Final Environmental Impact Statement

Muscle Shoals Reservation Redevelopment

Prepared by: Tennessee Valley Authority, November 2011

VOLUME II

Front Cover:

Chemical Plant with Wilson Dam in background - undated.

Inset:

Greenbrier Street, Industrial Village, United States Nitrate Plant #2, Muscle Shoals, Alabama.

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FINAL ENVIRONMENTAL IMPACT STATEMENT

MUSCLE SHOALS RESERVATION REDEVELOPMENT

Colbert County, Alabama

VOLUME II

APPENDICES

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

NOVEMBER 2011

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APPENDIX A – MEMORANDUM OF AGREEMENT BETWEEN TVA AND ALABAMA STATE HISTORIC PRESERVATION OFFICER FOR THE DISPOSAL OF LAND

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Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

July 27, 2011

Mr. Frank White
Executive Director and SHPO
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Mr. White:

MEMORANDUM OF AGREEMENT (MOA) BETWEEN THE TENNESSEE VALLEY AUTHORITY (TVA) AND THE ALABAMA STATE HISTORIC PRESERVATION OFFICER (AL SHPO) FOR THE TRANSFER OF 1400 ACRES OF FEDERAL PROPERTY AT THE MUSCLE SHOALS RESERVATION – COLBERT COUNTY, ALABAMA – AHC 2008-0002

Enclosed for your signature is one copy of the subject MOA, accompanied by three additional signatory pages. TVA has consulted with your office during the development of the MOA for the resolution of adverse effects to properties eligible for listing in the National Register of Historic Places.

Please sign the enclosed documents as indicated and return to the office of cultural compliance at the address above. If you have questions or comments regarding the MOA, please contact Jon Riley in Muscle Shoals, Alabama, at (265) 386-2750 or by email at jcriley@tva.gov.

Sincerely,

Susan J. Kelly
Senior Manager
Federal Determinations

Enclosures

MEMORANDUM OF AGREEMENT
PURSUANT TO 36 CFR PART 800 BETWEEN THE TENNESSEE VALLEY AUTHORITY
AND THE ALABAMA STATE HISTORIC PRESERVATION OFFICER
FOR THE DISPOSAL OF LAND ON THE TENNESSEE VALLEY AUTHORITY'S
MUSCLE SHOALS RESERVATION
COLBERT COUNTY, ALABAMA

WHEREAS the Tennessee Valley Authority (TVA) proposes the disposal of approximately 1,400 acres of land on TVA's Muscle Shoals Reservation (MSR) in Colbert County, Alabama (the undertaking); and,

WHEREAS the federal property on the MSR that is the subject of this undertaking (hereinafter the MSR property) includes the area bounded by Second Street to the South, Hatch Boulevard to the West, Wilson Dam Road to the East, and is generally bounded by Reservation Road to the north with the exception of two areas surrounding TVA's Western Area Radiological Building and TVA's Multi-Purpose Building Complex; and,

WHEREAS TVA, in consultation with the Alabama State Historic Preservation Officer (AL SHPO), has determined the area of potential effects (APE), as that term is defined in 36 CFR § 800.16(d), for this undertaking to be the approximately 1,400 acres proposed for transfer; and,

WHEREAS TVA has documented the boundary of that APE on topographic maps attached to this Memorandum of Agreement (MOA) and made a part of it by reference as Appendix A; and,

WHEREAS TVA, in consultation with the Alabama State Historic Preservation Office (AL SHPO), has found that 51 historic properties eligible for listing in the National Register of Historic Places (NRHP) are located within the boundary of the APE. These eligible properties are enumerated in Appendix B and shown on a topographic map as Appendix C, both made a part of this MOA by reference; and,

WHEREAS consistent with the documentation standards in 36 CFR § 800.11(e), TVA has provided to the AL SHPO and other consulting parties, documentation of the adverse effect this undertaking may have on the aforementioned eligible historic properties; and,

WHEREAS archaeological site identification and evaluation studies have been conducted and there are no known prehistoric archaeological sites eligible for listing in the NRHP and no known Native American sacred sites or human remains within the APE; and,

WHEREAS the cities surrounding the MSR property, including the cities of Florence, Muscle Shoals, Sheffield, and Tuscumbia, have expressed interest in redevelopment of the MSR property and the redevelopment of such property is consistent with TVA's economic development mission; and,

WHEREAS the former United States Nitrate Plant No. 2 (hereinafter USNP2) was built during World War I on the MSR property, but following the war was idle until the creation of TVA in 1933 (hereinafter this general period from World War I until 1933 is referred to as the "first architectural period," being generally defined as those buildings constructed in the industrial Army vernacular style and having the following character defining features: precast concrete

sills and lintels, low slope roofs with monitor and clerestory, hollow clay tile masonry with brick quoins, exposed structural steel framing, and hopper windows); and,

WHEREAS the USNP2 became, upon the creation of TVA in 1933, the nucleus of the Agency's National Fertilizer Development Center (NFDC); and,

WHEREAS the fertilizer development and production operations at NFDC were scaled back in 1990 and by 1998 had largely ceased (hereinafter the general period from 1933 to 1998 is referred to as the "second architectural period," being generally defined as those buildings constructed in the international style and having the following character defining features: linear rectangular massing, flat roofs, asymmetrical façades, windows which are set flush with the outer walls, and precast concrete window surrounds); and,

WHEREAS the cities and counties surrounding the MSR property, including the cites of Florence, Muscle Shoals, Sheffield, Tuscumbia, and Colbert and Lauderdale Counties, joined together to create the Northwest Alabama Cooperative District (NACD) pursuant to Alabama Code § 11-99B, and the NACD and the Historic Sheffield Commission have been provided the opportunity to review this MOA; and

WHEREAS TVA will retain ownership and monitoring responsibility of approximately 64 acres of land designated as solid waste management units, and these areas are shown as excluded from the MSR in topographic maps attached to this MOA and made a part of it by reference as Appendix A; and

NOW, THEREFORE, TVA and AL SHPO agree that the undertaking shall be implemented in accordance with the following stipulations to satisfy TVA's responsibilities under Section 106 of the National Historic Preservation Act (NHPA). TVA's Federal Preservation Officer, or the designee thereof, shall act for TVA in all matters concerning the administration of this Agreement.

STIPULATIONS

TVA shall ensure that the following stipulations are implemented:

1. INVENTORY AND CURATION OF ALL ORIGINAL RECORDS

TVA shall inventory all original records associated with the design, construction, and operation of the USNP2, and all NFDC facilities, comprised of buildings of the first and second architectural periods. Additionally, TVA shall catalog these records in a searchable electronic database. TVA shall provide the original materials and the database to the Special Collections Department of Collier Library at the University of North Alabama so that these records are curated consistent with the standards in 36 CFR Part 79. TVA shall complete the cataloging tasks associated with Stipulation 1 within two (2) years of the effective date of this MOA.

2. PREPARATION OF HISTORIC DISTRICT NOMINATION FORMS

TVA shall prepare a NRHP Registration Form (NPS 10-900) for the USNP2/NFDC Historic District. The nomination form and supporting information shall be prepared by individuals who meet the professional qualification standards as published in the Secretary of the Interior's (Secretary) *Standards and Guidelines for Archaeology and Historic Preservation*. TVA shall complete the task associated with Stipulation 2 and submit the Registration Form to the Alabama Historical Commission and the Keeper of the NRHP prior to the transfer of the MSR property, in whole or in part. TVA shall submit an annual report updating the status of this stipulation to the consulting parties.

3. COMPREHENSIVE PLAN, DESIGN GUIDELINES, AND ARCHITECTURAL CONTROLS

A comprehensive master plan for the redevelopment of the MSR Property (hereinafter Redevelopment Plan) will be formulated and developed by TVA in partnership with the NACD and/or other appropriate local governments or development entities, with opportunities for public input and with input from the AL SHPO. The Redevelopment Plan shall include design guidelines for new construction located within a reasonable distance from those buildings listed in Appendix B as being associated with Stipulation 3, requiring any such construction to be compatible with the massing, size, scale, and character that define architectural features of the first and second architectural periods. Additionally, the Redevelopment Plan shall incorporate architectural controls for those buildings listed in Appendix B as being associated with Stipulation 3, based on the Secretary's *Standards for the Treatment of Historic Properties* as defined in 36 CFR Part 68. These design guidelines and architectural controls will be made a part of any instrument that transfers the property out of federal ownership and will be enforceable by TVA and/or potentially by appropriate local government(s) or local historic commissions. TVA shall complete the tasks associated with Stipulation 3 prior to the transfer of the MSR property, in whole or in part. TVA shall submit an annual report updating the status of this stipulation to the consulting parties.

4. DOCUMENTATION OF PROPERTIES NOT ADDRESSED IN STIPULATION 3

TVA shall prepare documentation equivalent to Historic American Building Survey Level II for those properties identified in Appendix B as being associated with Stipulation 4. This level of documentation shall include:

a. Selected existing drawings of primary plans, elevations, and details in digital format and printed as ink on archival material; and,

b. Selected photographs of each principal elevation and all significant interior spaces in digital format with large format negatives and 8"X10" archival prints; and,

c. Selected history and description of each building (one page) printed as ink on archival paper.

TVA shall curate any documentation produced as a result of this stipulation with the Special Collections Department of Collier Library at the University of North Alabama. TVA shall complete the tasks associated with Stipulation 4 within two (2) years of the effective date of this MOA.

5. CONDITION SPECIFIC ASSESSMENTS

Until such time as all properties listed in Appendix B and referenced in Stipulation 3 have been transferred from federal ownership in accordance with the terms of this agreement, TVA will provide architectural and structural condition assessments, including information on the status of the project and property disposal, every three (3) years to the signatories to enable them to verify implementation of the terms of this MOA and to determine whether amendments are required.

6. ORAL HISTORY OF WILSON VILLAGE NO. 2

Historic archaeological sites 1CT500 and 1CT575 have been identified as the remains of Wilson Village No. 2 and are eligible for listing in the NRHP. The proposed undertaking will have an adverse effect on sites 1CT500 and 1CT575. Both archaeological sites have had extensive survey and recordation. To augment the archaeological and documentary information on Wilson Village No. 2, TVA will collect oral histories from a sample of the remaining inhabitants of Wilson Village No. 2. These oral histories shall be transcribed and collated into a descriptive report within two (2) years of the effective date of this MOA and curated with the Special Collections Department of Collier Library at the University of North Alabama.

7. TRANSFER OF PROPERTY FROM FEDERAL OWNERSHIP

In any document produced in connection with the sale or transfer of the MSR property, such as: the preliminary Request for Interest, Request for Proposal, or other bid solicitation, TVA shall include the following information:

a. Information on the history of the MSR property and the first and second architectural periods, including detailed information on character defining features;

b. Information on known applicable federal, state, and local tax incentives for the re-development of historic properties;

c. Information indicating that the design guidelines and architectural controls specified in the Redevelopment Plan will be included as part of the transfer instrument as restrictions and/or covenants.

In developing the above referenced information, TVA shall solicit the advice and assistance of the AL SHPO.

8. CHANGES IN PROJECT SCOPE

Should TVA change the project scope subsequent to the execution of this MOA, TVA, in consultation with the AL SHPO, will assess the APE and revise if applicable, identify and

evaluate any new historic properties within that revised APE (or properties not otherwise addressed under this MOA), and further consult with AL SHPO to assess project related effects to any historic properties determined eligible for listing in the NRHP and to resolve any adverse effect.

9. ADMINISTRATIVE CONDITIONS

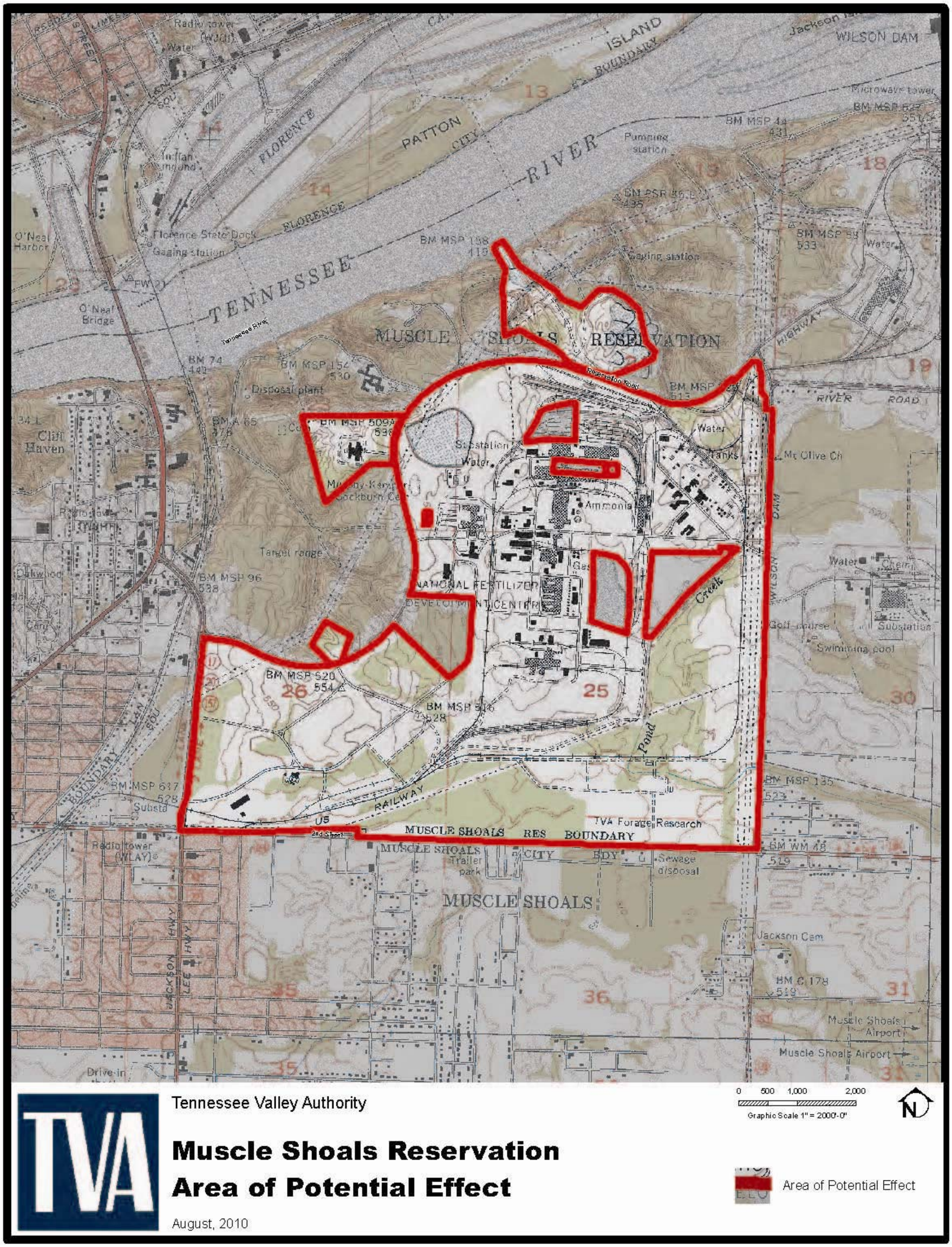
a. If TVA has not implemented stipulations 1 through 6, in whole or in part, within ten (10) years from the date of this MOA's execution, the parties shall discuss an extension to this MOA. If agreement cannot be reached on an extension, this MOA shall be terminated. Upon termination of this MOA, TVA and the AL SHPO will resume consultation pursuant to 36 CFR §§ 800.3 through 800.7 to resolve any adverse effects upon historic properties resulting from the undertaking.

b. The signatories of this MOA may agree to amend the terms of the MOA. Such amendment will take the form of an Amended MOA, and it shall be effective upon being signed by TVA and the AL SHPO. This MOA will be appended as an attachment to the Amended MOA.

c. Should the AL SHPO object within thirty (30) days after receipt of any documents provided for review pursuant to this MOA, TVA shall consult with AL SHPO to resolve the objection.

d. If signatories to this MOA object on the basis that the terms of this MOA cannot be carried out, or are not being carried out, the signatories shall consult to seek an amendment to the MOA that will resolve this objection. Signatories may terminate the MOA by giving written notice to TVA thirty (30) days prior to such termination. TVA shall either execute a new MOA pursuant to 36 CFR § 800.6(c) or request the comments of the Advisory Council on Historic Preservation pursuant to 36 CFR § 800.7(a).

The execution of this MOA by TVA and AL SHPO, and implementation of its terms, evidence that TVA has taken into account the effects of the undertaking on historic properties, and TVA has complied with its obligations under Section 106 of the NHPA.



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MOA APPENDIX A - AREA OF POTENTIAL EFFECT

APPENDIX B

MSR BUILDINGS AND STRUCTURES ELIGIBLE FOR LISTING IN THE NRHP

LINE ITEM NO.	RESOURCE NAME	TVA BUILDING/ STRUCTURE NO.	ASSOICATED WITH MOA STIPULATION 3	ASSOCIATED WITH MOA STIPULATION 4
1	CHEMICAL FEED HOUSE	01A	**YES**	NO
2	FILTER BUILDING	01B	NO	**YES**
3	OLD FILTRATION BUILDING	01C	NO	**YES**
4	RESERVOIR PUMPING STATION	01D	NO	**YES**
5	WATER TANK	02	NO	**YES**
6	DRUM STORAGE AREA BUILDING	05	NO	**YES**
7	R/M LAB	06	NO	**YES**
8	POWER SERVICE SHOP NO. 2	16	**YES**	NO
9	ENVIRONMENTAL RESEARCH CENTER BLDG.	17A	**YES**	NO
10	SERVICE BUILDING	17B	**YES**	NO
11	OLD MEDICAL BUILDING	21	**YES**	NO
12	L/N BUILDING	22	**YES**	NO
13	WAREHOUSE Z	25	**YES**	NO
14	CHEMICAL PLANT WAREHOUSE	35	**YES**	NO
15	MACHINE SHOP	37	**YES**	NO
16	ENGINEERING LAB	39	**YES**	NO
17	SHEETMETAL SHOP	41	**YES**	NO
18	PIPE SHOP	42	**YES**	NO
19	PROJECT OPERATIONS BATH HOUSE	44	**YES**	NO
20	PILOT PLANT BUILDING	47	NO	**YES**

APPENDIX B

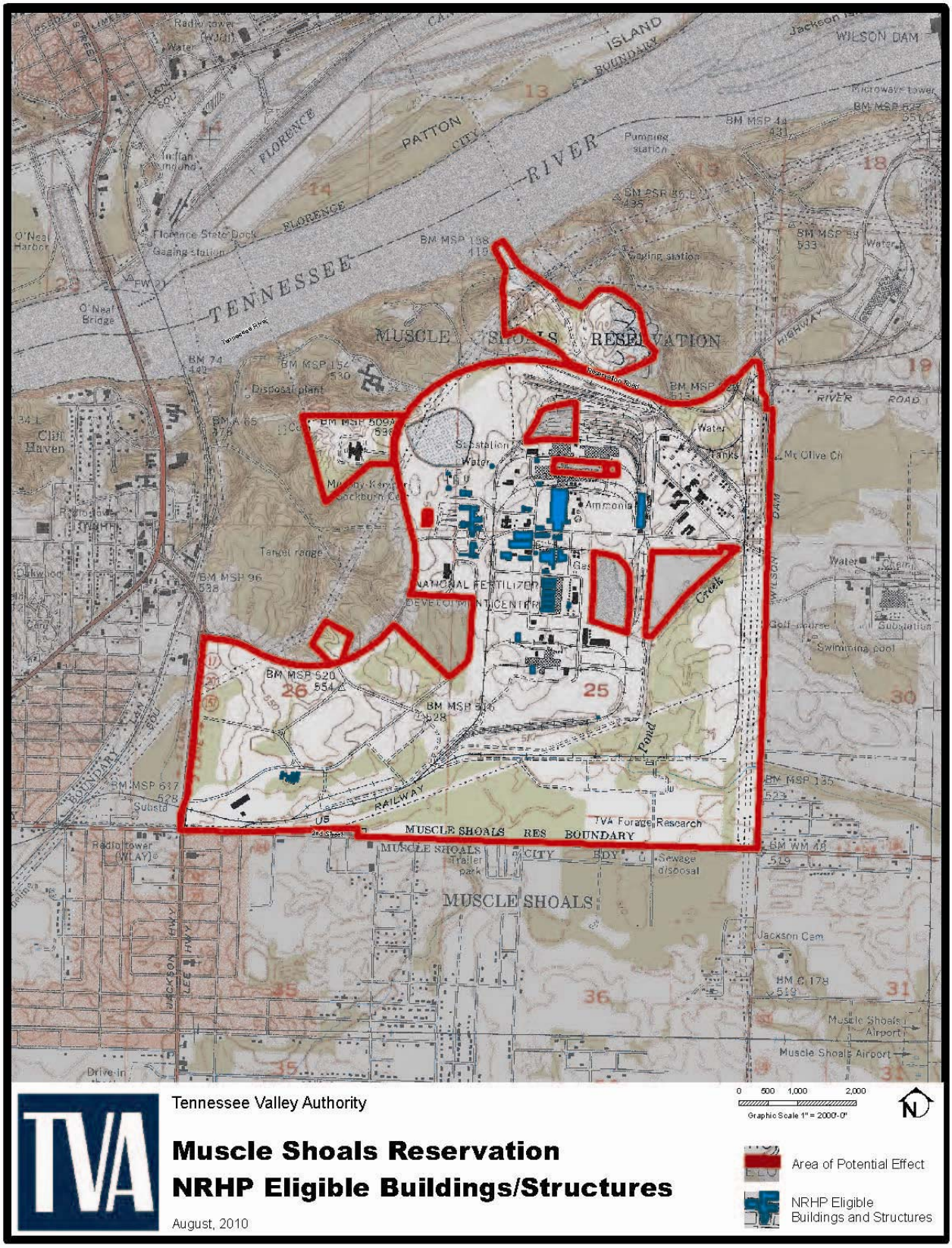
MSR BUILDINGS AND STRUCTURES ELIGIBLE FOR LISTING IN THE NRHP

LINE ITEM NO.	RESOURCE NAME	TVA BUILDING/ STRUCTURE NO.	ASSOICATED WITH MOA STIPULATION 3	ASSOCIATED WITH MOA STIPULATION 4
21	PAINT STORAGE BUILDING	48	NO	**YES**
22	AUTOCLAVE BUILDING	50	NO	**YES**
23	TIN SHOP	53	**YES**	NO
24	GRINDING BUILDING	54	NO	**YES**
25	BOILER HOUSE AND STACK	56	**YES (STACK)**	NO
26	SUBSTATION NO. 2	57	**YES**	NO
27	SUBSTATION NO. 4	68	**YES**	NO
28	SUBSTATION NO. 5	72A	**YES**	NO
29	SUBSTATION NO. 6	74A	**YES**	NO
30	CATALYZER BUILDING NO. 1	69	**YES**	NO
31	CATALYZER BUILDING NO. 2	70	**YES**	NO
32	CATALYZER BUILDING NO. 3	71	**YES**	NO
33	CATALYZER BUILDING NO. 4	72	**YES**	NO
34	CATALYZER BUILDING NO. 5	73	**YES**	NO
35	CATALYZER BUILDING NO. 6	74	**YES**	NO
36	NITRIC ACID STORAGE TANK 1	76A	NO	**YES**
37	NITRIC ACID STORAGE TANK 2	76B	NO	**YES**
38	3A BUILDING	79	**YES**	NO
39	5A BUILDING	81	**YES**	NO
40	GREEN HOUSE COMPLEX - HEAD HOUSE	118A	**YES**	NO

APPENDIX B

MSR BUILDINGS AND STRUCTURES ELIGIBLE FOR LISTING IN THE NRHP

LINE ITEM NO.	RESOURCE NAME	TVA BUILDING/ STRUCTURE NO.	ASSOICATED WITH MOA STIPULATION 3	ASSOCIATED WITH MOA STIPULATION 4
41	GREEN HOUSE COMPLEX - GREENHOUSE 1	118B	**YES**	NO
42	GREEN HOUSE COMPLEX - GREENHOUSE 2	118C	**YES**	NO
43	GREENHOUSE COMPLEX - GREENHOUSE 3	118D	**YES**	NO
44	GREENHOUSE COMPLEX - PERIPHERAL STR. 1	118E	NO	**YES**
45	GREENHOUSE COMPLEX - PERIPHERAL STR. 2	118F	NO	**YES**
46	GREENHOUSE COMPLEX - PERIPHERAL STR. 3	118G	NO	**YES**
47	GREENHOUSE COMPLEX - PERIPHERAL STR. 4	118F	NO	**YES**
48	CUBA YARD RR SCALE HOUSE	93	NO	**YES**
49	SIDEWALKS	N/A	NO	**YES**
50	FLUME, WATER PLANT	N/A	NO	**YES**
51	BUS BAR TERMINAL	N/A	**YES**	NO



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MOA APPENDIX C - NRHP ELIGIBLE BUILDINGS AND STRUCTURES

SIGNATORIES:

TENNESSEE VALLEY AUTHORITY

By: Anda A Ray Date: 7/22/11

Anda A. Ray, Senior Vice President and Senior Policy Official, Environment and Technology

Muscle Shoals Reservation Land Disposal

THE ALABAMA STATE HISTORIC PRESERVATION OFFICER

By: _____, Deputy Date: September 9, 2011

Frank White, Executive Director and Alabama State Historic Preservation Officer

CONCURRING PARTY

THE NORTHWEST ALABAMA COOPERATIVE DISTRIC

By: _____ Date: 10-13-11

David H. Bradford, Chairman

APPENDIX B – PUBLIC COMMENTS ON DRAFT EIS AND TVA RESPONSES

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Response to Public Comments

The draft environmental impact statement (draft EIS) was issued to the public on January 5, 2011, and the notice of its availability was published in the *Federal Register* on January 14, 2011. This initiated a 45-day public comment period ending on February 28, 2011. Printed copies and/or compact discs (CDs) containing electronic files of the document were mailed to state and federal agencies and federally recognized tribes. Others on the project contact list were mailed or e-mailed notifications of the availability of the document and were instructed how to submit comments. The draft EIS was also available on TVA's Web site for review. One hundred and forty agencies, businesses, organizations, and individuals commented on the draft EIS via commercial mail, e-mail, Internet, facsimile, and verbal statements.

TVA held a public meeting in Muscle Shoals, Alabama, on February 3, 2011, where the public had the opportunity to question TVA staff about the content of the draft EIS and to submit comments. About 80 individuals registered and participated in the meeting. This appendix summarizes the public's relevant comments on the draft EIS and provides TVA's responses to those comments.

Analysis of Comments

TVA received 146 comment submissions from 140 commenters. TVA carefully reviewed all comment submissions and identified the specific comments about the draft EIS in each of them. Specific comments received in different comment submissions that addressed the same issues and concerns were synthesized into comment statements. When a unique issue was raised in a comment, that unique issue appears as a separate comment statement even if the remainder of the comment is included in synthesized comment statements. The result of this analysis and synthesis process is a list of 186 individual comment statements. TVA has considered all of the substantive comments it received on the draft EIS and has either responded to them as set forth below or modified the text of the final EIS as appropriate. The comments and responses are categorized into 26 different topics. Many of these topics are further categorized into different issues.

The majority of the commenters did not state a preference for how they felt the land should be used in the future. Nineteen individuals stated a preference that the property be developed because of its potential to promote employment growth in the community. Some individuals stated a preference for certain alternative land uses evaluated in the draft EIS, while others mentioned a variety of concerns. Among those that stated a preference, the number of individuals desiring implementation of a particular alternative or type of future land use was mixed (see Comment Statements 6 through 13). Eleven individuals stated a preference for Alternative A; 10 individuals stated a preference for Alternative B; and 12 individuals stated a preference for Alternative E.

Other commenters expressed concerns about TVA's purpose and need for the proposal; effects on certain environmental resources, including wildlife, woodlands, wetlands, aesthetics, and historic buildings and structures; health and safety associated with solid and hazardous waste management; socioeconomics and environmental justice; specific future land uses; the role of the Comprehensive Master Plan (Master Plan) and how and when it would be developed; and the adequacy of the review. Two organizations, The American Chestnut Foundation and the Tennessee Valley Career Technology Center, made specific proposals for use of certain portions of the Muscle Shoals Reservation study area, and numerous citizens offered support for those proposals. Agencies expressed concerns

about effects on environmental resources, lack of details about future land uses, cumulative effects analysis, and public health and safety.

The individuals, businesses, organizations, and agencies that commented on the draft EIS are listed in Table 1. The table lists each commenter alphabetically and identifies the comment statement or statements attributed to the commenter. The identifiers for the comment statements are associated with each comment statement in the section immediately preceding the table. The actual letters, e-mails, facsimiles, and transcripts of verbal statements have been included in the administrative record.

Muscle Shoals Reservation Redevelopment Comment Response Report

Air Quality

1. Section 4.8.1 should discuss the positive impact the MSR study area's natural areas, especially its woodlands, has on local air quality. (*Commenter: Charles L. Rose - Shoals Environmental Alliance [SEA]*)

Response: The air quality in the vicinity of the Muscle Shoals Reservation (MSR) study area is generally good. Table 3-13 shows the results of ambient air quality monitoring of criteria pollutants that are considered representative of the site. Colbert County is currently in attainment for all criteria pollutants. It is recognized that the MSR study area, especially the woodlands, in its present state has a positive influence on local air quality. Vegetated areas, particularly large forests, can serve as potential sinks for the storage of carbon dioxide (CO_2), moderating the potential effects of global climate change (see Section 4.8 of the final EIS). In Section 4.8.2, Effects on Local Climatology, TVA acknowledges that the potential for perceptible impacts of MSR redevelopment on local climate could come directly from changes in the land surface. Within about 1 kilometer (1.6 miles) of the reservation, increases in buildings and pavement could contribute to warming of the surface due to greater absorption of solar radiation during the day, longer retention of the absorbed heat during the night, and the increase in waste heat released near the ground from building energy use. Other energy use by industrial equipment also generates waste heat. These various factors contribute to the “urban heat island” effect that causes large urban centers to be consistently warmer than their rural outskirts. Therefore, any redevelopment that increases the near-surface energy balance will lead to a local warming effect. The opposite effect, positive impact, is possible if MSR redevelopment were to lead to greater vegetation cover, especially forest cover.

2. As stated in the draft EIS in Section 3.8.2, development activities contribute to greenhouse gases (GHG) while parks and open land act as sinks for CO_2 storage. If TVA is really serious about its Environmental Stewardship mission it would leave the natural areas of the MSR study area alone. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. As discussed in Section 4.8.2 of the final EIS, increased vegetation cover is being considered by major cities in an effort to reduce cooling demand during the summer (to reduce power usage, GHG emissions, and air pollution formation). Thus, if vegetation cover were to increase from redevelopment, then it could have a small beneficial effect on both the local climate (providing a cooling effect in summer) and could be a new source of CO_2 removal. This could be taken into account through urban planning associated with development of the comprehensive Master Plan.

3. Section 4.8.2 of the draft EIS states 'Global atmospheric levels of GHGs would not be changed by any detectable amount by implementation of any of the alternatives.' This may be true, but does it mean that we should never consider the effect of local development on global warming? (*Commenter: Charles L. Rose - SEA*)

Response: The effect of local development on global warming is described in Section 4.8.2 in the final EIS. The greenhouse gas emissions from local developments, such as the proposed redevelopment of the MSR, are one of many sources, which while individually small, cumulatively contribute to climate change.

4. The final EIS should include additional analysis of the potential air quality impacts under Alternative C. The transportation section provides trip estimations in Table 4-5, which should be used with the emission factors to determine the amount of CO_2 emissions estimated for this Alternative. If truck traffic and emissions associated with other activities are accounted for, it is not unreasonable to conclude that the greenhouse gas emissions could easily be more than the indicator value of 25,000 metric tons per year. (*Commenter: Larry Gautney*)

Response: Final EIS Table 4-2 provides emission estimates for passenger vehicles as an annual average. Final EIS Table 4-4 provides estimates on daily trip totals, which does not necessarily equate to one additional vehicle per trip. For example, several trips can be generated per vehicle. Due to the inconsistency in the comparisons (i.e., vehicles vs. trips and annual averages vs. daily totals), direct correlations cannot be made. A more detailed analysis would require either speculation on the anticipated number of additional vehicles that would be in the study area or definitive data with regard to additional vehicle miles traveled due strictly to the proposed alternatives, neither of which is known at this time. Even if a direct correlation could be made from final EIS Tables 4-2 and 4-4, it would not be reasonable to conclude that the greenhouse gas emissions related to each proposed alternative could be more than the 25,000 metric tons per year based on the estimated totals found in final EIS Table 4-4.

Aquatic Resources

5. Section 4.14.1 states, 'No direct, indirect, or cumulative impacts to aquatic resources (including state- and federally listed species) are likely to result from upland development of the MSR study area.' How can this be known since no one knows what kind of industry will be developed on the MSR study area? (*Commenter: Charles L. Rose - SEA*)

Response: TVA sale deeds include a requirement that all land-disturbing activities be performed in accordance with best management practices (BMPs) so as to prevent adverse impacts on water quality and related aquatic interests in accordance with Section 208 of the Clean Water Act (CWA). In addition, for any and all land-disturbing activities in, along, or across streams, wetlands, or floodplains needing approval, TVA would require the responsible landowner/developer (i.e., permittee), by way of the Section 26a permit, to implement sound engineering and construction BMPs. Any direct, indirect, or cumulative impacts to aquatic resources (including endangered and threatened species) would be assessed, avoided, and/or minimized via existing state and federal regulatory mechanisms (particularly the CWA, the Endangered Species Act (ESA), and the National Environmental Policy Act [NEPA]). This would occur in association with future environmental reviews (i.e., Section 26a) of projects that could affect water quality. Stream corridors would likely be incorporated into green space or low-impact development areas within the comprehensive Master Plan. Therefore, no such effects on aquatic life are expected.

Comments For and Against the Alternatives

6. I oppose developing this area for commercial, industrial or residential purposes (Alternative C). (*Commenters: Jackie Posey, Susan Ruffrage*)

Response: Comment noted.

7. I am in favor of the redevelopment of the TVA Muscle Shoals Reservation. It will promote employment growth in our community. (*Commenters: Martin Abroms, Henry Allen, James Bedsole, Janet Blazer, James Bowles, Wil Bryant, Sammy Dodson, Alex Godwin, Brenda Griffith, Quinton Hanson, Matthew Hea, Steve Holt, Vernon McGee, Jerome McGouyrk, John Rusevlyan, Sam Scarborough, Rick Sharp, Billy Shoemaker, Mayda Simone*)

Response: Comment noted.

8. I prefer Alternative D or E with the exclusion of residential (*Commenter: David Bradford*)

Response: Comment noted.

9. I prefer Alternative A or Alternative B. (*Commenters: Gregory J. Harber - Alabama Ornithological Society [AOS], Greg Jackson, M.D. - AOS, Mike Jordan*)

Response: Comment noted.

10. I prefer the implementation of Alternative A. (*Commenters: Robert W. Bentley, Sr., Denise Chupp, Brenda Cummings, Ginny Lee Hill, Jerome McGouyrk, R. H. McNeece, William Nelson, Edwin Quigley, Mary Wakefield, Kenneth Warhurst, Marilyn Watson*)

Response: Comment noted.

11. I prefer the implementation of Alternative B. (*Commenters: Forrest Bailey - Alabama State Parks Division [ALSPD], Janice Barrett, Jane Beavers, Paul D. Kittle, John C. Rist - The American Chestnut Foundation [TACF], Susan Ruffrage, Jessica N. Smith, Mary Etoile Smith, Janet Spahn, Joyce Stanley - United States Department of the Interior [USDOI]*)

Response: Comment noted.

12. I prefer the implementation of Alternative C. (*Commenters: Sheila Dugger, Tom Dugger*)

Response: Comment noted.

13. I prefer the implementation of Alternative E. (*Commenters: Martin Abroms, Barry Auchly, Kim Boyd, Gary Doyle, Pam Doyle, Jackie Hendrix, Jerome McGouyrk, Dr. Joan Parris - Shoals Economic Development Association [SEDA], William Smith, Don Walker, Ricky Williams, Jeff Wooten*)

Response: Comment noted.

Comprehensive Master Plan

14. Due to the speculation of impacts made in the draft EIS, it is recommended that the Master Plan be developed prior to any decision, and the content of that plan be incorporated into the environmental review. (*Commenters: Larry Gautney, Charles L. Rose - SEA*)

Response: As indicated in Section 1.3, TVA must decide whether to declare this approximately 1,400-acre property unnecessary to carry out future business plans and projects (i.e., surplus) and whether to sell it for future development. Based upon TVA's experience and expert professional opinion, the reasonably likely future uses of the property are those described in Action Alternatives B, C, D, and E. Although TVA would not require a particular type of land use or uses under its Preferred Alternative F, it is reasonably foreseeable that the property would be used or developed for one or more of those uses. Land use and the extent of development would be determined by the Comprehensive Master Plan as well as existing and future applicable local laws, regulations, and ordinances and, to some extent, by the future property owner(s) themselves. Through a coordinated effort, TVA would work with the community and local government authorities in the development of the Master Plan and approve it. See Comment Statement 15 below for response regarding the Master Plan development and timing of the TVA decision about disposing of the land and selling it. TVA believes its analysis and evaluation of effects of alternative future uses of the property to be adequate.

15. How can the Master Planning proceed before the final EIS is issued and before the TVA Board makes a final decision? It seems that if the master planning proceeds before the release of the final EIS, TVA would be in violation of Section 1502.2 of NEPA. (*Commenter: Charles L. Rose - SEA*)

Response: As indicated in Section 1.4, TVA would make the decision on the proposed surplus and sale of the property no sooner than 30 days after the notice of availability of the final EIS is published in the *Federal Register*. This decision would be based on the anticipated environmental impacts, as documented in the final EIS, and other considerations. The Master Plan would be completed and approved after the TVA decision but prior to any land transfer from federal ownership. TVA may, however, begin certain aspects of the planning process while the preparation of the final EIS is underway by seeking public input regarding future development of the area. After action by the Board of Directors or its designee, TVA would issue a record of decision explaining its decision, the rationale for the decision, and any required mitigation measures and monitoring and enforcement requirements. TVA believes the effects of implementing the comprehensive Master Plan will have been adequately assessed within the range of alternative land uses in the final EIS, as outlined above, and would not violate NEPA regulations regarding prejudicing the outcome of the decision.

