to determine one equivalent volume (EV);

1 EV = volume in casing + volume in saturated sandpack. Or:

$$1\ EV = [\pi R_w^2 h_w + 0.30p(R_s^2 - R_w^2)h_s] * (0.0043)$$

Where:

R_s = radius of sandpack in inches
R_w = radius of well casing in inches
h_s = height of sandpack in inches
h_w = water depth in inches

$0.0043 = gal/in^3$

and filter pack porosity is assumed as 30%, or

Volume in casing =
$(0.0043\ gal/in^3)(p)(12\ in/ft)(R_c^2)(W_h)$

Where:

R_c = radius of casing in inches, and
W_h = water column height in feet

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Wh)(0.30)

(if Wh is less than the length of the sandpack), or

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Sh)(0.30)

(if Wh is greater than the length of the sandpack).

Where:

Rb = radius of the borehole, and
Sh = length of the sandpack.

Show this calculation in the comments section.

- PUMP RATE: Record pump rate;
- TOTAL PUMP TIME: Record total purge time and volume;
- WELL WENT DRY? Write "YES" or "NO";
- PUMP TIME: Record pump time that made the well go dry;
- VOLUME REMOVED: Record the volume of water (gal) removed before the well went dry;
- RECOVERY TIME: Record the time required for the well to refill;
- PURGE AGAIN?: Answer "YES" or "NO";
- TOTAL VOL. REMOVED: Record the total volume of water (in gallons) removed from the well;
- CAL REF.: Record the calibration reference for the pH meter;
- TIME: Record time started (INITIAL T(0)), 2 times DURING the sampling and the time sampling ended (FINAL);
- pH: Record the pH at start of sampling (INITIAL), twice DURING the sampling, and at the end of sampling (FINAL);
- TEMP: Record the water temperature (Celsius) at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
- COND: Record the conductivity of the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
- D.O.: Record the dissolved oxygen level in the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
- TURBIDITY: Record the readings from the turbidity meter (nephelometer) and units at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
- ORD: Record the oxidation/reduction (RedOx) potential of the water sample at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL);
- HEAD SPACE: Record any positive readings from organic vapor meter reading taken in well headspace before sampling;
- NAPL: Record the presence and thickness of any non-aqueous phase liquids (LNAPL and DNAPL)
- COMMENTS: Record any pertinent information not already covered in the form; and
- SIGNATURE: Sign the form.

4.3 FIELD CALIBRATION FORMS (REFER TO FORM 10.2-E)

- Record time and date of calibration;
- Record calibration standard reference number;
- Record meter ID number;
- Record initial instrument reading, recalibration reading (if necessary), and final calibration reading on appropriate line;
- Record value of reference standard (as required);
- COMMENTS: Record any pertinent information not already covered on form; and
- SIGNATURE: Sign form.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCE

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

FIELD PARAMETER/LOGBOOK FORM 10.2-a
SOIL AND SEDIMENT SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA _____

INST NAME _____ FILE NAME _____

SAMPLE MATRIX CODE _____ SITE ID _____
ENV. FIELD SAMPLE IDENTIFIER _____

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROGRAM

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNIT _____

SAMPLING METHOD:

SPLIT SPOON ___ AUGER ___ SHELBY TUBE ___ SCOOP ___ OTHER

CHK	ANALYSIS	SAMPLE CONTAINER	NO.	REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION:_____

_____

_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____ UNUSUAL FEATURES_____

_____

WEATHER/TEMPERATURE

SAMPLER _____

FIELD PARAMETER/LOGBOOK FORM 10.2-b
GROUNDWATER AND SURFACE WATER SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA

INST CODE _____ FILE NAME _____ SITE TYPE

SITE ID _____ FIELD SAMPLE NUMBER

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROG.

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNITS

SAMPLING MEASUREMENTS

CAL REF. ____ pH _____ TEMPERATURE °C _____ CONDUCTIVITY _____ REDOX _____

DISSOLVED OXYGEN ____ TURBIDITY _____ OTHER

CHK ANALYSIS SAMPLE CONTAINER NO. REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION_____

SAMPLING METHOD_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____

UNUSUAL FEATURES_____

WEATHER/TEMPERATURE_____ SAMPLER _____

EXAMPLE MAP FILE LOGBOOK FORM 10.2-c
SURFACE WATER, SOIL, AND SEDIMENT SAMPLES

SITE ID_____ POINTER_____

DESCRIPTION/MEASUREMENTS_____

SKETCH/DIMENSIONS :

MAP REFERENCE_____

COORDINATE DEFINITION (X is _____ Y is _____)

COORDINATE SYSTEM _____ SOURCE _____ ACCURACY_____

X-COORDINATE _____ Y-COORDINATE _____ UNITS_____

ELEVATION REFERENCE_____

ELEVATION SOURCE _____ ACCURACY _____ELEVATION_____

UNITS_____

SAMPLER_____

EXAMPLE MAP FILE AND PURGING LOGBOOK FORM 10.2-d
GROUNDWATER SAMPLES

WELL COORD. OR ID _____ SAMPLE NO._____

WELL/SITE DESCRIPTION_____

_____

X-COORD. _____ Y-COORD. _____ ELEV. _____ UNITS

DATE ____/____/____ TIME _____ AIR TEMP.

WELL DEPTH _____ FT. _____ IN. CASING HT. _____ FT. _____ IN.

WATER DEPTH _____ FT. _____ IN. WELL DIAMETER _____ IN.

WATER COLUMN HEIGHT _____ FT. _____ IN. SANDPACK DIAM. _____ IN.

EQUIVALENT VOLUME OF STANDING WATER _____ (GAL) (L)

VOLUME OF BAILER _____ (GAL) (L) or PUMP RATE _____ (GPM) (LPM)

TOTAL NO. OF BAILERS (5 EV) _____ or PUMP TIME _____ MIN.

WELL WENT DRY? [Yes] [No] NUM. OF BAILERS _____ or PUMP TIME

VOL. REMOVED _____ (GAL) (L) RECOVERY TIME

PURGE AGAIN? [Yes] [No] TOTAL VOL. REMOVED _____ (GAL) (L)

DATE & TIME	QUANTITY REMOVED	TIME REQ'D	pH	Cond	Temp	ORD	Turb	DO	Character of water (color / clarity / odor / partic.)
(before)									
(during)									
(during)									
(during									
(after)									

COMMENTS_____

SIGNATURE_____

INITIAL CALIBRATION	**FINAL CALIBRATION**
DATE:	**DATE:**
TIME:	**TIME:**

pH METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

pH STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
7.0			
10.0			
4.0			

CONDUCTIVITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

COND. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

TEMPERATURE METER CALIBRATION

METER ID_____

TEMP. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
ICE WATER			
BOILING WATER			
OTHER _____			

TURBIDITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

ORD METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

DISSOLVED OXYGEN METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

COMMENTS_____

SIGNATURE_____

STANDARD OPERATING PROCEDURE 10.3
BORING LOGS

1.0 INTRODUCTION

The purpose of this standard operating procedure (SOP) is to describe the methods to be followed for classifying soil and rock, as well as preparing borehole logs and other types of soil reports.

2.0 MATERIALS

The following equipment is required for borehole logging:

- HTRW ENG Form 5056-R and 5056A-R boring log forms;
- Daily inspection report forms;
- Chain-of-custody forms;
- Request for analysis forms;
- ASTM D 2488 classification flow chart;
- Soil and/or Rock color chart (i.e., Munsell®);
- Grain size and roundness chart;
- Graph paper;
- Engineer's scale;
- Previous reports and boring logs;
- Pocketknife or putty knife;
- Hand lens;
- Dilute hydrochloric acid (10% volume);
- Gloves;
- Personal protective clothing and equipment, as described in work plan addenda health and safety plan;
- Photoionization detector or other appropriate monitoring equipment per site-specific health and safety plan; and
- Decontamination supplies (SOP 80.1).

3.0 PROCEDURE

Each boring log should fully describe the subsurface environment and the procedures used to obtain this description.

Boring logs should be prepared in the field on USACE Engineer Form 5056-R and 5056-R. Logs should be recorded in the field directly on the boring log form and not transcribed from a field book.

A "site geologist" should conduct borehole logging and soil/rock identification and description or other professional trained in the identification and description of soil/rock.