16. How can TVA guarantee that the needs of low-income families would be taken into account during the Master Planning process when the draft EIS contained no detailed description about the Master Plan? (*Commenter: Charles L. Rose - SEA*)

Response: The comprehensive master planning process would include public meetings that would provide the opportunity for all segments of the community to be heard. The meetings would be scheduled at convenient times and locations, and appropriate timely notice would be given to encourage input from the public. In addition, the Northwest Alabama Cooperative District would participate in the process, representing all of its constituent groups, and improvements to the local and regional economies would benefit all communities and populations.

17. How can TVA state that it supports sustainable land uses and planning that promotes the smart growth of Sheffield, Muscle Shoals, Tuscumbia and Florence when the Shoals area is nothing but urban sprawl? Will TVA have the final say about development decisions or will the local officials control the redevelopment? (*Commenter: Charles L. Rose - SEA*)

Response: Recent trends in local city planning have focused on growth from within existing developed areas in their municipal limits instead of broadening their respective corporate limits, which suggests the potential for less characteristic sprawl in the future. TVA supports sustainable land uses and planning that promotes smart growth on the reservation property under consideration. Smart growth concepts would be discussed and evaluated during development of the comprehensive Master Plan. As indicated in Section 4.5, the potential for attracting new jobs and economic expansion opportunities from outside the region is a key to regional economic development and growth. The MSR study area has some potential advantages and attractions if well planned. Development decisions would be guided by the comprehensive Master Plan, which TVA would play a role in developing and ultimately approve. TVA's development philosophy will be reflected in the Master Plan, and accordingly, future land use decisions would be made by the local community.

18. The final EIS should include more details about the comprehensive Master Plan including the exact process for implementing the Master Plan, how public input will be used during planning, when it will be produced, etc. Will the future owner(s) of the property be required to follow this plan or will they have final say in what the property would be used for? (*Commenters: Paul D. Kittle, Charles L. Rose - SEA*)

Response: As indicated in the response to Comment Statement 15 above, the planning process for the comprehensive Master Plan began in the summer of 2011 while development of the final EIS was still underway. The Master Plan will not be completed or approved until after issuance of the final EIS and the TVA decision. The draft concept plan illustrating examples of how the historic buildings might be reused as a part of a larger redevelopment effort, included with the *Adaptive Re-Use Study* (Lord, Aeck, and Sargent Architecture 2009), may provide an initial vision for the Master Plan. See Section 2.1 of the final EIS for a description of the planned development approach and commitment under all the action alternatives. As indicated in Comment Statement 17, development decisions would be guided by the Master Plan and, thereby, future land use decisions would be made by the local community.

As indicated in Section 2.1, under all the Action Alternatives, the approved Master Plan would be relied on to guide future land use decisions, including adherence to measures for the treatment of historic properties in the Memorandum of Agreement (MOA) with the Alabama Historic Preservation Officer. Also, see discussion of the Master Plan in Sections 1.2, 1.3, 2.0, 2.3, 2.4, and elsewhere in the final EIS. Key considerations in developing the Master Plan would include appropriate site capability and suitability analyses and the integration of societal valued natural resources and avoidance of incompatible land uses. The environmental information summarized in this EIS would be a key input to the process of developing the Master Plan. The Master Plan would be implemented and enforced by local governments, perhaps through zoning or through other available means, thus, adhering to the plan. See also the response to Comment Statement 16 regarding public input into the planning process.

Economic Development

Impact to Local Economy

19. Conserving the MSR study area's natural areas can have a positive impact on home values. There are studies that show that the closer residential properties were to natural areas, the higher their values. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. As described in final EIS Section 4.15, the Action Alternatives would not directly affect formally designated natural areas such as the Old First Quarters Small Wild Area. Naturally appearing (e.g., woodlots, fields) areas of the MSR study area would likely be developed under the Action Alternatives, particularly under Alternatives C, D, E, and F. TVA anticipates that some portion of these areas would remain undeveloped under the Master Plan.

20. The final EIS should mention that the 'urban heat island effect' would be avoided if the natural areas on the MSR are preserved under its socioeconomic discussions of Alternatives A and B. By avoiding this effect, building energy use would not increase, which would provide positive economic impacts. (*Commenter: Charles L. Rose - SEA*)

Response: Effects on local climatology, such as the urban heat island effect, are discussed in Section 4.8.2 of the final EIS. As noted in Section 4.8.2, the effects on local climatology would be restricted to the area within about 1 kilometer of the reservation and the resulting economic impacts would be small. The effects of natural vegetation (e.g., woodlands) on local climate are also discussed in Comment Statement 1.

21. The redevelopment of the Muscle Shoals Reservation would have a significant positive impact to not only the Shoals area, but the Southeast. It would also increase job growth throughout the area. (*Commenters: David Bradford, Mitch Hamm, Steve Holt, Darren Rhodes, Ronnie Smith - AIDT, William Smith*)

Response: Comment noted. The extent of positive impact would depend upon the type and number of businesses that could potentially be created or relocated from outside the Shoals area. An influx of new dollars, instead of a redistribution of existing business development from within the area, would be key to the amount of economic benefit ultimately received in the community.

22. There is also a 'bottom line' benefit to the Shoals economy from the reduction in water and air pollutants provided by the MSR's green spaces. The reservation's woodlands and wetlands are constantly at work cleaning the air and water by removing pollutants. According to the Trust for Public Land, Atlanta's air pollution reduction from trees is worth $15 million annually. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. TVA agrees that there is benefit to the local economy from these pollutant reductions. While we have not attempted to estimate the dollar value of these benefits, we believe they are great enough to warrant serious consideration in development of the Master Plan for the MSR.

Recreation and Tourism

23. The implementation of Alternative B would have a huge financial impact on the local economy by increasing recreation and ecotourism. Therefore, I do not agree that social and economic impacts would only be 'relatively minor' under Alternative B. (*Commenter: Charles L. Rose - SEA*)

Response: There are three ways in which Alternative B would have social and economic impacts on the area. One, as mentioned in the final EIS, is improvement of the quality of life for those who already live in the area. The second is through attracting new residents and businesses or companies to the area. The third is by attracting more visitors to the area. Alternative B would likely have positive impacts in all three of these ways. New residents might be attracted due to the increased quality of life. Depending on the extent that new businesses or companies locate in the area, this effect would be limited largely to retirees or people who otherwise would be living in neighboring counties. It is unlikely that this would be a major impact. The quality of life in an area is one factor that affects location decisions of businesses and companies. Therefore, improving the quality of life in the Shoals area would increase the attractiveness of the area to businesses and companies. Attracting more visitors to the area is likely, but would be limited unless the area offers unique attraction to those living outside the Shoals area. While major economic impacts are possible, small to possibly moderate impacts appear to be more likely. Social impacts are likely to be more important as they relate to increasing the quality of life for residents of the area.

24. TVA should provide a location to house the many artifacts TVA has and encourage tourism where TVA 'was born.' (*Commenters: Anonymous, Debbie Bradford*)

Response: Comment noted. TVA acknowledges the important role the Shoals has played since TVA's inception in 1933.

Final EIS Section 4.4 and Appendix A describe the actions that TVA will complete in order to document and interpret the historic resources that would be affected by the Action Alternatives. The documentation and related items will be archived in the Special Collections Department of Collier Library at the University of North Alabama, where they would be available for public viewing. This could potentially serve as another valued tourist attraction.

Endangered & Threatened Species

Impacts

25. Considering that this stretch of the Tennessee River is an important mussel sanctuary, including many endangered species, why is TVA going to consider allowing a barge terminal at the Utility corridor as stated in Section 4.19.4? (*Commenter: Charles L. Rose - SEA*)

Response: As stated in final EIS Section 2.1 and elsewhere, TVA would not approve a barge terminal, commercial dock, or other similar shoreline facility along the adjacent (south) bank of the Tennessee River. If needed along the shore within the utility access corridor (in the vicinity of the slag pile), TVA would consider approval of intakes; outfalls; water, gas or petroleum pipelines; other chemical or electrical transmission lines; or other associated shoreline alterations, etc., to the river in support of development south of Reservation Road. Such actions within the floodplain would create obstructions, affect TVA land, and require independent review and approval under Section 26a once the details of such proposals were specified it (see the responses to Comment Statements 65, 121, and 180). In addition, see the response to Comment Statements 5, 26, and 177 on the potential effects on aquatic endangered species in the Tennessee River.

26. When discussing Alternative C, the draft EIS states: 'Actions resulting from the adoption of this alternative would have a greater potential for direct, indirect, or cumulative effects on

aquatic resources on Pond Creek and in the Tennessee River compared to Alternatives A and B.' Could these 'cumulative effects' negatively impact the endangered mussel species in the river here? (*Commenter: Charles L. Rose - SEA*)

Response: Any direct, indirect, or cumulative impacts to Pond Creek or aquatic resources in the Tennessee River (including endangered and threatened species) would be assessed, avoided, and/or minimized via existing state and federal regulatory mechanisms (particularly the CWA, the ESA and NEPA) associated with future environmental reviews of specific proposals for use of this area. It is not anticipated that development potentially occurring under Alternative C would have direct, indirect, or cumulative adverse impacts to these resources.

Adequacy of Surveys

27. I have found a glade plant similar to that of the Lyrate bladderpod, Widow's Cross, in several locations on the MSR even though the USDA database doesn't list it as being found in Colbert County. Databases are not always complete; therefore, a plant survey should be conducted in the MSR study area for the Lyrate bladderpod. (*Commenter: Charles L. Rose - SEA*)

Response: According to the U. S. Fish and Wildlife Service (USFWS), *Lesquerella lyrata* (lyrate bladderpod), a federally listed as threatened plant species, has a worldwide distribution consisting of six populations found in Colbert, Franklin, and Lawrence counties, Alabama. Dr. David Webb, a TVA aquatic plant specialist, botanist, and long-time resident of the Muscle Shoals area, discovered the Colbert County populations. Dr. Webb has worked on the MSR for more than 25 years and has never encountered lyrate bladderpod in the area of the reservation. He too has noted the presence of *Sedum pulchellum* but commented that the plants seem to be restricted to rock or gravel brought in for trails or road maintenance and are not associated with cedar glades. He concurs with the statement that “habitat to support lyrate bladderpod does not occur within the action area of the MSR EIS.”

28. The lack of data in TVA's Natural Heritage database doesn't mean there are no federally listed plants on the MSR study area, it simply means there is not one listed in the database. Databases are incomplete. A systematic survey of the MSR study area should be completed before TVA disposes of this land. (*Commenter: Charles L. Rose - SEA*)

Response: TVA agrees that database information is useful in providing occurrence records for species, and this information is systematically and regularly updated to reflect current data. The TVA database includes records collected from the field and other reliable sources (e.g., museums, arboretums) provided to us by all the state natural heritage programs as well as USFWS on listed species within the 201-county TVA power service area. These data allow TVA to determine what to expect in a given area and, with knowledge of its ecology, what habitat requirements are needed to support listed species. While all 1,400 acres within the MSR study area were not completely surveyed, much of the area has been covered by informal field reviews by staff working on the MSR and by TVA botanists. Habitats to support federally listed species known from the region do not occur within the project study area. The state-listed species found within the small wild area and ravines adjacent to the project area would not likely be impacted by the proposed actions.

Bats and Other Terrestrial Animals

29. The importance of protecting known foraging areas for the endangered bat species is well known. How is TVA still willing to let the natural areas be displaced by development when they know the gray bat forages on the MSR study area? (*Commenter: Charles L. Rose - SEA*)

Response: Gray bats typically forage over medium and large bodies of water, as well as smaller streams and branches. Given that suitable foraging habitat for gray bats is abundant throughout this area along Pickwick and Wilson reservoirs and associated tributaries, it is not anticipated that any impacts to this particular stretch of foraging habitat would significantly impact this species.

Environmental Justice

30. According to the DEIS, the minority population is lower in Colbert County and the Impact Area compared to the State of Alabama and the U.S. The DEIS also examined the minority populations in Census Tracks 207.01 and 207.02 and the blocks immediately around the site. The Census Tracks and blocks also showed minority populations below the County, State and National Average. Colbert County's poverty level is lower than the impact area and State, but is similar to the poverty level nationally. However, Table 3-8 also indicates that the average income levels in Colbert County and in the impact area are lower that the State of Alabama and national levels. (*Commenter: Heinz J. Mueller - United States Environmental Protection Agency [USEPA]*)

Response: Comment noted. Section 3.6 of the final EIS has been updated to reflect the recently released data from the United States Census of Population (2010).

31. It is unclear how low-income or minority populations currently utilize the MSR study area. The final EIS should include a discussion on the potential impacts on current uses for EJ populations, especially loss of recreational amenities. (*Commenters: Heinz J. Mueller - USEPA, Charles L. Rose - SEA*)

Response: Excluding the fence-restricted portion of the MSR study area, which comprises approximately 540 acres of its developed interior core, the reservation is public land available to all populations, regardless of race or income levels. This includes minority and low-income populations that reside in the area and elsewhere in the state or region who use the area (particularly the TVA land north of Reservation Road) for recreation. These recreational activities include walking, nature study, bird watching, fishing, boating (kayaking, canoeing, etc.), and historical interpretation (e.g., historic markers, information kiosk) and viewing. Recreation opportunities are somewhat limited on the study area but are more available on surrounding public and private land and on the Tennessee River. The local municipalities and private venues also provide substantial recreational activities and events at little or no cost. As indicated in Section 4.14.2, TVA's evaluation suggests that development under Alternatives C, D, E, and F could cause habitat loss in the southwest portion of the study area that could significantly affect migrant birdlife and local recreation opportunity (i.e., bird watching). Because similar habitat does not occur on the remainder of the TVA land on the Muscle Shoals/Wilson Dam Reservation, compensatory on-site mitigation for these losses would be difficult to accomplish. There are no known data, anecdotal evidence, or staff observations to suggest that bird watching is particularly desired or valued by low-income or minority recreationists, and such experiences could be found on other public or private land elsewhere in the area.

The potential for adverse loss of recreation opportunities would likely be greater for the 1-mile segment of the National Recreation walk/bike trail and a separate 900-foot section of this trail (see Section 3.16 Recreation of the final EIS). Observations suggest that the trails, including those that provide access to bank fishers, attract substantive use by minority and low-income populations from the surrounding communities. TVA would take necessary action to either maintain these segments for their present use or offset their loss by similar or increased opportunities provided elsewhere in the vicinity. Pending the nature of any proposed infrastructure enhancements in the utility access corridor, temporary effects could reduce access and associated opportunities for use of the Rockpile Hiking Trail. Minority and low-income populations, as well as others, would continue to have these opportunities available to them (see Sections 3.16 and 4.16 of the final EIS). Therefore, there would be no noticeable impacts to users of the trail network, including minority and low-income populations.

32. The Environmental Justice section should include a summary of the public comments, concerns and TVA's response to them and any efforts used to specifically engage potential EJ populations in the Scoping public involvement process. In addition, the project's website address should be included in the EJ section for those interested in more detailed information about the Scoping document. (*Commenter: Heinz J. Mueller - USEPA*)

Response: In the summer of 2009 during initial public scoping, notice to the communities of the proposal was provided via a notice of intent (NOI) in the *Federal Register* and several media outlets. As indicated in the final Scoping Report, numerous articles and editorials were subsequently published in newspapers with circulation throughout the area, including minority and low-income communities, furthering discussion of the proposal. TVA hosted a public meeting at a convenient location in Muscle Shoals in July 2009, and about 100 people attended. Minority participation in the meeting was not differentiated. TVA also posted its NOI, and later the final Scoping Report, on its Web site. Commenters were given the opportunity to provide their comments easily through several means, including online. Commenters could also sign up online to be included on a project mailing list; about 140 individuals signed up. TVA provided the draft EIS or notification of its availability to individuals on the mailing list, agencies, organizations, interests groups, and institutions. The draft EIS was posted on the TVA Web site, placed in 13 public libraries from Huntsville, Alabama to Iuka, Mississippi and public notices (ads) of the February 2011 public meeting were placed in four newspapers of circulation in the area and across the state. Additional outreach was performed to inform EJ populations by notifying local churches, the statewide Spanish-language *PAISANO* newspaper, African-American radio stations, a local chapter of the National Association for the Advancement of Colored People, and African-American fraternities and sororities in the project area. Although 146 comment submittals on the draft EIS were received from 140 commenters, there is no discernable evidence of a particular increase in the participation of EJ populations thus far. Additional opportunities would be forthcoming for participation in planning and development of the property.

Geology

33. The DEIS states: 'No mining, mineral extraction, or petroleum exploration, drilling, or deep excavation that could cause or contribute to bedrock subsidence are anticipated.' Does this statement mean that although it is not anticipated, this mining or drilling still might possibly occur? It doesn't appear to be prohibited. (*Commenter: Charles L. Rose - SEA*)

Response: Any development is expected to occur in accordance with acceptable sound engineering methods and environmental BMPs. Beyond necessary excavation for building

foundations and underground support structures for purposes of weight distribution and stability, TVA does not expect any extraction, exploration or deep excavation to occur. Although not specifically prohibited, any primary industrial development involving such disturbance would have to be compatible with the comprehensive Master Plan and local laws, regulations, and ordinances.

Groundwater

34. The ecological value of protected forests, wetlands, and green spaces is undisputed. These areas prevent runoff and restore rainwater to the groundwater at a time when flooding from severe episodes of rainfall is becoming more common in areas of our cities where asphalt and cement interrupt the natural cycle of groundwater restoration and runoff and erosion prevention provided only by trees. (*Commenter: Margaret M. McCloy*)

Response: Comment noted. Information regarding ecological values associated with this property is provided in the final EIS. This and other information would be considered by participants in the development of the comprehensive Master Plan and allocation of green spaces across the area.

Historic and Archaeological Resources

General

35. How will the redevelopment affect known cemeteries in the MSR study area? (*Commenter: Charles L. Rose - SEA*)

Response: There are two known cemeteries within the MSR study area, the Murphy-Kemper-Cockburn and Cuba cemeteries. Both would pass from federal control and be covered by state laws applying to cemeteries, such as the Alabama Burial Act (Section 13A-7-23.1). TVA has cleared these cemeteries of excess woody vegetation so that their locations are clearly defined for any future owners of this land. TVA has also erected a fence at the Cuba Cemetery. Because these cemeteries are not considered eligible for listing in the National Register of Historic Places, they are not included in the MOA on the treatment of adverse effects on historic properties.

36. How will this redevelopment affect the historic Wilson Village No. 2? (*Commenter: Charles L. Rose - SEA*)

Response: The Preferred Alternative would likely have an adverse effect on the remains of Wilson Village No. 2. All residential structures and outbuildings were relocated or demolished when the village was closed in the 1950s. The remaining archaeological evidence has been recorded and the adverse effect mitigated through an MOA with the Alabama State Historic Preservation Officer (SHPO).

37. The discussion of possible impacts to archaeological resources in the draft EIS is vague since it is not known what would be developed on the MSR study area. The final EIS should include a detailed description of the potential impacts on archaeological resources. (*Commenter: Charles L. Rose - SEA*)

Response: All of the MSR study area has been surveyed for both archaeological and architectural (i.e., buildings and structures) properties. Only three of the archaeological sites identified in the surveys for historic properties are eligible for listing in the National Register of Historic Places (NRHP). The Preferred Alternative would likely have an adverse effect on these three sites. TVA has consulted with the Alabama SHPO regarding

mitigation of the adverse effects on these historic properties. This includes an Oral History survey and report from interviews of some of the remaining inhabitants of Wilson Village No. 2 to augment the existing archaeological and documentary information covering the three eligible archaeological sites. This information will be donated to the Special Collections Department of Collier Library at the University of North Alabama. See final EIS Section 4.4 and Appendix A.

38. The MSR study area contains Native American history (Trail of Tears) and most likely burial sites that we don't know about so TVA needs to disturb as little land as possible. It was also used as the encampment site for Union troops under General Sherman during his march to Atlanta as well as General Hood's troops at one time. (*Commenters: Janet Spahn, Kenneth Warhurst*)

Response: As described in Section 3.4.1.5 of the final EIS, there have been two large-scale cultural resource surveys in the 21st century that included the MSR. All Civil War sites are north of Reservation Road and not in the MSR study area subject to potential disposal and redevelopment. No Trail of Tears sites or Native American burials have been identified in the MSR study area. Any burial, regardless of ethnic origin, would be covered under the Alabama Burial Act (Section 13A-7-23.1) once the property has been transferred from federal ownership.

39. The Shoals Environmental Alliance has no objections to the sale, and adaptive reuse of the MSR's industrial sites and office buildings, as long as no harm is done to the integrity of any historic sites or structures. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

40. Why under Alternative B (Conservation) is there discussion of activities that involve intensive or extensive earth disturbance that could adversely affect cemeteries and unavoidable adverse impacts on eligible buildings/structures and archaeological sites? The conservation Alternative should place high importance on the conservation of archaeological sites, cemeteries and historic buildings. (*Commenter: Charles L. Rose - SEA*)

Response: Alternative B – Conservation Alternative would require that the MSR study area be used for conservation of natural resources and/or sustainable low-impact development uses. The Conservation Alternative does make reference to ecotourism and the possibility of improvements made to existing recreation facilities. As stated in Section 4.4.1.2, TVA acknowledges the possibility that even low-impact development could have an effect on sensitive and fragile historic archaeological resources. However, under Alternative B, TVA is committed to encouraging development that has a small environmental footprint. Reuse of existing buildings, limited new construction that is restricted to brownfield areas of the MSR, and avoidance of greenfield areas are all elements expressed in Alternative B. TVA further acknowledges that Alternative B would likely result in beneficial effects on historic architectural resources.

41. What happened to the archives that were in the visitor center? (*Commenter: Gary Hester*)

Response: The Wilson Dam Visitors Center was closed in September 2001. TVA retained records of property removed from the center and properly stored these furnishings and materials. As indicated in Comment Statement 103, there are no plans to reopen the visitors center.

Memorandum of Agreement (MOA)

42. The draft EIS states: 'With the application of necessary and appropriate mitigation, potential effects to historic properties across the action alternatives would be insignificant.' How can this be known? How can impacts from Alternative C possibly be comparable to those from Alternative B, under which the goal should be to preserve all historical buildings and historical contexts as much as possible? (*Commenter: Charles L. Rose - SEA*)

Response: Previously identified potential mitigation measures described in Section 2.3 of the final EIS, stipulations in the MOA developed in partnership with the Alabama SHPO included in Appendix A, and context-sensitive site design associated with and resulting from the development of a comprehensive Master Plan would all serve to reduce the severity of impacts to historic properties associated with Alternative C or any of the Action Alternatives. The potential effects associated with any of the Action Alternatives would not be identical. However, through mitigation measures associated with the final EIS and stipulations in the MOA, the effects of the proposed Action Alternatives would be brought to similar levels of insignificance.

43. TVA should provide additional details regarding the Memorandum of Agreement (MOA) between TVA and the Alabama State Historic Preservation Officer (SHPO) in the final EIS; and the effect of the MOA on land use decisions. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. The terms of the MOA are summarized in final EIS Section 4.4 and a copy of the MOA is included in Appendix A. Included in the MOA is the commitment to develop a Comprehensive Master Plan for the redevelopment of the MSR property (see Elements Common to All Action Alternatives in Section 2.1 of the final EIS). This Master Plan would involve the consulting parties, local governments, and the public in shaping the vision for redevelopment on the site. This plan would also include design guidelines and architectural controls for new construction in the vicinity of historic properties so that infill development of any type is compatible and does not significantly affect the historic integrity of the extant features/resources. These design guidelines and architectural controls would not have an appreciable effect on land use decisions as many potential uses could be integrated into the historic context of the site. However, land use decisions may be affected by the involvement of all parties during the comprehensive planning process as potential uses as well as opportunities and constraints are discussed and refined.

Muscle Shoals Historic District

44. Considering that the entire Muscle Shoals Reservation is eligible for the National Register of Historic Places as the 'Muscle Shoals Historic District' (MSHD), why can TVA not take measures, even if they want to relinquish ownership here, that the MSR's natural areas are preserved and incorporated into this historic district, which could be the centerpiece of the Muscle Shoals National Heritage Area? (*Commenter: Charles L. Rose - SEA*)

Response: TVA has committed to work with the Northwest Alabama Cooperative District, the Alabama Historical Commission, and local citizens to develop a comprehensive Master Plan for the MSR property. Through this master planning process, areas could be identified to preserve, support, conserve, and interpret the legacy of the region. TVA anticipates that through this master planning process, future development of the property would promote heritage, cultural, and recreational tourism.

45. How can commercial, retail and residential development be compatible with a future Muscle Shoals Historic District? (*Commenter: Charles L. Rose - SEA*)

Response: Commercial, retail, and residential development have the potential to be compatible with a historic district. Through context-sensitive design of new construction and adaptive reuse of historic buildings, new development may be integrated with historic buildings that establish a historic district. TVA has committed to work with the Northwest Alabama Cooperative District to develop a comprehensive Master Plan, with input from the Alabama Historical Commission and local citizens. This Master Plan would address integration of new development into the context of a historic district. See MOA Stipulation No. 3 requiring implementation of certain design guidelines and architectural controls.

46. It seems like every building structure located on the MSR study area was examined individually without any associative relevance to its surroundings. To adequately assess this entire historical complex, each building structure should be weighed historically for its overarching legacy; first to the neighboring structures, then to the locale or region. The draft EIS doesn't seem to consider the totality of the cluster of historical structures with any sensitivity for discerning history, heritage, legacy, etc. (*Commenter: John Agricola - TACF*)

Response: In Section 3.4 of the final EIS, TVA explains the architectural context and relative eligibility of the buildings and structures within the study area. The two primary architectural contexts are the Industrial Army Vernacular buildings associated with USNP2 and the buildings associated with the New Deal and TVA. While TVA has listed the buildings and structures individually in final EIS Table 3-6, the buildings are only considered eligible, generally, as a complex (final EIS Table 3-4). The buildings/complexes within the study area are eligible for listing in the NRHP, primarily under Criterion A and not under Criterion C. These historic buildings and structures are eligible because of their association with the significant contributions made in peace time and in war, in fertilizer and munitions development. They are eligible in this context collectively because of the international significance of the area's contributions during World War I and the formative years of TVA. Also see response to Comment Statement 44.

47. There is no discussion in Chapter 4 of the Muscle Shoals Historic District. The final EIS should provide additional information regarding the potential impact of the alternatives on the district and if/how this would impact future land use decisions within the study area. Why has TVA not nominated the MSR to the National Register of Historic Places (NRHP)? (*Commenters: Heinz J. Mueller - USEPA, Charles L. Rose - SEA*)

Response: The Muscle Shoals Historic District, as described in the 2002 report by TRC, includes a large geographic area, of which the MSR is but a portion. This historic district was comprised of five contexts described in Section 3.4.1 of the final EIS. Within the MSR, only two of these contexts exist, with two primary identifying architectural features. The Wilson Dam (1916-1933) context includes the period of construction of the USNP2. This context is architecturally identifiable by the Industrial Army Vernacular Style, which is starkly in contrast with the neoclassical styled dam and powerhouse. The second context within the MSR is TVA's development of Muscle Shoals after the New Deal (1942-1970). This context is architecturally identifiable by the strong connection to the International Style, which was popular during the early part of the 20th century. Both contexts are described in detail in Section 3.4.2 of the final EIS. TVA, in consultation with the Alabama SHPO, determined that a redefined historic district with a narrower and more appropriately focused historic context would be developed as a result of the MSR Redevelopment Project. This historic district will focus on the two periods of significance previously identified in the TRC report and generally described above and in the final EIS. TVA will prepare an NRHP

Registration Form for this redefined historic district as part of the negotiated stipulations included in an MOA with the Alabama SHPO (Appendix A). Future land use decisions within the study area would be guided by the comprehensive Master Plan, which would be developed with the Northwest Alabama Cooperative District, the Alabama Historical Commission, and local citizens.

National Historic Preservation Act (NHPA) Compliance and Tribal Consultation

48. Section II of the National Historic Preservation Act (NHPA) states that 'it shall be the policy of the Federal Government...to provide leadership in the preservation of the prehistoric and historic resources of the United States.' TVA is disregarding its responsibilities under the NHPA with the proposed land disposal. (*Commenter: Charles L. Rose - SEA*)

Response: Section 106 of the NHPA (16 USC 470f) and the regulations implementing that section (36 CFR part 800) provide a mechanism where the Alabama SHPO and the Advisory Council on Historic Preservation (ACHP) can comment on federal undertakings such as the transfer of property out of federal ownership. TVA has funded archaeological and architectural surveys to identify historic properties that are eligible for listing in the NRHP. There are no prehistoric archaeological sites eligible for the NRHP within this project's area of potential effect. There are, however, historic archaeological sites and structures that are eligible for the NRHP. Following established regulations, TVA has negotiated an MOA with the SHPO to address the adverse effects to these historic properties. TVA will encourage the adaptive reuse of historic buildings under this agreement and recordation where reuse is not possible. TVA is funding an Oral History project to permanently record the memories of some of the remaining residents of Wilson Village No. 2 to augment the archaeological and documentary record of this historic site. This information will be donated to the University of North Alabama for preservation and public access.

49. The Alabama Historic Commission agrees with the content of the draft EIS. We look forward to working with you to address potential impact to cultural resources in the coming MOA. (*Commenter: Elizabeth Ann Brown - Alabama Historical Commission [AHC]*)

Response: Comment noted.

Viewshed

50. How are the viewsheds at the historic sites on the MSR study area going to be affected by the proposed redevelopment? (*Commenter: Charles L. Rose - SEA*)

Response: Viewing positions where a historic context is established by extant architectural features, such as the USNP2, would potentially be affected by the proposed redevelopment. TVA has acknowledged this potential, as well as the potential of new development to be compatible with viewsheds containing historic properties. To address the possibility of adverse effects, TVA has committed to work with the Northwest Alabama Cooperative District, the Alabama Historical Commission, and local citizens to develop a comprehensive Master Plan for the MSR property. This Master Plan would address integration of new development in a viewshed that contains historic properties. Additional information may be found in the MOA developed in consultation with the Alabama SHPO. Design guidelines for new construction located within a reasonable distance of certain historic buildings would be required. The MOA is included in Appendix A of the final EIS.

Land Use

Other

51. The Shoals Environmental Alliance feels that the Muscle Shoals Reservation, with its many historic sites and centrally located green spaces, offers the public a unique opportunity for recreation, observation of nature and the appreciation of our local history. Its redevelopment should be undertaken with great care. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

52. The wetlands, forested and all natural areas on the MSR study area should be left alone. (*Commenters: Janice Barrett, Noel M. Beck, Paul D. Kittle, Margaret M. McCloy, Grant Posey, Jackie Posey, Charles L. Rose - SEA*)

Response: Comment noted.

53. TVA is trying to sell the water source for Hall Memorial Native Plant Garden located on the north side of Reservation Road. (*Commenter: Marilyn Watson*)

Response: The water treatment plant, south of Reservation Road, is the source of water for the Hall Memorial Native Plant Garden and TVA's trailhead restroom facilities. The water plant could be sold, but TVA would have a continuing need for water for the restroom facilities. The native plant garden is located on TVA land north of the road and is maintained by conservation partners, the Shoals Environmental Alliance, Shoals Wildflower Society, and Shoals Master Gardeners. The garden is located in an area allocated for public recreation and open space and would not be sold. Under all the alternatives being considered, TVA would retain a source of water for its restroom facilities, and therefore, water would be available in the vicinity of the native plant garden. In the future, TVA could possibly reassess the need for this water source and make water available to the garden only at an appropriate usage fee.

Proposed Uses

54. Forever Wild would be wonderful stewards for the wetlands, woods, and possibly the walking trails. (*Commenter: Jackie Posey*)

Response: Comment noted.

55. I support the efforts to provide better education and training opportunities for the North Alabama community through the development of the Tennessee Valley Career Technical Center on the MSR study area. The existing facilities have the ability to easily be repurposed into world-class facilities for training in the agricultural, aquaculture, natural and environmental sciences. Many local educational institutions, businesses, and environmental groups support this proposal as well. (*Commenters: Anonymous, Robert B. Aderholt, Tim Alford, Grady Batchelor, George Blanks, Don Blazer, Steve Carpenter, Ed Castile, David Cline, Adam Daniel, Dennis Deaton, Pam Doyle, Tom Dugger, Lynn Greer, Coy Johnson, Jason Lard, James Laurent, Darin Liles, Brian Lindsey - Muscle Shoals City Schools [MSCS], Rex Mayfield, Brandon Moore - Alabama Farmers Federation [AFF], Nancy Muse - SEA, Stephanie Newland - SCC, Jackie Norton, Kathy Pigg, Jackie Posey, Billy Quesenberry, Joel Retherford, Darren Rhodes, Tommy Riner - National Alabama Corporation [NAC], Charles L. Rose - SEA, Celia Rudolph - MSCS, Susan Ruffrage, W. David Sample, Jeff Sibley, Ronnie Smith - AIDT, Tiffany Stonecipher - Muscle Shoals Center for Technology [MSCT], Joseph Touchton - Auburn University [AU], Gary Warren, Bonnie*

White, Jeff Wooten)

Response: Comment noted. TVA recognizes the support from within the Shoals community and the potential value of the career technical school. Depending on the Tennessee Valley Career Technical Center's ability to acquire the land, such land use decisions would ultimately be made through development of the comprehensive Master Plan by local governments, TVA, and citizens of the community.

56. I am formally requesting that a portion of the Muscle Shoals Reservation be utilized for an innovative secondary school career academy currently titles the Tennessee Valley Career Technology Center (TVCTC). It would serve as a career and technical magnet school for the state of Alabama and the Southeastern US. Buildings on the property could be remodeled and used for classrooms, research and learning laboratories, offices, and possibly dormitories. The existing wetlands, ponds and greenhouses could be used for future research and learning laboratories. The TVCTC would assist in meeting the steadily growing demand for employment in our region and state with highly qualified individuals. (*Commenter: Gary Dan Williams - MSCT*)

Response: Comment noted. See response to Comment Statement 55 above. This request has been provided to appropriate decision makers involved in this process.

57. I propose that the 'brown fields' on the MSR study area be used for solar farms. (*Commenters: Anonymous, Nancy Muse*)

Response: Comment noted. Use of appropriate portion(s) of the MSR study area for green energy research and development, as well as the application of green energy technology, would likely be considered in the Master Plan development and land use decision process.

58. I would like to see the MSR study area used as an interactive wildlife sanctuary and nature habitat allowing hiking, picnic areas, biking trails and other nature oriented activities managed by UNA as a teaching tool for administrative, archeological, biological training for UNA students and faculty as well as regional k-12 schools. (*Commenters: Nancy Muse, Kenneth Warhurst*)

Response: Comment noted. This concept could be considered in the potential integration of open green space concepts in the Master Plan development process.

59. Jack-o-Lantern farms should be subsidized to expansion at its current location as a producer of fresh local produce year round for the surrounding area. It could be used as a free roaming USDA organic chicken facility. This will boost our local economy and well being of future generations. (*Commenters: Nancy Muse, Jackie Posey*)

Response: Jack-O-Lantern Farms, under an existing revocable license agreement, began operating on the MSR in May 2005. The agreement has been modified, rent adjusted accordingly, and a small expansion of the business has occurred to include an additional greenhouse and some surrounding grounds. The agreement requires the licensee to accept full responsibility for maintaining the property and paying all operational expenses. TVA acknowledges the potential for additional growth, but has no plans to subsidize this business. Like any other property in the study area, the land being used by Jack-O-Lantern could still potentially be sold and, in accordance with the Master Plan, be used in the future for the same or another purpose.

60. The American Chestnut Foundation (TACF) would like to create a formal partnership with TVA to bring the American chestnut tree back to Alabama. TACF already has a Memorandum of Understanding with the USDA Forest Service, and in partnering with TACF and the Alabama Chapter, TVA will join a growing number of organizations and agencies committed to American chestnut restoration. (*Commenter: George M. Phillippi - TACF*)

Response: Comment noted. TVA and TACF have opened communications about each organization's interest and are seeking a possible mutually beneficial cooperative partnership. TVA and TACF have shared technical information about American chestnut genetics and TACF's long-term goals and possible cooperative approaches. TVA has shared information about its historical role in cooperative tree improvement research, tree seedling nurseries, land reclamation, watershed protection projects, and reforestation.

61. The Muscle Shoals Reservation should be turned into something free like a State Park so that people can enjoy the beauty of the property. The park could represent some of the history of TVA and the Muscle Shoals area. (*Commenters: Susan and Chuck Bolton, Kim Boyd, Debbie Bradford, Steve Carpenter, Alison Dodson, Jackie Posey, Linda Sherk, Mayda Simone*)

Response: Comment noted. This concept could be considered among other citizen's inputs and interests in the Master Plan development and land use decision process.

62. The Muscle Shoals Reservation should be used as a civic center that showcases music, especially how the Muscle Shoals area has influenced the music industry. This could include concerts, sporting events, and other community based activities. (*Commenters: Jackie Posey, Neal Willis*)

Response: Comment noted. See response to Comment Statement 61 above.

63. The Muscle Shoals Reservation should be used for Medical Uses; i.e., hospital, medical office buildings, medical retail, retirement center, nursing home, etc. Such investments would be beneficial to the local community. (*Commenters: Michael Lansdell, David J. Malone*)

Response: Comment noted. See response to Comment Statement 61 above.

Natural Areas

64. The identified 'informally recognized natural areas' in the draft EIS comprise the great majority of the MSR study area. In the past TVA has seen the value in preserving them, recognizing the park-like nature of the reservation. Instead of sacrificing them for the envisioned commercial, retail and residential development, why can't TVA create something of more value to the public here? Public open spaces are finite, especially those that are in such close proximity to the center of the Shoals area. (*Commenter: Charles L. Rose - SEA*)

Response: TVA recognizes the importance of preserving resource conservation areas of high biological integrity. See reference to the TVA *Natural Resource Plan* in Section 1.5.3 of the final EIS. The naturally appearing landscapes (native grass plots south of Reservation Road, forested and other types of wetland areas, and informal wetland trail complex) all within the MSR study area do provide habitat value for wildlife and are natural in appearance. Some of these areas occur on previously contaminated sites or lands with currently restricted use (See Sections 3.1 and 4.1 of the final EIS). Through the master planning process, local government officials and citizens can consider the value of these

areas in determining their future use.

The designated natural area (i.e., Old First Quarters SWA) and land allocated to open space and public recreation north of Reservation Road are not included in the property proposed for redevelopment. This area will remain available to public recreation and open space.

Navigation

65. Section 4.19.4 of the draft EIS 'These potential effects are related to the generation of additional barge traffic in a reach of the river that is not especially suitable for such traffic (see Section 4.19 above). All requests for such uses at this location would require independent review and Section 26a approval by TVA as described in Alternatives B and C.' However, earlier in the document it states that a barge terminal would not be allowed. (*Commenter: Charles L. Rose - SEA*)

Response: Final EIS Section 4.19 has been revised to better address the potential impacts on commercial navigation. TVA would not approve commercial docks and barge terminals along the left-descending bank (south shoreline) of the Tennessee River from Wilson Dam to O'Neal Bridge, particularly in the vicinity of the utility access corridor. However, other types of uses of the shoreline such as those identified in final EIS Section 4.19.4 would potentially be permissible. In order to determine the potential permissibility of a proposal that would affect TVA land and require approval under Section 26a, it would be independently reviewed once the details of such a proposal were specified. While industrial development of the MSR study area under Alternatives D, E or F could generate increased barge traffic, this barge traffic would be restricted to the commercial navigation channel located near the north shoreline and would likely use existing terminals.

NEPA Compliance/Adequacy

Adequacy

66. EPA has concerns that impacts to natural resources could range from minimal to significant based on final land use decisions at the MSR. EPA recommends that once final decisions are made with regards to land use changes at the MSR, impacts to natural resources be re-assessed in the final EIS. (*Commenter: Heinz J. Mueller - USEPA*)

Response: TVA has identified the resources present on the MSR study area, the nature of these resources, and their general extents and locations. The potential effects of a variety of potential alternative land uses on these resources are then described based on the types, extent, and intensities of use. Future land uses would be determined in accordance with a comprehensive Master Plan to be developed with local governments and community inputs. This Master Plan would also focus development of particular types on land uses at most suitable locations and help minimize or reduce effects of such use. The results of the Master Plan could reasonably be a mixture of future land uses, and this range of uses is bound by the alternatives considered and their effects evaluated in the EIS.

67. In accordance with 40 CFR Section 1502.22, the final EIS should provide specific details regarding proposed future zoning and proposed changes to current land uses within the MSR. It is also important for TVA to consider the relevance of the incomplete or unavailable information to evaluating reasonable foreseeable significant adverse impacts on the human environment. (*Commenter: Heinz J. Mueller - USEPA*)

Response: In the final EIS, TVA has revised Alternatives B, C, D, and E so that they each

prescribe specific land uses or combinations of uses. The new Preferred Alternative F would allow the property to be sold without restrictions on the types of future land uses. These land uses would be developed through a more detailed comprehensive master planning process with local governments and the public, thus representative of the norms, values, and needs of the community. TVA is confident that the analyses in the EIS including the effects on resources across the alternatives are adequately bounded by Action Alternatives B, C, D, and E.

Alternatives

68. The reasoning behind choosing Alternative E as the preferred alternative is flawed. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. TVA has revised the alternatives in the final EIS as described in the final EIS Section 2.1 and summarized in the response to Comment Statement 67. The new Alternative F is very similar to the Alternative E described in the draft EIS and is TVA's preferred alternative.

Adoption of Alternative F would provide the greatest opportunity for economic benefits to the area and region, would reduce TVA's O&M costs and environmental footprint, would encourage reuse of some historic buildings and structures, and leave future land use decisions to the local community. Also, see Section 2.4 in the final EIS.

TVA is working with local governments and the public to create a comprehensive Master Plan, which would guide development and allow these decisions to be made at the local level. Although TVA would not require a particular type of land use or uses under Alternative F, it is reasonably foreseeable that the property would be developed for one or more uses evaluated and the range of effects bounded by those described under the other Action Alternatives. TVA believes it is most likely that the property would be developed for mixed uses.

69. Alternatives C, D and E sound very similar. (*Commenter: Mayda Simone*)

Response: Comment noted. The final EIS has been revised to better describe and explain the Action Alternatives in Chapter 2. This includes revising Alternatives B through E to require specific types of land uses and the addition of Alternative F, which would require that the property be sold with no restrictions on the types of land uses that could occur.

70. If TVA adopts Alternative E as the Preferred Alternative, the Department of the Interior recommends that sustainable low-impact developments including business and residential uses that have a lower associated risk to surface waters be targeted for the redevelopment. (*Commenter: Joyce Stanley - USDOI*)

Response: Comment noted. Regardless of the land uses, TVA would offer insights, identify potential benefits, and attempt to motivate local governments and citizens to consider appropriate low-impact development (LID) strategies in the comprehensive Master Plan to minimize or reduce effects on water resources. Other agencies that practice LID methods would be encouraged to participate in the plan development process. As previously mentioned, adoption of the formerly Preferred Alternative E, Mixed Land Use Alternative, would require the property to be used for a mixture of land uses. Adoption of the new Preferred Alternative F would require that the property be sold with no restrictions on the types of future land uses that could occur.

71. Since the DEIS is very conceptual it is difficult to determine the true environmental impact of any of the alternatives, but overall EPA supports TVA's approach to designating areas of the MSR for conservation and utilizing environmentally responsible development practices such as LID. We hope that conservation of high quality natural areas will be a priority for future land use decisions at the MSR. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. As described in Section 4.15 of the final EIS, TVA does not anticipate adverse impacts to any of the designated natural areas in the vicinity of the MSR study area. High quality plant and animal habitats do occur on the MSR study area. While their future development and/or preservation would be addressed in the Master Plan, TVA does not intend to require their preservation under the preferred Alternative F. Final EIS Section 2.3 lists potential measures to reduce impacts to these areas and TVA will encourage the adoption of these measures in the Master Plan.

72. The draft EIS states: 'Redevelopment of the centrally located MSR study area, for the purposes of adjacent community growth and development, could potentially reduce the need for more impactful greenfield development.' If TVA wants to reduce the need for greenfield development, why are they willing to sell for development the hundreds of acres of woodlands, wetlands and grasslands in the MSR Study Area, all important urban wildlife habitat, with no restrictions on their use? (*Commenter: Charles L. Rose - SEA*)

Response: TVA is proposing this land for sale because it is likely unnecessary for TVA's future business plans and projects. The sale and redevelopment of the property would help foster economic development in the area, reduce TVA's related operation and maintenance (O&M) costs, and simultaneously facilitate the local governments' goals of furthering economic development. Reducing the need for greenfield development would also be a consequence of these actions, and reuse of this land could reduce the need elsewhere in the area or region. Through development and use of the comprehensive master planning approach, TVA believes that the effect on important resources such as those in question will be avoided, minimized, or mitigated.

73. The final EIS should add another Alternative that would include the conservation approach to the redevelopment of the MSR by TVA to form new TVA jobs. This would have a direct impact on local economy. (*Commenters: B. Paul Bernauer, M. Nash, Kenneth Warhurst*)

Response: TVA could decide to declare the 1,400-acre MSR study area unnecessary for its future business plans and projects because of its current underutilization. Thus, an alternative to increase operations there to create new jobs is not a viable alternative for future TVA development. See related response to Comment Statement 99. TVA has evaluated a reasonable range of future alternative uses of the property and logical environmental consequences. Under the Preferred Alternative, TVA would not restrict the types of future land uses that could occur on the land but, through the master planning process, would allow such decisions to be made at the local level.

74. The final EIS should include a new alternative that only allows development in the 'brown spaces' on the MSR and preserves all the 'green spaces.' The MSR is environmentally significant and retaining the green space would be a good marketing tool for any redevelopment of the buildings. (*Commenters: Gregory J. Harber - AOS, Greg Jackson, M.D. - AOS, Margaret M. McCloy, William Nelson, Tom Piper, Tom Ress, Charles*

L. Rose - SEA, Kenneth Wills)

Response: Comment noted. TVA has evaluated a reasonable range of future alternative uses of the property and logical environmental consequences. TVA would not restrict the types of future land uses that could occur on the land but, through the master planning process, allow such decisions to be guided by the comprehensive Master Plan. Through this process, TVA anticipates that the industrial core of the property (i.e., brownfield) would likely be designated to support appropriate redevelopment. TVA also expects that important natural and recreation resources would likely be incorporated into green spaces or LID areas, or set aside or enhanced as mitigation for development elsewhere on the area.

75. The final EIS should list the Alternatives in a descending order that present the highest environmental risk to TVA in regards to the Solid and Hazardous waste located on the MSR study area. Based on the information provided in the draft EIS, the alternative with the highest environmental (cost) risk to TVA is 1) Alternative C, 2) Alternative E, 3) Alternative D, 4) Alternative B, and 5) Alternative A. (*Commenter: B. Paul Bernauer*)

Response: Comment noted. Based upon records, data, information, health risk assessments, remediation, and monitoring and reporting to the Alabama Department of Environmental Management (ADEM), TVA has described areas on the property, depending upon future use, which could pose health risks. Under Alternative A (No Action), TVA would continue working with regulators to comply with appropriate laws and regulations and, as landowner, managing its risks. Future land uses could potentially expose landowners to differential level of risks of health effects from remaining contaminants. However, the Action Alternatives would involve potential postsale environmental risks, which from TVA's perspective, would not change. To minimize its risk, TVA has conducted a cleanup in accordance with applicable regulations and would conduct needed due diligence prior to transferring a building. TVA would also work with ADEM to have the property released from the area included in the Resource Conservation and Recovery Act (RCRA) permit. Regardless, TVA would provide any warranties required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Based on the information provided in the final EIS, the following is a ranking of the alternatives from the highest to lowest environmental (cost) risk to TVA from TVA's perspective is 1) Alternative C, 2) Alternative E, 3) Alternative F, 4) Alternative D, 5) Alternative B, and 6) Alternative A.

76. TVA correctly identifies the Environmentally Preferred Alternative as Alternative B, Conservation. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

77. TVA should identify programs within TVA where future needs could be met by utilizing existing TVA assets on the MSR under the No Action Alternative. The TVA Data Information Center is a great example of a program TVA could put on the MSR and have a direct impact on the local economy. (*Commenters: B. Paul Bernauer, Jerome McGouyrk*)

Response: TVA is developing program requirements for all current uses on the property that will provide the type of space being used and the square footage needed. Some of these uses may remain where they are, while others may be consolidated into fewer buildings on unsold property on the Reservation. As a part of developing the program, TVA

will also identify the type and quantity of space available that could be used for other TVA purposes on unsold property during the anticipated 20-year-plus development build-out.

78. We believe that the draft EIS contains a good range of Alternatives that were well thought out by TVA. (*Commenter: Steve Holt*)

Response: Comment noted.

79. Why does TVA acknowledge the Environmentally Preferred Alternative as Alternative B (Conservation), but then indicates that the TVA Preferred Alternative is Alternative E (Mixed Use)? It would appear that Alternative E would present the highest environmental liability/risk given the history of the site, especially since the site was cleaned up to industrial levels and not residential/commercial levels. (*Commenter: B. Paul Bernauer*)

Response: TVA analyses suggest the likely environmental effects of implementing Alternative B would be less than those of the other Action Alternatives evaluated, including the new Alternative F. TVA believes that the mixture of reasonably expected future land uses, now captured under the Preferred Alternative F (Unrestricted Land Use Alternative), would best meet the purpose and need of the proposed action by providing the most economic benefits to the area and region, reducing TVA's O&M costs and environmental footprint, encouraging reuse of historic buildings and structures, and leaving future land use decisions to the local community (see response to Comment Statement 68). The identification of the action agency's preferred alternative is based on a broader set of criteria than the identification of the environmentally preferred alternative, which includes environmental impacts. Potential environmental risk and liability will also be considered during the development of the Master Plan and any subsequent development of the site.

80. Why is TVA considering including commercial, retail and residential development as part of the Preferred Alternative when the draft EIS states that the implementation of the Alternative has so many negatives? Considering the DEIS's conclusions about the economic impact of commercial, retail & residential development in the MSR study area, it would seem entirely reasonable to bar it from all the MSR's natural areas. (*Commenter: Charles L. Rose - SEA*)

Response: On balance, TVA analysis suggests that socioeconomic benefits would result from an attractive and well-planned development initiative that includes commercial, retail, and residential elements. It further believes such development could be accomplished on this property consistent with a Master Plan directing the general types and locations of other compatible uses (i.e., conservation, industrial) and that development of this Master Plan would provide opportunities to avoid, minimize, or reduce potential environmental effects.

Cumulative Impacts Assessment

81. Cumulative impacts should be included in the 'Summary of Potential Effects by Alternative' table in the final EIS. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. See Tables S-1 and 2-1 in the final EIS. A more thorough analysis of the potential for cumulative impacts by resource across the alternatives is presented in the final EIS text and referenced in these tables (see footnotes).

82. The final EIS should include a cumulative impacts discussion for all affected

environment sections and a discussion that provides specifics on how cumulative impacts will differ under the different alternatives. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Chapter 4 of the final EIS has been revised to provide additional discussion of the cumulative impacts and how they might differ under the alternatives (see Chapter 4).

Draft EIS Errors

83. Statements in the summary table (Table 2-1) are not always supported by what is provided in the text of the draft EIS and there are many errors when comparing impacts related to each Alternative. These inconsistencies should be reconciled. (*Commenters: Larry Gautney, Charles L. Rose - SEA*)

Response: Comment noted. Several statements in Table 2-1 of the final EIS have been revised to better describe the impacts.

84. Table 2-1 (Groundwater) states that under Alternative D there is 'potential for contamination from spills or leaks,' but Alternative E, which includes industrial, there will only be 'Minor effect.' Why is the industrial development under Alternative E different than Alternative D? (*Commenter: Charles L. Rose - SEA*)

Response: Under Alternatives E and F, there is the expectation that there would be less industrial development compared to Alternative D (Industrial Land Use Alternative); and therefore, the likelihood of spills, leaks or other environmental releases would be less. Given the locally developed comprehensive Master Plan, TVA expects that the likelihood of a single use development (i.e., conservation, industrial) of this property would be low.

85. Table 2-1 states that there are 'minor impacts' for wetlands, surface water quality, floodplains, aquatic ecology, terrestrial ecology, natural areas and scenic resources. How can TVA make these claims when they have no idea about the specific developments that might occur on the MSR study area? (*Commenter: Charles L. Rose - SEA*)

Response: Table 2-1 reflects the anticipated context and intensity of effects on resources and assumes mitigation would be implemented for certain resources such as streams, floodplains, and wetlands. Future owners will utilize appropriate BMPs during construction and operation of the property. As appropriate, other agencies (i.e., local, state, or other federal agency) would be involved in permitting or land use approvals that impose environmental protection requirements. Some land would likely be set aside or developed in a compatible manner through guidance provided by the comprehensive Master Plan.

86. The final EIS should include a more quantitative evaluation of impacts for each resource issue and each alternative. Also, the terms 'small' and 'minor' as used in Table 2-1 should be defined for each resource. (*Commenter: Larry Gautney*)

Response: Analyses of effects are based on the anticipated consequences of land development associated with typical uses covered under the Action Alternatives. Analyses prepared in the EIS allow the determination of likely needs to mitigate for a land use change depending on the type and extent of the change. TVA also compared the effects on resources across the range of alternatives. Given the uncertainty of the ultimate change in use and where that use might occur, a quantitative evaluation of all resource effects is neither practical nor feasible. Terminology used is typical and acceptable for qualitative analysis and impacts comparison.

87. The Navigation section of Table 2-1 incorrectly states the impacts under the Alternatives in my written copy. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. The Navigation section of Table 2-1 in the final EIS has been revised.

Mitigation

88. The final EIS should include additional detail on how TVA will require incorporation of LID practices into future design projects at the MSR, what LID practices will be required, and proposed locations of LID projects within the MSR. (*Commenter: Heinz J. Mueller - USEPA*)

Response: As previously mentioned in Comment Statement 70, TVA would offer insights, identify potential benefits, and attempt to motivate local governments and citizens to consider appropriate LID strategies in the comprehensive master planning process. TVA would require development of the Master Plan and approve it prior to transfer of any study area property from federal ownership. In development of the Master Plan, TVA would include sensitive and societal valued resources in areas where environmental conflicts with development could likely be avoided and/or areas where such LID practices would be mandatory. As it relates to urban storm water management and green infrastructure, TVA believes that incorporation of LID-design principles into development plans would be cost effective and environmentally beneficial.

89. Why doesn't TVA require the mitigation measures identified in Section 2.3 of the draft EIS instead of stating that they would probably be required of future landowner(s) by agencies other than TVA? How can TVA describe the impacts of this federal action if these mitigations are not required? (*Commenter: Charles L. Rose - SEA*)

Response: In accordance with 40 CFR § 1502.14 and § 1502.16, Section 2.3 lists appropriate measures to mitigate adverse environmental impacts. These mitigation measures are listed regardless of whether they are within TVA's jurisdiction and whether TVA intends to implement them. TVA anticipates that many of these mitigation measures will be incorporated in the Master Plan. The Record of Decision will identify the mitigation measures that TVA will implement and the measures that TVA will require others to implement as conditions of the proposed land transfer and redevelopment.

NEPA requirements

90. If TVA disposes of this property 'without use restrictions' or any description of 'specific uses,' how is this compatible with NEPA's requirement that they 'prepare detailed statements assessing the environmental impact' of this action? (*Commenter: Charles L. Rose - SEA*)

Response: During and as a result of project scoping, TVA identified reasonable and likely future uses of the property and evaluated individual uses and combinations of uses that could be proposed to occur on the MSR property. As previously mentioned in responses to Comment Statements 66, 67, and 79, TVA would not dictate the future land uses that could occur on this property, but such use would be guided by a comprehensive Master Plan developed in concert with local governments and the community. This does not mean that use of the property for a particular purpose would be allowed without avoiding, minimizing, rectifying, reducing, or compensating for adverse environmental impacts or resource effects. This EIS identifies resources and potential effects of future alternative land uses. It also identifies potential mitigation measures to offset the adverse effects of future development. TVA believes that this EIS describes a discrete project scope, purpose and need for action, TVA decision, resources, alternatives, and potential effects, and compares

the effects of the alternative uses in sufficient detail so that informed choices can be made by responsible managers and agency decision makers.

91. The draft EIS does not satisfy the NEPA requirement that TVA provide a 'detailed statement' describing the environmental impact of the proposed action, any adverse environmental effects and alternatives to the proposed action. The draft EIS only discusses development concepts and is therefore premature and fundamentally deficient. (*Commenter: Charles L. Rose - SEA*)

Response: See Comment Response 90. As previously mentioned, this EIS identifies resources and potential effects of potential future alternative land uses. If land is declared surplus, sold (disposed) and projects proposed, the EIS also identifies potential mitigation measures to offset adverse effects. TVA believes that this EIS describes a discrete purpose and need for action, TVA decision, resources, alternatives, and potential effects, and compares the effects of the alternative uses in sufficient detail so that informed choices can be made by responsible managers and agency decision makers.

92. The draft EIS is insufficient to satisfy the requirements of the NEPA process since it is at a very early stage of the decision making process. I recommend that TVA use the tiering process defined in Section 1508.28(b) of the CEQ regulations, which provides a sensible and effective way to carry out the NEPA process in multiple-stage situations like the current proposal. (*Commenters: John Crowder, Charles L. Rose - SEA*)

Response: Comment noted. This EIS was not intended to address a broad TVA action, such as a program or plan (i.e., a programmatic EIS) for which only very general environmental information is known. In some cases, as the commenter describes, a site-specific EIS or environmental assessment may be “tiered” from a programmatic EIS on project-specific or site-specific action. However, TVA considers the MSR Redevelopment EIS to be a site-specific discrete proposed action involving 1,400 acres of its property for which substantial environmental detail is available. TVA will conduct additional environmental reviews for future TVA actions (i.e., Section 26a permitting) associated with the redevelopment of the MSR study area. These reviews may supplement or incorporate by reference the findings of this EIS.

Purpose and Need

93. Did TVA consider its environmental stewardship mandate in regards to this redevelopment? TVA should base its actions on its declared mission not just from a business perspective. (*Commenter: Charles L. Rose - SEA*)

Response: Yes. TVA’s mission is to serve the people of the region by providing reliable, low-cost electricity; managing the Tennessee River system; promoting economic development; and providing environmental stewardship. TVA believes that this proposed action reflects its vision and values. Through its environmental review procedures under NEPA, TVA assesses the effects of its plans, programs, and policies as well as its operations on the environment.

94. How will the redevelopment of the Muscle Shoals Reservation reduce TVA's operation and maintenance (O&M) costs when there are only a few jobs left at the Environmental Research Center? Current TVA employees are being relocated to the Multi-purpose building and most of the other buildings are empty, surely TVA's O&M costs for these facilities are minimal. (*Commenter: B. Paul Bernauer*)

Response: Square footage and acreage are two drivers of O&M costs associated with buildings and land. As you note, these costs have been reduced as the buildings were vacated, but there are still ongoing O&M costs required for maintenance of the buildings. In addition, there are long-term repairs that will need to be made.

95. It is stated that this action 'Will help TVA reduce its environmental footprint,' but how, under CERCLA regulation, can TVA transfer their environmental liability for this site and reduce its footprint? (*Commenter: B. Paul Bernauer*)

Response: TVA cannot transfer environmental liability. However, TVA would be reducing the square footage of buildings and acres of land used for TVA operations. Reducing TVA's energy use and waste streams is an example of reducing its environmental footprint.

96. So far, only one reasonable explanation for a sale has appeared – that TVA is operating an environmentally harmful number of facilities on the property. Instead of selling the property for development, however, a better solution would be to ask how much energy it takes to maintain the TVA Reservation. It can't take more than would be used by developers. If this is the best justification, then I have to question the real reason for this drive. (*Commenter: Jessica N. Smith*)

Response: The MSR is an underutilized piece of property and a large area of it is no longer needed for TVA operations. As a result, and consistent with the TVA Act, TVA is considering declaring it surplus and selling the 1,400-acre tract. TVA also believes this action could help support economic development in the Shoals area. TVA is currently operating facilities on the Reservation in accordance with applicable federal, state, and local laws and regulations and will continue to do so.

97. The disposal of the MSR may reduce TVA's 'environmental footprint,' but it is obviously going to increase the MSR study area' tract's environmental footprint. If the natural areas on the MSR are opened up for commercial development there is going to be a net increase in this tract's environmental footprint, therefore for TVA to be stating there would be a reduction in its own footprint is misleading. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. If the property is sold and redeveloped by others, the environmental impact from TVA's operations would decrease. As described in the final EIS, most of the Action Alternatives would increase the overall environmental impacts over those of the No Action Alternative.

98. The draft EIS states that 'in accordance with its economic development mission, TVA believes transfer and redevelopment of this property would help stimulate and grow the local and regional economy. In regards to commercial development on the MSR's fringes, on its natural areas, this statement is at odds with the DEIS's own findings in its 'Socioeconomic Resources' section. (*Commenter: Charles L. Rose - SEA*)

Response: TVA believes redevelopment of this property would support economic development in the Shoals area and recognizes some of the surrounding business and industrial properties have been underutilized, abandoned, or vacant for some time. As indicated in Section 4.5.3 (Alternative C) of the final EIS, TVA anticipates the economic effects to be positive but likely small. Benefits under this alternative are expected to be less than those under Alternatives D, E, and F. Under Alternative C, most of the development would likely be a transfer of locations within the area, including fringes of the study area, and would add little to the overall economy of the area. Under Alternatives D,

E, and F, developers would more likely be attracted from outside the area and the immediate community, bringing in new jobs and, thus, new ideas, talents, and money to the area.

99. The purpose and need for this proposed land disposal lacks clarity and direct reference to the original and revised TVA Act. TVA was established to create TVA jobs to directly enhance economic development. Economic development by means of transfer of property and redevelopment of said property to stimulate and grow the local and regional economy was not the intent of the TVA Act. (*Commenters: B. Paul Bernauer, Jessica N. Smith*)

Response: See Section 1.1 in the final EIS as well as Section 1.2 on Staffing and Building Space Reductions and Land Disposal Justification. As stated in responses to Comment Statements 96 and 100, TVA believes this is an underutilized piece of property that is no longer needed at its current size for TVA operations. As a result, and consistent with the TVA Act, TVA is considering declaring it surplus and selling it. In addition, TVA also believes this action would help support economic development in the Shoals area.

TVA's economic development mission is not limited to creation of TVA jobs, as the comment seems to state. Pursuant to its mission, the disposal of property to allow creation of jobs by private companies has long been a part of TVA's economic development activities.

100. There is ample land available in the Shoals area for commercial/retail and industrial development. Florence and Muscle Shoals have industrial parks which currently have less than 50 percent utilization. The Muscle Shoals Reservation should not be used for this purpose. (*Commenters: Janice Barrett, B. Paul Bernauer, Steve Carpenter, Greg Jackson, M.D. - AOS, Paul D. Kittle, Margaret M. McCloy, Jerome McGouyrk, Jackie Posey, Charles L. Rose - SEA, Jessica N. Smith, Mary Etoile Smith, Janet Spahn, Kenneth Warhurst, Marilyn Watson*)

Response: Comment noted. TVA believes that the MSR is an underutilized piece of property that could be used for other purposes. Consistent with the TVA Act, TVA is considering disposing of the property as it is no longer needed for TVA operations. The comprehensive Master Plan will guide how the property is used in the future to benefit the Shoals area community.

See Section 3.5 for a discussion of other potential development sites around the area and region and some attributes of these sites. The MSR study area provides a large site, centrally located near large population, and some existing infrastructure (water, electric, gas, etc.) that could be used to support various types of development. Other environmental factors (e.g., air quality attainment area, flat topography, nearby water-based transportation) generally make this land potentially attractive for industrial and other types of land use. Standards and expectations established under the Master Plan would also help create a holistic, well-planned environment with nearby or integrated recreation and open space.

101. TVA does not need to reduce its environmental footprint in this or any other area. TVA is much more than a power producer and should continue to be so. (*Commenter: Anonymous*)

Response: Comment noted. TVA agrees that it is much more than a power producer, as reflected in our vision and values.

Noise

102. Commercial, retail and residential development on the MSR, as envisioned in the draft EIS, would increase noise levels. How would this affect wildlife on the MSR? How would it affect the endangered Gray Bat, which forages here? Has TVA studied this? (*Commenter: Charles L. Rose - SEA*)

Response: TVA concurs that extensive development of virtually any type likely would increase the level of noise within the MSR study area. TVA has not conducted site-specific studies of the potential impact of noise on wildlife in general or on gray bats specifically within the redevelopment area. This area is surrounded on all sides by existing development and is near the Muscle Shoals Airport and thus already is subjected to the impacts of a variety of human-generated noise. As described in Section 4.20 of the final EIS, the increased level of noise from redevelopment could impact some wildlife and is unlikely to affect gray bats.

Other

Out of Scope

103. Are there any plans to open the visitors center at the Wilson Dam area? It would be an economic boost for the area if TVA and USACE would consider reopening the visitor center. (*Commenter: Gary Hester*)

Response: Comment noted. The future plans for the Wilson Dam Visitors Center are outside the scope of this EIS. While TVA does recognize the potential benefits, there are no plans to reopen the visitor center.

104. TVA should put the corporate headquarters back at Muscle Shoals like the TVA charter states it shall be. (*Commenter: Michael Lansdell*)

Response: Comment noted.

Public Involvement

105. Consistent with the federal NEPA process, The American Chestnut Foundation formally requests that a public hearing be held concerning this proposal and associated EIS in order to receive additional comment and input from the public and potentially affected parties. (*Commenter: George M. Phillippi - TACF*)

Response: TVA held public forums in July 2009 and in February 2011 to receive comments on the proposal allowing the public more than 90 days to provide scoping and draft EIS comments. This meets TVA's procedural requirement for implementing NEPA. TVA will publicly announce and individually notify those involved in the MSR redevelopment of the availability of the final EIS. TVA will also review any comments received on the final EIS prior to making its final decision.

106. I would like to serve on any TVA committee, especially those concerning the redevelopment of the Muscle Shoals Reservation. (*Commenter: Ginny Lee Hill*)

Response: Comment noted. TVA will ensure that the public is notified through various forms of media releases of opportunities to participate in the development of the comprehensive Master Plan.

107. TVA should consult with Muscle Shoals retirees on potential land uses for the MSR. (*Commenter: James Bedsole*)

Response: Comment noted. See response to Comment Statement 106 above. Several TVA retirees in the area have participated in public involvement efforts in support of this environmental review and are now on the TVA mailing list. This mailing list will be used as a part of the database of potential candidates for solicitation of continuing public involvement in development of the comprehensive Master Plan.

Prime Farmland

108. 'Agriculture development' would suffer if natural areas on the MSR are paved over and built upon. Most of the tracts that would be developed for retail, commercial or residential are prime farmland. 182 acres, mostly fescue fields, are currently in TVA's agricultural land use licensing program. There is also great potential in these areas for research into sustainable or organic farming methods under the Conservation Alternative. (*Commenter: Charles L. Rose - SEA*)

Response: See responses to Comment Statements 109 and 110 below. The current use of the area for agricultural purposes, as well as the presence of soils classified as prime farmland, are described in Section 3.9 and 4.9. As determined by the procedure described in the Farmland Protection Policy Act (FPPA) of 1981, the redevelopment of the MSR study area, including the permanent conversion of those areas classified as prime farmland to non-agricultural uses, would not result in significant impacts to prime farmland. The future use of areas classified as prime farmland, as well as other areas currently used for agricultural production, would be determined through the comprehensive master planning process at the local level.

109. TVA should try to retain the farmland on the MSR study area for public agricultural uses, we have loss too much prime farmland to urbanization, the farmland on the reservation does not need to be lost to urbanization as well. However, if any highway frontage land has to be sacrificed, it would do less environmental damage to develop the farmland rather than wetlands and forests. (*Commenter: Kenneth Wills*)

Response: As indicated in responses to Comment Statements 108 and 110, TVA evaluated impacts to prime farmland prior to allowing for the potential to permanently convert the land to a nonagricultural land use. To maintain its current level of agricultural productivity and unless otherwise compliant with the agreement, the presently farmed 182 acres would continue to be used until the land is sold. As indicated in Section 4.9, prior to the sale of any land covered under the TVA agricultural use license, such use would likely be terminated by TVA with a 30-day written notice. This would not prevent the licensee from pursuing a license agreement with the new landowner for use of the land.

110. Why are 747.4 acres of prime farmland being sacrificed for the typical sprawl-type development possible under the proposed action? All of these acres of prime farmland are in Zone C, land deemed suitable for 'unrestricted use.' (*Commenter: Charles L. Rose - SEA*)

Response: As indicated in Section 3.9.2 of the final EIS, about 53 percent (about 747.4 of the 1,400 acres) of the MSR study area contains the appropriate types of soils (i.e., mapping units) recognized by their inherent attributes as prime farmland. However, to be considered prime farmland, these soil types on the landscape cannot be urban, built up, or covered by water (or prone to flooding). This reduces the overall acreage, technically classified as prime farmland, to 669.3 acres. See Figures 3-22 and 3-23 for farmland soil

classifications. Finally, upon completion of the needed evaluation and consultation with the Colbert County Natural Resources Conservation Service, the total points for farmland conversion associated with the potential TVA land disposal and redevelopment were too low to suggest that the land's value for farming is high enough to recommend that it not be converted to nonfarm use. The total point score reflects the fact that buildings already occupy the best farmland in the study area.

Recreation

Public Use

111. I believe TVA's decision to dispose of this tract is short sighted. The demand by the public for recreational opportunities is always on the increase. Public green spaces are seldom increased. The MSR with its thousands of acres of open space right in the center of the Shoals is quite unique and should be preserved in order to meet future demand for recreation by the public. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. The majority of lands dedicated to public recreation and open space north of Reservation Road would remain available under any of the Action Alternatives. While Alternatives C and D would likely result in a loss of open space within the redevelopment area, implementation of Alternatives B, E, or F could result in the same or even an increase in total acreage allocated to recreation and open space compared to the No Action Alternative.

112. If the natural areas on the MSR study area are preserved for conservation and public recreation there could be a dollar and cents benefit to the Shoals area by reduction in health care costs. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

113. The draft EIS states that recreational use opportunities occur largely outside the MSR study area and north of Reservation Road. This is true, but recreation does occur on the MSR study area including jogging, walking, bird watching, botanizing, hiking, nature photography, even whitewater rafting and kayaking on Pond Creek. (*Commenter: Charles L. Rose - SEA*)

Response: As indicated in Section 3.16 of the final EIS, informal recreation use does currently occur on some of the lands within the proposed development area. Potential impacts on existing recreation uses would vary depending on the alternative selected and the resulting type, extent, and intensity of development. The desire to maintain open green space and recreation would be considered during preparation of the comprehensive Master Plan and implementation, as needed, of mitigation measures indicated in Section 2.3 to offset recreation opportunity losses.

114. The public access property should remain open to the public. (*Commenters: Susan Hardy, Janice Barrett*)

Response: As indicated in Section 4.16 of the final EIS, some of the lands currently designated as public recreation and open space under TVA's 1996 *Muscle Shoals/Wilson Dam Reservation Land Use Plan* could be converted to other uses, depending on the alternative selected. However, all formally developed public recreation facilities in the area, including the 12-mile-long trail complex, would remain open to the public. In addition, some additional recreational improvements on the properties retained by TVA could be provided

as mitigation for loss of opportunities within the redevelopment area.

Recreation Areas

115. Alternative B (Conservation), as stated in the draft EIS, would be ideal for encouraging recreational use of the MSR. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

116. The proposed redevelopment should not adversely impact the existing recreation areas on the Reservation. (*Commenter: Chuck Morring*)

Response: Under any of the Action Alternatives, it is TVA's goal to ensure the integrity of all formally developed recreation areas on Muscle Shoals /Wilson Dam Reservation, including the 12-mile trail complex.

117. The USEPA would recommend that TVA specifically protect the areas designated as 'Informal Recreation and Wildlife Observation area' from future development. Since the preferred alternative is described as the 'mix use' alternative it would appear that designating such areas as natural or recreational areas could be accommodated within this alternative. In addition, USEPA would support the preservation of these areas which would minimize the loss of forested areas located on the MSR. The final EIS should include specific details regarding areas to be designated and protected as natural and recreational areas. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. TVA envisions some forested areas and other green space being targeted for LID or set aside for protection of natural and recreation areas in the comprehensive Master Plan development.

Trail System

118. The Rockpile Trail should remain accessible through the proposed utility access corridor. The trail is heavily used by hikers and its unique features make it irreplaceable. (*Commenters: Larry Gautney, Chuck Morring*)

Response: Comment noted. Future use of the utility access corridor would not be likely to affect the integrity or character of the Rockpile Trail since this segment of the trail crosses an inlet over the top of a concrete skimmer wall developed as part of the old Wilson Steam Plant.

119. TVA has assured the public that the Nature Trail complex on the North side of Reservation Road would not be affected by the proposed project. However, under Alternative C, the draft EIS states that the overall experience of users of the SWA and MSR trail complex might decrease due to the potential increased traffic and noise levels. (*Commenter: Charles L. Rose - SEA*)

Response: Except for small parcels where the Western Area Radiological Laboratory and multipurpose buildings are located, the property north of Reservation Road would remain in federal ownership and not be considered for potential transfer. While recreation areas and activities located north of Reservation Road may not be directly affected, it is possible, as acknowledged in the final EIS, that increased traffic and noise levels associated with some alternative uses of the property could have some negative indirect impact on recreation activities in these areas.

120. TVA should protect the one mile segment of the paved National Recreation Trail Complex that extends south of Reservation Road into the MSR study area. These areas could be excluded or an agreement could be made with future property owners that these trails remain as-is with future maintenance consideration born by the new property owner(s). (*Commenters: Larry Gautney, Chuck Morring*)

Response: As indicated in Section 4.16 of the final EIS, there are options, including mitigation measures, for maintaining the integrity of the paved walkway/bikeway and ensuring it remains open to the public.

Section 26a Authority

121. The draft EIS states that TVA would review any proposed development on portions of the MSR study area that are located within the limits of the 100-year floodplain under Section 26a of the TVA Act and complete appropriate environmental review. However, numerous projects that lie within the 100-year floodplain have not been required to obtain Section 26a approval because it was determined that the 'obstruction' did not affect navigation, flood control, or 'public lands or reservations.' The final EIS should include a description of the potential Section 26A actions and properly recognize the limitations of this section of the TVA Act. (*Commenter: John Crowder*)

Response: Section 26a of the TVA Act requires that TVA's approval be obtained prior to the construction, operation, or maintenance of any dam, appurtenant works, or other obstruction affecting navigation, flood control, or public lands or reservations along, across, or in the Tennessee River or any of its tributaries. TVA jurisdiction under Section 26a is implemented through Section 26a regulations (18 CFR Part 1304). With regard to the range of construction and development activities along the shoreline, an obstruction is any man-made physical condition that during its continuance after completion, impounds, checks, hinders, restricts, retards, diverts, or otherwise interferes with the movement of water or of objects on or in the water. TVA would not approve large water use facilities such as a barge terminal or commercial dock along the left-descending bank of the river in the vicinity of the utility access corridor. Future TVA reviews and approvals under Section 26a could potentially involve such proposals as intakes; outfalls; water, gas or petroleum pipelines; other chemical or electrical transmission lines; or other associated shoreline alterations. By way of example only, activities or alterations in, on, over, or along Pond Creek could include some similar activities but could also include proposals for such obstructions as aerial cables, culverts, devices for discharging effluent, bridge construction and fills for roads, businesses, and homes.

On land over which TVA owns a flowage easement, such as most of the Wilson Reservoir shoreline, a request for a dredge, even if it is located within the 100-year floodplain, would not require Section 26a approval because removal of such spoil material does not create an obstruction. TVA may conduct project reviews and determine that a proposed action does not create an obstruction requiring approval. For example, excavation of a trench for a submarine sewer, telephone, or other utility line, in which the trench is backfilled to the original contour and is located outside the area of a marked navigation channel does not create an obstruction. However, Section 26a approval is required for trenches excavated in the marked navigational channel or for a dredge constructed in association with a new dock permit.