3.1 BORING LOG INFORMATION

As appropriate, the following information should be recorded on the boring log during the course of drilling and sampling activities:

- Project information including name, location, and project number;
- Each boring and well should be uniquely numbered and located on a sketch map as part of the log;
- Type of exploration;
- Weather conditions including events that could affect subsurface conditions;
- Dates and times for the start and completion of borings, with notations by depth for crew shifts and individual days;
- Depths/heights in feet and in decimal fractions of feet;
- Descriptions of the drilling equipment including rod size, bit type, pump type, rig manufacturer and model, and drilling personnel;
- Drilling sequence and descriptions of casing and method of installation;
- Description and identification of soils in accordance with ASTM Standard D 2488;
- Descriptions of each intact soil sample for the parameters identified in Section 3.2;
- Descriptions and classification of each non-intact sample (e.g., wash samples, cuttings, auger flight samples) to the extent practicable;
- Description and identification of rock;
- Description of rock (core(s)) for the parameters identified in Section 3.7;
- Scaled graphic sketch of the rock core (included or attached to log) according to the requirements identified in Section 3.7;
- Lithologic boundaries, with notations for estimated boundaries;
- Depth of water first encountered in drilling, with the method of first determination (any distinct water level(s) below the first zone will also be noted);
- Interval by depth for each sample taken, classified, and/or retained, with length of sample recovery and sample type and size (diameter and length);
- Blow counts, hammer weight, and length of fall for driven samplers;
- Rate of rock coring and associated rock quality designation (RQD) for intervals cored;
- Drilling fluid pressures, with driller's comments;

- Total depth of drilling and sampling;
- Drilling fluid losses and gains should be recorded;
- Significant color changes in the drilling fluid returned;
- Soil gas or vapor readings with the interval sampled, with information on instrument used and calibration;
- Depth and description of any in-situ test performed; and
- Description of other field tests conducted on soil and rock samples.

3.2 SOIL PARAMETERS FOR LOGGING

In general, the following soil parameters should be included on the boring log when appropriate:

- Identification per ASTM D 2488 with group symbol;
- Secondary components with estimated percentages per ASTM D 2488;
- Color;
- Plasticity per ASTM D 2488;
- Density of non-cohesive soil or consistency of cohesive soil;
- Moisture condition per ASTM D 2488 (dry, moist, or wet);
- Presence of organic material;
- Cementation and HCL reaction testing per ASTM D 2488;
- Coarse-grained particle description per ASTM D 2488 including angularity, shapes, and color;
- Structure per ASTM D 2488 and orientation;
- Odor; and
- Depositional environment and formation, if known.

ASTM D 2488 categorizes soils into 13 basic groups with distinct geologic and engineering properties based on visual-manual identification procedures. The following steps are required to classify a soil sample:

- Observe basic properties and characteristics of the soil. These include grain size grading and distribution, and influence of moisture on fine-grained soil.
- Assign the soil an ASTM D 2488 classification and denote it by the standard group name and symbol.
- Provide a written description to differentiate between soils in the same group if necessary.

Many soils have characteristics that are not clearly associated with a specific soil group. These soils might be near the borderline between groups, based on particle distribution or plasticity characteristics. In such a case, assigning dual group names and symbols (e.g., GW/GC or ML/CL) might be an appropriate method of describing the soil. The two general types of soils,

for which classification is performed, coarse- and fine-grained soils, are discussed in the following sections.

3.3 COURSE-GRAINED SOIL IDENTIFICATION

For soils in the coarse-grained soils group, more than half of the material in the soil matrix will be retained by a No. 200 sieve (75-μm).

- Coarse-grained soils are identified on the basis of the following:
- Grain size and distribution;
- Quantity of fine-grained material (i.e., silt and clay as a percentage); and
- Character of fine-grained material.

2. The following symbols are used for classification:

Basic Symbols	Modifying Symbols
G = gravel	W = well graded
S = sand	P = poorly graded
	M = with silty fines
	C = with clayey fines

3. The following basic facts apply to coarse-grained soil classification.

- The basic symbol G is used if the estimated percentage of gravel is greater than that for sand. In contrast, the symbol S is used when the estimated percentage of sand is greater than the percentage of gravel.
- Gravel ranges in size from 3-inch to 1/4-inch (No. 4 sieve) diameter. Sand ranges in size from the No. 4 sieve to No. 200 sieve. The Grain Size Scale used by Engineers (ASTM Standards D 422-63 and D 643-78) is the appropriate method to further classify grain size as specified by ASTM D 2488.
- Modifying symbol W indicates good representation of all particle sizes.
- Modifying symbol P indicates that there is an excess or absence of particular sizes.
- The symbol W or P is used only when there are less than 15% fines in a sample.
- Modifying symbol M is used if fines have little or no plasticity (silty).
- Modifying symbol C is used if fines have low to high plasticity (clayey).
- Figure 10.03a is a flowchart for identifying coarse-grained soils by ASTM D 2488.

3.4 FINE-GRAINED SOIL IDENTIFICATION

If one-half or more of the material will pass a No. 200 sieve (75 μm), the soil is identified as fine-grained.

- Fine-grained soils are classified based on dry strength, dilatancy, toughness, and plasticity.
- Classification of fine-grained soils uses the following symbols:

Basic Symbols			Modifying Symbols		
M	=	silt (non plastic)	L	=	low liquid limit (lean)
C	=	clay (plastic)	H	=	high liquid limit (fat)
O	=	organic			
Pt	=	peat			

3. The following basic facts apply to fine-grained soil classification:

- The basic symbol M is used if the soil is mostly silt, while the symbol C applies if it consists mostly of clay.
- Use of symbol O (group name OL/OH) indicates that organic matter is present in an amount sufficient to influence soil properties. The symbol Pt indicates soil that consists mostly of organic material.
- Modifying symbols (L and H) are based on the following hand tests conducted on a soil sample:
- Dry strength (crushing resistance).
- Dilatancy (reaction to shaking).
- Toughness (consistency near plastic limit).
- Soil designated ML has little or no plasticity and can be recognized by slight dry strength, quick dilatency, and slight toughness.
- CL indicates soil with slight to medium plasticity, which can be recognized by medium to high dry strength, very slow dilatancy, and medium toughness.
- Criteria for describing dry strength per ASTM D 2488 are as follows:
- Description Criteria
- None Dry sample crumbles into powder with pressure of handling
- Low Dry specimen crumbles into powder with some finger pressure
- Medium Dry specimen breaks into pieces or crumbles with considerable finger pressure
- High Dry specimen cannot be broken with finger pressure but will break into pieces between thumb and a hard surface
- Very high Dry specimen cannot be broken between the thumb and a hard surface stiffness
- Criteria for describing dilatancy per ASTM D 2488 are as follows:
- None No visible change in the sample
- Slow Water appears slow on the surface of the sample during shaking and does not disappear or disappears slowly upon squeezing
- Rapid Water appears quickly on the surface of the sample during shaking and disappears quickly upon squeezing
- Criteria for describing toughness per ASTM D 2488 are as follows:

- Description Criteria
- Low Only slight pressure is required to roll the thread near the plastic limit and the thread and lump are weak and soft
- Medium Medium pressure is required to roll the thread to near the plastic limit and the thread and lump have medium stiffness
- High Considerable pressure is required to roll the thread to near the plastic limit and the thread and lump have very high stiffness
- Figure 10.03b is a flowchart for identifying fine-grained soils by ASTM D 2488.

3.5 DENSITY AND CONSISTENCY

Relative density for coarse-grained soils and consistency for fine-grained soils can be estimated using standard penetration test blow count data (ASTM D 1586). The number of blows required for each 6 inches of penetration or fraction thereof is recorded. If the sampler is driven less than 18 inches, the number of blows per each complete 6-inch interval and per partial interval is recorded.

For partial increments, the depth of penetration should be recorded to the nearest 1 inch. If the sampler advances below the bottom of the boring under the weight of rods (static) and/or hammer, then this information should be recorded on the log.

The following are some "rule-of-thumb" guidelines for describing the relative density of coarse-grained soils:

Blow Count	Relative Density for Sand
0–4	Very loose
4–10	Loose
10–30	Medium dense
30–50	Dense
>50	Very Dense

The following are some "rule-of-thumb" guidelines for describing the consistency of fine-grained soils:

Blow Count	Consistency for Clays	Description
0–2	Very Soft	Sample sags or slumps under its own weight
2–4	Soft	Sample can be pinched in two between the thumb and forefinger
4–8	Medium Stiff	Sample can be easily imprinted with fingers
8–16	Stiff	Sample can be imprinted only with considerable pressure of fingers
16–32	Very Stiff	Sample can be imprinted very slightly with fingers
>32	Hard	Sample cannot be imprinted with fingers; can be pierced with pencil

3.6 OTHER DESCRIPTIVE INFORMATION

The approximate percentage of gravel, sand, and fines (use a percentage estimation chart) should be recorded per ASTM D 2488 as follows:

Modifiers	Descriptions
Trace	Less than 5%
Few	5%–10%
Little	15%–25%
Some	30%–45%
Mostly	50%–100%

Color/discoloration should be recorded and described using a soil color chart, such as the Munsell® Soil Color Charts. A narrative and numerical description should be given from the color chart, such as Brown 10 YR, 5/3 (Munsell®). Odor should be described if organic or unusual.

Plasticity should be described as follows:

Description	Criteria
Non-plastic	A 1/8-inch thread cannot be rolled at any water content
Low	Thread can barely be rolled and lump cannot be formed when drier than plastic limit.
Medium	Thread is easy to roll; plastic limit can be reached with little effort and lump crumbles when drier than plastic limit.
High	Considerable time is required to reach the plastic limit and lump can be formed without crumbling when drier than plastic limit

Moisture condition should be recorded as dry (absence of moisture), moist (damp but no visible water) or wet (visible free water).