122. The final EIS should clarify whether, after transfer of the MSR study area, the MSR study area would be considered to be 'public lands or reservations' as stated in Section 26a of the TVA Act. Does the term 'public lands or reservations' refer to only those lands under

TVA ownership or does it include other federal lands or public lands of states and/or local governments? Unless the “public lands or reservations” of the transferred MSR study area are subject to Section 26A, TVA cannot legally invoke its Section 26A authority on the basis of an “obstruction’s” impact on “public lands or reservations” absent a finding that a proposed action affects lands owned by TVA outside the former reservation lands transferred to others. (*Commenter: John Crowder*)

Response: TVA’s jurisdiction under Section 26a applies to both the geographical reach and range of activities described in the response to Comment Statement 121. It is most likely that, upon disposal, the MSR study area will be owned by private developers; at that point, the land would cease to be “public lands or reservations” under Section 26a. However, under Section 26a, TVA would continue to have the authority to regulate obstructions across, along, or in the Tennessee River or its tributaries that affect navigation or flood control; this is regardless of the landrights or ownership at the location. TVA can exercise this jurisdiction on private land within the geographical reach of the Tennessee River basin and its tributaries including on land previously owned by TVA.

Solid and Hazardous Waste

Cleanup

123. It appears that CERCLA regulations were not sufficiently addressed in the draft EIS. (*Commenter: B. Paul Bernauer*)

Response: CERCLA and RCRA are the primary federal environmental laws governing the investigation and cleanup of contaminated sites. These laws share the common primary goal of protecting human health and the environment. The cleanup of contaminated sites may be governed by either CERCLA or RCRA depending on such factors as the source and cause of the contamination, the status of the installation as either a National Priorities List (NPL) or a non-NPL site, and whether the installation has sought or is seeking a RCRA permit for managing hazardous wastes. Although CERCLA and RCRA are separate statutes, each remedial cleanup program should operate consistently with the other and should yield similar environmental solutions when faced with similar circumstances. Any procedural differences between CERCLA and RCRA should not substantively affect the outcome of remediation. Both CERCLA and RCRA investigations were initiated at this site. Early in the process, USEPA decided that duplication could be eliminated, and a satisfactory cleanup achieved, by managing the site under the RCRA Corrective Action Program.

124. The HWSA Permit issued for the site was to TVA and, therefore, TVA is solely liable under CERCLA with the liability nontransferable, not the United States. Have the TVA Act and CERCLA regulations been changed to allow for the United States (Appropriated Funds) to assume the environmental liability for TVA? (*Commenter: B. Paul Bernauer*)

Response: The land known as the Muscle Shoals Reservation is owned by the United States and in the custody and control of TVA. In certain situations, CERCLA requires that deeds for transfer of land owned by the United States include a covenant warranting that the United States will perform any remediation found to be necessary on the property. The required covenant does not address the source of funding for the remediation, which would be determined at the time any necessary remediation is undertaken.

Human Health

125. Condition Number 9 on page 19 of the draft EIS states 'TVA would warrant in the sale

deed that the property has been cleaned up to USEPA/ADEM (i.e., the extent believe necessary to protect human health and the environment) and that the United States will perform any cleanup that becomes necessary in the future.' This must be clarified that the property was cleaned up to USEPA/ADEM Industrial Use Levels. Thus, the reference to protecting 'human health and the environment' should be deleted. (*Commenter: B. Paul Bernauer*)

Response: TVA acknowledges its obligations to comply with applicable laws and regulations and as indicated in Section 1.7, TVA would comply with applicable provisions of the RCRA, including required coordination with ADEM, and CERCLA in disposing of the property.

The property in the MSR study area was investigated and cleaned up to the extent believed necessary to protect human health and the environment. In the draft EIS, Item Number 9 was identified among other elements common to all the Action Alternatives. Instead, for more appropriate context and emphasis, this assurance is provided in Section 4.1, Solid and Hazardous Waste, and elsewhere in the final EIS. As required by law, TVA would warrant in the sale deed(s) that the property has been cleaned up to the extent necessary to protect human health and the environment and that the U.S. will perform any cleanup that becomes necessary in the future. Section 4.1, also indicates that this commitment would apply to all Action Alternatives (i.e., Alternatives B through F).

126. If undisclosed hazardous waste is discovered after the transfer, who will be responsible? If anyone is injured as a result of such undisclosed buried waste, who will be responsible? (*Commenter: Charles L. Rose - SEA*)

Response: In accordance with applicable state and federal regulations, TVA has expended every effort to document activities and areas at the MSR where waste, either hazardous or nonhazardous, could have been buried or otherwise released to the environment. In the unlikely event that a site, previously not investigated, is discovered that contains wastes that could potentially cause harm, as indicated in Section 2.1 of the final EIS, the United States will perform any necessary remediation. It is speculative at this time to assign liability for a hypothetical future injury, and TVA declines to do so.

127. With the MSR study area being a RCRA Remediation site, I feel it is not prudent for TVA to conclude that all actions have been taken to protect human health and the environment. Even if the site cleanup was to residential levels, I would not advise making a statement that the area is safe for human health and environment. As with any RCRA Remediation Site, unknowns remain. (*Commenter: B. Paul Bernauer*)

Response: As with any former industrial site, the potential for unknown contamination may exist within the MSR study area. However, TVA has extended great effort over many years to evaluate all potential and/or unknown areas of contamination. To the extent practicable, all areas were investigated that could have ever been impacted by TVA facilities and processes. Under the provisions of TVA's RCRA permit, Section 3004(u) of RCRA, the permit issued to the TVA facility addressed corrective actions for all releases of hazardous waste and hazardous constituents from any solid waste management unit (SWMU) regardless of when the waste was placed in such unit. This initial step, the RCRA Facility Assessment, included a review (by USEPA, ADEM, and TVA personnel) of existing information about the Environmental Research Center facility, a visit to the facility, and sampling to determine if there was an actual or potential release of hazardous wastes or hazardous constituents from the SWMUs at the facility. The primary focus was to

determine if there was the potential for contamination at levels that would pose human health or environmental concerns. This process continued in the RCRA Facility Investigation where extensive sampling and analyses were used to define the nature and extent of all known contamination. These steps, as prescribed by RCRA, ensured that all known sources of contamination were addressed to the full extent of all applicable federal and state regulations.

Low-Level Radioactive Waste Burial Site

128. How is TVA considering transferring the LLRWBS without cleanup even though it is now known that radioactive materials were illegally buried at the site? (*Commenter: Charles L. Rose - SEA*)

Response: See related responses to Comment Statements 131 and 132. TVA has undertaken an extensive search of all records pertaining to the low-level radioactive waste burial site (LLRWBS) and has found no written evidence that radioactive liquids were "illegally buried" at the LLRWBS. If citizens have knowledge and supporting data concerning "illegal" burial or radioactive material at the LLRWBS, such information should be provided to TVA as soon as possible so that it can be properly assessed as it relates to the future transfer or disposal of the site.

129. If the LLRWBS is not cleaned up prior to sale, how is TVA going to guarantee that some future land owner doesn't act irresponsibly? The site should be protected from accidental excavation as part of redevelopment activities by excluding it from the MSR study area and provide a concrete cap/barrier over the site. (*Commenters: Chuck Morring, Charles L. Rose - SEA*)

Response: See elements common to all the Action Alternatives in Sections 2.1 and ADEM guidance regarding the possible disposal and transfer of land in the MSR study area in Section 4.1 of the final EIS. Access to the LLRWBS is currently fence-restricted and, as indicated in Section 4.1.1, the site has a clay soil cap that prevents aboveground radiation exposure. No land would be sold or transferred from within the existing RCRA Hazardous and Solid Waste Amendments Permit area unless remediated to a level that would allow unrestricted use or transferred with appropriate covenants to protect human health and the environment. Such environmental covenants are outlined in ADEM Administrative Code Chapter 335-5-1 and are attached to and run with the land. Examples of covenants include groundwater development restrictions, use controls, engineering controls, and exclusion requirements. ADEM has authority through the civil court system to enforce these types of covenants.

130. Was there any additional Radiological Survey/Monitoring Data collected at the LLRWBS between 2005-2009? (*Commenter: B. Paul Bernauer*)

Response: TVA has no records of any official data collected at the LLRWBS between 2005 and 2009. As noted in Section 3.1.1.4 of the final EIS, the Nuclear Regulatory Commission released this site for unrestricted use in 1999, and no additional radiological surveys or monitoring was required.

131. Were only solids disposed at the LLRWBS? A listing/inventory of the types of materials disposed at the LLRWBS is needed in the final EIS. (*Commenter: B. Paul Bernauer*)

Response: See related response to Comment Statement 132. Most of the material buried at the LLRWBS was contaminated laboratory waste (i.e., gloves, paper towels, and contaminated soil from agricultural experiments at the nearby TVA greenhouse). Records

also indicate that a small amount of a xylene-based liquid scintillation cocktail, contained in 50 milliliter high-density plastic vials, was also buried at the site. A list of all radioactive isotopes buried at the LLRWBS is included in Appendix D in the final EIS.

132. What other TVA programs disposed of LLRW at the LLRWBS other than the fertilizer research and radioanalytical lab? What other radionuclides were in this waste? This information should be included in the final EIS. (*Commenter: B. Paul Bernauer*)

Response: Section 3.1.1.4 of the final EIS provides an overview of the material buried at the LLRWBS, and a list of radioactive isotopes is included in Appendix D in the final EIS. The material buried at the site was generated from agricultural experiments for fertilizer development and various lab analyses. The waste consisted mainly of isotopes of phosphorus, zinc, manganese, carbon, and sulfur. Also buried at the site was a small amount of waste containing uranium from quality control checks conducted at the Power Service Center on nonirradiated fuel pellets. No material from any of TVA's nuclear plants was buried at this site.

Phosphate Slag Storage Area

133. All alternatives should include the statement that the use of the phosphate slag storage area would be restricted to infrastructure enhancements and would not be available for occupied facilities. This language should be similar to what is stated under Alternative D (page 22 of the draft EIS). (*Commenter: James L. McNees - Alabama Department of Public Health [ADPH]*)

Response: A statement similar to that in Alternative D was added to the 'Elements Common to all Action Alternatives' list in Section 2.1 of the final EIS.

134. Due to the radiological concerns and lack of sampling data, the Alabama Department of Public Health recommends that the area identified as the phosphate slag storage area be removed from the MSR study area analyzed in the draft EIS. This area should continue to be managed under TVA's current land management plan until such time that the area is remediated to the standard of 5 pCi/g total radium. (*Commenter: James L. McNees - ADPH*)

Response: The final EIS emphasizes that the phosphate slag storage area is available only for infrastructure enhancements such as a utility corridor and will not be sold or transferred. In the event that the slag storage area is proposed to be used for infrastructural uses (e.g., pipeline, water intake), additional radiological monitoring will be conducted to ensure worker safety.

135. Release of the 90 acre phosphate slag area would require that the new owner(s) of the area be licensed by the Alabama Office of Radiation Control to possess the radioactive material on site or a variance of the Agency's Rules would be required to allow possession of the material on land that would no longer be exclusive federal jurisdiction. (*Commenter: James L. McNees - ADPH*)

Response: As stated in Section 2.1, Section 2.1.4, Section 2.3, and Section 4.1.1 of the final EIS, the phosphate slag storage area is available only for infrastructure enhancements such as a utility corridor necessary for the operation of adjoining industrial facilities or commercial businesses south of Reservation Road. It would not be sold or transferred or be made available for other types of development.

136. Table S-1 summarizes the potential effects by alternative. For the phosphate slag storage area (Zone B), footnote 1 states that TVA would warrant in the sale deed that the property has been cleaned up to EPA and ADEM standards, and that the United States will perform any clean up as necessary in the future. Yet, page 42 of the document states that the phosphate slag is excluded from RCRA and that EPA concluded that the area did not require a hazardous waste permit. (*Commenter: James L. McNees - ADPH*)

Response: The reference to footnote 1 for the phosphate slag storage area (Zone B) has been removed from Tables S-1 and 2-1. TVA does not intend to sell or transfer any land within the phosphate slag storage area.

137. The Alabama Department of Public Health believes that in order for the phosphate slag storage area to be released for unrestricted use, it should be remediated such that soil within the top fifteen centimeters of the surface contains no more than the national standard of 5 pCi/g total radium, and that all areas exceeding that standard should be clearly posted that utilization is restricted due to the presence of 'radiological contamination.' (*Commenter: James L. McNees - ADPH*)

Response: As stated in the final EIS, TVA does not intend to release this parcel of MSR property for “unrestricted use.” Additional cleanup at this time is not deemed warranted by TVA. If the proposed use of the property should change, TVA would remediate the site according to applicable regulatory guidelines and standards.

138. The draft EIS does not address exposure to workers developing and constructing infrastructure enhancements in the phosphate slag storage area. (*Commenter: James L. McNees - ADPH*)

Response: The exposure to workers developing and constructing infrastructure enhancements in the phosphate slag storage area will be evaluated if and when specific proposals are made for use of the area. Any radiological exposure estimate without a specific time, frequency, and duration would be speculative and would not provide useful information at this time.

139. The draft EIS proposes making the phosphate slag storage area available under specific use agreements that limit access to the area to 500 hours per year. This number is based on a 2002 four point survey of ambient radiation levels one meter above ground. Additional surveys, including soil analysis, should be performed using statistically valid methodology such as MARSSIM. (*Commenter: James L. McNees - ADPH*)

Response: The radiation measurements conducted in and around the slag storage area over the course of several years have provided sufficient evidence for likely use as an aboveground conveyance for surface utilities or other infrastructure needs. If no subsurface or surface development use is proposed for this site, no additional surveys or monitoring will be conducted at the site. If it becomes necessary through the proposed use of the area for subsurface infrastructure enhancements, TVA will assess the need for further radiation measurements using the appropriate methodology.

140. The draft EIS proposes to restrict access to the phosphate slag storage area based on annual hours to comply with the 25 millirem per year limit. The statement allows for additional soil coverage to be used for longer exposures times. Who will evaluate the

effectiveness of the soil coverage and determine the additional exposure times allowed? (*Commenter: James L. McNees - ADPH*)

Response: If conditions at the slag storage area are altered as a part of the proposed infrastructure development or other appropriate usage and it becomes necessary to reevaluate radiation exposure, TVA, in consultation with the appropriate state and federal agencies (i.e., Alabama Department of Public Health), will verify any changes to the phosphate slag storage area that would allow increased exposure times. This would include any effort to mitigate radioactive levels at the site through the use of soil cover or caps of various materials.

141. The final EIS needs to include the actual Rad Survey Data as recorded by TVA and ADPH for the Phosphate Slag Storage Area for the last 15 years. (*Commenter: B. Paul Bernauer*)

Response: The summary of the actual radiological survey data for the phosphate slag storage area is included in Section 3.1.1.4. As stated in previous comments, TVA does not propose to sell or transfer any land within the phosphate slag storage area.

142. What is the personnel exposure as calculated by taking a direct reading using a calibrated Micro R Meter or equal instrument from the center line of Reservation Road where it is nearest to the Phosphate Slag Storage Area? (*Commenter: B. Paul Bernauer*)

Response: The use of 50 microRems/hour measured directly on the site will accurately reflect the likely radiation dose to a potential worker. Should any subsurface development be necessary for infrastructure enhancement, a more in-depth study of radiation measurements will be conducted.

143. Will TVA secure the Phosphate Slag Storage Area with a fence? (*Commenter: B. Paul Bernauer*)

Response: No decision has been made at this time on securing the Phosphate Slag Storage Area. TVA will investigate security measures along with any proposed infrastructure use of the site.

RCRA Permit

144. The USEPA concurs with ADEM's guidance for disposal of lands on the MSR stated in Section 4.1 of the draft EIS. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. TVA appreciates USEPA's concurrence with ADEM guidance for MSR disposal and will ensure that all regulatory and procedural requirements are followed.

Terrestrial Ecology

American Chestnut Orchard

145. The American Chestnut Foundation (TACF) urges TVA to consider not only the immediate environmental impact of the reservation redevelopment, but the longer term economic, social and environmental impacts of eliminating an important regional American chestnut tree research and breeding orchard currently located on the reservation. To this end, we are requesting that TVA group the approximately 4-acre Alabama TACF research orchard and its proposed 20-acre expansion with other environmentally important areas –

specifically the adjacent wetlands and floodplain areas to the west and south of the orchard -- and exclude these areas from the redevelopment plan. This is entirely consistent with TVA's local economic development and environmental sustainability objectives. (*Commenters: George M. Phillippi - TACF, Paul Sisco - TACF*)

Response: Comment noted. Please see Section 4.14 for TVA's analysis of the impacts that would likely result from elimination of TACF research orchard plot. TVA recognizes the support from within the Shoals area for maintenance of TACF research orchard plot and the potential value of the research being conducted. To that end, TVA is working with TACF to identify other lands that could be used for its research efforts if necessary; TVA and TACF are also discussing other projects and activities of mutual interests. However, land use decisions regarding the continued use of the 4-acre plot on the MSR and expansion into the proposed additional 20-acre area would be made through development of the comprehensive Master Plan by local governments and citizens of the community in cooperation with TVA. TVA's decisions regarding appropriate resource mitigation on the MSR are principally driven to ensure compliance with environmental laws and regulations and applicable executive orders, and there are no applicable laws, regulations, or executive orders related to the chestnut orchard. As a result, the decision whether to retain or expand the orchard would be best made at the local level as a part of the master planning process.

146. TVA should maintain the research orchard of the Alabama Chapter of the American Chestnut Foundation at the Muscle Shoals Reservation. The loss of this orchard would result in a setback to the mission of chestnut restoration in the state of Alabama. (*Commenters: Forrest Bailey - ALSPD, Steven W. Barnett - National Wild Turkey Federation, Janice Barrett, Noel M. Beck, Jim Bennett, Bryan Burhans, Linda Casey - Alabama Forestry Commission, Victor Dura - SEA, Leslie Ecklund, Larry Gautney, Steve Holt, Mark Johnston, Paul D. Kittle, Anthony L. Leigh, Jimmy Maddox - TACF, Patricia T. McMillion, Matthew Miller, Clint Neal - TACF, Grant Posey, Jackie Posey, Holly Rene', Amy Rhuland, John C. Rist - TACF, Susan Roessel, Charles L. Rose - SEA, Linda Sherk, Mary Etoile Smith, Stephen Smith - Southern Alliance for Clean Energy, Marilyn Watson, William White*)

Response: Comment noted. See previous response. TVA recognizes the support from within the Shoals area for maintenance of TACF research orchard plot and the potential value of the research being conducted. As previously mentioned, TVA is also working with TACF to identify other lands that could be used for its research efforts if necessary.

147. TVA states throughout the draft EIS that the 4-acre TACF Research Orchard is an interim site use. Are gas stations, car washes and strip malls more important than the work that is going on at the orchard? Why doesn't TVA guarantee TACF's lease on the property, it is only 4-acres? This is at odds with TVA's claim of being environmental stewards. (*Commenter: Charles L. Rose - SEA*)

Response: See response to Comment Statement 145. There is no lease or other formal land use agreement between TVA and TACF for use of this land for this purpose; as a result, it is considered an indefinite but interim use. By allowing the decision on the continued existence of the chestnut orchard at this location to be handled during the master planning process, TVA is not making a value judgment regarding the importance of the orchard versus the importance of other potential uses of the property, such as for commercial and/or industrial uses. Rather, TVA is simply allowing the planning process to determine the highest and best use of this parcel of land.

Habitat Fragmentation

148. The draft EIS does not address the potential impacts of habitat fragmentation caused by the proposed redevelopment. For example, development in the MSR study area will affect the wildlife habitat on the north side of the road. (*Commenter: Charles L. Rose - SEA*)

Response: The potential impacts of habitat fragmentation are described in final EIS in Section 4.14.2. Fragmentation of habitat is currently present both within the proposed redevelopment area boundary and the area north of Reservation Road in the form of existing rights-of-way, roads, agricultural use, industrial use, and other disturbances. These areas also are surrounded by land use practices (commercial, residential, etc.) that have fragmented habitat used by wildlife. Any clearing of forested habitat that occurs as a result of development within the MSR study area would contribute to further habitat fragmentation, but given the current extent of habitat fragmentation present, species present within the study area are already exposed to some degree to the effects of habitat fragmentation. Species that continue to use these habitats have adapted to such conditions to fulfill all or a part of their life cycles.

Invasive Species

149. If TVA allows commercial development, the invasive species removal volunteer efforts in the Old First Quarters Small Wild Area and elsewhere on the MSR will suffer. (*Commenter: Charles L. Rose - SEA*)

Response: As previously mentioned, there are no designated natural areas on the MSR Redevelopment study area. The invasive species removal in the Old First Quarters SWA would not be affected by any of the actions associated with the proposed disposal, sale, or alternative uses of the property considered in the MSR Redevelopment EIS. This SWA is located north of Reservation Road and, therefore, outside the geographic scope of the EIS.

Invasive species removal activities are also being implemented by TVA and its partners on parts of the study area. However, as indicated in Section 4.14.1.3, due to the number of invasive species present on the study area, development-related disturbance could foster their spread during and after construction. Preventive measures implemented by future landowners could potentially curb or reduce the introduction or spread of these species and their impact on native plants. The invasive species on the MSR, however, are relatively well established and widespread in the area and region.

150. The Shoals Environmental Alliance would be interested in helping remove invasive plant species from areas adjacent to streams in the MSR study area to improve habitat for the gray bats. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. Thank you for your past support and continuing interest in assisting with removal of invasive plants from TVA public land. Such assistance from the SEA could be feasible, particularly while the property remains in public ownership. Stream corridors that provide gray bat foraging habitat, such as along Pond Creek, could be subject to protection from future land use depending on the results of development and implementation of the Master Plan.

Site Impacts

151. I am concerned with the pristine old growth forest located between Hatch Boulevard and Wilson Dam Road along Second Avenue. This land could be used for strip mall

development and those businesses will be vacant and unoccupied five to ten years from now. (*Commenter: J. C. Hester*)

Response: The wooded area that lies between Hatch Boulevard and Wilson Dam Road along Second Avenue does contain some fairly large trees, primarily water and willow oaks. Soils through much of this area are wet during the growing season. This area would not, in biological terms, be classified as pristine or old-growth due to its age and structural characteristics. This area has remained relatively undisturbed in recent decades due to the presence of wetlands, the potential presence of cultural resources, and other factors. See response to Comment Statements 80 and 100. TVA believes that economic development on the MSR property, with appropriate mitigation, can be viable and long-lasting.

152. Section 4.14.2.3 of the draft EIS states: '...potential habitat loss from the MSR study area site would not likely adversely impact these bird populations or the recreational opportunity created on a regional scale.' By this logic, any negative impact by development can be explained away. At some point the accumulated 'insignificant habitat losses' add up to major losses. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. See discussion of potential cumulative effects on terrestrial ecology (i.e., plants and wildlife) in Section 4.14 of the final EIS.

153. TVA should preserve the habitat for rare plant populations and the location of the former Alabama Champion tree instead of just suggesting it. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. As noted in Section 3.14.1 of the final EIS, the former Alabama champion American chestnut tree occurs within the MSR study area. As of April 2010, it has been heavily infested with the chestnut blight; however, live sprouts still persist. Former champion trees have no status, and TVA is under no obligation to protect them. As a stewardship function, TVA will continue to attempt to avoid adversely impacting champion trees through its actions throughout the 201-county power service area.

154. While trying to conserve the green space areas, it might alter the natural ecosystems that are present through conversion of these areas to unnaturally open parklands through clearing of the understory (an important feature of this area to migrant birds). This should be avoided and in fact should be stipulated in any plan that is adopted. (*Commenters: Gregory J. Harber - AOS, Greg Jackson, M.D. - AOS*)

Response: Green space is used to refer to a wide variety of settings, from those reflecting more of a parklike setting to those that remain in a more natural state. TVA concurs that clearing of understory vegetation could result in a change in the type of habitat available to wildlife. Given the long existence of invasive plants, such as Chinese privet in the area, this structural component in forested areas would likely remain prominent.

Wildlife

155. Consulting the Land Use map on page 87 of the draft EIS, it seems that about 85.6 percent (1,198.4 acres) of the MSR study area is wildlife habitat of some kind or other. The great majority of this diverse habitat should be preserved as open land in support of local wildlife. If TVA truly wants to decrease its 'environmental footprint' it will not be responsible for allowing this land to be gutted during the proposed development. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. Local citizens and governments will play a role in determining how this land might eventually be used through their participation in the Master Plan development and enforcement process. Identification of future green space locations will be an important part of conserving wildlife habitat.

156. Instead of attempting to sell this invaluable urban green space, TVA should be working to improve it as wildlife habitat. If TVA doesn't want it anymore, instead of selling it for development, it should consider transferring it to another federal agency, the Alabama Dept. of Conservation and Natural Resources or an nongovernmental organization (NGO) such as the North Alabama Land Trust, that would be interested in maintaining it as an urban nature preserve. (*Commenter: Charles L. Rose - SEA*)

Response: Because of the potential for the redevelopment of this land to promote economic development and growth, TVA is primarily interested in selling the land for redevelopment purposes. TVA has had internal discussions about the potential of transferring the land to other federal agencies such as the Department of the Interior or Department of Defense for various uses. Informal contacts with these agencies have not prompted interests. These federal agencies would similarly be responsible for resource management and protection while, depending upon actions proposed, the State of Alabama or an NGO would likely not. In addition, see response to Comment Statement 158.

157. The currently undeveloped areas are highly significant biologically and should remain undeveloped. This mix of forest, wetlands, and small open spaces is heavily used by migrant birds in spring and fall, and also is of importance to both breeding and wintering birds. The reservation's proximity to the Tennessee River, which serves as a major "landmark" for migrating birds, is crucial to its significance as a migratory stopover point for birds where they can rest and feed. (*Commenters: Gregory J. Harber - AOS, Greg Jackson, M.D. - AOS*)

Response: Comment noted. See TVA's assessment and description of potential effects in Sections 3.11, 3.14.2, 3.14.3.2, 4.14.2, and 4.14.2.3 for discussion and potential effects on migrant birds.

158. The draft EIS states: 'Some migratory bird populations, particularly neotropical migrants and others that rely on wetland habitats, including those on the Muscle Shoals/Wilson Dam Reservation, are declining.' This is all the more reason to protect the MSR's natural areas from the non-productive commercial, retail and residential development TVA would allow. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. See response to Comment Statement 156 and discussion of potential cumulative effects on terrestrial ecology (i.e., plants and wildlife) in Section 4.14 of the final EIS.

159. There have been multiple cougar sightings on the MSR. (*Commenter: Charles L. Rose - SEA*)

Response: Eastern cougar (*Puma concolor cougar*) is native to the eastern United States and southeastern Canada. Based on the 2010 five-year review of the eastern cougar, the USFWS concludes that this species is extinct (http://www.fws.gov/northeast/ecougar/QA.html). TVA would welcome any documentation of eastern cougars on the reservation, but according to both the recent five-year review by

the USFWS and Alabama Wildlife, Volume 3, *Imperiled Amphibians, Reptiles, Birds, and Mammals*, the eastern cougar is considered extirpated from Alabama.

Transportation

160. Please explain in general detail the proposed 'Transportation Option 2,' specifically what is meant by 'Realign US 43/72 through Hatch Blvd'. Also what is the purpose of re-routing Jackson through Birmingham? (*Commenter: Nathan Willingham - NACOLG*)

Response: Section 4.17.3 of the final EIS was revised to include more details about the transportation mitigation options, especially the need to realign US 43/72 through Hatch Boulevard. In mitigation Option 1, Jackson Highway would be rerouted to the intersection of US 43/72 and Reservation Road to alleviate the traffic congestion at the intersection of Hatch Boulevard and US 43/72.

161. The final EIS should provide additional information on how the traffic mitigation strategies will be funded and how the cost of the mitigation strategies factors into the selection of the preferred Alternative. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Road construction and improvements needed to accommodate the MSR development (on- and off-site) would be funded by future landowners, Colbert County Road Commission, and/or Alabama Department of Transportation. The cost of the mitigation strategies would not have an impact on the selection of the Preferred Alternative for this EIS.

162. Transportation mitigation strategy 'Option 2' includes an additional access point to the MSR between the Tennessee River and Hatch Boulevard and a flyover for southbound US 43/72. How will these activities impact the recreational opportunities on the North side of Reservation Road? (*Commenter: Charles L. Rose - SEA*)

Response: The transportation projects developed as part of the analysis are conceptual in nature and are not intended to indicate exact alignments or locations. A variety of factors would likely affect the nature and/or applicability of the recommended mitigation options as the proposed redevelopment options are refined. Likewise, when any of the applicable recommended transportation projects are designed, mitigation measures would be developed to address impacts as appropriate.

163. It appears that all action alternatives have a similar impact on transportation in Table S-1, however that is not the case in Section 4.17. The final EIS should provide a clearer description of the potential traffic related impacts in all summary tables in the document. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Tables S-1 and 2-1 of the final EIS have been revised to include a clearer description of potential impacts of the Action Alternatives. As stated in Section 4.17.1, all Action Alternatives would involve level of service (LOS) failures at three intersections along the Hatch Boulevard corridor even though Alternatives C and E are likely to generate more trips to and from the MSR study area than Alternatives B and D. TVA believes this LOS failure at these locations would also likely occur under Alternative F.

164. The final EIS should include a description on how future traffic counts were predicted for the proposed action alternatives. It should also include a clearer discussion on how the LOS failures were determined for such conceptual plans. (*Commenter: Heinz J. Mueller -*

USEPA)

Response: As indicated in Section 4.17, future traffic counts for the proposed Action Alternatives were predicted using conceptual assumptions for generalized land uses that would potentially be constructed at build-out by the year 2035. The land use assumptions were determined using a variety of considerations including reasonable floor-to-area ratios, the amount of developable land, and an analysis previously conducted for TVA and documented in the *Muscle Shoals Reservation Adaptive Re-Use Study* (Lord, Aeck, and Sargent 2009). The land use assumptions were also utilized to conduct a trip generation analysis based on the rates and equations published in the standard Institute of Transportation Engineers' (2008) reference *Trip Generation User's Guide*. The results of the trip generation analysis are shown in Table 4-4. The resulting estimated new project trips for each Action Alternative were assigned to the local roadway network utilizing existing traffic distribution patterns to estimate the total (background + project) number of peak-hour vehicles at each intersection in the year 2035, which were then analyzed to determine future LOS.

TVA

Land Disposal

165. Based on the past actions of the NACD members, TVA should not depend on the NACD to make decisions with a favorable outcome for the environment or recreation, or that would be consistent with TVA's alternatives. It is recommended that if TVA decides to dispose of a part of the MSR, TVA should remain an active participant with NACD to ensure that environmental and recreational concerns are at least given some degree of consideration. In addition, TVA should ensure that there will be opportunities for meaningful public participation in decisions about the future use of the property. (*Commenter: Larry Gautney*)

Response: TVA believes the Northwest Alabama Cooperative District (NACD) would support the goals of many different constituents in the Shoals area. TVA intends to work with this group, which represents the people of the surrounding cities and counties, and other appropriate local government agencies to develop a comprehensive Master Plan for the land. Citizens of the area will be invited, and public notice provided, to participate in development of the Master Plan. Once TVA approves the plan, it feels decisions associated with its implementation would best be made with inputs from the local community. As the redevelopment effort moves forward, there will be many opportunities for public input from both public and private individuals, groups, and business interests. Commitments and mitigation measures, such as those listed in the final EIS, along with the plan, will help ensure that important environmental resources are protected.

166. I am concerned that selling this land at auction to the highest bidder without regard to the future use of the land purchased creates the opportunity for devastation of the MSR study area. TVA should sell with conditions for use of this land that assure appropriate environmental protection. Covenants can and should be required when this land is purchased, either by a public or a private entity. TVA should not relinquish control subject to only the zoning and building codes of the community of Sheffield or of Muscle Shoals. (*Commenter: David Cope*)

Response: Various ways of protecting the environmental resources (e.g., designation of green space) would be considered in the development of the comprehensive Master Plan. Where appropriate, TVA would include restrictive covenants and other prohibitions in

transfer deeds and other legal instruments to reduce, avoid, or minimize impacts to the environment. TVA would review future development actions that could affect the Tennessee River, streams, floodplains, and wetland areas. Local zoning laws and regulations (e.g., floodplain management regulations) are expected to be adhered to for future uses of the property. In addition, other federal and state agencies (e.g., USACE, ADEM) would be involved or require authorizations for the conduct of some activities.

167. The price of the Muscle Shoals Reservation should be based on local price of land and not inflated prices from other areas. TVA should not charge large prices to redevelop this land. (*Commenter: James Bedsole*)

Response: Prior to any land sale, TVA would obtain an appraisal of the property, which would take into account the fair market value of similar land in the area. This land would be valued the same way other land similarly situated and with similar amenities would be valued. Such appraisals are typically used to establish minimum bid prices.

168. TVA should revise the final EIS to clarify whether the proposed action is in fact anticipated to involve disposal of all of the 1,400 acres of reservation or whether TVA is reserving the option to dispose of its reservation lands “in whole or in part.” (*Commenter: John Crowder*)

Response: At this time, TVA has not sought or received any expressions of interest in the property as a whole. TVA prefers to sell the entire 1,400-acre property as a whole in a single sales transaction. However, given the current status of the national and global economy, TVA recognizes the potential difficulty associated with attracting a purchaser to such a large acreage at this location. TVA and local government partners plan to develop and circulate requests for interests (RFI) and requests for proposals (RFP) in the future in an effort to attract potential buyers. Therefore, at its discretion, TVA would entertain the possibility of selling the land in smaller tracts or parcels. The potential disposition of unsold property is discussed in the final EIS in Section 1.3.

Mission

169. TVA is proposing the redevelopment of the MSR study area from a business perspective, which is the main reason to my objections to this project. What is TVA's mission? Is TVA just a power company? Is every TVA action going to be taken based on 'dollars and cents?' (*Commenter: Charles L. Rose - SEA*)

Response: TVA is not just a power company but a federal corporation with many other responsibilities to the people of the Tennessee Valley and the nation beyond production of electricity. TVA has not received taxpayer funding since 1999. Like any other large business, TVA must operate in a businesslike manner to be successful and fulfill its mission, while prudently relying on ratepayer (and bond holder) funding.

170. TVA's 'technological innovation' mission goal could be well served if the adaptive reuse of existing buildings and plant sites emphasized new technologies, including solar, and 'green,' energy efficient materials and building techniques. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

Other

171. I would like to obtain copies of all written comments received at the public scoping meeting for the Muscle Shoals Reservation Redevelopment initiative and all written comments on the scoping document received by TVA from the NACD, affiliated cities and counties of the NACD, and individual elected municipal or county governmental representatives from any of the affiliated cities or counties within the NACD. (*Commenter: John Crowder*)

Response: TVA complied with this request for public scoping comments on January 25, 2011, and the recipient confirmed receipt of the comments February 1, 2011.

Visual Resources

172. Based on the definition of 'Urban Landscape Character' in the draft EIS, I would suggest that not all urban areas have the same level of 'scenic value class.' For example, the historic buildings on the MSR Study Area are of a much higher 'scenic value class' than typical urban sprawl development, as is found along Woodward Ave. in Muscle Shoals, Florence Blvd., and many other locations in the Shoals area. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. TVA did not perform a comparative analysis of landscape character types outside the scope of the MSR study area (e.g., Woodward Avenue, Florence Boulevard). Although an urban landscape character could be perceived as aesthetically pleasing and have a strong sense of place, it would generally be difficult for areas of urban landscape character to have a high scenic value class as a result of impacts to scenic attractiveness and scenic integrity. Through the comprehensive planning process, TVA anticipates the eventual development of the MSR to be contextually sensitive to existing landscape character types.

173. The final EIS should include a detailed description of how scenic resources on the MSR would be affected by the redevelopment. (*Commenter: Charles L. Rose - SEA*)

Response: Scenic resources were evaluated and described in Chapters 3 and 4 of the EIS in terms of landscape character types. These landscape character types generally describe human perceptions of an area or viewshed and broadly establish the aesthetic sense of place. The scenic resource assessment included in this EIS identifies landscapes by their character and groups areas of a similar and contiguous character types, rather than a detailed description of discernable changes from specific viewing positions. TVA's methodology for assessing impacts to scenic resources was developed from the United States Forest Service's (USFS) detailed practice for scenic resource management entitled: *Landscape Aesthetics, A Handbook for Scenery Management,* Agriculture Handbook Number 701, USFS, USDA 1995. TVA's methodology for assessing scenic value is described in Appendix P of the final EIS.

174. The general public in the Muscle Shoals area would be opposed to commercial development that would degrade the visual characteristic of the MSR. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted.

175. The phosphate slag storage pile is more pleasing to the eye than typical Shoals area urban development because nature is slowly reclaiming it; a great variety of vegetation is

taking hold there. Why does the draft EIS include a portion of the phosphate slag storage area as 'areas of urban landscape character?' (*Commenter: Charles L. Rose - SEA*)

Response: TVA acknowledges that the slag storage area is slowly reverting to a landscape character type more closely associated with a rural or naturally appearing landscape. TVA staff evaluated the phosphate slag storage area using a combination of field reconnaissance, aerial photography, topographic maps, and land use/land cover maps. At the time of data collection, several factors, including vegetation patterns, variations in topography and soil type, foreground visibility of transmission lines, rail features, and materials storage within the phosphate slag storage area resulted in a scenic value class of common to minimal. The scenic integrity was determined to be low to very low. Further, the phosphate slag storage area experiences a very low scenic visibility due to land uses and available points of public access. The number and duration of views are generally low, with most being available to motorists and recreational trail users to the south of the phosphate slag storage area. Visibility from these positions includes a foreground view of moderately dense trees and herbaceous vegetation, which screens portions of the slag storage area that would otherwise be directly visible. The portions of the slag storage area that exhibit characteristics of an urban landscape character include areas where vegetation is sparse, where topography has been noticeably altered, and where material storage/stockpile areas are visible in the immediate foreground.

Water Quality

176. When discussing Alternative D, the draft EIS states: 'Industrial development could also require water withdrawals from or discharges to the Tennessee River.' What kind of discharges are anticipated? (*Commenter: Charles L. Rose - SEA*)

Response: Depending on the type of industry and extent of development, TVA expects that potential discharge to the river could include a variety of liquid effluents. However, depending on the nature of the effluent and how it is conveyed (e.g., outfall pipe), state and other federal approvals would likely be necessary, including additional environmental review and approval by TVA under Section 26a. Such effluent would also have to meet specific quantity and quality standards prior to being discharged.