Cementation should be recorded (carbonates or silicates) along with the results of HCL reaction testing. The reaction with HCL should be described as none (no visible reaction), weak (some reaction with slowly forming bubbles) or strong (violent reaction with bubbles forming immediately).

Particle description information for coarse-grained soil should be recorded where appropriate per ASTM D 2488 including maximum particle size, angularity (angular, subangular, subrounded, or rounded), shape (flat, elongated or flat and elongated), and color.

Structure (along with orientation) should be reported using the following ASTM D 2488 descriptions:

Description	Criteria
Stratified	Alternating layers of varying material or color with layers greater than 6 millimeters thick
Laminated	Alternating layers of varying material or color with layers less than 6 millimeters thick
Fissured	Breaks along definite planes of fracture with little resistance
Slickensided	Fracture planes that appear polished or glossy, can be striated
Blocky	Inclusion of small pockets of different soils
Homogeneous	Same color and appearance throughout

3.7 ROCK CORE PARAMETERS FOR LOGGING

In general, the following parameters should be included on the boring log when rock coring is conducted:

- Rock type;
- Formation;
- Modifier denoting variety;
- Bedding/banding characteristics;
- Color;
- Hardness;
- Degree of cementation;
- Texture;
- Structure and orientation;
- Degree of weathering;
- Solution or void conditions;
- Primary and secondary permeability including estimates and rationale; and
- Lost core interval and reason for loss.

A scaled graphic sketch of the core should provided on or attached to the log, denoting by depth, location, orientation, and nature (natural, coring-induced, or for fitting into core box) of all core breaks. Where fractures are too numerous to be shown individually, their location may be drawn as a zone.

The RQD values for each core interval (run) should be calculated and included on the boring log. The method of calculating the RQD is as follows per ASTM D 6032:

RQD = [Σ length of intact core pieces > 100 mm (4-inches)] x 100%/total core length.

3.8 PROCEDURES FOR ROCK CLASSIFICATION

For rock classification record mineralogy, texture, and structural features (e.g., biotite and quartz fine grains, foliated parallel to relict bedding oriented 15 to 20 degrees to core axis, joints coated with iron oxide). Describe the physical characteristics of the rock that are important for engineering considerations such as fracturing (including minimum, maximum, and most common and degree of spacing), hardness, and weathering.

- The following is to be used as a guide for assessing fracturing:

AEG Fracturing	Spacing
Crushed	up to 0.1 foot
Intense	0.1–0.5 foot
Moderate	0.5 foot–10 feet
Slight	1.0 foot–3.0 feet

Massive	>3.0 feet

- Record hardness using the following guidelines:

Hardness	Criteria
Soft	Reserved for plastic material
Friable	Easily crumbled by finger pressure
Low	Deeply gouged or carved with pocketknife
Moderate	Readily scratched with knife; scratch leaves heavy trace of dust
Hard	Difficult to scratch with knife; scratch produces little powder and is often faintly visible
Very Hard	Cannot be scratched with knife

- Describe weathering using the following guidelines:

Weathering	Decomposition	Discoloration	Fracture Condition
Deep	Moderate to complete alteration of minerals feldspars altered to clay, etc.	Deep and thorough	All fractures extensively coated with oxides, carbonates, or clay
Moderate	Slight alteration of minerals, cleavage surface lusterless and stained	Moderate or localized and intense	Thin coatings or stains
Weak	No megascopic alteration of minerals	Slight and intermittent and localized	Few strains on fracture surfaces
Fresh	Unaltered, cleavage, surface glistening		

3.9 PROCEDURE FOR LOGGING REFUSE

The following procedure applies to the logging of subsurface samples composed of various materials in addition to soil as may be collected from a landfill or other waste disposal site.

1. Observe refuse as it is brought up by the hollow stem auger, bucket auger, or backhoe.

2. If necessary, place the refuse in a plastic bag to examine the sample.

3. Record observations according to the following criteria:

    - Composition (by relative volume), e.g., paper, wood, plastic, cloth, cement, or construction debris. Use such terms as “mostly” or “at least half.” Do not use percentages;
    - Moisture condition: dry, moist, or wet;

- State of decomposition: highly decomposed, moderately decomposed, slightly decomposed, etc.;
- Color: obvious mottling and/or degree of mottling;
- Texture: spongy, plastic (cohesive), friable;
- Odor;
- Combustible gas readings (measure down hole and at surface); and
- Miscellaneous: dates of periodicals and newspapers, ability to read printed materials, degree of drilling effort (easy, difficult, and very difficult).

3.10 SUBMITTAL REQUIREMENTS

Each original boring log should be submitted to the Contracting Officer Representative (CRO) after completion of the boring. When a monitoring well will be installed in a boring, the boring log and well installation diagram should be submitted together.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Not applicable.

6.0 REFERENCES

ASTM Standard D 1586–84 (1992). 1992. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Standard D 2488-93. 1993. *Standard Practice for Description and Identification of Soils Visual-Manual Procedure).*

ASTM Standard D 5434-93. 1993. *Guide for Field Logging of Subsurface Explorations of Soil and Rock.*

ASTM Standard D 6032-96. 1996. *Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core.*

Compton, R. R. 1962. *Manual of Field Geology*. John Wiley & Sons, Inc., New York.

USACE. 1998. *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites.* EM 1110-1-4000, 1, November.

U.S. Department of the Interior. 1989. *Earth Manual.* Water and Power Resources Service, Washington, DC.

STANDARD OPERATING PROCEDURE 10.4
CHAIN-OF-CUSTODY FORM

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for use of the chain-of-custody form. An example is provided as part of this SOP. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Chain-of-custody form; and
- Indelible ink pen.

3.0 PROCEDURE

- Record the project name and number.
- Record the project contact's name and phone number.
- Print sampler's names in "Samplers" block.
- Enter the Field Sample No.
- Record the sampling dates for all samples.
- List the sampling times (military format) for all samples.
- Indicate, "grab" or "composite" sample with an "X."
- Record matrix (e.g., aqueous, soil).
- List the analyses/container volume across top.
- Enter the total number of containers per Field Sample No. in the "Subtotal" column.
- Enter total number of containers submitted per analysis requested.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
- List any comments or special requests in the "Remarks" section.
- Sign, date, and time the "Relinquished By" section when the cooler is relinquished to the next party.
- Upon completion of the form, retain the shipper copy and place the forms and the other copies in a zip seal bag to protect from moisture. Affix the zip seal bag to the inside lid of the sample cooler to be sent to the designated laboratory.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Not applicable.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, DC, December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program.* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January 1991.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

FIGURE 10.4-a
EXAMPLE CHAIN-OF-CUSTODY FORM

Project Number	Project Name				Matrix	A N A L Y S E S									LAB :
Project Contact (Name and Phone Number)															AIRBILL No:
Samplers:															Courier:
Field Sample No.	Date (MM-DD-YY)	Time	Comp	Grab										Subtotal	REMARKS
TOTAL															

Relinquished by:	Date/time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished by:	Date/time	Received by: (for lab)	Date/Time	Remarks	

STANDARD OPERATING PROCEDURE 30.1
SOIL SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for sampling surface and subsurface soils.

2.0 MATERIALS

- Stainless steel scoop, spoon, trowel, knife, spatula, (as needed);
- Split-spoon, Shelby tube, or core barrel sampler;
- Hand auger or push tube sampler;
- Drill rig and associated equipment (subsurface soil);
- Stainless steel bowls;
- Photoionization detector or other appropriate instrument as specified in site-specific health and safety plan;
- Sampling equipment for collection of volatile organic samples;
- Appropriate sample containers;
- Appropriate sample labels and packaging material.;
- Personal protective equipment and clothing (PPE) per site-specific health and safety plan; and
- Decontamination equipment and supplies (SOP 80.1).

3.0 PROCEDURE

3.1 DOCUMENTATION

- Soil sampling information should be recorded in the field logbooks as described in SOPs 10.1 and 10.2.

3.1 SURFICIAL SOIL SAMPLES

The targeted depths for surficial soil samples (surface and near surface) will be specified in the work plan addenda developed for site-specific investigations.

- All monitoring equipment should be appropriately calibrated before beginning sampling according to the requirements of the work plan addenda and SOP 90.1 or 90.2.
- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- Use a spade, shovel, or trowel or other equipment (manufactured from material, which is compatible with the soil to be sampled) to remove any overburden material present (including vegetative mat) to the level specified for sampling.

- Measure and record the depth at which the sample will be collected with an engineers scale or tape.
- Remove the thin layer that was in contact with the overburden removal equipment using a clean stainless steel scoop or equivalent and discard it.
- Begin sampling with the acquisition of any discrete sample(s) for analysis of volatile organic compounds (VOCs), with as little disturbance as possible. VOC samples will not be composited or homogenized.
- When a sample will not be collected with a core type of sampler (push tube, split spoon, etc.), the sample for VOC analysis will be collected from freshly exposed soil. The method of collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
- Field screen the sample with properly calibrated photoionization detector (PID) or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
- Collect a suitable volume of sample from the targeted depth with a clean stainless steel scoop (or similar equipment), push tube sampler, or bucket auger
- For core type of samplers, rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife. Samples collected with a bucket auger or core type of sampler should be logged per the requirements of SOP 10.3.
- If homogenization or compositing of the sampling location is not appropriate for the remaining parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
- If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and then placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
- Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
- Return any remaining unused soil to the original sample location. If necessary, add clean sand to bring the subsampling areas back to original grade. Replace the vegetative mat over the disturbed areas.

3.1 SUBSURFACE SAMPLES

- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- All monitoring equipment should be appropriately calibrated before sampling according to the requirement of the work plan addendum and SOP 90.1 or SOP 90.2.

- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- Collect split-spoon; core barrel, Shelby tube, sonic core or other similar samples during drilling.
- Upon opening sampler or extruding sample, immediately screen soil for VOCs using a PID or appropriate instrument. If sampling for VOCs, determine the area of highest concentration; use a stainless steel knife, trowel, or lab spatula to cut the sample; and screen for VOCs with monitoring instrument(s).
- Log the sample on the boring log before extracting from the sampler per the requirements of SOP 10.3.
- Any required VOC samples will be collected first followed by the other parameters. VOC samples will not be composited or homogenized and will be collected from the area exhibiting the highest screening level. The method of VOC sample collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
- Field screen the sample with properly calibrated photoionization detector (PID) or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
- Rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife.
- If homogenization or compositing of the sampling location is not appropriate for other parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
- If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
- Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
- Discard any remaining sample into the drums used for collection of cuttings.
- Abandon borings according to procedures outlined in SOP 20.2.

3.1 INVESTIGATION DERIVED MATERIALS

Investigation-derived material will be managed in accordance with procedures defined in the work plan addenda for the site being investigated and SOP 70.1.

NOTES: If sample recoveries are poor, it may be necessary to composite samples before placing them in jars. In this case, the procedure will be the same except that two split-spoon samples (or other types of samples) will be mixed together. The boring log should clearly state

that the samples have been composited, which samples were composited, and why the compositing was done. In addition, VOC fraction should be collected from the first sampling device.

When specified, samples taken for geotechnical analysis (e.g., percent moisture, density, porosity, and grain size) will be undisturbed samples, such as those collected using a thin-walled (Shelby tube) sampler, sonic core sampler, etc.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Refer to the site-specific health and safety plan.

Soil samples will not include vegetative matter, rocks, or pebbles unless the latter are part of the overall soil matrix.

6.0 REFERENCES

ASTM Standard D 1586-84. 1984. *Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Standard D 1587-83. 1983. *Thin Walled Sampling of Soils.*

ASTM Standard D 5633-94. 1994. *Standard Practice for Sampling with a Scoop.*

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM 200-1-3. 1 February.

STANDARD OPERATING PROCEDURE 30.6
CONTAINERIZED MATERIAL

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the opening and sampling of containerized liquids of potentially unknown substances.

2.0 MATERIALS

- Work Plans;
- Field logbooks;
- Personal protective equipment and clothing per the site-specific health and safety plan;
- Monitoring instruments per the site-specific health and safety plan;
- Decontamination equipment and supplies (SOP 80.1);
- Tools;
- Historical data, if available;
- Sampling tube; and
- Remote samplers, as required.

3.0 PROCEDURE

Sealed containers with unknown contents represent potential severely hazardous situations for sampling teams. Even when the original identity of the contents is reasonably certain, contents may be under pressure or in a decomposed state and may readily react (sometimes violently) with air or water vapor in the atmosphere.

Only hazardous material specialists that have appropriate training and experience will inspect and sample unidentifiable drums or containers. Specialist team members will use extreme caution and care when opening sealed drums or cans of unknown content for purposes of inspection and sampling.

Efforts will be made to determine the identity of the contents, through markings, history of activities at the site, and similarity and proximity to containers of known contents. The range of possible hazards will dictate which specific procedure will be followed, and specific procedures will be identified in work plan addenda. All predetermined procedures will be strictly followed as designated by the site-specific conditions.

Using this SOP and appropriate health and safety protocols, field personnel will use extreme caution and care in opening sealed drums or cans of unknown contents for purposes of inspection and sampling. Specific activities include the following:

- Determine the identity of the contents through markings, history of activities at the site, and similarity and proximity to containers of known contents. The range of possible hazards will dictate which specific procedure should be followed.
- Handle containers as little as possible; however, if it is necessary to reorient a drum to allow access to a bung or cap, perform this activity using remote-handling forklift equipment with special drum-holding attachments.
- If contents are deemed to be under pressure, highly reactive, or highly toxic (or if these possibilities cannot be disproven), perform initial opening of the container remotely.
- Air monitoring stations will be established as necessary, using the following procedures:
- Affix a remote bung opener to the drum.
- Evacuate personnel to a safe distance or station them behind a barricade.
- Activate the non-sparking motor of the opener.
- After the bung is removed, monitor the drum for potential activity of the contents, such as vapor emission, smoking, or audible reaction.
- Approach cautiously while monitoring for toxic levels of airborne contaminants.
- If the contents of the drum pose acceptable hazards, accomplish opening (or inspection if previously opened remotely) and sampling with one of three approved devices. The preferred method is to use a clean glass tube, with or without bottom stopper, which can be placed in the drum (breaking it if necessary) after sampling is complete. Alternately (if a bung has been removed), a well sampler such as a Kemmererbailer can be used (but would require removal and cleaning or disposal according to the nature of the waste). By opening either of these devices at a desirable depth, stratified sampling can be performed. Also, the sampling tubes can be made with a plunger rod and O-ring seals at selected intervals, allowing simultaneous collection of multiple samples in a stratified medium.
- Following sampling, the drum will be resealed and/or overpacked to prevent any possibility of leakage while analysis determines the identity of the contents.
- Drums that do not have removable bungs may be opened remotely with a solenoid-activated punch (this requires that the drum be recontainerized or overpacked after sampling is complete).

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USEPA. 1989. A Compendium of Superfund Field Operation Methods. EPA/540/P-87/001. December.

STANDARD OPERATING PROCEDURE 30.7
SAMPLING STRATEGIES

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate sampling strategies for sampling various media.

2.0 MATERIALS

- Historical site data;
- Site topography;
- Soil types; and
- Sampled media.

3.0 PROCEDURE

The primary goal of any investigation is to collect samples representative of existing site conditions. Statistics are generally used to ensure samples are as representative as possible. Sampling plans may employ more than one approach to ensure project data quality objectives are adequately addressed. A comparison of sampling strategies is presented in Table 1.

3.1 CLASSICAL STATISTICAL SAMPLING

- Classical statistical sampling strategies are appropriately applied to either sites where the source of contamination is known or small sites where the entire area is remediated as one unit. Primary limitations of this sampling approach include (1) inability to address media variability; (2) inadequate characterization of heterogenous sites; and (3) inadequate characterization of sites with unknown contamination characteristics.

3.1.1 Simple Random Sampling

Simple random sampling is generally more costly than other approaches because of the number of samples required for site characterization. This approach is generally used when minimal site information is available and visible signs of contamination are not evident and includes the following features:

- Sampling locations are chosen using random chance probabilities.
- This strategy is most effective when the number of sampling points is large.

3.1.2 Stratified Random Sampling

This sampling approach is a modification to simple random sampling. This approach is suited for large site investigations that encompass a variety of soil types, topographic features, and/or land uses. By dividing the site into homogenous sampling strata based on background and historical data, individual random sampling techniques are applied across the site. Data acquired from each stratum can be used to determine the mean or total contaminant levels and provide these advantages:

- Increased sampling precision results due to sample point grouping and application of random sampling approach.
- Control of variances associated with contamination, location, and topography.

3.1.3 Systematic Grid

The most common statistical sampling strategy is termed either systematic grid or systematic random sampling. This approach is used when a large site must be sampled to characterize the nature and extent of contamination.

Samples are collected at predetermined intervals within a grid pattern according to the following approach:

- Select the first sampling point randomly; remaining sampling points are positioned systematically from the first point.
- Determine the grid design: one or two-dimensional. One-dimensional sample grids may be used for sampling along simple man-made features. Two-dimensional grid systems are ideal for most soil applications.
- Determine the grid type: square or triangular. Sampling is usually performed at each grid-line intersection. Other strategies include sampling within a grid center or obtaining composite samples within a grid.
- Each stratum is sampled based on using the simple random sampling approach but determined using a systematic approach.

3.1.4 Hot-Spot Sampling

Hot spots are small, localized areas of media characterized by high contaminant concentrations. Hot-spot detection is generally performed using a statistical sampling grid. The following factors should be addressed:

- Grid spacing and geometry. The efficiency of hot-spot searches is improved by using a triangular grid. An inverse relationship exists between detection and grid point spacing, e.g., the probability of hot-spot detection is increased as the spacing between grid points is decreased.
- Hot-spot shape/size. The larger the hot spot, the higher the probability of detection. Narrow or semi-circular patterns located between grid sampling locations may not be detected.
- False-negative probability. Estimate the false negative (β-error) associated with hot-spot analysis.