177. The Tennessee River below Wilson Dam has been designated as a state mussel sanctuary. The Tennessee River/Wilson Dam tailwaters is also designated as habitat for Nonessential Experimental Populations (NEP) of 16 federally listed mussels and one federally listed aquatic snail. While this area of the Tennessee River remains one of the most important remaining habitats for mussels of the Tennessee River mainstem fauna, it remains under constant stress from impairments to upstream water quality. It is understood that development with the highest potential to affect aquatic resources in the Tennessee River would be addressed as part of TVA's environmental review of proposed projects subject to Section 26a of the TVA Act, and as such be subject to Section 7 review under the Endangered Species Act. However, water quality parameters have already been shown to exceed protective standards and any additional inputs may further degrade this critically important and already stressed habitat and fauna. (*Commenter: Joyce Stanley - USDOI*)

Response: TVA recognizes the high value of this portion of the Tennessee River and will work within existing state and federal regulatory mechanisms (particularly the CWA, the ESA, and NEPA) to assess, avoid, and/or minimize any direct, indirect, or cumulative impacts to aquatic resources (including endangered and threatened species) that could result from development of the MSR.

178. TVA should work with the local Municipal Separate Storm Sewer System (MS4) program to incorporate LID practices into all phases of the redevelopment of this area. TVA has an opportunity to guide the redevelopment of the MSR which could be a model for the region for redeveloping federal lands in an environmentally responsible manner. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Comment noted. TVA would be involved in working with local governments on the comprehensive Master Plan. Its development and implementation would involve local, state, and other federal authorities including those experienced in LID practices and responsible for regulation and protection of water quality.

179. Since the preferred alternative is described as the 'mixed use' alternative, future land use decisions such as designating areas suitable for industrial or agricultural use could potentially exacerbate the impaired condition of Pond Creek. EPA recommends that TVA clearly identify in the final EIS what types of land uses would be permitted in areas of the MSR that could potentially negatively impact Pond Creek. EPA also recommends that TVA coordinate with ADEM regarding land use decisions that could negatively impact Pond Creek. (*Commenter: Heinz J. Mueller - USEPA*)

Response: Under the Preferred Alternative F, TVA would make the property available for unrestricted land use. TVA, therefore, would not dictate the ultimate land uses across this property but would work with local governments and the public in the development of a Master Plan. TVA expects that some amount of conservation and green space would be established by the plan and that some of this land would encompass areas of sensitive or important resources such as Pond Creek and its floodplain, wetland, agricultural land, and woodlots, thus, minimizing the potential for negative effects to these areas. Further, even after the land is sold, TVA would review future projects that could affect Pond Creek and areas within the limits of the 100-year floodplain, which includes some wetlands, under Section 26a of the TVA Act. ADEM received the draft EIS and is aware of the proposal. Depending of the nature of future actions that could affect Pond Creek, ADEM could be involved through its water quality regulation and permitting requirements.

180. The Department of Interior is concerned with any Action Alternative that may lead to increased degraded water quality in Pond Creek and/or in the Tennessee River mainstem by allowing future developments that may result in new industrial/municipal point source discharges. Pond Creek is already a stressed system and is listed on the Alabama 303(d) list for impairments to water quality by organic enrichment (CBOD/NBOD) and metals (arsenic, cyanide, and mercury). Pond Creek empties into the Tennessee River below Wilson Dam. The Pond Creek watershed already supports several point source discharges including a municipal wastewater treatment facility and industrial discharges (i.e., Wise Alloys and Occidental Chemical). It also supports multiple Confined Animal Feeding Operations, primarily poultry broiler and breeder houses in the upper portions of the watershed. The adjacent drainages (e.g., Spring Creek and Sweetwater Creek) support multiple other industrial discharges. Recent continuous monitoring (unpublished TVA data, 2010) of dissolved oxygen (DO) at three monitoring stations below Wilson Dam to the head of Seven Mile Island has shown numerous exceedances of the minimum state water quality standard (4 mg/l DO). (*Commenter: Joyce Stanley - USDOI*)

Response: TVA has documented in the final EIS the current status of water quality and related aquatic resources issues in Pond Creek and the Tennessee River (Wilson Dam tailwater) in the vicinity of the proposed land disposal. As previously described, TVA

expects the Master Plan development process to result in some potential impact avoidance and resource protection including in the vicinity of Pond Creek. TVA would review future projects that could affect Pond Creek and the Tennessee River and areas within the limits of their 100-year floodplains under Section 26a of the TVA Act. TVA would also work with ADEM and other permitting authorities, as appropriate.

181. Section 4.2.3 of the draft EIS describes the impacts of the expected loss of pervious surfaces and possible sinkhole development due to the activities associated with Alternative C. This is another reason against allowing commercial, retail and residential development on the MSR study area. (*Commenter: Charles L. Rose - SEA*)

Response: Comment noted. TVA expects that through the Master Plan development process, involvement of knowledgeable individuals and agencies with experience in low-impact development practices, use of sound engineering principles and practices, water quality protection, and storm water runoff management, the effects of such potential development on surface water and possible sinkhole development would be minimal.

Wetlands

182. Section 404 permitting should be summarized in the final EIS when discussing potential impacts to wetlands. (*Commenter: Heinz J. Mueller - USEPA*)

Response: As indicated in Section 4.11 of the final EIS, the Section 404 permitting process, administered by the USACE regulates wetlands under the CWA, which regulates the discharge of fill. The regulatory review process for jurisdictional wetlands involves a standard sequence of avoidance, minimization, and mitigation of wetland impacts. Permit applicants must avoid wetlands wherever practicable, minimize impacts, and mitigate impacts according to USACE district guidelines. Public review of Section 404 permits is a part of the regulatory review. Mitigation planning is in many cases site-specific, but in most cases will consist of the purchase of credits in a USACE-approved mitigation bank.

183. For wetlands deemed not to be “jurisdictional wetlands” TVA should include provisions within the conveyance document, including provisions for further NEPA review that will assure a thorough assessment of the impacts of such work and the imposition of appropriate mitigation for loss or damage to such wetlands. (*Commenter: John Crowder*)

Response: As described in Section 4.11 of the final EIS, TVA procedures implementing Executive Order (EO) 11990 provide that the agency, once a no practicable alternative determination is made, minimize wetland destruction, loss, or degradation and preserve and enhance natural and beneficial wetland values, while carrying out its responsibilities, including the disposal of federal land. TVA will include specific language in the conveyance documents pertaining to the sale of the property describing the presence of wetlands, and all legal obligations regarding wetland avoidance, protection, and impact minimization. TVA will review future proposals to alter wetlands and conduct any additional environmental review necessary to determine whether there is no practicable alternative to adversely impacting the wetland. If no alternative is available, effects on wetlands would be minimized. Where appropriate, TVA would work with the USACE during the Section 404 process in making such determinations and developing appropriate mitigation strategies.

184. The final EIS should state which, if any, of the wetlands on the property are deemed to be jurisdictional and which are deemed non-jurisdictional. It should also discuss the

regulatory review and mitigation planning for each classification. (*Commenters: John Crowder, Charles L. Rose - SEA*)

Response: Nonjurisdictional wetlands are wetlands that lack one of the three criteria (prevalence of wetland vegetation, hydric soils, and wetland hydrology) used to identify wetlands that are regulated by state and federal regulations. In the project area, nonjurisdictional wetlands typically lack hydric soils but will have a prevalence of wetland vegetation and undergo saturation or inundation long enough to drive the composition of the plant community.

For the purposes of this EIS, wetlands were identified primarily via National Wetland Inventory maps, aerial photography, and limited ground surveys. There was no distinction made between jurisdictional and nonjurisdictional wetlands. Jurisdictional wetlands, as the name suggests, fall under the jurisdiction of state and federal wetland regulations. Alabama, however, does not have separate wetlands permitting regulations. Applications for wetlands projects are made directly to USACE with copies to ADEM for water quality certification. USACE regulates wetlands under the CWA, specifically Section 404, which regulates the discharge of fill.

The regulatory review process for jurisdictional wetlands involves a standard sequence of avoidance, minimization, and mitigation of wetland impacts. Permit applicants must avoid wetlands wherever practicable, minimize impacts, and mitigate impacts according to USACE district guidelines. Public review of Section 404 permits is a part of the regulatory review. Mitigation planning is in many cases site specific but, in most cases, will consist of the purchase of credits in a USACE-approved mitigation bank.

Nonjurisdictional wetlands are not regulated by state or federal law as waters of the State or the United States, but do have some level of protection under Presidential EO 11990. This EO defines wetlands as “Those areas which are inundated or saturated by surface or groundwater with a frequency sufficient to support or that under normal hydrologic conditions does or would support, a prevalence of vegetation or aquatic life typically adapted to saturated or seasonally saturated soil conditions. Examples of wetlands include, but are not limited to, swamps, fresh and salt water marshes, estuaries, bogs, beaches, wet meadows, sloughs, potholes, mud flats, river overflows, and other similar areas.” This definition is based primarily on a prevalence of wetland vegetation.

See response to Comment Statement 183 above. Regarding EO 11990, TVA will include specific language in the legal documents pertaining to the sale of the property describing the presence of wetlands, and all legal obligations regarding wetland avoidance, protection, and impact minimization. This fulfills agency responsibility under Section 4 of EO 11990, which states “When Federally-owned wetlands or portions of wetlands are proposed for lease, easement, right-of-way or disposal to non-Federal public or private parties, the Federal agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State or local wetlands regulations; and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successor, except where prohibited by law; or (c) withhold such properties from disposal.”

185. To ensure wetlands are protected on the MSR during future development, EPA recommends TVA place these aquatic systems under the protection of a perpetual restrictive covenant or conservation easement before the land is transferred to new ownership. EPA also recommends that a minimum 25-foot upland riparian buffer be included in the protection

instrument. If this is not an option, EPA recommends that additional information be provided in the final EIS regarding potential mitigation options that TVA would consider if no practicable alternatives can be identified to prevent adverse impacts to wetlands on the MSR. (*Commenter: Heinz J. Mueller - USEPA*)

Response: See responses to Comment Statements 183 and 184 above. TVA will include specific language in the conveyance documents pertaining to the sale of the property describing the presence of wetlands and all legal obligations regarding wetland avoidance, protection, and impact minimization. Prior to the sale of the properties, the local community will develop a comprehensive Master Plan to guide development options for the site. This process will identify suitable land uses for the parcel. Public input could set aside wetland and streamside areas for preservation. Potential vehicles for this level of protection include conservation easements held by a local land trust, natural resource management agency, or other entity. These areas could also be delineated as separate parcels and purchased in fee by a local conservation entity.

As discussed in the EIS, the need for wetland mitigation would also be assessed and determined during additional project review in coordination with the Section 404 permitting process. Developers would have to show why wetland areas are unavoidable, minimize impacts to the degree practicable, and finally mitigate impacts.

186. Why is TVA considering selling the wetlands on the MSR study area, especially when they recognize the local and regional importance? Executive Order 11990 (Protection of Wetlands) requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible. By selling the wetlands on the MSR study area that are now in its care, TVA is violating EO 11990. (*Commenter: Charles L. Rose - SEA*)

Response: TVA is cognizant of the local and regional importance of wetlands on the site and is hopeful that community input into the Master Plan development process will facilitate enhanced protection of these areas. The Master Plan will be developed prior to the sale of the properties and will identify suitable land uses for these parcels. Public input could set aside wetland areas for preservation; potential vehicles for this level of protection include conservation easements held by a local land trust, natural resource management agency, or other entity. These areas could also be divided out as separate parcels and purchased in fee by a local conservation entity.

See responses to Comment Statements 183, 184, and 185 above. TVA has determined it is not practicable from a long-term financial standpoint to continue to maintain ownership of these discrete wetland parcels, thus withholding these areas from disposal was not considered in this review. As stated in the response to Comment Statement 183, TVA complies with EO 11990 and minimizes its effects on wetlands while carrying out its responsibilities, including the disposal of federal property.

Table 1. List of Commenters

Name Business or Organization	Associated Comment Statement Numbers
Anonymous	24
Abroms, Martin *Abroms & Associates, P.C.*	7, 13
Aderholt, Robert B.	55
Agricola, John *The American Chestnut Foundation – Alabama Chapter (TACF)*	46
Alford, Tim *Alabama Construction Recruitment Institute*	55
Allen, Henry	7
Auchly, Barry *Chamber of Commerce*	13
Bailey, Forrest *Alabama State Parks Division (ALSPD)*	11, 147
Barnett, Steven W. *National Wild Turkey Federation - Alabama Chapter (NWTF)*	147
Barrett, Janice	11, 52, 100, 114, 147
Batchelor, Grady *Winston County Industrial Development Authority*	55
Beavers, Jane	11
Beck, Noel M.	52, 147
Bedsole, James	7, 107, 168
Bennett, Jim *State of Alabama Department of Labor*	147
Bentley, Robert W., Sr.	10
Bernauer, B. Paul	73, 75, 79, 94, 95, 99, 100, 124, 125, 126, 128, 131, 132, 133, 142, 143, 144
Blanks, George	55
Blazer, Don	55
Blazer, Janet	1
Bolton, Susan and Chuck	61
Bowles, James *B Electric Inc.*	7
Boyd, Kim	13, 61
Bradford, David *City of Muscle Shoals*	8, 21
Bradford, Debbie *Muscle Shoals Education Foundation*	24, 61
Brown, Elizabeth Ann *Alabama Historic Commission*	49
Bryant, Wil *Emerald River Hotel*	7
Burhans, Bryan *The American Chestnut Foundation (TACF)*	147
Carpenter, Steve *Tuscumbia City Board of Education*	55, 61, 100
Casey, Linda *Alabama Forestry Commission*	147
Castile, Ed	55

Name Business or Organization	Associated Comment Statement Numbers
Chupp, Denise	10
Cline, David *Alabama Cooperative Extension System*	55
Cope, David	167
Crowder, John	92, 122, 123, 169, 172, 184, 185
Cummings, Brenda	10
Daniel, Adam *Hatton High School Agriscience Department*	55
Deaton, Dennis	55
Dodson, Alison *Hendrix Glass Service, Inc.*	61
Dodson, Sammy *Hendrix Glass Service, Inc.*	7
Doyle, Gary	13
Doyle, Pam *Superior Print Solutions*	13, 55
Dugger, Sheila	12
Dugger, Tom	12, 55
Dura, Victor *Shoals Environmental Alliance (SEA)*	147
Ecklund, Leslie *Burritt on the Mountain*	147
Gautney, Larry	4, 14, 83, 86, 118, 120, 147, 166
Godwin, Alex *Wise Alloys LLC*	7
Greer, Lynn *Greer Construction LLC*	55
Griffith, Brenda *Shoals Home Builders Association*	7
Hamm, Mitch *Shoals Chamber of Commerce*	21
Hanson, Quinton	7
Harber, Gregory J. *Alabama Ornithological Society (AOS)*	9, 74, 155, 158
Hardy, Susan	114
Hea, Matthew *Northwest Alabama Regional Airport*	7
Hendrix, Jackie	13
Hester, Gary	41, 103
Hester, J. C.	152
Hill, Ginny Lee	10, 106
Holt, Steve *Shoals Chamber of Commerce*	7, 21, 78, 147
Jackson, Greg, M.D. *Alabama Ornithological Society (AOS)*	9, 74, 100, 155, 158
Johnson, Coy	55
Johnston, Mark, Executive Director *McDowel Environmental Center*	147
Jordan, Mike	9
Kittle, Paul D.	11, 18, 52, 100, 147
Lansdell, Michael	63, 104

Name Business or Organization	Associated Comment Statement Numbers
Lard, Jason *Lexington High School*	55
Laurent, James	55
Leigh, Anthony L. *Huntingdon College*	147
Liles, Darin *R. A. Hubbard High School*	55
Lindsey, Brian *Muscle Shoals City Schools (MSCS)*	55
Maddox, Jimmy *The American Chestnut Foundation-Alabama Chapter (TACF)*	147
Malone, David J., Executive Vice President *Balfour Concord*	63
Mayfield, Rex *Russellville City Schools*	55
McCloy, Margaret M.	34, 52, 74, 100
McGee, Vernon *SBS Electric Supply Company, Inc.*	7
McGouyrk, Jerome	7, 10, 13, 77, 100
McMillion, Patricia T.	147
McNeece, R. H.	10
McNees, James L. *Alabama Department of Public Health (ADPH)*	134, 135, 136, 137, 138, 139, 140
Miller, Matthew *Living River Environmental Center*	147
Moore, Brandon *Alabama Farmers Federation (AFF)*	55
Morring, Chuck	116, 118, 120, 130
Mueller, Heinz J. *United States Environmental Protection Agency (USEPA)*	30, 31, 32, 43, 47, 66, 67, 71, 81, 82, 88, 117, 145, 162, 164, 165, 179, 180, 183, 186
Muse, Nancy *Shoals Environmental Alliance (SEA)*	55, 57, 58, 59
Nash, M.	73
Neel, Clint *The American Chestnut Foundation (TACF)*	147
Nelson, William	10, 74
Newland, Stephanie *Shoals Chamber of Commerce (SCC)*	55
Norton, Jackie *Sheffield Junior High School*	55
Parris, Dr. Joan *Shoals Economic Development Association (SEDA)*	13
Phillippi, George M. *The American Chestnut Foundation (TACF)*	60, 105, 146
Piggq, Kathy *Brindley Construction LLC*	55
Piper, Tom	74
Posey, Grant	52
Posey, Jackie	6, 52, 54, 55, 59, 61, 62, 100, 147

Name Business or Organization	Associated Comment Statement Numbers
Shoals Environmental Alliance (SEA)	
Quesenberry, Billy *Alabama Electric Motor Services LLC*	55
Quigley, Edwin	10
Rene', Holly *People For TVA*	147
Ress, Tom	74
Retherford, Joel *LCCT*	55
Rhodes, Darren *AGC*	21, 55
Rhuland, Amy	147
Riner, Tommy *National Alabama Corporation (NAC)*	55
Rist, John C. *The American Chestnut Foundation (TACF) - Alabama Chapter*	11, 147
Roessel, Susan	147
Rose, Charles L. *Shoals Environmental Alliance (SEA)*	1, 2, 3, 5, 14, 15, 16, 17, 18, 19, 20, 22, 23, 25, 26, 27, 28, 29, 31, 33, 35, 36, 37, 39, 40, 42, 44, 45, 47, 48, 50, 51, 52, 55, 64, 65, 68, 72, 74, 76, 80, 83, 84, 85, 87, 89, 90, 91, 92, 93, 97, 98, 100, 102, 108, 110, 111, 112, 113, 115, 119, 127, 129, 130, 147, 148, 149, 150, 151, 153, 154, 156, 157, 159, 160, 163, 170, 171, 173, 174, 175, 176, 177, 182, 185, 187
Rudolph, Celia *Muscle Shoals City Schools (MSCS)*	55
Ruffrage, Susan	6, 11, 55
Rusevlyan, John	7
Sample, W. David	55
Scarborough, Sam *ABC*	7
Sharp, Rick *Integrated Corporate Solutions, Inc.*	7
Sherk, Linda *AWS*	61, 147
Shoemaker, Billy *City of Tuscumbia*	7
Sibley, Jeff *Auburn University*	55
Simone, Mayda *Southern Accounting Systems, Inc.*	7, 61, 69
Sisco, Paul *The American Chestnut Foundation (TACF)*	146
Smith, Jessica N.	11, 96, 99, 100
Smith, Mary Etoile	11, 100, 147
Smith, Ronnie *Alabama Industrial Development Training*	21, 55
Smith, Stephen *Southern Alliance for Clean Energy (SACE)*	147
Smith, William	13, 21
Spahn, Janet	11, 38, 100

Name Business or Organization	Associated Comment Statement Numbers
Stanley, Joyce *United States Department of the Interior (USDOI)*	11, 70, 178, 181
Stonecipher, Tiffany *Muscle Shoals Center for Technology (MSCT)*	55
Touchton, Joseph *Auburn University (AU)*	55
Wakefield, Mary	10
Walker, Don	13
Warhurst, Kenneth	10, 38, 58, 73, 100
Warren, Gary *Alabama State Board of Education, District 7*	55
Watson, Marilyn	10, 53, 100, 147
White, Bonnie	55
White, William *The American Chestnut Foundation (TACF)*	147
Williams, Gary Dan *Muscle Shoals Center for Technology (MSCT)*	56
Williams, Ricky *City of Muscle Shoals*	13
Willingham, Nathan *Northwest Alabama Council of Local Governments*	161
Willis, Neal	62
Wills, Kenneth	74, 109
Wooten, Jeff *Muscle Shoals Board of Education*	13, 55

APPENDIX C – SUMMARY OF THE RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION OF SOLID WASTE MANAGEMENT UNITS

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Table C-1. Resource Conservation and Recovery Act Facility Investigation Summary

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
5	Outdoor Drum Storage Area No. 1, Drum Storage ca. 1975 to 1992	PCB, lead, beryllium, arsenic	HHRA found contaminants in soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
6	Abandoned Rail Cars, Container Unknown to 1991	Waste stored in rail cars	All rail cars that contained waste were eliminated. TVA recommended no further action in the RFI Report. ADEM approved 9/11/98.	RFI
7	Furnace Building, Drum Storage Unknown to 1992	PCBs, antimony, lead, thallium, PAH	HHRA found contaminants on the floor and in soil to be below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
8	Dumpster, Container Unknown to 1992	Unknown materials	There is no evidence of a release from this SWMU, and the contents of the dumpster contained no hazardous constituents. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
9	Tank Car Wash Pit, Sump ca. 1977 to 1991	Beryllium	HHRA found contaminants in pit and soil below levels of concern and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
10	Tank Car Wash Sumps, Sump ca. 1977 to 1991	Beryllium, thallium, PAH	In the RFI, the sumps were empty and free of contaminants. HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
42	Phosphate Fertilizer Storage Building, Drum Storage Unknown to 1991	Unknown materials	Drums and contaminants removed during an interim measure with SWMU 43. The HHRA found contaminants on floor and in soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
43	Sulfur Cake Storage Area, Waste Pile Unknown to 1991	Vanadium, beryllium, lead, thallium, and PAH	Contaminants removed during an interim measure. The HHRA found contaminants on floor and in soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
53	Carpenter Shop Outdoor Drum Storage Area, Drum Storage Unknown to 1991	Beryllium, thallium, PAH	Drums were removed in RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
59	Phosphate Development Works Service Pits, Sumps 1953 to Present	PAH	An interim measure cleaned the pits with six pits remaining active in the RFI. The HHRA found contaminants in the pits and soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
60	Phosphate Development Works Step Zero Clarifier, Sump 1953 to 1998	Selenium	An interim measure was performed to remove the material, clean, and backfill the clarifier. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
65	Phosphate Development Works Fuel Oil Storage Tanks, Tank 1953 to 1992	Fuel Oil	The tanks' contents were properly disposed. Since there was no evidence of a release from the tanks, TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
76	Phosphate Development Works Area 309 Drum Storage Area, Drum Storage Unknown to 1992	Unknown materials	The drums have been disposed. No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
83	Phosphate Development Works Area 307 Drum Storage Area, Drum Storage Unknown to ca. 1992	Unknown materials	Drums were removed in the RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
84	Phosphate Development Works Surface Drainage Ditch, Ditch 1953 to Present	Beryllium, PAHs, and PCBs	The HHRA found contaminants in the soil in and around the ditch below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
85	Phosphate Development Works Storm Water Pond, Impoundment 1953 to ca. 1976	Beryllium and PAH	No hazardous materials were detected in the environment above local background levels. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
86	Phosphate Development Works Lagoons, Impoundment 1953 to 1996	Unknown materials	In 1996, an interim measure eliminated water retention in the lagoons. No hazardous materials were detected above screening levels. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
91	Ammonia From Coal Gasifier Blow Down Sump, Sump 1980 to 1985	PAH	The sump contents have been removed, and there was no evidence of release. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
92	Ammonia From Coal Drum Storage Area #2, Drum Storage 1985 to Present	Beryllium, PAH, pesticides	Drums were removed in RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
93	Ammonia From Coal Drum Storage Area #3, Drum Storage 1985 to 1993	Unknown materials	The drums have been disposed. No hazardous materials were detected in the environment after an interim measure in 1995. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
97	Ammonia From Coal Conditioner Tank, Sump 1980 to 1992	Selenium, thallium	The water in the tank was disposed. No hazardous materials were detected in the environment outside the tank. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
100	Ammonia From Coal Equalization Basin, Impoundment 1980 to Present	Unknown materials (former wastewater treatment unit)	The HHRA found contaminants in the soil in and around the basin below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
104*	Ash Settling Pond, Impoundment 1936 to Present	Elemental phosphorus	Corrective measures were implemented due to the presence of elemental phosphorus in the sediment. Maintenance was performed on the existing water/ash covering and its containment berm to minimize the threat to human health and the environment. A groundwater and surface water monitoring program was implemented along with other institutional controls (fence, signs, and deed restrictions). The CMI Final Report was submitted to ADEM on 9/22/03, and TVA recommended no further corrective measures. ADEM approved the report and issued a Certification of Remedy Completion on 12/12/03.	CMI With Post-Closure Monitoring
105	Plant Drainage Ditch, Ditch 1980 to Present	PAH and PCBs	The HHRA found contaminants in the soil in and around the ditch below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
106	Central Ditch, Ditch ca. 1935 to Present	Beryllium, PAH	The HHRA found contaminants in the soil in and around the ditch below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
107	Scrap Yard, Waste Pile 1955 to Present	Arsenic, beryllium, lead, PAH	The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
108*	Phosphate Development Works Landfill, Landfill 1953 to Present	Elemental phosphorus, phosphorus compounds, organic solvents, and unknown materials	Due to contamination of soil and groundwater with organic compounds, corrective measures were implemented for this site. Shot crete was added to the existing cap to stabilize the steep banks, improve water runoff, and minimize the threat to human health and environment from landfill contaminants. A groundwater and surface water monitoring program was implemented along with other institutional controls (fence, signs, and deed restrictions). The CMI Final Report was submitted to ADEM on 9/22/03, and TVA recommended no further corrective measures. ADEM approved the report and issued a Certification of Remedy Completion on 12/12/03.	CMI With Post-Closure Monitoring
109	Northeast End Drum Storage Area, Drum Storage/UST Unknown to 1993	TPH	The UST drums were removed in 1988 and the soil remediated in 1993. No hazardous materials were detected in the environment after the UST remediation. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
110	Coal Pile Runoff Ditch, Ditch Dates Unknown	Arsenic, beryllium, lead and thallium	The potential source of contamination, the coal pile, was removed before the RFA in 1989. The HHRA found contaminants in the soil in and around the ditch below levels of concern and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
112*	Precipitator Dust, Waste Pile 1940 to Present	Radionuclides, elemental phosphorus, beryllium, lead, thallium, cadmium	Due to the presence of radionuclides in the groundwater, metals in the precipitator dust and soil, and elemental phosphorus in the precipitator dust, a RCRA cap was installed to minimize the threat to human health and the environment. The cap consisted of 2 feet of soil followed by a flexible membrane liner, a 1-foot layer of sand, 18 inches of clay and topsoil. Institutional controls (fence, signs, and deed restrictions) were implemented at the site, and TVA recommended no further action in the CMI Final Report (9/22/03). ADEM approved the report and issued a Certification of Remedy Completion on 12/12/03.	CMI With Post-Closure Monitoring
115	Coal Slag Landfill, Landfill 1980 to Present	Beryllium and thallium	No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
117	Old Ammonia Plant, Drum Storage Unknown to Present	PAH, copper, lead, thallium, PCBs, and Zinc	An interim measure (work plan approved by ADEM 3/21/2000) was performed to remove and properly dispose of contaminated debris on the main floor and basement area. HHRA found remaining contamination on basement floor below levels of concern. TVA recommended no further action in an Interim Measure Report submitted to ADEM on 11/06/2000. ADEM approved report on 11/15/2000.	CMS Phase 1
122	Building 321 Outdoor Drum Storage Area, Drum Storage Unknown to 1988	Arsenic	Drums were removed in RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
123	Building 321 Storage Area, Container Storage 1980 to 1989	Unknown materials	The drums have been disposed. No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
128	Building 404 Outdoor Drum Storage Area, Drum Storage Unknown to 1991	PAH, beryllium, lead, and thallium	Drums were removed in RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
130	Waste Oil Containment Area, Tank Containment/ Drum Storage 1985 to 1990	Unknown materials	The waste oil and other materials were disposed. No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
131	Waste Oil Storage Area, Drum Storage 1985 to 1988	Arsenic	The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
137	Building 407 Outdoor Drum Storage Area, Drum Storage Unknown to ca. 1992	Unknown materials	Drums were removed in the RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
140	Building 508 Sulfur Cake Storage Area, Waste Pile 1983 to 1985	Sulfur cake	All materials in area have been disposed and the area decontaminated. No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
141	Building 509 Drum Storage Area, Drum Storage/Waste Pile Unknown to 1994	Beryllium, lead, PAH, and PCB	Drums of tar and spilled tar were removed in the RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
150	Ammonia Plant Compressor Blow Down Sump, Sump Unknown to Present	Arsenic	No hazardous constituents of concern were detected in the sump, and the contents have been removed. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
151	Ammonia Plant Oil/Water Separator, Tank Unknown to ca. 1992	Arsenic	The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
152	Ammonia Plant Oil Accumulation Area, Container Unknown to ca. 1992	Arsenic	No hazardous constituents were detected above screening levels in air and soil samples. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
153	Ammonia Plant Compressor Oil Area, Container Unknown to ca. 1992	Arsenic	No hazardous constituents were detected above screening levels in soil and air samples. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
164	Urea Plant Waste Oil Accumulation Area #1, Container Unknown to ca. 1992	Petroleum	No hazardous constituents were detected above screening levels in soil and air samples. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
165	Urea Plant Waste Oil Accumulation Area #2, Container Unknown to ca. 1991	TPH and PCBs	Drums were removed in the RFI. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
166	Urea Plant Waste Oil Catch Basin, Container 1973 to ca. 1991	TPH and lead	The drum was removed during the decommissioning of the urea plant. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
168	Urea Plant Oil and Ammonia Sump, Sump 1973 to ca. 1991	TPH and lead	The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
169	Urea Plant Waste Oil Accumulation Area, Container Unknown to ca. 1991	Arsenic, lead, thallium, and TPH	The drum was removed during the decommissioning of the Urea Plant. The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
170	Urea Plant Ditch, Ditch Unknown to Present	Unknown materials	No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
173	Urea Plant Overflow Sump, Sump 1973 to Present	Pesticides and mercury	No hazardous materials were detected in the environment. Contents of the sump were removed by an interim measure on 8/14/98. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
189	Phosphate Development Works Chemical Sewer, Sewer 1953 to Present	Unknown materials	No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
194*	Trestle Drum Storage Area, Drum Storage Unknown to 1992	Unknown	No hazardous materials were detected in the environment. Because of SWMU 194's close location to SWMU 112, this site was capped during the corrective measure implementation for SWMU 112. TVA recommended no further action in the CMI Final Report (9/22/03). ADEM approved the report and issued a Certification of Remedy Completion on 12/12/03.	CMI Included with SWMU 112 Post-Closure Monitoring
195	Phosphate Development Works UST, UST 1953 to 1993	TPH	The UST was removed on 2/24/93 under ADEM UST rules. No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
196	Ammonia Pumping Station, Oil Spill Unknown to Present	PCBs, beryllium, and PAH	An interim measure was performed to remove areas of elevated PCBs and approved by ADEM on 7/26/99. The HHRA then found PCBs in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
197	Shop No. 2 West Wall, Oil Spill Unknown to Present	Cadmium, lead, and TPH	The HHRA found contaminants in the soil below levels of concern, and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase1

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
198	North End Storm Sewer, Sewer ca. 1935 to Present	Elemental phosphorus	Due to the lack of sediment in the north-to-south section of the sewer, TVA recommended no further action for this section of the sewer in the RFI Report. ADEM approved 9/11/98. The remainder of the sewer was classified as no quantifiable risk in the HHRA, and TVA recommended no further action on this section. ADEM approved on 10/14/99.	CMS Phase 1
199	Boiler Fuel Area, Tank Containment Unknown to 1994	No. 2 Fuel Oil	No hazardous materials were detected in the environment. TVA recommended no further action in the RFI Report. ADEM approved on 9/11/98.	RFI
201	Ammonia From Coal Drum Storage Area #4 1995	TPH	Drums were removed in RFI. The HHRA found contaminants in the soil below levels of concern and TVA recommended no further action. ADEM approved on 10/14/99.	CMS Phase 1
203	Paint Shop Wastewater Sump, Sump 1970 to Present	Paint and Solvents	ADEM was notified of a new SWMU (203) on 6/15/99. SAR was submitted on 9/1/99. Sampling showed no hazardous constituents in the sump above residential screening levels. Soil near the sump was slightly higher than the ERC background levels for arsenic. An interim measure was conducted to remove contents and clean the sump. ADEM approved interim measure on 9/18/00 with no further action.	CMS Phase I
204	Catalyzer No. 4 Laboratory Holding Tank, Tank 1960 to Present	Radioactive Isotopes	ADEM was notified of a new SWMU (204) on 9/13/99. SAR was submitted on 10/14/99. Sampling showed no radioactive isotopes in the tank and only background radiation levels in tank and surrounding soil. No hazardous constituents were detected above residential screening levels other than a low level of vanadium. An interim measure was approved on 12/27/00 by ADEM with no further action required.	CMS Phase I

SWMU Number	SWMU Name, Unit Type, and Dates of Operation	Suspected Contaminants	Findings and Recommendations	RCRA Closure Phase
205	Firing Range, Waste Pile ca. 1950 to 1996	Lead	ADEM was notified of a new SWMU (205) on 3/05/02. SAR was submitted on 04/29/02. ADEM recommended confirmatory sampling or interim measure to continue with permitted corrective actions at the ERC site. Interim Measure Work Plan submitted to ADEM on 09/05/02 to remove and dispose of contaminated soil. Confirmatory sampling and HHRA showed that lead remaining at the site did not pose a significant risk to human health or the environment. ADEM approved the interim measure on 01/05/04 with no further action required.	CMI

***** Require post-closure monitoring

Acronyms/Abbreviations:

ADEM = Alabama Department of Environmental Management
ca. = Circa, meaning “approximate date”
CMI = Corrective measures implementation
CMS = Corrective measures study
ERC = Environmental Research Center
HHRA = Human health risk assessment
PAH = Polyaromatic hydrocarbon; a class of hydrocarbon compounds
PCB = Polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
RFA = RCRA facility assessment
RFI = RCRA facility investigation
SAR = Subterranean arsenic removal
SWMU = Solid waste management unit
TPH = Total petroleum hydrocarbons
TVA = Tennessee Valley Authority
UST = Underground storage tank

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APPENDIX D – NUCLEAR REGULATORY COMMISSION CORRESPONDENCE

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Tennessee Valley Authority, Post Office Box 1010, Muscle Shoals, Alabama 35660

September 5, 1995

Ms. Diane Heim
Materials Licensing Section
Nuclear Regulatory Commission
101 Marietta Street, NW
Atlanta, Georgia 30323

Dear Ms. Heim:

DESCRIPTION OF A LOW-LEVEL RADIOACTIVE MATERIAL BURIAL SITE ON THE TENNESSEE VALLEY AUTHORITY RESERVATION IN MUSCLE SHOALS, ALABAMA

From 1966 to 1981, the Tennessee Valley Authority operated a burial site for low-level radioactive wastes on the TVA Reservation in Muscle Shoals, Alabama. The burial site was authorized by license number 01-06113-02, issued by the Atomic Energy Commission. We have decided pursuant to 10 CFR 30.36 that we no longer intend to use this site for the burial of low-level radioactive materials.

Enclosed is a report on the site and its contents. In compliance with 10 CFR 30.36(d), we are developing a decommissioning plan for this burial site that will be submitted to you as soon as possible.

If you have any questions regarding this matter, please write me or call David Sorrelle at (205) 386-3515.

Sincerely,

Ronald J. Williams

Ronald J. Williams, Acting Manager
Environmental Research Center

Enclosure

A LOW-LEVEL RADIOACTIVE WASTE BURIAL SITE ON THE TENNESSEE VALLEY AUTHORITY (TVA) RESERVATION IN MUSCLE SHOALS, ALABAMA

DESCRIPTION OF THE BURIAL SITE

This low-level radioactive waste burial site is located in the southwest corner of the TVA Reservation in Colbert County, Muscle Shoals, Alabama. It is about 120 feet from the southwest corner of the rhizotron-lysimeter building on a magnetic bearing of 228 degrees. The facility is surrounded by a 10-foot chain-link fence topped with barbed wire. The facility is about 100 feet long and 100 feet wide. Its location is shown in figure 1.

Forty-two holes were dug at the burial site. Each hole was dug by an auger 2 feet in diameter to a depth of 10 feet. The holes were filled with waste to a depth of 6 feet and capped with 4 feet of clay. Two of the holes (holes No. 41 and 42) were not used and were completely filled with nonradiological cover material. Thus, the waste was buried in 40 holes. Each hole is marked with a metal pole with a numbered metal tag attached. Over the years, the waste has compacted slightly and some of the fill material on some of the holes has subsided. Additional soil cover material has been added when necessary to maintain the level of the tops of the filled-in holes. Typical hole subsidence has never exceeded a few inches.

The holes were dug in five rows. The locations of the holes in the burial site are shown in figure 2. The holes in the first three rows (holes 1 through 30) have a spacing of about 7 feet between the holes and from the fence. The spacing of the holes in the next two rows is somewhat greater with only nine holes (numbers 31 through 39) in the fourth row. Only three holes were dug in the fifth row, and only one (hole No. 40) was used to store radioactive material.

The surface soil is classified as a Decatur clay loam. The thickness of this clay in the area of the burial site is 50 to 75 feet (Harris, Moore and West Geology and Ground-Water Resources of Colbert County, 1960). Wells dug by TVA within 1 mile of the site show the clay to be relatively uniform to a depth of 50 feet. Groundwater usage in the shallow 50- to 75-foot aquifer has largely been curtailed because of industrial pollution and urban runoff into sink holes.

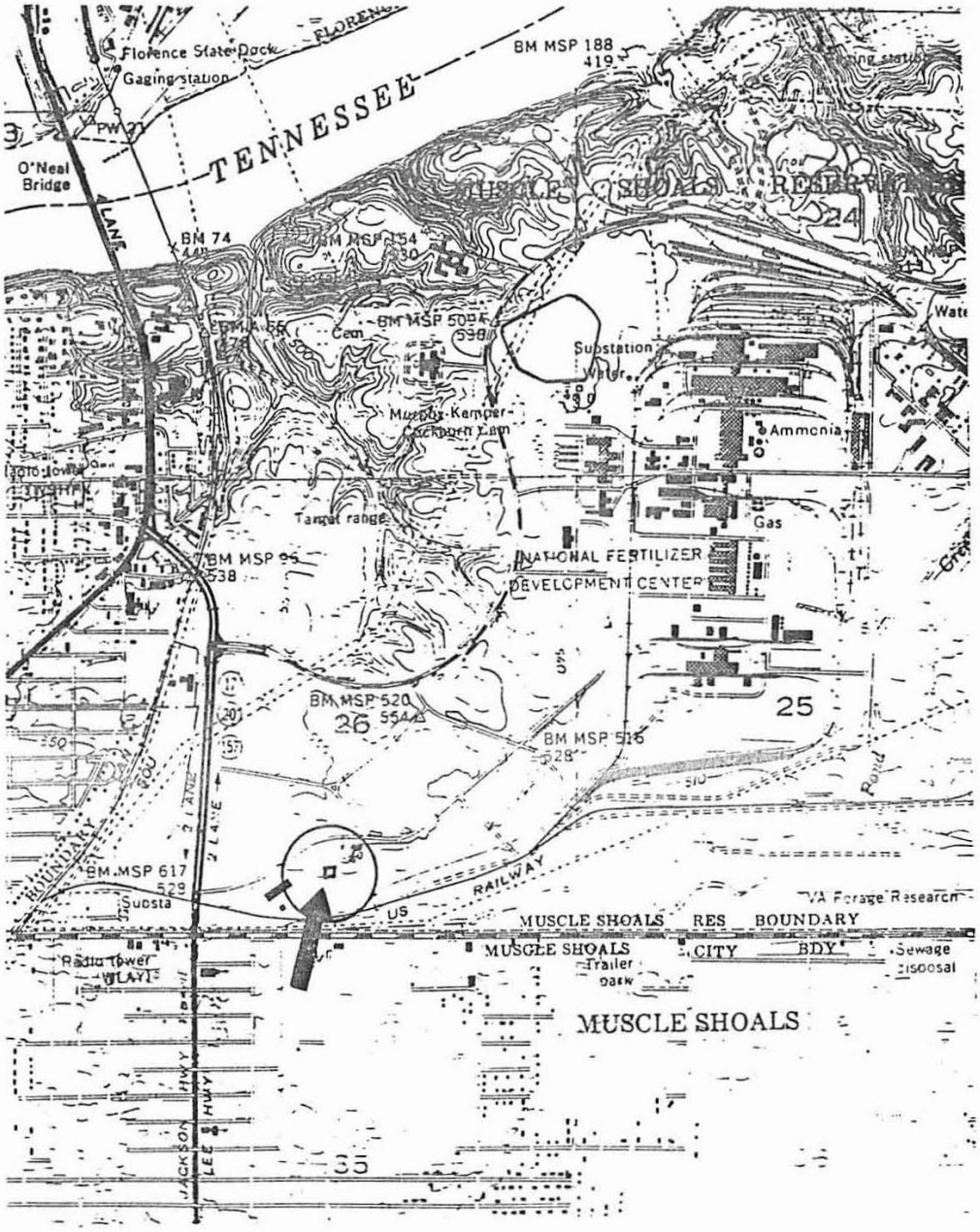

Figure 1. Location of the Inactive, Low-Level Radioactive Waste Burial Site on the TVA Reservation in Muscle shoals, AL

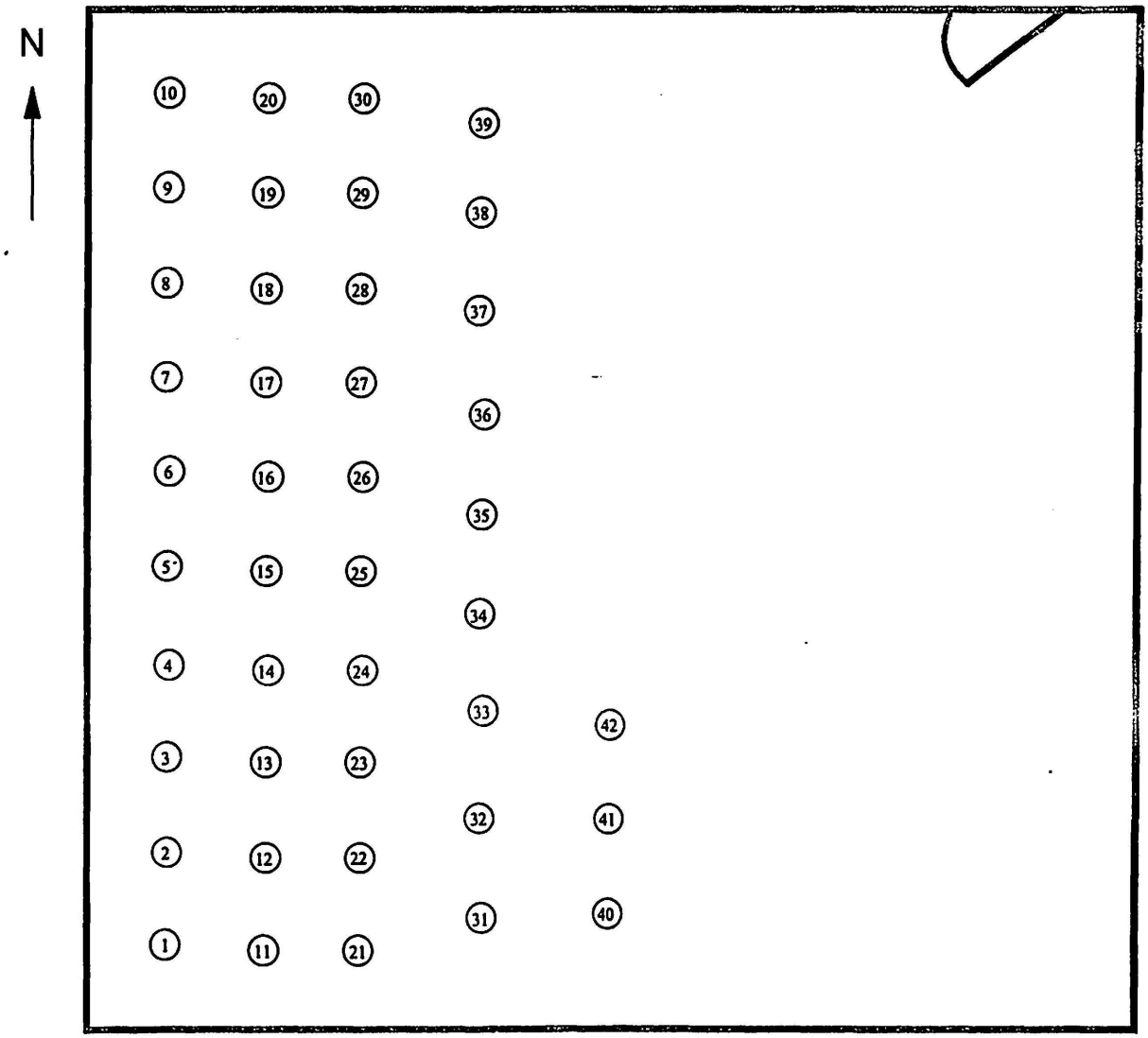

Figure 2
Location of the Holes in the Inactive Low-Level
Radioactive Waste Burial Site

This soil has a cation exchange capacity of 10 to 15 me/100 gm. This is a measure of the mass of clay that is required to capture an ionic material through a natural cation exchange process. An "me" is a milliequivalent. One equivalent of an ionic material is defined as the gram atomic weight of the ion divided by the valence of the ion. Calculations indicate that most radionuclides in the burial site were captured in a very small mass of clay and migrated no more than a few inches from their initial location.

HISTORY OF THE BURIAL SITE

Licensing: This burial site was approved by the Atomic Energy Commission by-product license No. 01-06113-02, dated July 15, 1964, and issued to TVA's Office of Agricultural and Chemical Development. This by-product license was renewed several times until 1992 when it was merged with several other licenses into license No. 01-06113-03. The operation of low-level radioactive material burial sites was allowed under 10 CFR 20.304. This rule was deleted effective January 29, 1981. After that time, disposal of low-level radioactive wastes was accomplished by other means as authorized by the Nuclear Regulatory Commission.

Burials of low-level radioactive wastes occurred on this site from April 1966 to January 1981. The material buried in this site was waste generated by several licenses issued to different organizations within TVA. Records indicate that no material from non-TVA licensees and no material from TVA's nuclear power plants was buried at this site. The material was primarily wastes from agricultural experiments and laboratories located in the Muscle Shoals area.

Records indicate that all of the material buried at this site was classified as by-product materials except for a small quantity of enriched uranium that was classified as special nuclear material. The records indicate that less than 20 grams of uranium were buried. Hole number 34 contains 9.167 grams of U-238 + U-235 and 0.1857 grams of U-235. Hole number 39 contains 7.96 grams of U-238 and 0.15 grams of U-235. This material appears to be waste material from quality control checks of nonirradiated fuel pellets with enrichments of a nominal 3 percent or less. This material was possessed under a special nuclear material license that was terminated in the 1980s.

NONRADIOLOGICAL ASPECTS OF THE BURIED MATERIAL

Surviving records describe the radiological content of the disposals in detail. However, the physical and chemical aspects of the disposals were usually not described. Records indicate the following: Less than 4 gallons of xylene-based liquid scintillation cocktail was buried. The xylene-contained activity in the picocurie and microcurie range with most isotopes having short half-lives. The xylene is contained in 50-ml high-density plastic vials. The major volume of material buried was contaminated laboratory waste consisting of such things as gloves and paper towels. Contaminated soil from greenhouse experiments was also buried.

The records do not indicate that any lead was ever placed in this burial site. The presence of lead in the burial site is unlikely. Lead would have been needed only to shield intense gamma ray sources and such sources were not buried in this site.

RADIOLOGICAL ASPECTS OF THE BURIED MATERIAL

The activity of each radionuclide placed in each hole was entered into a computer spreadsheet, and the activity was decay corrected to August 1995. These detailed data are listed in appendix 3.

In order to summarize the radionuclides that remain in the burial site, the radioisotopes were divided into two classes depending on their half-lives.

The initial quantities of radionuclides with short half-lives are listed in appendix 2. The radionuclide with the longest half-life in this group is Cd-109 with a half-life of 1.27 yr. Appendix 2 indicates that a total of 1642 μCi of Cd-109 was buried in the site. During the 15 years the site has been closed, this material has undergone at least 12 half-lives, so that less than a quarter of a μCi of this radionuclide remains. We regard all of the short-lived material listed in appendix 2 as decayed away and of little significance.

Appendix 1 lists the quantity of all long-lived radioactive materials in each hole. These quantities were decay corrected to August 1995.

The tables in appendices 1 and 2 provide the sums of all activities in each hole and also the sums of activities for each radionuclide summed over all holes.

Listed below is the total of each of the long-lived radionuclides that remain in the burial site. These quantities are decay corrected to August 1995.

Isotope	Quantity (μCi)	Isotope	Quantity (μCi)
H-3	30	Eu-152	40.8
C-14	16301	Bi-207	8.44
Na-22	0.000074	Po-208	0.00012
Cl-36	1.22	Pb-210	0.745
K-40	0.308	Ra-226	1.89
Co-60	18.6	Ra-228	0.000052
Sr-90	65.6	Th-230	0.78
Sb-125	0.374	U-235	0.105
Ba-133	0.605	U-238	3.47
Cs-134	0.097	U-Natural	3.58
Cs-137	39.2	Am-241	14.3

APPENDIX 1

ACTIVITY OF LONG-LIVED RADIOISOTOPES AS OF AUGUST 1995

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci)

Isotope:		H-3	C-14	Na-22	Cl-36	K-40	Co-60
Half Life (yr.):		12.35	5730	2.602	3.01E+05	1.28E+09	5.271
Hole No.	Date Closed						
1	April 1966	0	0	0	0	0	0
2	Feb. 1967	0	0	0	0	0	0
3	Oct. 1967	0	0	0	0	0	0
4	Oct. 1967	0	0	0	0	0	0
5	May 1968	0	0	0	0	0	0
6	Oct. 1968	0	0	0	0	0	0.000765
7	Mar. 1969	0	0	0	0	0	0
8	Aug. 1969	0	0	0	0	0	0
9	Feb. 1970	0	0	0	0	0	0.00106
10	Feb. 1970	0.024	0.1	0	0	0	0.000707
11	Aug. 1970	0.0247	0.1	0	0	0	0.00755
12	Feb. 1971	0.0508	0.1	0	0	0	0.0806
13	Nov. 1971	0	0.2	0	0	0	1.11
14	April 1972	0.0572	0.1	0	0	0	0.951
15	Feb. 1973	0.0568	5000	0	0	0	0.262
16	April 1974	0.0607	0	0	0	0	0.00367
17	July 1975	0.0651	10000	0	0	0	0.00144
18	Jan. 1976	0	0	0	0	0	0
19	Jan. 1976	0.0067	0	0	0	0	0.00231
20	Aug. 1976	0	0	0	0	0	0
21	Aug. 1976	0.344	0	0	0	0	2.47
22	Oct. 1976	0	0	0	0	0	0
23	Oct. 1976	0.00349	0	0	0	0	0.017
24	Feb. 1977	0.00356	0.1	0	0.01	0	0.000888
25	Aug. 1977	0.331	1000	0	0.01	0	0.0422
26	Dec. 1977	16.5	0.001	0	0	0.008	0.0516
27	May 1978	0	0	0	0	0	0
28	March 197	0.189	0	0	0	0	0.0144
29	June 1978	0.383	0	0	1.2	0	0.127
30	Oct. 1978	0	0	0	0	0	0
31	Jan. 1979	1.58	86	0	0	0	0.491
32	Nov. 1978	0.000392	0	0	0	0	0.702
33	Jan. 1979	0.000396	0	0	0	0	0.0891
34	Aug. 1979	2.31	14.1	0	0	0.3	2.05
35	Nov. 1979	0.125	0	0	0	0	0.319
36	Nov. 1979	0	0	0	0	0	0
37	June 1980	16.8	100.08	0	0	0	0.307
38	June 1980	0.0858	0	0	0	0	0.0044
39	Jan. 1981	0.0137	100.4	0	0	0	8.97
40	Jan. 1981	0.0239	0	0.000074	0	0.0001	0.542
Totals by Isotope:		39.03924	16301.28	0.000074	1.22	0.3081	18.61869

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

Isotope:	Sr-90	Sb-125	Ba-133	Cs-134	Cs-137	Eu-152
Half Life (yr.):	29.12	2.77	10.74	2.062	30	13.33
Hole No.						
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0.0658	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0.00546	0	0	0	0	0
10	0.0546	0	0	0	0.0111	0
11	0.0553	0	0	0	0	0
12	0.224	0	0	0	0.0114	0
13	0.342	0	0	0	0.232	0
14	0.236	0	0	0.000041	0.123	0
15	0.0117	0	0	0.000053	0.119	0
16	0.0603	0	0	0	0.0918	0
17	0.0621	0	0	0.00012	0.063	0
18	0	0	0	0	0	0
19	0.0189	0	0.00284	0.00005	0.0191	0
20	0	0	0	0	0	0
21	0	0	0	0	3.22	0
22	0	0	0	0	0	0
23	0	0	0	0.00732	0.00648	0
24	0	0	0	0.00002	6.6	0.768
25	0.0195	0	0	0.00262	1.056	9.81
26	0.0658	0	0	0.00006	0.554	0
27	0	0	0	0	0	0
28	0	0	0	5.9E-06	0.0415	0
29	0.000666	0	0	0.0468	2.7	20.6
30	0	0	0	0	0	0
31	0.00675	0	0	0.000039	1.5	0
32	0.000673	0	0	0	3.51	0
33	0.000675	0	0	0	0.13	0
34	3.3	0	0	0.0353	13.6	0
35	0	0	0	0.0017	0.195	0
36	0	0	0	0	0	0
37	0.00307	0	0.567	0.00261	0.882	9.67
38	65.1	0	0	0	0.0212	0
39	0.000708	0	0	0	3.3	0
40	0.0029	0.374	0.0353	0.000489	1.16	0
Totals by Isotope:	69.5711	0.374	0.60514	0.097228	39.21238	40.848

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

Isotope:	Bi-207	Po-208	Pb-210	Ra-226	Ra-228	Th-230
Half Life (yr.):	38	2.896	22.3	1600	5.75	7.7E+04
Hole No.						
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0.1	0	0
17	0	0	0	0	0	0
18	0	0	0	0	0	0
19	0	0	0	0	0	0
20	0	0	0	0	0	0
21	0	0	0	0.01	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0	0	0	0.01	0	0
25	0	0	0.743	0.002	0	0.002
26	0	0.000022	0	0.0016	0	0.02
27	0	0	0	0	0	0
28	0	0.000016	0	0.005	0	0.01
29	0	0.000017	0	0.005	0	0.01
30	0	0	0	0	0	0
31	0	0	0	0.1	0	0.1
32	0	0	0	0.075	0	0.075
33	0	0	0	1.08	0	0.08
34	0	2.4E-06	0	0.16	0	0.16
35	0	0	0	0.08	0	0.08
36	0	0	0	0	0	0
37	0	0	0	0.17	0	0.16
38	0	0	0	0.08	0	0.08
39	0	0.000034	0.00127	0.002	0	0.002
40	8.44	0.000031	0.000637	0.011	0.000052	0.001
Totals by Isotope:	8.44	0.000122	0.744907	1.8916	0.000052	0.78

Activity of Long Lived Radioisotopes as of August 1995 (micro Ci), Continued

Isotope:	U-235	U-238	U-Nat.	Am-241	Total per Hole (micro Ci)
Half Life (yr.):	7.0E+08	4.468E+09	4.468E+09	432.2	
Hole No.					
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0.066565
7	0	0	0	0	0
8	0	0	0	0	0
9	0	0	0	0	0.00652
10	0	0	0	0	0.190407
11	0	0	0	0	0.18755
12	0	0	0	0	0.4668
13	0	0	0	0	1.884
14	0	0	0	0	1.467241
15	0	0	0	0	5000.45
16	0	0	0	0	0.31647
17	0	0	0	0	10000.19
18	0	0	0	0	0
19	0	0	0	0	0.0499
20	0	0	0	0	0
21	0	1	0	1	8.044
22	0	0	0	0	0
23	0	0	0	0	0.03429
24	0	0	0	0.01	7.502468
25	0	0	0.002	0	1012.02
26	0	0	0	0	17.20208
27	0	0	0	0	0
28	0	0	0	0	0.259922
29	0	0	0	0	25.07248
30	0	0	0	0	0
31	0.1	0	0	0	89.87779
32	0	0	0.075	0.003	4.441065
33	0	0.081	0	0	1.461171
34	0	0	3.18	10.001	49.1963
35	0	0	0.08	0	0.8807
36	0	0	0	0	0
37	0	0.00005	0.16	0.004	128.8057
38	0	0	0.08	0	65.4514
39	0.0045	2.388	0.002	0.009	115.0932
40	0	0	0.0022	3.31	13.90368
Totals by Isotope:	0.1045	3.46905	3.5812	14.337	16544.52

APPENDIX 2

INITIAL ACTIVITY OF SHORT-LIVED RADIOISOTOPES

Initial Activity of Short Lived Radioisotopes (micro Ci.)

Isotope:		Be-7	P-32	P-33	S-35	Ca-45	Cr-51
Half Life(yr):		0.146	0.039	0.070	0.239	0.446	0.076
Half Lives in 15 yr:		103	385	214	63	34	197
Hole No.	Date Closed						
1	April 1966	0	500	0	0	0	0
2	Feb. 1967	0	1500	0	20000	0	0
3	Oct. 1967	0	9400	0	0	0	0
4	Oct. 1967	0	4000	0	0	0	0
5	May 1968	0	5000	0	0	0	0
6	Oct. 1968	0	0	0	0	0	0
7	Mar. 1969	0	1000	0	0	0	0
8	Aug. 1969	0	1000	0	0	0	0
9	Feb. 1970	0	0	0	0	0	0
10	Feb. 1970	0	0.01	0	0	0.03	0
11	Aug. 1970	0	0	0	0	0	0
12	Feb. 1971	0	0	0	0	0	0
13	Nov. 1971	0	0	0	0	0	0
14	April 1972	0	1000.2	0	500	0	0.1
15	Feb. 1973	0	1000	0	1000	0	0.1
16	April 1974	0	0	0	0	0	0
17	July 1975	0	500	10	500	0	0
18	Jan. 1976	0	1500		500	0	0
19	Jan. 1976	0	0	0	0	0	0.02
20	Aug. 1976	0	500	0	0	0	0
21	Aug. 1976	0	1000	0	0	0	0.01
22	Oct. 1976	0	4000	0	1000	0	0
23	Oct. 1976	0	0	0	0	0	0.01
24	Feb. 1977	0	0.02	0	0	0	0.1
25	Aug. 1977	0.202	4000.02	0	0	0	0.06
26	Dec. 1977	0.05	0.06	0	1	0	0.304
27	May 1978	0	0	0	1300	0	0
28	March 197	0.012	0	0	0	0	0.007
29	June 1978	0	2100	0	0	0	1.4
30	Oct. 1978	0	0	0	7490	0	0
31	Jan. 1979	0.2	500	0	200	0	0
32	Nov. 1978	0	0	0	0	0	0
33	Jan. 1979	0	0	0	0	0	0
34	Aug. 1979	0.072	1000.552	0	501	0	0.02
35	Nov. 1979	0.23	0.02	0	5000	0	0.03
36	Nov. 1979	0	0	0	4500	0	0
37	June 1980	0.0001	1500	0	18.001	0	0.006
38	June 1980	0	0.001	0	0	0	0
39	Jan. 1981	0	500.002	250	0	0	0
40	Jan. 1981	0.0013	0.04	0	0	0	0.017
Totals by Isotope:		0.7674	41500.93	260	42510	0.03	2.184

Initial Activity of Short Lived Radioisotopes (micro Ci.), Continued

Isotope:	Mn-54	Co-57	Co-58	Fe-59	Zn-65	SE-75
Half Life(yr):	0.856	0.742	0.194	0.122	0.668	0.328
Half Lives in 15 yr:	18	20	77	123	22	46
Hole No.						
1	0	0	0	0	12000	0
2	150	0	0	0	7100	0
3	200	0	0	0	200	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0.0743	0	0	0	0.0748	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0.01	0	0	0	0.01	0
11	0	0	0	0	0	0
12	0.2	0	0	0	0.1	0
13	0	0	0	0	0	0
14	0.2	0	0	0	0.1	0
15	0.2	0	0	0	0.1	0
16	0.0025	0	0	0	0.001	0
17	0	0	0.1	0	0.01	0
18	0	0	0	0	1000	0
19	0.11	0	0	0	0	0
20	0	0	0	0	1000	0
21	1	0	0.1	0.5	0.01	0
22	0	0	0	0	0	0
23	0	0	0	0	0.01	0
24	0.01	0	0.2	0	0.01	0
25	0.021	0.12	0.011	0	0.621	0.8
26	0.021	1.71	0.9	0.5	0.015	0
27	0	0	0	0	0	0
28	0.001	0.022	0.009	0	0.001	0
29	1.5	0.04	0	0	0.12	0
30	0	0	0	0	0	0
31	0.01	0	0	0.1	0.03	0
32	0	0.026	0.002	0	0	0
33	0	0.032	0	0	0	0
34	0.782	0.074	0	0	0.484	0.05
35	0	0.3	0.04	0.2	0.1	0
36	0	0	0	0	0	0
37	0.405	0.18	0.005	0	0.323	0
38	0.001	0.006	0	0.011	0.001	0
39	0.0001	4.273	0	0.08	0.0001	0
40	0.0065	0.59	0.051	0.091	0.0054	0
Totals by Isotope:	354.5544	7.373	1.418	1.482	21302.16	0.85

Initial Activity of Short Lived Radioisotopes (micro Ci.), Continued

Isotope:	Sr-85	Sr-89	Y-88	Zr-95	Mo-99	Ru-103
Half Life(yr):	0.177	0.138	0.292	0.278	0.007	0.107
Half Lives in 15 yr:	85	109	51	54	2143	140
Hole No.						
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0.023	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0.03	0	0.01
11	0	0	0	0	0	0
12	0	0	0	0.1	0	0
13	0	0	0	0	0	0
14	0	0	0	0.11	0	0
15	0	0	0	0.1	0	0
16	0	0	0	0	0	0
17	0	0	0	0.1	0	0
18	0	0	0	0	0	0
19	0	0	0	0.04	0	0
20	0	0	0	0	0	0
21	0	0	0	0.1	0	0
22	0	0	0	0	0	0
23	0	0	0	0	0	0
24	0.02	0.2	0	0	0	0
25	0.304	0.1	3.5	0.023	0.02	0
26	0.021	0.03	0.32	3	0	0
27	0	0	0	0	0	0
28	0.02	0	0.202	0	0	0
29	0	0.11	0.005	0.4	0	0
30	0	0	0	0	0	0
31	0	0.2	1.5	0	0	0
32	0.005	0.001	0.09	0	0	0
33	0.053	0.001	0.121	0.1	0	0
34	0.167	0.241	0.37	0	0.0001	0
35	0.03	0	0.13	0	0	0
36	0	0	0	0	0	0
37	0.356	0.003	1.04	0.002	0	0
38	0.013	0.15	0.028	0	0	0
39	0.058	0.001	0.175	0	0	0
40	0.039	0.091	0.245	0.000064	0	0
Totals by Isotope:	1.086	1.128	7.726	4.128064	0.0201	0.01

Initial Activity of Short Lived Radioisotopes (micro Ci.), Continued

Isotope:	Ru-106	Cd-109	Ag-110m	Sn-113	I-131	Ce-139
Half Life(yr):	1.010	1.270	0.684	0.315	0.022	0.377
Half Lives in 15 yr:	15	12	22	48	682	40
Hole No.						
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0.256	0	0	0	0.09	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0.01	0
10	0.3	0	0	0	0.01	0
11	0	0	0	0	0	0
12	0.2	0	0	0	0.01	0
13	0	0	0	0	0.2	0
14	0.2	0	0	0	0.02	0
15	0.1	0	0	0	0.01	0
16	0.1	0	0	0	0	0
17	0.1	0	0	0	0.1	0
18	0	0	0	0	0	0
19	0.03	0	0	0	0.011	0
20	0	1000	0	0	0	0
21	0.01	0.01	0	0	0.01	0
22	0	500	0	0	0	0
23	0	0.1	0	0	0.01	0
24	0.01	0	0	0	0.11	0
25	0.01	33.01	0	0.32	3.22	0.115
26	0.011	3.45	0	0.11	0.28	0.11
27	0	0	0	0	0	0
28	0	0.37	0	0.042	1.001	0.015
29	4.8	0.7	0	0	0.2	0
30	0	0	0	0	0	0
31	0	20.21	0	0	1.3	0
32	0	0.7	0	0.09	0.008	0.008
33	0	0.8	0	0.06	0.2	0.02
34	11.03	2.2	2.4	0.197	1.6	0.06
35	0.22	1	0	0.061	0.48	0.21
36	0	0	0	0	0	0
37	0.017	41.5	0	0.463	0.402	0.15
38	0	0.13	0	0.017	0.34	0.005
39	0	33.56	0	0.095	0.134	0.035
40	0.722	4.28	0	0.084	0.1	0.07
Totals by Isotope:	18.116	1642.02	2.4	1.539	9.856	0.798

Initial Activity of Short Lived Radioisotopes (micro Ci.), Continued

Isotope:	Ce-141	Ba-140	Ce-144	Au-195	Hg-203	Po-210	Totals
Half Life(yr):	0.089	0.035	0.778	0.501	0.128	0.379	By Hole:
Half Lives in 15 yr:	169	429	19	30	117	40	
Hole No.							
1	0	0	0	0	0	0	12500
2	0	0	0	0	0	0	28750
3	0	0	0	0	0	0	9800
4	0	0	0	0	0	0	4000
5	0	0	0	0	0	0	5000
6	0	0.0123	0.063	0	0	0	0.5934
7	0	0	0	0	0	0	1000
8	0	0	0	0	0	0	1000
9	0	0	0	0	0	0	0.01
10	0	0.01	0.03	0	0	0	0.45
11	0	0	0	0	0	0	0
12	0	0.01	0.2	0	0	0	0.82
13	0	0.2	0	0	0	0	0.4
14	0	0.01	0.2	0	0	0	1501.14
15	0	0.01	0.2	0	0	0	2000.82
16	0	0	0.1	0	0	0	0.2035
17	0	0	0.1	0	0	0	1010.51
18	0	0	0	0	0	0	3000
19	0	0.011	0.08	0	0	0	0.302
20	0	0	0	0	0	0	2500
21	0	0.01	0.01	0	0	0	1001.77
22	0	0	0	0	0	0	5500
23	0	0	0	0	0	0	0.16
24	0	0.11	0.01	0	0.02	0	0.82
25	0	0.111	0.033	0	0.301	0	4042.922
26	0	0	0.232	0	0.011	0.001	12.136
27	0	0	0	0	0	0	1300
28	0	0	0.0013	0	2.006	0	3.7093
29	0.02	0	0.001	0	0	0	2109.296
30	0	0	0	0	0	0	7490
31	0	0.1	0	0	0	0	723.65
32	0	0.007	0	0	0.008	0	0.945
33	0.02	0.05	0.19	0	0.024	0	1.671
34	0	0	2.42	0	0.0891	0	1523.808
35	0	0	0	0.002	0.006	0	5003.059
36	0	0	0	0	0	0	4500
37	0	0.003	2.106	0	0.166	0.0001	1565.128
38	0	0.01	0.0001	0	0.006	0	0.7191
39	0	0	0.031	0	0.023	0.001	788.4682
40	0.008	2.0E-06	0.025	0	0.0075	0.000243	6.474009
Totals by Isotope:	0.048	0.664302	6.0324	0.002	2.6676	0.002343	107640

APPENDIX 3

DETAILED LISTING OF ALL RADIOISOTOPES IN EACH HOLE, INCLUDING INITIAL ACTIVITIES AND ACTIVITIES DECAY CORRECTED TO AUGUST 1995

Hole No.: 1
Date filled: April 1966
Decay Time to Aug '95: 29.25 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	500	0.039124	747.6	<E-99
Zn-65	12000	0.667762	43.8	7.8E-10

Hole No.: 2
Date filled: March 1967
Decay Time to Aug '95: 28.42 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	1500	0.039124	726.3	<E-99
S-35	20000	0.239398	118.7	3.7E-32
Mn-54	150	0.855578	33.2	1.5E-08
Zn-65	7100	0.667762	42.6	1.1E-09

Hole No.: 3
Date filled: Oct. 1967
Decay Time to Aug '95: 27.83 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	9400	0.039124	711.4	<E-99
Mn-54	200	0.855578	32.5	3.2E-08
Zn-65	200	0.667762	41.7	5.7E-11

Hole No.: 4
Date filled: Oct. 1967
Decay Time to Aug '95: 27.83 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	4000	0.039124	711.4	<E-99

Hole No.: 5
Date filled: May 1968
Decay Time to Aug '95: 27.17 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	5000	0.039124	694.4	<E-99

Hole No.: 6
Date filled: Oct. 1968
Decay Time to Aug '95: 26.75 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
Mn-54	0.0743	0.855578	31.3	2.9E-11
Co-60	0.0258	5.271	5.1	0.000765
Zn-65	0.0748	0.667762	40.1	6.5E-14
Zr-Nb-95	0.0230	0.27826	96.1	2.6E-31
Ru-Rh-106	0.2560	1.008077	26.5	2.6E-09
I-131	0.0900	0.022012	1215.2	<E-99
Cs-137	0.1220	30	0.9	0.065757
Ba-La-140	0.0123	0.03488	766.9	<E-99
Ce-Pr-144	0.0630	0.778371	34.4	2.8E-12

Hole No.: 7
Date filled: Mar. 1969
Decay Time to Aug '95: 26.33 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	1000	0.039124	673.1	<E-99

Hole No.: 8
Date filled: Aug. 1969
Decay Time to Aug '95: 25.92 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	1000	0.039124	662.4	<E-99

Hole No.: 9
Date filled: Feb. 1970
Decay Time to Aug '95: 25.42 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
Co-60	0.03	5.271	4.8	0.001061
Sr-Y-90	0.01	29.12	0.9	0.005461
I-131	0.01	0.022012	1154.7	<E-99

Hole No.: 10
Date filled: Feb. 1970
Decay Time to Aug '95: 25.42 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.10	12.35	2.1	0.024014
C-14	0.10	5730	0.0	0.099693
P-32	0.01	0.039124	649.6	<E-99
Ca-45	0.03	0.44627	57.0	2.1E-19
Mn-54	0.01	0.855578	29.7	1.1E-11
Co-60	0.02	5.271	4.8	0.000707
Zn-65	0.01	0.667762	38.1	3.5E-14
Sr-Y-90	0.10	29.12	0.9	0.054608
Zr-Nb-95	0.03	0.27826	91.3	9.6E-30
Ru-103	0.01	0.107543	236.3	7.2E-74
Ru-106	0.30	1.008077	25.2	7.7E-09
I-131	0.01	0.022012	1154.7	<E-99
Cs-137	0.02	30	0.8	0.011117
Ba-La-140	0.01	0.03488	728.7	<E-99
Ce-Pr-144	0.03	0.778371	32.7	4.4E-12

Hole No.: 11
Date filled: Aug. 1970
Decay Time to Aug '95: 24.92 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.1	12.35	2.0	0.024698
C-14	0.1	5730	0.0	0.099699
Co-60	0.2	5.271	4.7	0.007551
Sr-Y-90	0.1	29.12	0.9	0.055261

Hole No.: 12
Date filled: Feb. 1971
Decay Time to Aug '95: 24.42 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.2	12.35	2.0	0.050801
C-14	0.1	5730	0.0	0.099705
Mn-54	0.2	0.855578	28.5	5.1E-10
Co-60	2	5.271	4.6	0.080645
Zn-65	0.1	0.667762	36.6	9.8E-13
Sr-Y-90	0.4	29.12	0.8	0.223692
Zr-Nb-95	0.1	0.27826	87.7	3.8E-28
Ru-106	0.2	1.008077	24.2	1.0E-08
I-131	0.01	0.022012	1109.2	<E-99
Cs-137	0.2	30	0.8	0.113769
Ba-La-140	0.01	0.03488	700.0	<E-99-
Ce-Pr-144	0.2	0.778371	31.4	7.2E-11

Hole No.: 13
Date filled: Nov. 1971
Decay Time to Aug '95: 23.67 yr.

Isotope	Initial Activity (micro Ci)			Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
	Transfer 1	Transfer 2	Total			
C-14	0.1	0.1	0.2	5730	0.0	0.199428
Co-60	15	10	25	5.271	4.5	1.112557
Sr-Y-90	0.4	0.2	0.6	29.12	0.8	0.341582
I-131	0.1	0.1	0.2	0.022012	1075.2	<E-99
Cs-137	0.3	0.1	0.4	30	0.8	0.231516
Ba-La-140	0.1	0.1	0.2	0.03488	678.5	<E-99

Hole No.: 14
Date filled: June 1972
Decay Time to Aug '95: 23.17 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Transfer 3	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.2	0	0.01	0.21	12.35	1.9	0.057218
C-14	0.1	0	0	0.10	5730	0.0	0.09972
P-32	0.2	1000	0	1000.20	0.039124	592.1	<E-99
S-35	0	500	0	500.00	0.239398	96.8	3.7E-27
Cr-51	0.1	0	0	0.10	0.075849	305.4	1.1E-93
Mn-54	0.2	0	0	0.20	0.855578	27.1	1.4E-09
Co-60	10	0	10	20.00	5.271	4.4	0.950534
Zn-65	0.1	0	0	0.10	0.667762	34.7	3.6E-12
Sr-Y-90	0.4	0	0.01	0.41	29.12	0.8	0.236209
Zr-Nb-95	0.1	0	0.01	0.11	0.27826	83.3	9.5E-27
Ru-106	0.2	0	0	0.20	1.008077	23.0	2.4E-08
I-131	0.01	0	0.01	0.02	0.022012	1052.4	<E-99
Cs-134	0.1	0	0	0.10	2.062	11.2	0.000041
Cs-137	0.2	0	0.01	0.21	30	0.8	0.122958
Ba-La-140	0.01	0	0	0.01	0.03488	664.2	<E-99
Ce-Pr-144	0.2	0	0	0.20	0.778371	29.8	2.2E-10

Hole No.: 17
Date filled: July 1975
Decay Time to Aug '95: 20.00 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.2	0	0.2	12.35	1.6	0.065093
C-14	0	10000	10000	5730	0.0	9975.836
P-32	0	500	500	0.039124	511.2	<E-99
P-33	0	10	10	0.069541	287.6	2.7E-86
S-35	0	500	500	0.239398	83.5	3.5E-23
Co-58	0.1	0	0.1	0.19384	103.2	8.7E-33
Co-60	0.02	0	0.02	5.271	3.8	0.001442
Zn-65	0.01	0	0.01	0.667762	30.0	9.6E-12
Sr-Y-90	0.1	0	0.1	29.12	0.7	0.062122
Zr-Nb-95	0.1	0	0.1	0.27826	71.9	2.3E-23
Ru-106	0.1	0	0.1	1.008077	19.8	1.1E-07
I-131	0.1	0	0.1	0.022012	908.6	<E-99
Cs-134	0.1	0	0.1	2.062	9.7	0.00012
Cs-137	0.1	0	0.1	30	0.7	0.062996
Ce-144	0.1	0	0.1	0.778371	25.7	1.8E-09

Hole No.: 18
Date filled: Jan. 1976
Decay Time to Aug '95: 19.50 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	1500	0.039124	498.4	<E-99
S-35	500	0.239398	81.5	1.5E-22
Zn-65	1000	0.667762	29.2	1.6E-06

Hole No.: 19
Date filled: Jan. 1976
Decay Time to Aug '95: 19.50 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.01	0.01	0.02	12.35	1.6	0.006695
Cr-51	0.01	0.01	0.02	0.075849	257.1	8.1E-80
Mn-54	0.1	0.01	0.11	0.855578	22.8	1.5E-08
Co-60	0.01	0.02	0.03	5.271	3.7	0.002309
Sr-Y-90	0.02	0.01	0.03	29.12	0.7	0.01886
Zr-Nb-95	0.02	0.02	0.04	0.27826	70.1	3.2E-23
Ru-106	0.01	0.02	0.03	1.008077	19.3	4.5E-08
I-131	0.01	0.001	0.011	0.022012	885.9	<E-99
Ba-133	0.01	0	0.01	10.74	1.8	0.002841
Cs-134	0.015	0.02	0.035	2.062	9.5	0.00005
Cs-137	0.01	0.02	0.03	30	0.7	0.019118
Ba-140	0.01	0.001	0.011	0.03488	559.1	<E-99
Ce-144	0.06	0.02	0.08	0.778371	25.1	2.3E-09

Hole No.: 20
Date filled: Aug.1976
Decay Time to Aug '95: 19.00 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	500	0.039124	485.6	<E-99
Zn-65	1000	0.667762	28.5	2.7E-06
Cd-109	1000	1.270363	15.0	0.031455

Hole No.: 21
Date filled: Aug.1976
Decay Time to Aug '95: 19.00 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	1	0	1	12.35	1.5	0.344252
P-32	0	1000	1000	0.039124	485.6	<E-99
Cr-51	0.01	0	0.01	0.075849	250.5	3.9E-78
Mn-54	1	0	1	0.855578	22.2	2.1E-07
Co-58	0.1	0	0.1	0.19384	98.0	3.1E-31
Fe-59	0.5	0	0.5	0.121914	155.8	6.1E-48
Co-60	30	0	30	5.271	3.6	2.466152
Zn-65	0.1	1000	1000.1	0.667762	28.5	2.7E-06
Sr-85	0.01	0	0.01	0.177522	107.0	6.0E-35
Zr-Nb-95	0.1	0	0.1	0.27826	68.3	2.8E-22
Ru-106	0.01	0	0.01	1.008077	18.8	2.1E-08
Cd-109	0.01	0	0.01	1.270363	15.0	3.1E-07
I-131	0.01	0	0.01	0.022012	863.2	<E-99
Cs-137	5	0	5	30	0.6	3.223426
Ba-140	0.01	0	0.01	0.03488	544.7	<E-99
Ce-144	0.01	0	0.01	0.778371	24.4	4.5E-10
Ra-226	0.01	0	0.01	1600	0.0	0.009918
U-238	1	0	1	4.468E+09	0.0	1
Am-241	1	0	1	432.2	0.0	0.969988

Hole No.: 22
Date filled: Oct. 1976
Decay Time to Aug '95: 18.75 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
P-32	4000	0.039124	479.2	<E-99
S-35	1000	0.667762	28.1	3.5E-06
Cd-109	500	1.270363	14.8	0.018026

Hole No.: 23
Date filled: Oct. 1976
Decay Time to Aug '95: 18.75 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.01	12.35	1.5	0.003491
Cr-51	0.01	0.075849	247.2	3.8E-77
Co-60	0.2	5.271	3.6	0.016991
Zn-65	0.04	0.667762	28.1	1.4E-10
Cd-109	0.1	1.27036	14.8	3.6E-06
I-131	0.01	0.022012	851.8	<E-99
Cs-134	4	2.062	9.1	0.007324
Cs-137	0.01	30	0.6	0.006484

Hole No.: 24
Date filled: Feb. 1977
Decay Time to Aug '95: 18.42 yr.