3.1.5 Geostatistical Approach

Geostatistics describe regional variability in sampling and analysis by identifying ranges of correlation or zones of influence. The general two-stage approach includes the following:

- Conducting a sampling survey to collect data defining representative sampling areas.
- Defining the shape, size, and orientation of the systematic grid used in the final sampling event.

3.2 NON-STATISTICAL SAMPLING

3.2.1 Biased Sampling

Specific, known sources of site contamination may be evaluated using biased sampling. Locations are chosen based on existing information.

3.2.2 Judgmental Sampling Grid

This sampling approach entails the subjective selection of sampling locations that appear to be representative of average conditions. Because this method is highly biased, it is suggested that a measure of precision be included through the collection of multiple samples.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM200-1-3. 1 February.

TABLE 1
SAMPLING STRATEGIES

SAMPLING STRATEGY	DESCRIPTION	APPLICATION	LIMITATIONS
Classical Statistical Sampling Strategies			
Simple Random Sampling	Representative sampling locations are chosen using the theory of random chance probabilities.	Sites where background information is not available and no visible signs of contamination are present.	May not be cost-effective because samples may be located too close together. Does not take into account spatial variability of media.
Stratified Random Sampling	Site is divided into several sampling areas (strata) based on background or site survey information.	Large sites characterized by a number of soil types, topographic features, past/present uses, or manufacturing storage areas.	Often more cost-effective than random sampling. More difficult to implement in the field and analyze results. Does not take into account spatial variability of media.
Systematic Grid Sampling	Most common statistical strategy; involves collecting samples at predetermined, regular intervals within a grid pattern.	Best strategy for minimizing bias and providing complete site coverage. Can be used effectively at sites where no background information exists. Ensures that samples will not be taken too close together.	Does not take into account spatial variability of media.
Hot-Spot Sampling	Systematic grid sampling strategy tailored to search for hot spots.	Sites where background information or site survey data indicate that hot spots may exist.	Does not take into account spatial variability of media. Tradeoffs between number of samples, chance of missing a hot spot, and hot spot size/shape must be weighed carefully.
Geostatistical Approach	Representative sampling locations are chosen based on spatial variability of media. Resulting data are analyzed using kriging, which creates contour maps of the contaminant concentrations and the precision of concentration estimates.	More appropriate than other statistical sampling strategies because it takes into account spatial variability of media. Especially applicable to sites where presence of contamination is unknown.	Previous investigation data must be available and such data must be shown to have a spatial relationship.
Non-Statistical Sampling Strategies			
Biased Sampling	Sampling locations are chosen based on available information.	Sites with known contamination sources.	Contaminated areas can be overlooked if background information or visual signs of contamination do not indicate them. Best used if combined with a statistical approach, depending on the project objectives.
Judgmental Sampling	An individual subjectively selects sampling locations that appear to be representative of average conditions.	Homogenous, well-defined sites.	Not usually recommended due to bias imposed by individual, especially for final investigations.

STANDARD OPERATING PROCEDURE 50.1
SAMPLE LABELS

1.0 SCOPE AND APPLICATION

Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. The purpose of this standard operating procedure (SOP) is to delineate protocols for the use of sample labels. An example label is included as Figure 50.1-A. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Sample label; and
- Indelible marker.

3.0 PROCEDURE

The use of preprinted sample labels is encouraged and should be requested from the analytical support laboratory during planning activities.

- As each sample is collected, fill out a sample label ensuring the following information has been collected:
- Project name;
- Sample ID: enter the SWMU number and other pertinent information concerning where the sample was taken. This information should be included in site-specific work plan addenda;
- Date of sample collection;
- Time of sample collection;
- Initials of sampler(s);
- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with lab *a priori*); and
- Preservatives (water samples only).

Double-check the label information to make sure it is correct. Detach the label, remove the backing and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

FIGURE 50.1-A
SAMPLE LABEL

PROJECT NAME _____

SAMPLE ID _____

DATE: ____/____/____ TIME: _____:_____

ANALYTES: VOC SVOC P/P METALS CN
PAH D/F HERBs ANIONS TPH
ALK TSS

PRESERVATIVE: [HCl] [HNO_3] [NaOH] [H_2SO_4]

SAMPLER: _____

STANDARD OPERATING PROCEDURE 50.2
SAMPLE PACKAGING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the packing and shipping of samples to the laboratory for analysis.

2.0 MATERIALS

- Waterproof coolers (hard plastic or metal);
- Metal cans with friction-seal lids (e.g., paint cans);
- Chain-of-custody forms;
- Chain-of-custody seals (optional);
- Packing material;
- Sample documentation;
- Ice;
- Plastic garbage bags;
- Clear Tape;
- Zip-top plastic bags; and
- Temperature blanks provided by laboratory for each shipment.

3.0 PROCEDURE

- Check cap tightness and verify that clear tape covers label and encircles container.
- Wrap sample container in bubble wrap or closed cell foam sheets. Samples may be enclosed in a secondary container consisting of a clear zip-top plastic bag. Sample containers must be positioned upright and in such a manner that they will not touch during shipment.
- Place several layers of bubble wrap, or at least 1 in. of vermiculite on the bottom of the cooler. Line cooler with open garbage bag, place all the samples upright inside the garbage bag and tie.
- Double bag and seal loose ice to prevent melting ice from soaking the packing material. Place the ice outside the garbage bags containing the samples.
- Pack shipping containers with packing material (closed-cell foam, vermiculite, or bubble wrap). Place this packing material around the sample bottles or metal cans to avoid breakage during shipment.
- A temperature blank (provided by laboratory) will be included in each shipping container to monitor the internal temperature. Samples should be cooled to 4 degrees C on ice immediately after sampling.

- Enclose all sample documentation (i.e., Field Parameter Forms, Chain-of-Custody forms) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, each cooler will have its own documentation. Add the total number of shipping containers included in each shipment on the chain-of-custody form.
- Seal the coolers with signed and dated custody seals so that if the cooler were opened, the custody seal would be broken. Place clear tape over the custody seal to prevent damage to the seal.
- Tape the cooler shut with packing tape over the hinges and place tape over the cooler drain.
- Ship all samples via overnight delivery on the same day they are collected if possible.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

5.1 PERMISSIBLE PACKAGING MATERIALS

- Non-absorbent
- Bubble wrap; and
- Closed cell foam packing sheets.
- Absorbent
- Vermiculite.

5.2 NON-PERMISSIBLE PACKAGING MATERIALS

- Paper;
- Wood shavings (excelsior); and
- Cornstarch “peanuts”.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C., December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program.* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January 1991.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C

STANDARD OPERATING PROCEDURE 70.1
INVESTIGATION-DERIVED MATERIAL

1.0 SCOPE AND APPLICATION

Management of investigation-derived material (IDM) minimizes the potential for the spread of waste material onsite or offsite through investigation activities. The purpose of this standard operating procedure (SOP) is to provide general guidelines for appropriate management of potentially contaminated materials derived from the field investigations. Specific procedures related to the transportation and disposal of hazardous waste are beyond the scope of this SOP.

2.0 INTRODUCTION

Investigation derived material (IDM) consists of waste materials that are known or suspected to be contaminated with waste substances through the actions of sample collection or personnel and equipment decontamination. These materials include decontamination solutions, disposable equipment, drill cuttings and fluids, and water from groundwater monitoring well development and purging. To the extent possible, the site manager will attempt to minimize the generation of these materials through careful design of decontamination schemes and groundwater sampling programs. Testing conducted on soil and water investigation-derived material will show if they are also hazardous wastes as defined by RCRA. This will determine the proper handling and ultimate disposal requirements.

The criteria for designating a substance as hazardous waste according to RCRA is provided in 40 CFR 261.3. If IDM meet these criteria, RCRA requirements will be followed for packaging, labeling, transporting, storing, and record keeping as described in 40 CFR 262.34. Those materials that are judged potentially to meet the criteria for a regulated solid or hazardous waste will be placed in DOT-approved 55-gallon steel drums or another type of DOT approved container; based on waste characteristics and volume.

Investigation-derived material will be appropriately placed in containers, labeled, and tested to determine disposal options in accordance with RCRA regulations and Virginia Hazardous Waste Management Regulations.

3.0 INVESTIGATION-DERIVED MATERIAL MANAGEMENT

Procedures that minimize potential for the spread of waste material include minimizing the volume of material generated, material segregation, appropriate storage, and disposal according to RCRA requirements.

3.1 WASTE MINIMIZATION

In the development of work plan addenda, each aspect of the investigation will be reviewed to identify areas where excess waste generation can be eliminated. General procedures that will eliminate waste include avoidance of unnecessary exposure of materials to hazardous material and coordination of sampling schedules to avoid repetitious purging of wells and use of sampling equipment.