Isotope	Initial Activity (micro Ci)			Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
	Transfer 1	Transfer 2	Total			
H-3	0	0.01	0.01	12.35	1.5	0.003557
C-14	0	0.1	0.1	5730	0.0	0.099777
P-32	0.01	0.01	0.02	0.039124	470.7	<E-99
Cl-36	0.01	0	0.01	3.01E+05	0.0	0.01
Cr-51	0	0.1	0.1	0.075849	242.8	8.1E-75
Mn-54	0	0.01	0.01	0.855578	21.5	3.3E-09
Co-58	0.1	0.1	0.2	0.19384	95.0	5.0E-30
Co-60	0	0.01	0.01	5.271	3.5	0.000888
Zn-65	0	0.01	0.01	0.667762	27.6	5.0E-11
Sr-85	0.01	0.01	0.02	0.177522	103.7	1.2E-33
Sr-89	0.1	0.1	0.2	0.138261	133.2	1.6E-41
Ru-106	0	0.01	0.01	1.008077	18.3	3.2E-08
I-131	0.01	0.1	0.11	0.022012	836.7	<E-99
Cs-134	0	0.01	0.01	2.062	8.9	0.00002
Cs-137	0.1	10	10.1	30	0.6	6.599673
Ba-140	0.01	0.1	0.11	0.03488	528.0	<E-99
Ce-144	0	0.01	0.01	0.778371	23.7	7.5E-10
Eu-152	0	2	2	13.33	1.4	0.767588
Hg-203	0.01	0.01	0.02	0.127584	144.3	7.0E-46
Ra-226	0	0.01	0.01	1600	0.0	0.009921
Am-241	0.01	0	0.01	432.2	0.0	0.009709

Hole No.: 25
Date filled: Aug. 1977
Decay Time to Aug '95: 18.00 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Transfer 3	Transfer 4	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.01	0.5	0.4	0	0.91	12.35	1.5	0.331355
Be-7	0.2	0	0.002	0	0.202	0.145927	123.3	1.5E-38
C-14	0	0	0	1000	1000	5730	0.0	997.8249
P-32	0	0	0.02	4000	4000.02	0.039124	460.1	<E-99
Cl-36	0	0.01	0	0	0.01	3.01E+05	0.0	0.01
Cr-51	0.01	0	0.05	0	0.06	0.075849	237.3	2.2E-73
Mn-54	0.01	0.01	0.001	0	0.021	0.855578	21.0	9.8E-09
Co-57	0	0.1	0.02	0	0.12	0.741684	24.3	5.9E-09
Co-58	0.01	0	0.001	0	0.011	0.19384	92.9	1.2E-30
Co-60	0.05	0.2	0.2	0	0.45	5.271	3.4	0.042191
Zn-65	0.01	0.6	0.011	0	0.621	0.667762	27.0	4.8E-09
Se-75	0	0	0.8	0	0.8	0.327995	54.9	2.4E-17
Sr-85	0	0.3	0.004	0	0.304	0.177522	101.4	9.1E-32
Sr-89	0.1	0	0	0	0.1	0.138261	130.2	6.4E-41
Sr-90	0	0	0.03	0	0.03	29.12	0.6	0.019545
Y-88	0	1.2	2.3	0	3.5	0.291964	61.7	9.7E-19
Zr-Nb-95	0.01	0.01	0.002	0	0.022	0.175168	102.8	2.6E-33
Mo-99	0	0.02	0	0	0.02	0.007529	2390.7	<E-99
Ru-106	0.01	0	0	0	0.01	1.008077	17.9	4.2E-08
Cd-109	0.01	2	31	0	33.01	1.270363	14.2	0.001792
Sn-113	0	0.3	0.02	0	0.32	0.315127	57.1	2.0E-18
I-131	1	1.2	1.02	0	3.22	0.022012	817.7	<E-99
Cs-134	1.1	0.01	0.001	0	1.111	2.062	8.7	0.002618
Cs-137	0.1	1.3	0.2	0	1.6	30	0.6	1.055606
Ce-139	0	0.08	0.035	0	0.115	0.376893	47.8	4.8E-16
Ba-140	0.1	0.01	0.001	0	0.111	0.03488	516.1	<E-99
Ce-144	0.01	0.02	0.003	0	0.033	0.778371	23.1	3.6E-09
Eu-152	5	0	20	0	25	13.33	1.4	9.805007
Hg-203	0	0.3	0.001	0	0.301	0.127584	141.1	1.0E-43
Pb-210	0	1.3	0	0	1.3	22.3	0.8	0.74295
Ra-226	0	0	0.002	0	0.002	1600	0.0	0.001984
Th-230	0	0	0.002	0	0.002	7.7E+04	0.0	0.002
U-238-235	0	0	0.002	0	0.002	4.468E+09	0.0	0.002

Hole No.: 26
Date filled: Dec. 1977
Decay Time to Aug '95: 17.58 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.3	44.1	44.4	12.35	1.4	16.54973
Be-7	0.03	0.02	0.05	0.145927	120.5	2.7E-38
C-14	0.001	0	0.001	5730	0.0	0.000998
P-32	0.06	0	0.06	0.039124	449.4	<E-99
S-35	0	1	1	0.239562	73.4	8.0E-23
K-40	0	0.008	0.008	1.28E+09	0.0	0.008
Cr-51	0.3	0.004	0.304	0.075849	231.8	5.0E-71
Mn-54	0	0.021	0.021	0.855578	20.6	1.4E-08
Co-57	0	1.71	1.71	0.741684	23.7	1.2E-07
Co-58	0	0.9	0.9	0.19384	90.7	4.4E-28
Co-60	0	0.521	0.521	5.271	3.3	0.051599
Fe-59	0.5	0	0.5	0.121997	144.1	2.1E-44
Zn-65	0	0.015	0.015	0.667762	26.3	1.8E-10
Sr-85	0	0.021	0.021	0.177522	99.0	3.2E-32
Sr-89	0	0.03	0.03	0.138261	127.2	1.6E-40
Sr-90	0	0.1	0.1	29.12	0.6	0.065801
Y-88	0	0.32	0.32	0.291964	60.2	2.4E-19
Y-90	0	0.1	0.1	0.007306	2406.7	<E-99
Zr-95	0	2	2	0.175168	100.4	1.2E-30
Nb-95	0	3	3	0.096301	182.6	3.3E-55
Ru-106	0	0.011	0.011	1.008077	17.4	6.2E-08
d-109	0	3.45	3.45	1.270363	13.8	0.000235
Sn-113	0	0.11	0.11	0.315127	55.8	1.8E-18
I-131	0.07	0.21	0.28	0.022012	798.8	<E-99
Ba-133	0.02	0.1	0.12	10.74	1.6	0.038578
Cs-134	0	0.022	0.022	2.062	8.5	0.00006
Cs-137	0.001	0.831	0.832	30	0.6	0.554225
Ce-139	0	0.11	0.11	0.376893	46.7	9.9E-16
Ce-144	0	0.232	0.232	0.778371	22.6	3.7E-08
Hg-203	0	0.011	0.011	0.127584	137.8	3.6E-44
Po-208	0.001	0.0005	0.0015	2.896	6.1	0.000022
Po-210	0.001	0	0.001	0.379123	46.4	1.1E-17
Ra-226	0.001	0.0006	0.0016	1600	0.0	0.001588
Th-230	0.01	0.01	0.02	7.7E+04	0.0	0.019997

Hole No.: 27
Date filled: May 1978
Decay Time to Aug '95: 17.17 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
S-35	600	700	1300	0.239562	71.7	3.5E-19

Hole No.: 28
Date filled: March 1978
Decay Time to Aug '95: 17.33 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.5	12.35	1.4	0.189004
Be-7	0.012	0.145927	118.8	2.1E-38
Cr-51	0.007	0.075849	228.5	1.1E-71
Mn-54	0.001	0.855578	20.3	8.0E-10
Co-57	0.022	0.741684	23.4	2.0E-09
Co-58	0.009	0.19384	89.4	1.1E-29
Co-60	0.141	5.271	3.3	0.014431
Zn-65	0.001	0.667762	26.0	1.5E-11
Sr-85	0.02	0.177522	97.6	8.1E-32
Y-88	0.202	0.291964	59.4	2.7E-19
Cd-109	0.37	1.270363	13.6	0.000029
Sn-113	0.042	0.315127	55.0	1.2E-18
I-131	1.001	0.022012	787.4	<E-99
Cs-134	0.002	2.062	8.4	5.9E-06
Cs-137	0.062	30	0.6	0.04154
Ce-139	0.015	0.376893	46.0	2.1E-16
Ce-144	0.0013	0.778371	22.3	2.6E-10
Hg-203	2.006	0.127584	135.9	2.5E-41
Po-208	0.001	2.896	6.0	0.000016
Ra-226	0.005	1600	0.0	0.004963
Th-230	0.01	7.7E+04	0.0	0.009998

Hole No.: 29
Date filled: June, 1978
Decay Time to Aug '95: 17.08 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	1	0	1	12.35	1.4	0.38335
P-32	0	2100	2100	0.039124	436.6	<E-99
Cl-36	1.2	0	1.2	3.01E+05	0.0	1.199953
Cr-51	1.4	0	1.4	0.075849	225.2	2.2E-68
Mn-54	1.5	0	1.5	0.855578	20.0	1.5E-06
Co-57	0.04	0	0.04	0.741684	23.0	4.7E-09
Co-60	1.2	0	1.2	5.271	3.2	0.126923
Zn-65	0.12	0	0.12	0.667762	25.6	2.4E-09
Sr-89	0.11	0	0.11	0.138261	123.6	7.0E-39
Sr-90	0.001	0	0.001	29.12	0.6	0.000666
Y-88	0.005	0	0.005	0.291964	58.5	1.2E-20
Zr-Nb-95	0.4	0	0.4	0.175168	97.5	1.8E-30
Ru-106	4.8	0	4.8	1.008077	16.9	0.000038
Cd-109	0.7	0	0.7	1.270363	13.4	0.000063
I-131	0.2	0	0.2	0.022012	776.1	<E-99
Cs-134	14.6	0	14.6	2.062	8.3	0.046813
Cs-137	4	0	4	30	0.6	2.695505
Ce-141	0.02	0	0.02	0.089041	191.9	3.5E-60
Ce-144	0.001	0	0.001	0.778371	21.9	2.5E-10
Eu-152	50	0	50	13.33	1.3	20.56738
Po-208	0.001	0	0.001	2.896	5.9	0.000017
Ra-226	0.005	0	0.005	1600	0.0	0.004963
Th-230	0.01	0	0.01	7.7E+04	0.0	0.009998

Hole No.: 30
Date filled: Oct. 1978
Decay Time to Aug '95: 16.75 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
S-35	7490	0.239562	69.9	6.7E-18

Hole No.: 31
Date filled: Jan. 1979
Decay Time to Aug '95: 16.50 yr.

Isotope	Initial Activity (micro Ci)				Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
	Transfer 1	Transfer 2	Transfer 3	Total			
H-3	4	0	0	4	12.35	1.3	1.584434
Be-7	0.2	0	0	0.2	0.145927	113.1	1.8E-35
C-14	0	0	86	86	5730	0.0	85.82852
P-32	0	500	0	500	0.039124	421.7	<E-99
S-35	0	200	0	200	0.239562	68.9	3.7E-19
Mn-54	0.01	0	0	0.01	0.855578	19.3	1.6E-08
Co-60	4.3	0	0	4.3	5.271	3.1	0.49107
Fe-59	0.1	0	0	0.1	0.121997	135.2	1.9E-42
Zn-65	0.03	0	0	0.03	0.667762	24.7	1.1E-09
Sr-89	0.2	0	0	0.2	0.138261	119.3	2.4E-37
Sr-90	0.01	0	0	0.01	29.12	0.6	0.006752
Y-88	1.5	0	0	1.5	0.291964	56.5	1.5E-17
Cd-109	20.21	0	0	20.21	1.270363	13.0	0.002487
I-131	1.3	0	0	1.3	0.022012	749.6	<E-99
Ba-133	2	0	0	2	10.74	1.5	0.689531
Ba-140	0.1	0	0	0.1	0.034904	472.7	<E-99
La-140	0.1	0	0	0.1	0.004597	3589.3	<E-99
Cs-134	0.01	0	0	0.01	2.062	8.0	0.000039
Cs-137	2.2	0	0	2.2	30	0.6	1.502644
Ra-226	0.1	0	0	0.1	1600	0.0	0.099288
U-Natural	0.1	0	0	0.1	4.468E+09	0.0	0.1
Th-230	0.1	0	0	0.1	7.7E+04	0.0	0.099985

Hole No.: 32
Date filled: Nov. 1978
Decay Time to Aug '95: 16.67 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.001	12.35	1.3	0.000392
Co-57	0.026	0.741684	22.5	4.5E-09
Co-58	0.002	0.19384	86.0	2.6E-29
Co-60	6.28	5.271	3.2	0.701643
Sr-85	0.005	0.177522	93.9	2.7E-31
Sr-89	0.001	0.138261	120.5	5.2E-40
Sr-90	0.001	29.12	0.6	0.000673
Y-88	0.09	0.291964	57.1	5.9E-19
Cd-109	0.7	1.270363	13.1	0.000079
Sn-113	0.09	0.315127	52.9	1.1E-17
I-131	0.008	0.022012	757.2	<E-99
Ba-140	0.007	0.034904	477.5	<E-99
La-140	0.007	0.004597	3625.5	<E-99
Cs-137	5.16	30	0.6	3.510838
Ce-139	0.008	0.376893	44.2	3.9E-16
Hg-203	0.008	0.127584	130.6	3.8E-42
Ra-226	0.075	1600	0.0	0.07446
Th-230	0.075	7.7E+04	0.0	0.074989
U-Natural	0.075	4.468E+09	0.0	0.075
Am-241	0.003	432.2	0.0	0.002921

Hole No.: 33
Date filled: Jan. 1979
Decay Time to Aug '95: 16.50 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.001	12.35	1.3	0.000396
Co-57	0.032	0.741684	22.2	6.4E-09
Co-60	0.78	5.271	3.1	0.089078
Sr-85	0.053	0.177522	92.9	5.6E-30
Sr-89	0.001	0.138261	119.3	1.2E-39
Sr-90	0.001	29.12	0.6	0.000675
Y-88	0.121	0.291964	56.5	1.2E-18
Zr-Nb-95	0.1	0.183562	89.9	8.7E-29
Cd-109	0.8	1.270363	13.0	0.000098
Sn-113	0.06	0.315127	52.4	1.0E-17
I-131	0.2	0.022012	749.6	<E-99
Ba-133	3	10.74	1.5	1.034296
Ba-La-140	0.05	0.034904	472.7	<E-99
Cs-137	0.19	30	0.6	0.129774
Ce-139	0.02	0.376893	43.8	1.3E-15
Ce-141	0.02	0.089041	185.3	3.3E-58
Ce-144	0.19	0.778371	21.2	7.9E-08
Hg-203	0.024	0.127584	129.3	2.8E-41
Ra-226	1.08	1600	0.0	1.072308
Th-230	0.08	7.7E+04	0.0	0.079988
U-Natural	0.081	4.468E+09	0.0	0.081

Hole No.: 34
Date filled: Aug. 1979
Decay Time to Aug '95: 16.00 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Transfer 3	Transfer 4	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.001	5.5	0.164	0	5.665	12.35	1.3	2.307818
Be-7	0	0	0.072	0	0.072	0.145927	109.6	7.1E-35
C-14	0	14.1	0	0	14.1	5730	0.0	14.07274
P-32	0	0.52	0.032	1000	1000.552	0.039124	409.0	<E-99
S-35	0	0	0	501	501	0.239562	66.8	3.9E-18
K-40	0	0	0.3	0	0.3	1.28E+09	0.0	0.3
Cr-51	0	0.02	0	0	0.02	0.075849	210.9	6.3E-66
Mn-54	0.65	0.02	0.112	0	0.782	0.855578	18.7	1.8E-06
Co-57	0.012	0.03	0.032	0	0.074	0.741684	21.6	2.4E-08
Co-60	5	2.7	9.074	0	16.774	5.271	3.0	2.045818
Zn-65	0.04	0.3	0.144	0	0.484	0.667762	24.0	3.0E-08
Se-75	0.05	0	0	0	0.05	0.328219	48.7	1.1E-16
Sr-85	0.02	0.13	0.017	0	0.167	0.177522	90.1	1.2E-28
Sr-89	0.001	0.12	0.12	0	0.241	0.138261	115.7	3.5E-36
Sr-90	0.02	0.003	4.8	0	4.823	29.12	0.5	3.295461
Y-88	0.06	0.21	0.1	0	0.37	0.291964	54.8	1.2E-17
Y-90	0.02	0	0	0	0.02	0.007306	2190.0	<E-99
Mo-99	0	0	0.0001	0	0.0001	0.007534	2123.6	<E-99
Ru-106	10	1	0.03	0	11.03	1.008077	15.9	0.000184
Cd-109	0.4	0.6	1.2	0	2.2	1.270363	12.6	0.000356
Ag-110m	2.4	0	0	0	2.4	0.684658	23.4	2.2E-07
Sn-113	0.032	0.11	0.055	0	0.197	0.315127	50.8	1.0E-16
I-131	0.6	0.7	0.3	0	1.6	0.022012	726.9	<E-99
Cs-134	0	0.02	7.631	0	7.651	2.062	7.8	0.035309
Cs-137	0.3	0.2	19.14	0	19.64	30	0.5	13.57038
Ce-139	0.01	0.03	0.02	0	0.06	0.376893	42.5	1.0E-14
Ce-144	0.9	0	1.52	0	2.42	0.778371	20.6	1.6E-06
Hg-203	0.006	0.08	0.0031	0	0.0891	0.127584	125.4	1.6E-39
Po-208	0	0	0.00011	0	0.00011	2.896	5.5	2.4E-06
Ra-226	0.08	0.08	0	0	0.16	1600	0.0	0.158895
Th-230	0.08	0.08	0	0	0.16	7.7E+04	0.0	0.159977
U-235	0	0	0	0.39	0.39	7.0E+08	0.0	0.39
U-Normal	0.1	0.08	0	3	3.18			
Am-241	0.05	0.001	9.95	0	10.001	432.2	0.0	9.747637

Transfer # 4 is a composite of 3 smaller transfers.

Hole No.: 35
Date filled: Nov. 1979
Decay Time to Aug '95: 15.67 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.3	0	0.3	12.35	1.3	0.124523
Be-7	0.23	0	0.23	0.145927	107.4	1.1E-33
P-32	0.02	0	0.02	0.039124	400.4	<E-99
S-35	0	5000	5000	0.239562	65.4	1.0E-16
Cr-51	0.03	0	0.03	0.075849	206.5	2.0E-64
Co-57	0.3	0	0.3	0.741684	21.1	1.3E-07
Co-58	0.04	0	0.04	0.19384	80.8	1.9E-26
Co-60	2.5	0	2.5	5.271	3.0	0.318572
Fe-59	0.2	0	0.2	0.121997	128.4	4.4E-40
Zn-65	0.1	0	0.1	0.667762	23.5	8.7E-09
Sr-85	0.03	0	0.03	0.177522	88.3	8.1E-29
Y-88	0.13	0	0.13	0.291964	53.7	9.1E-18
Ru-106	0.22	0	0.22	1.008077	15.5	4.6E-06
Cd-109	1	0	1	1.270363	12.3	0.000194
Sn-113	0.061	0	0.061	0.315127	49.7	6.6E-17
I-131	0.48	0	0.48	0.022012	711.7	<E-99
Cs-134	0.33	0	0.33	2.062	7.6	0.001704
Cs-137	0.28	0	0.28	30	0.5	0.194964
Ce-139	0.21	0	0.21	0.376893	41.6	6.4E-14
Au-195	0.002	0	0.002	0.501027	31.3	7.7E-13
Hg-203	0.006	0	0.006	0.127584	122.8	6.5E-40
Ra-226	0.08	0	0.08	1600	0.0	0.079459
Th-230	0.08	0	0.08	7.7E+04	0.0	0.079989
U-Normal	0.08	0	0.08			
Am-241	0.07	0	0.07	432.2	0.0	0.068263

Hole No.: 36
Date filled: Nov-1979
Decay Time to Aug '95: 15.67 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
S-35	4500	0.239562	65.4	9.3E-17

Hole No.: 37
Date filled: June 1980
Decay Time to Aug '95: 15.08 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Transfer 3	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	2	37.1	0	39.1	12.35	1.2	16.76957
Be-7	0.0001	0	0	0.0001	0.145927	103.4	7.7E-36
C-14	0.08	0	100	100.08	5730	0.0	99.89756
P-32	0	0	1500	1500	0.039124	385.5	<E-99
S-35	0	0.001	18	18.001	0.239562	63.0	2.0E-18
Mn-54	0.4	0.005	0	0.405	0.856164	17.6	2.0E-06
Cr-51	0	0.006	0	0.006	0.075849	198.9	8.2E-63
Co-57	0.14	0.04	0	0.18	0.741684	20.3	1.4E-07
Co-58	0	0.005	0	0.005	0.19384	77.8	1.9E-26
Co-60	0.83	1.4	0	2.23	5.271	2.9	0.306822
Zn-65	0.31	0.013	0	0.323	0.667762	22.6	5.1E-08
Sr-85	0.3	0.056	0	0.356	0.177522	85.0	9.4E-27
Sr-89	0	0.003	0	0.003	0.138356	109.0	4.6E-36
Sr-90	0.0004	0.004	0	0.0044	29.12	0.5	0.003073
Y-88	0.85	0.19	0	1.04	0.291964	51.7	2.9E-16
Y-90	0	0.004	0	0.004	0.007306	2064.5	<E-99
Zr-95	0	0.002	0	0.002	0.175288	86.0	2.5E-29
Nb-95	0	0.002	0	0.002	0.096301	156.6	1.4E-50
Ru-106	0.004	0.013	0	0.017	1.008077	15.0	5.3E-07
Cd-109	40.3	1.2	0	41.5	1.270363	11.9	0.011062
Sn-113	0.36	0.103	0	0.463	0.315127	47.9	1.8E-15
I-131	0.002	0.4	0	0.402	0.022012	685.2	<E-99
Ba-133	1.5	0	0	1.5	10.74	1.4	0.56666
Ba-140	0.003	0	0	0.003	0.034904	432.1	<E-99
Cs-134	0.41	0.006	0	0.416	2.062	7.3	0.002613
Cs-137	0.7	0.55	0	1.25	30	0.5	0.882183
Ce-139	0.11	0.04	0	0.15	0.376893	40.0	1.3E-13
Ce-144	2.1	0.006	0	2.106	0.778904	19.4	3.1E-06
Eu-152	21.2	0	0	21.2	13.33	1.1	9.676327
Hg-203	0.15	0.016	0	0.166	0.127584	118.2	4.3E-37
Po-210	0.0001	0	0	0.0001	0.379123	39.8	1.1E-16
Ra-226	0.09	0.08	0	0.17	1600	0.0	0.168893
U-238	0	0.00005	0	0.00005	4.468E+09	0.0	0.00005
Th-230	0.08	0.08	0	0.16	7.7E+04	0.0	0.159978
U-Normal	0.08	0.08	0	0.16			
Am-241	0.001	0.003	0	0.004	432.2	0.0	0.003904

Transfer 3 is a combination of 3 small transfers.

Hole No.: 38
Date filled: June 1980
Decay Time to Aug '95: 15.08 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.2	12.35	1.2	0.085778
P-32	0.001	0.039124	385.5	<E-99
Mn-54	0.001	0.856164	17.6	5.0E-09
Fe-59	0.011	0.121997	123.6	6.7E-40
Co-57	0.006	0.741684	20.3	4.5E-09
Co-60	0.032	5.271	2.9	0.004403
Zn-65	0.001	0.667762	22.6	1.6E-10
Sr-85	0.013	0.177522	85.0	3.4E-28
Sr-89	0.15	0.138356	109.0	2.3E-34
Sr-90	93.2	29.12	0.5	65.0865
Y-88	0.028	0.291964	51.7	7.9E-18
Cd-109	0.13	1.270363	11.9	0.000035
Sn-113	0.017	0.315127	47.9	6.6E-17
I-131	0.34	0.022012	685.2	<E-99
Ba-140	0.01	0.034904	432.1	<E-99
Cs-137	0.03	30	0.5	0.021172
Ce-139	0.005	0.376893	40.0	4.5E-15
Ce-144	0.0001	0.778904	19.4	1.5E-10
Hg-203	0.006	0.127584	118.2	1.5E-38
Ra-226	0.08	1600	0.0	0.079479
U-Normal	0.08			
Th-230	0.08	7.7E+04	0.0	0.079989

Hole No.: 39
Date filled: Jan. 1981
Decay Time to Aug '95: 14.5 yr.

Isotope	Initial Activity (micro Ci) Transfer 1	Transfer 2	Transfer 3	Total	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.031	0	0	0.031	12.35	1.2	0.013738
C-14	0.2	0.2	100	100.4	5730	0.0	100.224
P-32	0	0.0002	500	500.0002	0.039151	370.4	<E-99
P-33	0	0	250	250	0.069589	208.4	4.7E-61
Mn-54	0	0.0001	0	0.0001	0.856164	16.9	8.0E-10
Fe-59	0	0.08	0	0.08	0.121997	118.9	1.3E-37
Co-57	0.033	4.24	0	4.273	0.741684	19.6	5.6E-06
Co-60	0.259	60.12	0	60.379	5.271	2.8	8.969787
Zn-65	0	0.0001	0	0.0001	0.668219	21.7	2.9E-11
Sr-85	0.036	0.022	0	0.058	0.177522	81.7	1.5E-26
Sr-89	0	0.001	0	0.001	0.138356	104.8	2.8E-35
Sr-90	0	0.001	0	0.001	29.12	0.5	0.000708
Y-88	0.14	0.035	0	0.175	0.291964	49.7	2.0E-16
Cd-109	1.06	32.5	0	33.56	1.270363	11.4	0.012298
Sn-113	0.078	0.017	0	0.095	0.315127	46.0	1.3E-15
I-131	0.014	0.12	0	0.134	0.022012	658.7	<E-99
Cs-137	0.249	4.36	0	4.609	30	0.5	3.296924
Ce-139	0.03	0.005	0	0.035	0.376893	38.5	9.2E-14
Ce-144	0	0.031	0	0.031	0.778904	18.6	7.7E-08
Hg-203	0.009	0.014	0	0.023	0.127584	113.7	1.4E-36
Po-208	0.001	0.0011	0	0.0021	2.896	5.0	0.000065
Pb-210	0.001	0.001	0	0.002	22.3	0.7	0.001274
Po-210	0	0	0	0	0.379123	38.2	0
Ra-226	0.001	0.001	0	0.002	1600	0.0	0.001987
Th-230	0.001	0.001	0	0.002	7.7E+04	0.0	0.002
U-235	0	0	0.0045	0.0045	7.0E+08	0.0	0.0045
U-238	0	0	2.388	2.388	4.468E+09	0.0	2.388
U-Normal	0.001	0.001	0	0.002			
Am-241	0.006	0.003	0	0.009	432.2	0.0	0.008793

Transfer #3 was a combination of 4 small transfers.

Hole No.: 40
Date filled: Jan. 1981
Decay Time to Aug '95: 14.5 yr.

Isotope	Initial Activity (micro Ci)	Half Life (yr)	Number of Half Lives to Aug. '95	Activity Aug. 1995 (micro Ci)
H-3	0.054	12.35	1.2	0.023931
Be-7	0.001	0.146027	99.3	1.7E-33
Na-22	0.0035	2.602	5.6	0.000074
P-32	0.04	0.039151	370.4	<E-99
K-40	0.0001	1.28E+09	0.0	0.0001
Cr-51	0.017	0.075901	191.0	5.3E-60
Mn-54	0.0065	0.856164	16.9	5.2E-08
Fe-59	0.091	0.121997	118.9	1.5E-37
Co-57	0.59	0.741684	19.6	7.7E-07
Co-58	0.051	0.193973	74.8	1.6E-24
Co-60	3.65	5.271	2.8	0.542237
Zn-65	0.0054	0.668219	21.7	1.6E-09
Sr-85	0.039	0.177522	81.7	1.0E-26
Sr-89	0.091	0.138356	104.8	2.6E-33
Sr-90	0.0041	29.12	0.5	0.002903
Y-88	0.245	0.291964	49.7	2.7E-16
Zr-Nb-95	0.000064	0.271589	53.4	5.4E-21
Ru-106	0.722	1.008767	14.4	0.000034
Cd-109	4.28	1.270363	11.4	0.001568
Sn-113	0.084	0.315127	46.0	1.2E-15
Sb-125	14.1	2.77	5.2	0.374481
I-131	0.1	0.022012	658.7	<E-99
Ba-133	0.09	10.74	1.4	0.035304
Ba-La-140	2.0E-06	0.039501	367.1	<E-99
Cs-134	0.064	2.062	7.0	0.000489
Cs-137	1.62	30	0.5	1.158823
Ce-139	0.07	0.376893	38.5	1.8E-13
Ce-141	0.008	0.089044	162.8	7.6E-52
Ce-144	0.025	0.778904	18.6	6.2E-08
Hg-203	0.0075	0.127584	113.7	4.6E-37
Bi-207	11	38	0.4	8.443567
Po-208	0.001	2.896	5.0	0.000031
Pb-210	0.001	22.3	0.7	0.000637
Po-210	0.000243	0.379123	38.2	7.5E-16
Ra-226	0.011	1600	0.0	0.010931
Ra-228	0.0003	5.75	2.5	0.000052
Th-230	0.001	7.7E+04	0.0	0.001
U- Normal	0.0022			
Am-241	3.31	432.2	0.0	3.233915

September 4, 1997

Ms. Dianne Heim
Materials Licensing Section
Nuclear Regulatory Commission
61 Forsyth Street SW, Suite 23T85
Atlanta, Georgia 30303

Dear Ms. Heim:

This is a decommissioning plan for the inactive low-level radioactive material burial site located on the Tennessee Valley Authority reservation in Muscle Shoals, Alabama. Burials of low-level radioactive materials were made at this site from 1966 to 1981 as authorized by the former 10 CFR 20.302 or 20.304. A detailed description of the contents of the burial site was transmitted to the NRC in a letter from TVA dated September 5, 1995. The low-level radioactive materials buried in this site were primarily wastes from fertilizer research and laboratory quality assurance tests.

This burial site contains isotopes with an atomic number greater than 88. Therefore, it fails screening tests 2 and 3 described in the NRC's "Branch Technical Position on Screening Methodology for Assessing Prior Land Burials of Radioactive Waste Authorized Under Former 10 CFR 20.304 and 20.302" (BTP), published in the Federal Register November 4, 1996. Because of the inability to use the screening methodologies described in the BTP, TVA performed a case-by-case evaluation of the burial site as instructed in the BTP. We used the RESRAD for Windows computer code Version 5.75, developed by the Environmental Assessment Division of the Argonne National Laboratory for the Department of Energy. The detailed listing of the radionuclides and their quantities buried in this site reported to NRC in the letter dated September 5, 1995, satisfies Step 1 (Records Review) of the BTP.

Of the 51 different radionuclides that TVA placed in the burial site, 27 are not analyzed by RESRAD. These are primarily short-lived isotopes. A conservative estimate of the maximum possible dose to an individual from these remaining materials is shown in Appendix A of the enclosed report. The analysis indicates that the 27 radionuclides would contribute much less than a mrem to any member of the public.

The enclosed report describes the input parameters used for the RESRAD analysis and the hydrology and geology of the site. The report also includes the results of the computer analysis. Also attached is a report entitled NFERC Regional Groundwater Investigation, an extensive description of the hydrology and geology of the Muscle Shoals reservation. (NFERC stands for National Fertilizer and Environmental Research Center, a previous name for the Muscle Shoals reservation where this inactive burial site is located.)

According to computer analysis, the maximally exposed individual (MEI) would have received a total effective dose equivalent (TEDE) of 0.55 mrem during the year 1983. However, 92% of that calculated dose was from the drinking water pathway which assumes that drinking water is obtained from a well located in the center of or downgradient of the burial site. No wells are now nor have been located within 1,000 feet of the burial site, so the hypothetical dose was never delivered to any individual. Also, groundwater flow at the burial site is vertically downward. The maximum dose during 1997 is calculated to be only 2.5 E-6 mrem. RESRAD does not indicate any significant increase in this very low-dose rate at any time in the future. The low dose to the MEI is below the limits of both the BTP (100 mrem/yr) and 10 CRF 20, Subpart E (25 mrem/yr) published in the Federal Register on July 21, 1997.

ALARA considerations suggest that the removal of any remaining radioactive materials from the burial site should not be conducted. Such removal would be very expensive and would require considerable excavation to a depth of over 10 feet. The excavation would expose personnel to conventional safety hazards from the use of heavy equipment, excavation and transportation. These safety hazards to personnel removing and transporting the residual remaining material would probably exceed the minor hypothetical radiation risk to the public from the remaining radioactive materials.

Because of the low dose to the maximally exposed member of the public, TVA requests unrestricted access for this burial site.

If you have any questions regarding this matter, please contact Ms. Lenora Sheffey at (205) 386-3051.

David W. Sorrelle, Manager
Environmental Compliance
and Operations Support
Environmental Research Center

DWS:LCJ:HGG
Enclosures
cc: W. C. McArthur, BR 5D-C
Files, ERC, CEB 1B-M

AN ASSESSMENT OF THE ENVIRONMENTAL EFFECTS OF THE

INACTIVE LOW-LEVEL RADIOACTIVE MATERIAL BURIAL SITE

LOCATED ON THE MUSCLE SHOALS RESERVATION

MUSCLE SHOALS, ALABAMA

INTRODUCTION

From 1966 to 1981, the Tennessee Valley Authority (TVA) buried small quantities of low-level radioactive materials at a site on the TVA reservation located in Muscle Shoals, Alabama. These materials were wastes from fertilizer research and quality control programs in laboratories, primarily radioanalytical laboratories. Burials were authorized by the former 10 CFR 20.302 or 20.304. Regulations were terminated by the U.S. Nuclear Regulatory Commission (NRC) in January 1981. At that time, TVA ceased burials of low-level radioactive materials at the site.

Recently enacted NRC regulations require that the environmental impacts of this site be evaluated and a decommissioning plan provided. This report provides that evaluation and also describes the hydrology and geology of the region and of the burial site. The primary tool for evaluating the environmental impact of the site was the RESRAD computer code. This code, developed at Argonne National Laboratory, evaluates the radiation dose of the buried material to members of the public from the most conceivable environmental pathways.

A total of 51 different radionuclides were buried in this site. RESRAD was used to analyze the impact of 27 of them. However, 24 of the radionuclides that were buried in this site are not included in RESRAD, which are primarily short-lived radionuclides. A conservative estimate of the impact of these isotopes is given in Appendix A. Appendix B is a listing of the 27 isotopes that are analyzed by RESRAD. Appendix C is the printed output from RESRAD.

DESCRIPTION OF REGIONAL GEOLOGY:

The TVA reservation in Muscles Shoals, Alabama, is located in the Interior Low Plateau, a karst plateau lying on the southern flank of the Nashville Dome in northern Alabama. Erosion over a long period of time has stripped off the Pennsylvanian and younger Mississippian clastic rocks to expose Mississippian limestone formations throughout much of Tennessee, Alabama, and Kentucky. The reservation lies on the Mississippian limestone rocks which have a regional south-southwestern dip of 25 to 30 feet per mile.

The most relevant stratigraphic units underlying the inactive burial site are the Chattanooga Shale, the Fort Payne Chert, and the Tuscumbia Limestone. The Chattanooga Shale is an extensive regional marker and unconformably overlies the undifferentiated Ordovician and Silurian rocks. It does not crop out in the area, but well drilling suggests that it underlies the entire region with a thickness of 5 to 37 feet. It ranges from 250 to 450 feet below the surface in the reservation area and probably serves as a hydraulic barrier to groundwater. The Chattanooga Shale is overlain by the Mississippian Fort Payne Chert in the northern Alabama region.