3.2 WASTE SEGREGATION

Waste accumulation and management procedures to be used depend upon the type of material generated. For this reason, IDM described below are segregated into separate 55-gallon storage drums or other appropriate DOT containers. Waste materials that are known to be free of potential hazardous waste contamination (such as broken sample bottles or equipment containers and wrappings) must be collected separately for disposal to municipal systems. Large plastic garbage or "lawn and leaf" bags are useful for collecting this trash. Even "clean" sample bottles or Tyvek should be disposed of with care. Although they are not legally a problem, if they are discovered by the public they may cause concern. Therefore, items that are known to be free from contamination but are also known to represent "hazardous or toxic waste" to the public must not be disposed of in any public trash receptacle, such as found at your hotel or park.

3.2.1 Decontamination Solutions

Solutions considered investigation-derived materials range from detergents, organic solvents, and acids used to decontaminate small hand samplers to steam-cleaning rinsate used to wash drill rigs and other large equipment. These solutions are to be placed in 55-gallon drums with bolt-sealed lids or other appropriate DOT approved containers. Residual liquid IDM from decontamination pads will be removed and appropriately placed in container(s) at the end of each field day.

3.2.2 Soil Cuttings and Drilling Muds

Soil cuttings are solid to semi-solid soils generated during trenching activities or drilling for the collection of subsurface soil samples or the installation of monitoring wells. Depending on the type of drilling, drilling fluids known as "muds" may be used to remove soil cuttings. Drilling fluids flushed from the borehole must be directed into a settling section of a mud pit. This allows reuse of the decanted fluids after removal of the settled sediments. Drill cuttings, whether generated with or without drilling fluids, are to be removed with a flat-bottomed shovel and placed in 55-gallon drums with bolt-sealed lids or other appropriate DOT containers, as conditions or volume of IDM dictate.

3.2.3 Well Development and Purge Water

Well development and purge water is removed from monitoring wells to repair damage to the aquifer following well installation, obtain characteristic aquifer groundwater samples, or measure aquifer hydraulic properties. The volume of groundwater to be generated will determine the appropriate container to be used for accumulation of IDM.

For well development and purging, 55-gallon drums are typically an efficient container for accumulation. When larger volumes of water are removed from wells, such as when pumping tests are conducted, the use of large-volume portable tanks such as "Baker Tanks" should be considered for IDM accumulation.

Analytical data for groundwater samples associated with the well development and purge water will be used to assist in characterizing IDM and evaluating disposal options.

3.2.4 Personal Protective Equipment and Disposable Sampling Equipment

Personal protective equipment and clothing (PPE) may include such items as Tyvek coveralls, gloves, booties, and APR cartridges. Disposable sampling equipment may include such items as plastic sheeting, bailers, disposable filters, disposable tubing and paper towels. PPE and disposable sampling equipment that have or may have contacted contaminated media (soil,

water, etc.) will be segregated and placed in 55-gallon drums separate from soil and water IDM. Disposition of this type of IDM will be determined by the results of IDM testing of the media in which the PPE and sampling equipment contacted.

3.3 MATERIAL ACCUMULATION

The IDM in containers must be placed in an appropriate designated RCRA container accumulation area at RFAAP, where it is permissible to accumulate such waste. IDM placed into a designated 90-day accumulation area will be properly sealed, labeled and covered. All drums will be placed on pallets.

A secure and controlled waste staging area will be designated by the installation prior the commencement of field sampling activities. Per the facility's requirements as a RCRA large quantity generator, waste accumulation cannot exceed 90 days for materials presumed or shown to be RCRA-designated hazardous wastes; waste which is known not to be RCRA-designated waste should be promptly disposed to municipal waste systems or appropriate facility.

3.3.1 IDM Accumulation Containers

Containers will be DOT-approved (DOT 17H 18/16GA OH unlined) open-head steel drums or other DOT approved container, as appropriate.

Container lids should lift completely off be secured by a bolt ring (for drum). Order enough containers to accumulate all streams of expected IDM including soil, PPE and disposable sampling equipment, decontamination water, purge water, etc.

Solid and liquid waste streams will not be mixed in a container. PPE and expendable sampling equipment will be segregated from other IDM and placed in different containers than soil. Containers inside containers are not permitted. PPE must be placed directly in a drum not in a plastic bag.

Pallets are often required to allow transport of filled drums to the staging area with a forklift. Normal pallets are 3×4 ft and will hold two to three 55-gallon drums depending on the filled weight. If pallets are required for drum transport or storage, field personnel are responsible for ensuring that the empty drums are placed on pallets before they are filled and that the lids are sealed on with the bolt-tighten ring after the drums are filled. Because the weight of one drum can exceed 500 lbs, under no circumstances should personnel attempt to move the drums by hand.

3.3.2 Containers Labeling

Each container that is used to accumulate IDM will be appropriately labeled at the time of accumulation and assigned a unique identification number for tracking purposes. The following information will be written in permanent marker on a drum label affixed on the exterior side at a location at least two-thirds of the way up from the bottom of the drum.

- Facility name.
- Accumulation start date and completion date.
- Site identifier information (SWMU, boring, well, etc.).
- Description of IDM.
- Drum ID No.

4.0 MATERIAL CHARACTERIZATION AND DISPOSAL

IDM will be characterized and tested to determine whether it is a hazardous waste as defined by 40 CFR Part 261 and to determine what disposal options exist in accordance with RCRA regulations and the Virginia Hazardous Waste Management Regulations (VHWMR).

In general, IDM will be considered a hazardous waste if it contains a listed hazardous waste or if the IDM exhibits a characteristic of hazardous waste.

Work plan addenda will identify the appropriate characterization and testing program for IDM based on the following:

- Site-specific conditions related to chemicals of concern, etc.
- The nature and quantity of expected IDM to be generated during site-specific investigations.
- Applicable Federal, State, and local regulations, such as RCRA, VHWMR regulations and policies and procedures, and Army Regulation 200-1.
- RFAAP specific requirements and policies for IDM characterization and disposal at the time of the investigation.

In general, appropriate USEPA SW 846 Test Methods for Evaluating Solid Waste will be used for testing IDM and will be specified in work plan addenda. Other appropriate test methods may be specified by RFAAP in addition to SW 846 Methods that are specific to installation operations, the site of interest (percent explosive content, reactivity, etc.), or requirements for disposal at RFAAP water treatment facilities or publicly owned treatment works.

Responsibility for the final disposal of IDM will be determined before field activities are begun and will be described in work plan addenda. Off-site disposal of IDM will be coordinated with RFAAP (generator) to ensure appropriate disposition. The contractor will coordinate IDM transportation and disposal activities for RFAAP (generator).

At the direction of RFAAP, appropriate waste manifests will be prepared by the USACE contractor or Alliant Techsystems subcontractor for transportation and disposal. Alliant Techsystems or other appropriate RFAAP entity will be listed as the generator and an appointed representative from RFAAP will review and sign the manifest for offsite disposal.

RFAAP will make the final decision on the selection of the transporter, storage, and disposal facility (TSDFs) or recycling facility. RFAAP will provide the contractor a listing of previously used TSDFs for priority consideration. Proposed facilities that are not included on the listing are required to provide a copy of the TSDFs most recent state or federal inspection to the installation. Waste characterization and testing results will be submitted to RFAAP (generator) for review and approval before final disposition of the material.

Hazardous waste: Prior to final disposition, a hazardous waste manifest will be furnished by the TSDF to accompany transport to the disposal facility. Following final disposition, a certificate of disposal will be furnished by the disposal facility. Copies of the manifests and certificates of disposal are to be provided to RFAAP and retained on file by the contractor or subcontractor.

5.0 PRECAUTIONS

- Because the weight of one drum can exceed 500 lbs, under no circumstances should personnel attempt to move drums by hand.
- Refer to the site-specific health and safety plan when managing IDM.

6.0 REFERENCE

Safety Rules for Contractors and Subcontractors, 1995. Alliant Techsystems, Incorporated, Radford Army Ammunition Plant.

STANDARD OPERATING PROCEDURE 80.1
DECONTAMINATION

1.0 SCOPE AND APPLICATION

Before leaving the site, all personnel or equipment involved in intrusive sampling or having entered a hazardous waste site during intrusive sampling must be thoroughly decontaminated to prevent adverse health effects and minimize the spread of contamination. Equipment must be decontaminated between sites to preclude cross-contamination. Decontamination water will be free of contaminants as evidenced through either chemical analyses or certificates of analysis. This standard operating procedure (SOP) describes general decontamination requirements for site personnel and sampling equipment. Decontamination procedures for contaminants requiring a more stringent procedure, e.g., dioxins/furans, will be included in site-specific addenda.

2.0 MATERIALS

- Plastic sheeting, buckets or tubs, pressure sprayer, rinse bottles, and brushes;
- U.S. Army Corps of Engineers or installation approved decontamination water source;
- Deionized ultra-filtered, HPLC-grade organic free water (DIUF);
- Non-phosphate laboratory detergent;
- Nitric Acid, 0.1 Normal (N) solution;
- Pesticide-grade solvent, Methanol;
- Aluminum foil;
- Paper towels;
- Plastic garbage bags; and
- Appropriate containers for management of investigation-derived material (IDM).

3.0 PROCEDURE

3.1 SAMPLE BOTTLES

At the completion of each sampling activity the exterior surfaces of the sample bottles must be decontaminated as follows:

- Be sure that the bottle lids are on tight.
- Wipe the outside of the bottle with a paper towel to remove gross contamination.

3.2 PERSONNEL DECONTAMINATION

Review the site-specific health and safety plan for the appropriate decontamination procedures.

3.3 EQUIPMENT DECONTAMINATION

3.3.1 Drilling Rigs

Drilling rigs and associated equipment, such as augers, drill casing, rods, samplers, tools, recirculation tank, and water tank (inside and out), will be decontaminated before site entry, after

over-the-road mobilization and immediately upon departure from a site after drilling a hole. Supplementary cleaning will be performed before site entry. There is a likelihood that contamination has accumulated on tires and as spatter or dust en route from one site to the next.

- Place contaminated equipment in an enclosure designed to contain all decontamination residues (water, sludge, etc.).
- Steam-clean equipment until all dirt, mud, grease, asphaltic, bituminous, or other encrusting coating materials (with the exception of manufacturer-applied paint) has been removed.
- Water used will be taken from an approved source.
- When cross-contamination from metals is a concern, rinse sampling components such as split spoons, geo-punch stems, and augers with nitric acid, 0.1N.
- Rinse with DIUF water.
- When semi-volatile and non-volatile organics may be present, rinse the sampling components with pesticide-grade solvent methanol.
- Double rinse the sampling components with DIUF water.
- Decontamination residues and fluids will be appropriately managed as IDM per work plan addenda and SOP 80.1.

3.3.2 Well Casing and Screen

Prior to use, well casing and screen materials will be decontaminated. This activity will be performed in the leak proof, decontamination pad, which will be constructed prior to commencement of the field investigation. The decontamination process will include:

- Steam cleaning with approved source water.
- Rinse with DUIF water.
- Air-dry on plastic sheeting.
- Wrap in plastic sheeting to prevent contamination during storage/transit.

3.3.3 Non Dedicated Submersible Pumps Used for Purging and Sampling

- Scrub the exterior of the pump to remove gross (visible) contamination using appropriate brushes, approved water, and non-phosphate detergent (steam cleaning may be substituted for detergent scrub).
- Pump an appropriate amount of laboratory detergent solution (minimum 10 gallons) to purge and clean the interior of the pump.
- Rinse by pumping no less than 10 gallons of approved water to rinse.
- Rinse the pump exterior with approved decontamination water.
- When cross-contamination from metals is a concern, rinse the pump exterior with approved nitric acid 0.1N solution.
- Rinse the pump exterior with DIUF water.
- When semi-volatile and non-volatile organics may be present, rinse the pump exterior with pesticide-grade solvent methanol.

- Double rinse the pump exterior with DIUF water.
- Air-dry on aluminum foil or clean plastic sheeting.
- Wrap pump in aluminum foil or clean plastic sheeting, or store in a clean, dedicated PVC or PTFE storage container.
- Solutions and residuals generated from decontamination activities will be managed appropriately as IDM per work plan addenda and SOP 80.1.

3.3.4 Sample Equipment and Measuring Water Level Devices

- Scrub the equipment to remove gross (visible) contamination using appropriate brush (es), approved water, and non-phosphate detergent.
- Rinse with approved source water.
- When cross-contamination from metals is a concern, rinse the sampling equipment with approved nitric acid 0.1N solution.
- Rinse equipment with DIUF water.
- When semi-volatile and non-volatile organics may be present, rinse the sampling equipment with pesticide-grade solvent methanol.
- Double rinse the sampling equipment with DIUF water.
- Air-dry on aluminum foil or clean plastic sheeting.
- Wrap in aluminum foil, clean plastic sheeting, or zip top bag or store in a clean, dedicated PVC or PTFE storage container.
- Solutions and residuals generated from decontamination activities will be managed appropriately as IDM per work plan addenda and SOP 80.1.

3.3.5 Other Sampling and Measurement Probes

Temperature, pH, conductivity, Redox, and dissolved oxygen probes will be decontaminated according to manufacturer's specifications. If no such specifications exist, remove gross contamination and triple-rinse probe with DIUF water.

5.0 PRECAUTIONS

- Manage IDM appropriately according to the requirements specified in work plan addenda.
- Follow appropriate procedures as specified in the site-specific health and safety plan.

6.0 REFERENCE

USACE. 2001. Requirements for the Preparation of Sampling and Analysis Plans. EM 200-1-3. 1 February.

Appendix C
Laboratory Quality Assurance Plan for Accutest Laboratories

Appendix D
Health and Safety Forms

Form D–1
Revision Form
Building 4343 Interim Measures Work Plan

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 D–2
Worker Acknowledgment Form

Document: Building 4343 Interim Measures Work Plan

Version: Final

Project: Radford Army Ammunition Plant

Location: Cadmium Plating Facility, Building 4343

Prior to the initiation of field activities, I have been given an opportunity to read and question the contents of the Building 4343 Interim Measures Work Plan. 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

Appendix E
Shaw Health and Safety Procedures

Appendix F
Material Safety Data Sheets

Appendix G
Letter of Authority

Shaw Environmental, Inc.
2113 Emmorton Park Rd
Edgewood, MD 21040
410 612 6350
FAX: 410 612 6350

Shaw® Shaw Environmental, Inc.

June 30, 2005

Mr. Erik Zimmers
Shaw Environmental, Inc.
1725 Duke Street
Alexandria, VA 22314

Re: CQC System Manager
USACE District Baltimore EMARC
Radford AAP Interim Measures Removal/Demolition Action,
Contract No. DACW31-03-D-001,
Task Order No. 025

Dear Mr. Zimmers:

This letter will serve as your appointment as the CQC System Manager on the referenced project and will also clarify your duties and authority in this position. In this position, you will be authorized to use available resources to satisfy all applicable quality requirements of the Program and Task Order Plan(s).

This authorization specifically gives you the authority to direct removal and replacement or correction of nonconforming materials or work and stop work authority when continuation would be unsafe to personnel, harmful to the environment, or result in a significant degradation of quality.

You will be expected to work closely with the Project Manager, Interim Measures Task Manager, Site Supervisor, customer and other project personnel, but you will not be directly responsible to anyone but myself for resolution of quality issues when working in your capacity.

If you have any question in this matter, please call me at (609) 584-6840.

Sincerely,

Charles W. Hunter
Shaw Quality Manager

Appendix H
Quality Control Forms

Shaw® Shaw Environmental, Inc.

FINAL INSPECTION FORM

DATE:

Page ___of ___

CONTRACT NO.: DACW31-03-D-001	TITLE AND LOCATION: Building 4343 IM, Radford, Virginia	DELIVERY ORDER NO.:
CONTRACTOR: Shaw Environmental, Inc.	NAME OF SITE SUPERINTENDENT: Steve Kritak	
INSPECTED WORK:		COMPLETION DATE:

PERFORMANCE SPECIFICATION BY CONTRACT DELIVERY ORDER REFERENCE	STATUS OF INSPECTION

On behalf of Shaw Environmental, Inc., I certify that the work inspected is complete and meets the performance specifications cited above and that all material and equipment used and work performed was completed in accordance with approved plans and work instructions and meets contract delivery order requirements.

_____ _____

QC Officer Date

Shaw® Shaw Environmental, Inc.

INITIAL INSPECTION

Contract No: DACW31-03-D-001	Date:
Definable Feature of Work:	Specification References:
CQC System Manager: Erik Zimmers	Project Manager: Jeff Parks
Notifications:	

I. Personnel Present

Name	Position	Affiliation

II. Preparatory Inspection

Verify full compliance with procedures identified at preparatory inspection. Coordinate plans, specifications, and submittals.

Comments:

III. Preliminary Work

Is all preliminary work complete and correct?

If not, what action is taken?

IV. Level of Workmanship

Where is work located?
Is a sample panel required?
Will the initial work be considered as a sample?

V. Discrepancies

Are there any discrepancies between planned and actual conditions and/or practices? If so, explain the discrepancies and actions taken.

VI. Safety

Review job conditions against governing safety documents (e.g. HASP, USACE EM 385-1-1) and job hazard analysis.

Shaw® Shaw Environmental, Inc.

INSPECTION SCHEDULE AND TRACKING FORM

Project: Building 4343 IM	Project Manager: Jeff Parks	CQC System Manager: Erik Zimmers

Reference No.	Definable Feature of Work	Preparatory		Initial		Follow-up		Completion		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

Shaw Environmental, Inc.

PREPARATORY INSPECTION

Contract No:	Date:
Definable Feature of Work:	Specification Reference: NA
CQC System Manager: Erik Zimmers	Project Manager: Jeff Parks
Notifications:	

I. Personnel Present

Name	Position	Affiliation

Shaw Environmental, Inc.