The Fort Payne Chert underlies all of the area and crops out along the southern bluffs of the Tennessee River. It is a distinctive lithologic marker at the base of the Mississippian system of northern Alabama. The thickness of the Fort Payne Chert in the subsurface ranges from 162 to 210 feet. The Fort Payne Chert is conformably overlain by the Tuscumbia Limestone; the contact is gradational. However, in the weathered outcrops the nodular thin beds of the Fort Payne Chert contrast with massive limestone beds of Tuscumbia Limestone along the southern Bluffs of the Tennessee River.

The Tuscumbia Limestone underlies all of the region and is the uppermost bedrock unit in the reservation area. Exposures are common along the Tennessee River and along valleys of the larger tributaries. The thickness of the Tuscumbia Limestone ranges up to 200 feet; however, the formation has been extensively weathered in the area and its thickness remains as little as 50 feet in places. Throughout most of the area the Tuscumbia Limestone is overlain by a clayey overburden.

DESCRIPTION OR REGIONAL HYDROLOGY:

The north Alabama area has a mild, humid climate. Average precipitation is almost 52 inches per year (1.32 m/yr) with average monthly highs of 6.2 inches and lows of 2.8 inches in March and September, respectively. Precipitation is the source of all natural recharge into the groundwater system. Groundwater recharge occurs either very slowly through soil infiltration, or very rapidly by direct entry through storm-drainage wells or natural openings such as sinkholes. Recharge also occurs from surface streams and impoundments as well as other sources such as leaky sewer lines. Average recharge for the regional area has been estimated to be 13 inches per year. Twenty or more stormwater drainage wells have been constructed in the region and have been used for flood alleviation in the area during the last 35 years.

Although the area surrounding the ERC is flood prone due to inadequate drainage, the burial site is not located in a flood prone area. The Tuscumbia-Fort Payne aquifer system underlying the area is the most important water-bearing unit in the region because it is the source of water for both wells and springs in the area. Tuscumbia (Big) Spring is the closest public water supply. The spring issues from the Tuscumbia-Fort Payne aquifer system and is located about three miles southwest of the burial site. This spring serves as the drinking water supply for the city of Tuscumbia. The city of Sheffield takes its drinking water supply from the Tennessee River several miles downstream from the burial site. There are no known water supply wells within 1,000 feet of the burial site.

HYDROLOGY AND GEOLOGY OF THE BURIAL SITE:

The unsaturated soil layer varies in thickness throughout the year. A representative value of 50 feet (15.25 m), based on studies of near-by wells, was used for this analysis. The unsaturated layer and an additional 30-foot thick layer are composed of a residual silty, sandy, clay soil overburden. Under that layer lies a 200-foot thick layer of karstic cherty limestone. Groundwater flow is nearly vertically downward for a depth of approximately 280 feet where a anisotropic and heterogeneous karst aquifer is encountered. Dye tracer tests in the area indicate that this aquifer carries the majority of all groundwater horizontally to either the Tennessee River or to Tuscumbia Spring. Rapid solute migration accompanied by high dilution occurs in this bedrock. Dye velocities of 100 ft/day are commonly reported. Based on borehole flowmeter data, the majority of groundwater flow occurs near the overburden-bedrock contact across a 3-foot to 5-foot vertical interval. The transmissivity of this epikarst zone varies more than 4 orders of magnitude and may be greater than 500 ft^2/day.

This means that groundwater under the burial site flows slowly vertically downward for about 280 feet where it then flows rapidly horizontally and exits either in the Tennessee River (average flow is 32,800,000,000 gallons per day) where it is extensively diluted or to Tuscumbia Spring. Tuscumbia Spring has an average flow of 42,000,000 gallons per day with high seasonal variation.

Any radioactive materials reaching this spring from the burial site would be extensively diluted by this high flow and would present no hazard.

Dye studies indicate that material may flow either to the river or to the spring. To be conservative, we have assumed that groundwater is to Tuscumbia Spring which has an estimated recharge area of 84 square miles.

HYDROLOGICAL, GEOLOGICAL, AND OTHER INPUTS INTO RESRAD:

The following site-specific inputs to the RESRAD code were used:

Area of the contaminated zone:	308.5 m^2 (3,319 ft^2)
Thickness of the Contaminated Zone:	1.83 m (6 ft)
Length parallel to aquifer flow:	17.6 m (square root of 308.5 m^2)
Basic radiation dose limit:	10 mrem
Time since placement of material:	0 yr.
Times for calculations:	1, 5, 16, 40, 100, 300, 1000 yr
Cover depth:	1.22 m (4 ft)
Density of all soil and other materials:	1.5 g/cm^3
Contaminated zone total porosity:	0.4
Contaminated zone effective porosity:	0.06
Contaminated zone hydraulic conductivity:	0.3 m/yr
Contaminated zone b parameter:	7.75
Precipitation:	1.32 m
Watershed area for nearby stream or pond:	2.18 E+8 m^2 (84 sq mi)
Saturated zone total porosity:	0.3
Saturated zone effective porosity:	0.14
Saturated zone hydraulic conductivity:	53,400 m/yr
Saturated zone hydraulic gradient:	0.003
Water table drop rate:	0.0 m/yr
Unsaturated layer thickness	15.25 m (50 ft)
Unsaturated layer effective porosity	0.06
Unsaturated layer b parameter	10.4
Unsaturated layer hydraulic conductivity	0.3 m/yr

The initial concentrations of the 27 radionuclides in the burial site that were analyzed by RESRAD are listed in Appendix B.

Initial concentrations of radionuclides in groundwater was set to zero.

Default values were used for dose conversion factors, food transfer factors, bioaccumulation factors, distribution factors, dose shape factors, food consumption factors, contamination factors, all crop and livestock factors, all C-12 factors, and all building factors. The radon pathway was suppressed due to the small quantities of radon parents in the burial site.

The initial placement of all material was conservatively assumed to be 1981, the date the burial site was closed. This ignores the radiological decay that occurred from the time of actual burial to 1981. The date of 1981 corresponds to the year zero in the RESRAD run.

Any radioactive materials reaching this spring from the burial site would be extensively diluted by this high flow and would present no hazard.

Dye studies indicate that material may flow either to the river or to the spring. To be conservative, we have assumed that groundwater is to Tuscumbia Spring which has an estimated recharge area of 84 square miles.

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Time since placement of material:	0 yr.
Times for calculations:	1, 5, 16, 40, 100, 300, 1000 yr
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The initial placement of all material was conservatively assumed to be 1981, the date the burial site was closed. This ignores the radiological decay that occurred from the time of actual burial to 1981. The date of 1981 corresponds to the year zero in the RESRAD run.

APPENDIX A

Analysis of Buried Radionuclides Not Included in RESRAD

Of the 51 different radionuclides that were placed in TVA's inactive low-level burial site. 24 are not included in RESRAD. Thus, the computer model cannot estimate the dose to a member of the public from those 24 radionuclides. This appendix estimates the maximum possible dose to an individual that could result from the ingestion of all this material that remains in the burial site in 1997.

The 24 radionuclides are listed in Table A-1, with most of these radionuclides having rather short half-lives. Table A-1 lists the half-life of these isotopes and also the total activity that had been buried when the site was closed in 1981. The total activities listed in Table A-1 were taken from Appendices 2 and 3 of the report on the burial site submitted to the NRC in TVA's letter dated September 5, 1995. These total activities were assumed to have been buried in 1981, whereas they were actually buried at various times over a period of 15 years from 1966 to 1988 and had decayed to quantities lower than the total listed. These "total" activities were decayed for 16 years from 1981 to 1997. Table A-1 also lists the number of half-lives for each isotope for this 16-year period. With the exceptions of Ba-133 and Po-208, all radionuclides experienced from about 40 to several hundred half-lives and thus decayed to insignificant levels.

The ingestion Annual Limit on Intake (ALI) for each radionuclide is also listed in Table A-1. These ALIs were taken from Title 10 of the Code of Federal Regulations, Part 10, Appendix B, Table 1, Column 1 and from Federal Guidance Report 11 (EPA 1988). An ingestion ALI for Po-208 was not listed in either source. This ALI was conservatively estimated to be 2 μCi by a process described below.

In order to conservatively estimate the maximum environmental effect of the radionuclides remaining in the burial site and not included in RESRAD, we assume that all of this radioactive material that remained in 1997 was hypothetically gathered into a single small volume and was ingested by reference man in a single intake. The inhalation pathway is not considered credible for this hypothetical intake.

We now estimate the ingestion ALI for Po-208. The ingestion ALI for Po-208 is not listed in such standard references as Title 10 of the Code of Federal Regulations or Federal Guidance Report 10. For the purposes of this report, the ingestion ALI for Po-208 is estimated by considering the ALI for Po-210 and the properties of the radiations from Po-210 and Po-208. The ingestion ALI for Po-210 is 3 μCi (10CFR20). Po-210 is an alpha emitter with a maximum alpha energy of 5.3 MeV and a half-life of 138 days. Po-208 is an alpha emitter with a maximum energy of 5.1 MeV and a half-life of 2.9 years. All isotopes of polonium follow the same metabolic pathways in the body and have the same biological excretion rates from the same metabolic compartments. The biological half-lives for all isotopes of polonium in all systemic compartments is 50 days. Thus, the effective half-life for Po-210 in these compartments is 36.7 days and the effective half-life for Po-208 is 50 days. This means that Po-208 resides in systemic compartments about 33% longer, but has an alpha particle that is about 4% lower in energy. Thus, comparing unit intakes, Po-208 will be about 33% more hazardous than Po-210. Based on the ingestion ALI of 3 μCi for Po-210, we assign a value of 2 μCi to the ingestion ALI for Po-208.

Ingestion of one ALI results in an committed effective dose equivalent of 5,000 mrem. The hypothetical dose from the ingestion of each radionuclide in the burial site in 1997 was estimated by ratio. For example, 0.057 μCi of Ba-133 remains in the burial site and the ALI for this isotope is 2,000 μCi. The dose from the ingestion of 0.057 μCi of Ba-133 is (5,000 mrem)*(0.057 μCi)/ (2,000 μCi) = 1.4 mrem. As shown in Table A-1, only one other radionuclide had a calculated dose greater than 0.000 mrem. The estimated dose from the ingestion of the entire quantity of Po-208 remaining in the burial site is only 0.4 mrem. These doses are listed in Table A-1.

The hypothetical dose that would result from the ingestion of the entire quantity of all of these 24 radionuclides would be less than 2 mrem. It is important to notice that this is an extremely conservative overestimate of any actual dose that could result from these radioactive materials. The actual dose that a person may actually receive from these materials is expected to be several orders of magnitude lower that this value of 2 mrem, primarily from dilution in environmental media and the isolation of the materials in the environment.

APPENDIX B

Radionuclide Inputs into RESRAD

Of the 51 different radionuclides that were placed in the burial site, the environmental impact of 27 of them is analyzed by RESRAD. As input, RESRAD requires the activity per unit mass (pCi/g) for each radionuclide, averaged over the volume of soil in which the radioactive material was buried.

The material was buried in 40 holes, 2 feet in diameter, from 4 to 10 feet deep. Thus, the material is in a layer 6 feet (1.83m) thick. The area covered by the 40 holes, including the spaces between the holes, is 308.5 sq m. Thus, the volume occupied by the material is 5.65 E+8 cm^3. The density of the soil is 1.5 g/cm^3, thus, the mass of the soil in which the material is buried is 8.47 E+8 grams.

The activity of the 27 radionuclides that are analyzed by RESRAD as of August 1995 was taken from the report on the burial site submitted to the NRC in TVA's letter dated September 5, 1995. These 27 radionuclides are listed in Table B-1, along with their half-lives and their activities as of 1995.

RESRAD was run using 1981, the date the burial site was closed, as the starting time. Thus, the activities listed in Table B-1 were decay-corrected from 1995 to 1981. The decay factor for this 14-year period is greater than unity because we are calculating the activity 14 years in the past based on a known activity in 1995. The decay factors for each of the 27 radionuclides are also listed in Table B-1.

The left column in Table B-1 is the activity per unit mass in the burial site in 1981 and was used as input data for the RESRAD computer code. These activities per unit mass in 1981 were calculated by multiplying the activity in 1995 (pCi) by the decay factor and dividing by the mass of soil in which the material was buried.

Natural uranium was listed as being in the burial site in TVA's letter to the NRC dated September 5, 1995. That activity of U-natural was added to that of U-235 and U-238, which is proportional to the activity fraction of these two isotopes in natural uranium.

APPENDIX C

RESRAD Output

Table A1

Radionuclides in the Burial Site That are not Included in RESRAD

	Isotope	Half Life (yr)	Total Activity Buried (μCi)	Number of Half lives 1981 to 1997 (16 years)	Total Activity in 1997 (μCi)	Ingestion ALI (μCi)	Ingestion Dose (mrem)
1	Be-7	0.146	0.767	110	7.9E-34	4.E+04	0.000
2	P-32	0.039	41500	410	1.3E-119	6.E+02	0.000
3	P-33	0.070	260	229	4.1E-67	6.E+03	0.000
4	S-35	0.239	42510	67	3.0E-16	6.E+03	0.000
5	Ca-45	0.446	0.030	36	4.8E-13	2.E+03	0.000
6	Cr-51	0.076	2.180	211	9.2E-64	4.E+04	0.000
7	Co-58	0.194	1.420	82	2.1E-25	1.E+03	0.000
8	Fe-59	0.122	1.480	131	4.9E-40	8.E+02	0.000
9	Se-75	0.328	0.850	49	1.8E-15	5.E+02	0.000
10	Sr-85	0.177	1.090	90	6.7E-28	3.E+03	0.000
11	Sr-89	0.138	1.130	116	1.4E-35	5.E+02	0.000
12	Y-88	0.292	7.730	55	2.5E-16	1.E+03	0.000
13	Zr-95	0.175	4.130	91	1.2E-27	1.E+03	0.000
14	Mo-99	0.007	0.020	2286	0.0E+00	1.E+03	0.000
15	Ru-103	0.107	0.010	150	9.7E-48	2.E+03	0.000
16	Sn-113	0.315	1.540	51	7.9E-16	2.E+03	0.000
17	I-131	0.022	9.860	727	1.2E-218	3.E+01	0.000
18	Ce-139	0.377	0.800	42	1.3E-13	5.E+03	0.000
19	Ce-141	0.089	0.048	180	3.7E-56	2.E+03	0.000
20	Ba-133	10.740	1.600	1.5	5.7E-01	2.E+03	1.424
21	Ba-140	0.035	0.660	457	1.6E-138	5.E+02	0.000
22	Hg-203	0.128	2.670	125	6.3E-38	5.E+02	0.000
23	Po-208	2.896	0.0067	6	1.5E-04	2.E+00	0.364
24	Po-210	0.379	0.0023	42	4.6E-16	3.E+00	0.000
						Sum =	1.79

Table B 1

Concentration of Radionuclides in Burial site in 1981
For Radionuclides in RESRAD

		Activity in 1995 (μCi)	Activity in 1995 (pCi)	Half Life (yr)	Decay Factor for -14 years	Act/Mass of Soil in 1981 (pCi/g)
1	Ag-110m	2.2E-07	2.2E-01	0.684	1.4E+06	3.76E-04
2	Am-241	1.4E+01	1.4E+07	432.2	1.0E+00	1.73E-02
3	Au-195	8.0E-13	8.0E-07	0.501	2.6E+08	2.43E-07
4	Bi-207	8.4E+00	8.4E+06	38	1.3E+00	1.29E-02
5	C-14	1.6E+04	1.6E+10	5730	1.0E+00	1.93E+01
6	Cd-109	1.0E-01	1.0E+05	1.27	2.1E+03	2.45E-01
7	Ce-144	6.0E-06	6.0E+00	0.778	2.6E+05	1.85E-03
8	Cl-36	1.2E+00	1.2E+06	3.01E+05	1.0E+00	1.44E-03
9	Co-57	1.0E-05	1.0E+01	0.742	4.8E+05	5.63E-03
10	Co-60	1.9E+01	1.9E+07	5.27	6.3E+00	1.39E-01
11	Cs-134	9.7E-02	9.7E+04	2.062	1.1E+02	1.27E-02
12	Cs-137	3.9E+01	3.9E+07	30	1.4E+00	6.40E-02
13	Eu-152	4.1E+01	4.1E+07	13.33	2.1E+00	9.98E-02
14	H-3	3.9E+01	3.9E+07	12.35	2.2E+00	1.01E-01
15	K-40	3.1E-01	3.1E+05	1.28E+09	1.0E+00	3.64E-04
16	Mn-54	1.0E-05	1.0E+01	0.856	8.4E+04	9.88E-04
17	Na-22	7.4E-05	7.4E+01	2.602	4.2E+01	3.64E-06
18	Pb-210	7.5E-01	7.5E+05	22.3	1.5E+00	1.36E-03
19	Ra-226	1.9E+00	1.9E+06	1600	1.0E+00	2.25E-03
20	Ra-228	5.2E-05	5.2E+01	5.75	5.4E+00	3.32E-07
21	Ru-106	2.00E-04	2.0E+02	1.01	1.5E+04	3.51E-03
22	Sb-125	3.7E-01	3.7E+05	2.77	3.3E+01	1.47E-02
23	Sr-90	7.0E+01	7.0E+07	29.12	1.4E+00	1.15E-01
24	Th-230	7.8E-01	7.8E+05	7.70E+04	1.0E+00	9.21E-04
25	U-235	3.4E-03	3.4E+03	7.00E+08	1.0E+00	4.06E-06
26	U-238	4.3E-03	4.3E+03	4.47E+09	1.0E+00	5.02E-06
27	Zn-65	5.0E-06	5.0E+00	0.668	2.0E+06	1.20E-02

1.5 = Density of soil (g/ml)

308.5 = Surface area of burial site (sq m)
1.83 = Thickness of pits (m)

5.65E+02 = Volume of burial site (cu m)
5.65E+08 = Volume of burial site (cu cm)
8.47E+08 = Mass of soil (g)

NRC Contact
Jay Henson
404-562-4738

September 1, 1997
80 Valley View Dr.
Tuscumbia, Alabama 35674

Mr. David Sorrelle
CTR 2S
Tennessee Valley Authority
Muscle Shoals, Alabama

Dear Mr. Sorrelle:

Enclosed is a draft letter to the Nuclear Regulatory Commission (NRC). The letter includes a report on the environmental impact of the inactive low-level radioactive material burial site on the Muscle shoals reservation. Because of the low dose to the maximally exposed individual from the material remaining in this site, TVA is requesting unrestricted access for this site. This decommissioning plan is due to the NRC by September 5, 1997.

This letter and report are the decommissioning plan for the site. Because of the low dose resulting from this site, the decommissioning plan is simply a request for unrestricted access to the site. I believe that NRC will grant TVA unrestricted access for this site. The exact meaning on "unrestricted access" is not clear, however. The site still contains small amounts of radioactive materials and also plastic warning labels on the bags and containers that were buried. These plastic signs will probably be readable for many years. Very adverse publicity would result if someone was to dig into this site and come up with such a sign. However, unrestricted access will probably allow such digging on the site.

The US Environmental Protection Agency sets environmental radioactivity standards, not the NRC. The EPA has not agreed to the NRC's standards for this decommissioning process and a noisy dispute is currently being conducted between these two agencies on this subject.. Thus, there a remote possibility that EPA may require that some sort of analysis be conducted on this site in the future.

Also, the role of the State of Alabama concerning this site may not be clear. The State may eventually want to be satisfied that the site represents a sufficiently low hazard to the public.

The current physical status of the burial site is excellent. The site has been recently covered with a few inches of gravel to prevent erosion. I suggest that the site continue to be sprayed with herbicide to suppress vegetation, that it be inspected at regular intervals to make sure that the signs indicating pit numbers remain in place and that unplanned intrusion is avoided and that the chain link fence be maintained until its ultimate fate is decided.

The hydrological and geological information supplied by Mark Boggs and Hank Julian of TVA's Engineering Lab in Norris has been an invaluable input for the RESRAD runs. I have also directly copied portions of previous reports on the Muscle Shoals garage concerning the geology and hydrology of the nearby burial site.

I appreciate the opportunity to have worked on this project. Please excuse the submission of this report with such short time for review. If I may be of further assistance, please let me know. I may be reached at 381-4059.

Jesse H. Coleman

Jesse H. Coleman, Health Physicist

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

April 30, 1999

Tennessee Valley Authority
ATTN: David Sorrelle
Environmental Compliance
Officer at ERC
P. O. Box 1010
TVA Reservation Road
Muscle Shoals, AL 35662

SUBJECT: RELEASE OF FORMER BURIAL SITE FOR UNRESTRICTED USE

Dear Mr. Sorrelle:

This refers to the dose assessment dated September 4, 1997, submitted by the Tennessee Valley Authority (TVA) requesting unrestricted release of the inactive low-level radioactive material burial site located at the TVA-Muscle Shoals, Alabama, reservation. NRC has completed its review of the dose assessment and other supporting documents. Based on this review, the NRC considers that no further remediation is required and that the site may be released for unrestricted use.

If you have any questions concerning this letter, please contact Bryan Parker of my staff by telephone at (404) 562-4728 or by e-mail at bap@nrc.gov.

Sincerely,

Jay L. Henson
for

Thomas R. Decker, Chief
Materials/Licensing Inspection Branch 1
Division of Nuclear Materials Safety

License No. 01-06113-03 (retired)
Docket No. 030-03571 (retired)

cc: Bobby Gray, TVA
Tim Harris, NMSS

5/5/99
pc: Chuck Gilbert, CEB 4C-M
Mark Hastings, ET 11A-K
Randy Weatherington, CTR 2Q-M
Ron Williams, CTR 2C-M
Bill Raines, WAR 1A-M
Wilson McArthur, LP 2R-C
Ed Vigluicci, ET 10A-K
Files, ER&S, CEB 1B-M

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MAY 0 5 1999
D.W. SORRELLE

APPENDIX E – SUMMARY OF MONITORING FOR SOLID WASTE MANAGEMENT UNIT 108

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Table E-1. Solid Waste Management Unit 108 Sampling Summary, 1985-1997

Date	Sample Location	Parameters
12/85, 2/86, 4/86	W9, W10, W11, W12, Ash Pond	Polychlorinated biphenyls (PCBs), Total Organic Carbon and Total Organic Halogens TOX
11/86	W9, W10, W11, W12	Nutrients, Metals
2/87	W9, W10, W11, W12	Volatiles & Semivolatiles, Cyanides, Phenols, Radioactivity
3/87	W9, W10, W11, W12	Pesticides
6/89	PZ-1A, PZ-3A, PZ-9A, PZ-11A, PZ-l2A	Volatiles & Semivolatiles, Metals, Nutrients, Cyanides, Phenols, Sulfides, Major Cations & Anions, Radioactivity
10/89	Pond Creek Surface Water & Sediments	Volatiles & Semivolatiles, Pesticides & PCBs Metals, Nutrients, Major Cations & Anions
7/90	W9, W11, W12, W13, W16, W18, PZ-1A, PZ-1C, PZ-2B, PZ-2D, PZ-9B, PZ-11A, PZ-12B	Volatiles & Semivolatiles, Metals, Nutrients, Cyanides, Phenols, Sulfides, Metals, Radioactivity
11/90	W13	Radioactivity
7/91	W9, W11, W12, PZ-11C	Volatiles, Pesticides/ Herbicides, PCBs, Base-Neutral Extractables
7/91 - 12/94	W10, PZ-1, PZ-9, PZ-11, PZ-12	Nitrate+Nitrite (quarterly)
6/92	PZ-11, PZ-12	Nitrate, Chloride
5/97	Pond Creek Sediments	Cadmium, Lead, Volatile Organic Compounds, Coal-Range PAHs
5/97, 8/97, 11/97	PZ-1, PZ-9, PZ-11, PZ-12, PZ-31 to PZ-35, PZ-39, PZ40	Total Phosphorous, Total Phosphate, Nitrate+Nitrite, Cadmium, Lead, Selected Volatile Organic Compounds
11/97	Borings A, B, & C	Volatile Organic Compounds

Source: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Table E-2. List of Substances From 40 Code of Federal Regulations Part 264, Appendix IX, From the Resource Conservation and Recovery Act Facility Investigation

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Acenaphthene	83-32-9	6.00E-02	r	IRIS	2.1E+00	DWEL	4.8E+03	08-01-94
Acenaphthylene	208-96-8				N/C		N/C	
Acetone	67-64-1	1.00E-01	r	IRIS	3.5E+00	DWEL	8.0E+03	08-01-94
Acetophenone	98-86-2	1.00E-01	r	IRIS	3.5E+00	DWEL	8.0E+03	08-01-94
Acetonitrile; Methyl cyanide	75-05-8	6.00E-03	r	IRIS	2.1E-01	DWEL	4.8E+02	08-01-94
2-Acetylaminofluorene; 2-AAF	53-96-3				N/C		N/C	
Acrolein	107-02-8	2.00E-02	r	HEAST	7.0E-01	DWEL	1.6E+03	08-01-94
Acrylonitrile	107-13-1	5.40E-01	c	IRIS	6.5E-05	DWEL	1.3E+00	08-01-94
Aldrin	309-00-2	1.70E+01	c	IRIS	2.1E-06	DWEL	4.1E-02	08-01-94
Allyl chloride	107-05-1				N/C		N/C	
4-Aminobiphenyl	92-67-1				N/C		N/C	
Aniline	62-53-3	5.70E-03	c	IRIS	6.1E-03	DWEL	1.2E+02	08-01-94
Anthracene	120-12-7	3.00E-01	r	IRIS	1.1E+01	DWEL	2.4E+04	08-01-94
Antimony	7440-36-0	4.00E-04	r	IRIS	6.0E-03	MCL	3.2E+01	08-01-94
Aramite	140-57-8	2.50E-02	c	IRIS	1.4E-03	DWEL	2.8E+01	08-01-94
Arsenic	7440-38-2	1.50E+00	r	IRIS	5.0E-02	MCL	2.4E+01	08-01-94
Barium	7440-39-3	7.00E-02	r	IRIS	2.0E+00	MCL	5.6E+03	08-01-94
Benzene	71-43-2	2.90E-02	c	IRIS	5.0E-03	MCL	2.4E+01	08-01-94
Benzidine	92-87-5	2.30E+02	c	IRIS	1.5E-07	DWEL	3.0E-03	05-22-95
Benzoic Acid	65-85-0	4.00E+00	r	IRIS	1.4E+02	DWEL	3.2E+05	05-22-95
Benzo(a)anthracene	56-55-3	7.30E-01	c	EPA RPF	1.0E-04	MCL	9.6E-01	08-01-94
Benzo(b)fluoranthene	205-99-2	7.30E-01	c	EPA RPF	2.0E-04	MCL	9.6E-01	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Benzo(k)fluoranthene	207-08-9	7.30E-02	c	EPA RPF	2.0E-04	B(a)P MCL	9.6E+00	08-01-94
Benzo(g,h,i)perylene	191-24-2				2.0E-04	B(a)P MCL	N/C	
Benzo(a)pyrene	50-32-8	7.30E+00	c	IRIS	2.0E-04	MCL	9.6E-02	08-01-94
Benzyl Alcohol	100-51-6	3.00E-01	r	HEAST	1.1E+01	DWEL	2.4E+04	08-01-94
Beryllium	7440-41-7	4.30E+00	c	IRIS	4.0E-03	MCL	1.1E+00	08-01-94
Bis(2-chloroethoxy)methane	111-91-1				N/C		N/C	
Bis(2-chloroethyl)ether	111-44-4	1.10E+00	c	IRIS	3.2E-05	DWEL	6.4E-01	08-01-94
Bis(2-chloroisopropyl)ether	39638-32-9	7.00E-02	c	HEAST	5.0E-04	DWEL	1.0E+01	08-01-94
Bis(2-chloro-1-methylethyl)ether	108-60-1	7.00E-02	c	EPA Region III	5.0E-04	DWEL	1.0E+01	08-01-94
Bis(2-ethylhexyl)phthalate	117-81-7	1.40E-02	c	IRIS	6.0E-03	MCL	5.0E+01	08-01-94
Bromodichloromethane	75-27-4	6.20E-02	c	IRIS	1.0E-01	MCL	1.1E+01	08-01-94
n-Butylbenzene	104-51-8				3.5E-01		N/C	
Cadmium	7440-43-9	5.00E-04	r	IRIS	5.0E-03	MCL	4.0E+01	08-01-94
Carbon disulfide	75-15-0	1.00E-01	r	IRIS	3.5E+00	DWEL	8.0E+03	08-01-94
Carbon tetrachloride	56-23-5	1.30E-01	c	IRIS	5.0E-03	MCL	5.4E+00	08-01-94
Chlordane	57-74-9	1.30E+00	c	IRIS	2.0E-03	MCL	5.4E-01	08-01-94
p-Chloroaniline	106-47-8	4.00E-03	r	IRIS	1.4E-01	DWEL	3.2E+02	08-01-94
Chlorobenzene	108-90-7	2.00E-02	r	IRIS	7.0E-01	DWEL	1.6E+03	08-01-94
Chlorobenzilate	510-15-6	2.00E-02	r	IRIS	7.0E-01	DWEL	1.6E+03	08-01-94
p-Chloro-m-cresol	59-50-7				N/C		N/C	
Chloroethane	75-00-3	4.00E-01	r	EPA Region III	1.4E+01	DWEL	3.2E+04	09-14-94
2-Chloroethylvinyl ether	110-75-8	2.50E-02	r	EPA Region III	8.8E-01	DWEL	2.0E+03	05-22-95
Chloroform	67-66-3	6.10E-03	c	IRIS	1.0E-01	MCL	1.1E+02	08-01-94
2-Chloronaphthalene	91-58-7	8.00E-02	r	IRIS	2.8E+00	DWEL	6.4E+03	08-01-94
2-Chlorophenol	95-57-8	5.00E-03	r	IRIS	1.8E-01	DWEL	4.0E+02	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
4-Chlorophenyl phenyl ether	7005-72-3				N/C		N/C	
Chloroprene	126-99-8				N/C		N/C	
Chromium	7440-47-3	5.00E-03	r	IRIS	1.0E-01	MCL	4.0E+02	08-01-94
Chrysene	218-01-9	7.30E-03	c	EPA RPF	2.0E-04	B(a)P MCL	9.6E+01	08-01-94
Cobalt	7440-48-4	1.80E-01	r	EPA Region III	6.3E+00	DWEL	1.4E+04	08-01-94
Copper	7440-50-8	3.71E-02	r	HEAST	1.3E+00	DWEL	3.0E+03	08-01-94
m-Cresol; 3-Methyl phenol	108-39-4	5.00E-02	r	IRIS	1.8E+00	DWEL	4.0E+03	08-01-94
o-Cresol; 2-Methyl phenol	95-48-7	5.00E-02	r	IRIS	1.8E+00	DWEL	4.0E+03	08-01-94
p-Cresol, 4-Methyl phenol	106-44-5	5.00E-03	r	HEAST	1.8E-01	DWEL	4.0E+02	08-01-94
Cyanide	57-12-5	2.00E-02	r	IRIS	2.0E-01	MCL	1.6E+03	08-01-94
2,4-Dichlorophenoxyacetic acid	94-75-7	1.00E-02	r	IRIS	7.0E-02	MCL	8.0E+02	08-01-94
4,4'-DDD	75-54-8	2.40E-01	c	IRIS	1.5E-04	DWEL	2.9E+00	08-01-94
4,4'-DDE	72-55-9	3.40E-01	c	IRIS	1.0E-04	DWEL	2.1E+00	08-01-94
4,4'-DDT	50-29-3	3.40E-01	c	IRIS	1.0E-04	DWEL	2.1E+00	08-01-94
Diallate	2303-16-4	6.10E-02	c	HEAST	5.7E-04	DWEL	1.1E+01	08-01-94
Dibenz[a,h]anthracene	53-70-3	7.30E+00	c	EPA RPF	3.0E-04	MCL	9.6E-02	08-01-94
Dibenzofuran	132-64-9				N/C		N/C	
Dibromochloromethane	124-48-1	8.40E-02	c	IRIS	4.2E-04	DWEL	8.3E+00	08-01-94
1,2-Dibromo-3-chloropropane	96-12-8	1.40E+00	c	HEAST	2.0E-04	MCL	5.0E-01	08-01-94
1,3-Dichlorobenzene	541-73-1	8.90E-02	r	EPA Region III	6.0E-01	MCL	7.1E+03	08-01-94
3,3'-Dichlorobenzidine	91-94-1	4.50E-01	c	IRIS	7.8E-05	DWEL	1.6E+00	08-01-94
trans-1,4-Dichloro-2-butene	110-57-6				N/C		N/C	
Dichlorodifluoromethane	75-71-8	2.00E-01	r	IRIS	7.0E+00	DWEL	1.6E+04	08-01-94
1,1-Dichloroethane	75-34-3	1.00E-01	r	HEAST	3.5E+00	DWEL	8.0E+03	08-01-94
1,2-Dichloroethane	107-06-2	9.10E-02	c	IRIS	5.0E-03	MCL	7.7E+00	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
1,1-Dichloroethylene	75-35-4	6.00E-01	c	IRIS	7.0E-03	MCL	1.2E+01	08-01-94
trans-1,2-Dichloroethylene	156-60-5	2.00E-02	r	IRIS	1.0E-01	MCL	1.6E+03	08-01-94
2,4-Dichlorophenol	120-83-2	3.00E-03	r	IRIS	1.1E-01	DWEL	2.4E+02	08-01-94
2,6-Dichlorophenol	87-65-0				N/C		N/C	
1,2-Dichloropropane	78-87-5	6.80E-02	c	HEAST	5.0E-03	MCL	1.0E+01	08-01-94
1,3-Dichloropropene	542-75-6	1.75E-01	c	HEAST	2.0E-04	DWEL	4.0E+00	08-01-94
Dieldrin	60-57-1	1.60E+01	c	IRIS	2.2E-06	DWEL	4.4E-02	08-01-94
Diethyl phthalate	84-66-2	8.00E-01	r	IRIS	2.8E+01	DWEL	6.4E+04	08-01-94
0,0-Diethyl 0-2-pyrazinyl phosphoro-	297-97-2				N/C		N/C	
Thioate; Thionazin								
Dimethoate	60-51-5	2.00E-04	r	IRIS	7.0E-03	DWEL	1.6E+01	08-01-94
p-(Dimethylamino)azobenzene	60-11-7				N/C		N/C	
7,12-Dimethlbenz[a]anthracene	57-97-6				N/C		N/C	
3,3'-Dimethylbenzidine	119-93-7	9.20E+00	c	HEAST	3.8E-06	DWEL	7.6E-02	08-01-94
alpha, alpha-Dimethylphenethylamine	122-09-8				N/C		N/C	
2,4-Dimethylphenol	105-67-9	2.00E-02	r	IRIS	7.0E-01	DWEL	1.6E+03	08-01-94
Dimethyl phthalate	131-11-3				N/C		N/C	
m-Dinitrobenzene; 1,3-Dinitrobenzene	99-65-0	1.00E-04	r	IRIS	3.5E-03	DWEL	8.0E+00	08-01-94
4-6-Dinitro-o-cresol	534-52-1				N/C		N/C	
2,4-Dinitrophenol	51-28-5	2.00E-03	r	IRIS	7.0E-02	DWEL	1.6E+02	08-01-94
2,4-Dinitrotoluene	121-14-2	2.00E-03	r	IRIS	7.0E-02	DWEL	1.6E+02	08-01-94
2,6-Dinitrotoluene	606-20-2	1.00E-03	r	HEAST	3.5E-02	DWEL	8.0E+01	08-01-94
Dinoseb	88-85-7	1.00E-03	r	IRIS	7.0E-03	MCL	8.0E+01	08-01-94
Di-n-octyl phthalate	117-84-0	2.00E-02	r	HEAST	7.0E-01	DWEL	1.6E+03	08-01-94
1,4-Dioxane	123-91-1	1.10E-02	c	IRIS	3.2E-03	CMAL	6.4E+01	08-01-94
Diphenylamine	122-39-4	2.50E-02	r	IRIS	8.8E-01	DWEL	2.0E+03	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Disulfoton	298-04-4	4.00E-05	r	IRIS	1.4E-03	DWEL	3.2E+00	08-01-94
Endosulfan	115-29-7	6.00E-03	r	HEAST	2.1E-01	DWEL	4.8E+02	08-01-94
Endosulfan I	959-98-8				N/C		N/C	
Endosulfan II	33213-65-9				N/C		N/C	
Endosulfan sulfate	1031-07-8				N/C		N/C	
Endrin	72-20-8	3.00E-04	r	IRIS	2.0E-03	MCL	2.4E+01	08-01-94
Ethylbenzene	100-41-4	1.00E-01	r	IRIS	7.0E-01	MCL	8.0E+03	08-01-94
Ethyl ether; diethyl ether	60-29-7	2.00E-01	r	IRIS	7.0E+00	DWEL	1.6E+04	08-01-94
Ethyl methacrylate	97-63-2	9.00E-02	r	HEAST	3.2E+00	DWEL	7.2E+03	08-01-94
Ethyl methanesulfonate	62-50-0				N/C		N/C	
Famphur	52-85-7				N/C		N/C	
Fluoranthene	206-44-0	4.00E-02	r	IRIS	1.4E+00	DWEL	3.2E+03	08-01-94
Fluorene	86-73-7	4.00E-02	r	IRIS	1.4E+00	DWEL	3.2E+03	08-01-94
Heptachlor	76-44-8	4.50E+00	c	IRIS	4.0E-04	MCL	1.6E-01	08-01-94
Heptachlor epoxide	1024-57-3	9.10E+00	c	IRIS	2.0E-04	MCL	7.7E-02	08-01-94
Hexachlorobenzene	118-74-1	1.60E+00	c	IRIS	1.0E-03	MCL	4.4E-01	08-01-94
Hexachlorobutadiene	87-68-3	7.80E-02	c	IRIS	4.5E-03	DWEL	9.0E+01	08-01-94
alpha-BHC	319-84-6	6.30E+00	c	IRIS	5.6E-06	DWEL	1.1E-01	08-01-94
beta-BHC	319-85-7	1.80E+00	c	IRIS	1.9E-04	DWEL	3.9E+00	08-01-94
delta-BHC	319-86-8				N/C		N/C	
gamma-BHC; Lindane	58-89-9	1.30E+00	c	