PREPARATORY INSPECTION

II. Submittals

Have all submittals been approved? If not, what items have not been submitted? The site Work Plan rewrite will be submitted for review and approval.
Are all materials on hand? If not, what items are missing?
Do approved submittals correspond to delivered materials? All delivered materials have been inspected to be in accordance with the Procurement Requisition. No discrepancies have been noted. If not, what discrepancies are found?

III. Material Storage

Are materials stored properly? If not, what action is taken?

IV. Specifications

Required Action	Comments
Review each paragraph of specifications.	
Discuss procedure for accomplishing work.	
Clarify any differences.	

Shaw Environmental, Inc.

PREPARATORY INSPECTION

V. Preliminary Work Permits

Ensure preliminary work is correct and permits are on file. If not, what action is taken?

VI. Testing

Is test plan complete and accurate? If not, what action is taken?
Has each testing organization been approved? If not, what action is taken?

VII. Safety

Review applicable portion of governing safety document (e.g., USACE EM 385-1-1).
Activity Hazard Analysis approved?

VIII. Client Comments

CQC System Manager Signature/Date:

Shaw® Shaw Environmental, Inc.

PREPARATORY INSPECTION

NCR Number	Date of Issue	Subject	Responsible organization	Impact on Other Activities	Date of Disposition Approval	Date of Corrective Action Verification	Remarks

Shaw® Shaw Environmental, Inc.

PREPARATORY INSPECTION

Shaw Environmental, Inc. **NONCONFORMANCE REPORT**	NCR Report No. Date:
Project:	Delivery/Task Order No.
Feature of Work:	Responsible Organization: (Shaw E&I, Subcontractor, Supplier, etc.)
References: (Specification, Drawing, Procedure, incl. rev.)	
Description of Nonconforming Condition:	
Organization Code:_____ Inspection Code:_____ Nonconformance Cause Code:_____	
Disposition Category: Rework Repair Use-As-Is Return to Vendor Scrap/Reject	
Disposition & Corrective Action:	

NCR Initiated By:_____ Date:
QC Representative

Disposition and Corrective Action Provided By:_____ Date:_____.
Shaw Engineer / Responsible Organization

Disposition and Corrective Action Approved By:_____ Date:_____.
Project Manager

Disposition and Corrective Action Completed By:_____ Date:_____.
Responsible Organization

Disposition and Corrective Action Verified By:_____ Date:_____.
QC Representative

Shaw® Shaw Environmental, Inc.

Nonconformance Report Form Instructions:

Initiator: Complete the upper portion of the report by providing the following information:

NCR Report Number - Unique NCR number per procedure (e.g. 97-19656-01).
Date - Date that the Nonconforming Condition was detected.
Project - Name of the Project.
Delivery / Task Order Number - Delivery / Task Order number applicable to project work.
Feature of Work - Actual feature of work i.e. Soil/concrete placement, pump installation, etc.
Responsible Organization - Organization responsible for the nonconformance.
References - Source requirements in which the condition is nonconforming to.
Description Of Non-conforming Condition - Complete description of the condition supplemented by photographs, sketches, reports and other documents.
Organization Code - See below
Inspection Code - See Below
Cause Code - See Below

Provide signature and issue date at the bottom of the form

Organization Codes:

001 Engineering/Design
002 Vendor/Supplier
003 Operations
004 Subcontractor
005 Quality Control
006 Field Sampling/Analytical
007 Purchasing
008 Project Management
009 Health & Safety
010 Program Management

Inspection Codes:

100 Receipt Inspection
200 In-process Inspection (incl. Preparatory, Initial or Follow up)
300 Completion / Final Inspection

Nonconformance Codes:

101 Indeterminate
102 Inadequate Documentation
103 Inadequate Plan/Procedure
104 Failure to Follow Plan/Procedure
105 Fails to meet Specification
106 Fails to meet Drawing Dimensions
107 Damage
108 Improper Handling, Storage, or Shipping
109 Poor Workmanship
110 Incomplete Work Performance
111 Test Failure
112 Poor Maintenance

Disposition Category: To be checked by the individual responsible for providing both disposition and corrective action. Check the appropriate box.

Corrective Action: Provide a complete corrective action that will ensure that the condition will be made to meet the disposition requirements. Corrective action shall include identification of the cause, steps to be taken to correct the condition, and steps to be taken to preclude recurrence, where possible. Use attachments where necessary.

Responsible Organization: Complete the corrective action as describe in the corrective action portion of the form and its attachments. Sign and date the Disposition and Corrective Action Completed By line at the bottom portion of the form.

Disposition & **Corrective Action Verification:** Disposition and Corrective Action will be verified by QC Representative. Once verification is considered complete and acceptable the QC Representative will sign and date the Disposition and Corrective Action Verified By line at the bottom of the form indicating closure of the report.

Shaw Environmental, Inc.

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Building 4343 IM Report No. _____

Contract No. DACW31-03-D-001 CTO No. _____ Date: _____

Number of Manhours worked onsite through today

WEATHER: ☐ Clear ☐ P. Cloudy ☐ Cloudy Wind _____

Temperature: High _____ Low _____

Precipitation: Today None Previous Period (e.g., weekend) _____

Site Conditions: Dry

Lost Time Due to Inclement Weather: _____ %

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:
(Include number, trade, hours, employer, location, and description of work)

a.

WORK PERFORMED (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attach subcontractor daily activity reports when applicable):

1.

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier).

RESULTS OF SURVEILLANCE: (Include satisfactory work completed or deficiencies with action to be taken)

a. Preparatory Inspection: (Attach minutes)

b. Initial Inspection: (Attach minutes) See attached Initial Inspection Form

c. Follow-Up Inspection: (List results of inspection compared to specification requirements.)

d. Final Inspection:

e. Completion Inspection: (USACE)

f. Safety Inspection:(Include safety violations and corrective actions taken.)

OFF-SITE SURVEILLANCE ACTIVITIES:(Include action taken)

QC TESTS PERFORMED AND RESULTS: (As required by plans and/or specifications.)

1.

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by IT on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [e.g., scope of work and/or drawings], delays to the project attributable to site, and weather conditions, etc)

SUBMITTALS REVIEWED: (Include submittal number, specification reference, and name of submitter.)

1.

Shaw Environmental, Inc.

DAILY CONSTRUCTION QUALITY CONTROL REPORT

MEETINGS: (List the meetings, e.g., Health and Safety, Site Operations, Cost/Schedule, etc.)

VISITORS: (See attached visitors log)

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.)

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Attachments:

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above:

Construction QC System Manager

Shaw Environmental, Inc.

CORRECTIVE ACTION REQUEST

CAR Number:_____ Date Issued:_____.
Subject:_____.
Responsible Organization:_____ Location:_____ Project Number:
_____

Reference Requirement(s):

Description of Condition:

Classification: Significant ? Yes_____ No_____ (If Yes, Corrective Actions 1, 2, 3, & 4 Below Apply)
Stop Work Warranted ? Yes_____ No_____.

Corrective Action Required:

1. Remedial Action Required (always) Yes__X__ No_____.
2. Root Cause Determination Yes_____ No_____.
3. Action to Prevent Recurrence Yes_____ No_____.
4. Action Regarding Similar Work Yes_____ No_____.

Response Due Date:_____.

Initiator:_____ Date:_____.

Proposed Corrective Action:

Proposed Completion Date:_____.

Responsible Individual:_____ Date:_____.

Evaluated By:_____ Date: _____.

Completed Corrective Action Verification & Closure:

Verification Method:

Verifier:_____ Date:_____.

Shaw

CORRECTIVE ACTION REQUEST TRACKING & STATUS LOG

Shaw Environmental, Inc.

CAR No.	Date Issued	Subject	Response Due Date	Date Evaluated	Date Completed	Date Verified

CAP NUMBER:	
[ ] FYI	[ ] APPROVAL REQ'D

CORRECTIVE ACTION PLAN

1. CAP number is lowest corresponding CAR number. Designate revisions with original CAP number followed by consecutive letter.
2. Attach clarifications and additional information as needed. List attached material in appropriate section of the CAP.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE.

CONTRACT: DACW31-03-D-001	PROJECT: Building 4343 IM	
PROJECT MANAGER: Jeff Parks	QUALITY MANAGER: Charles Pete Hunter	
CAR NO(S) & DATE(S) ISSUED:		
DEFICIENCY DESCRIPTION & LOCATION:		
RESULTS OF ROOT CAUSE ANALYSIS:		
PLANNED ACTIONS 1, 2. 3.	ASSIGNED RESPONSIBILITY	COMPLETION DUE DATE
PROJECT MANAGER SIGNATURE:		DATE:

PART B: TO BE COMPLETED BY ISSUING AGENT OR DESIGNEE.

CAP REVIEWED BY:	DATE:
REVIEWER COMMENTS:	
CAP DISPOSITION: (CHECK ONLY ONE & EXPLAIN WHERE NEEDED) [ ] APPROVED WITHOUT STIPULATIONS [ ] APPROVED WITH STIPULATIONS: [ ] APPROVAL DELAYED, FURTHER PLANNING REQUIRED:	
AUTHORIZED BY (PRINTED NAME & TITLE): SIGNATURE:	DATE: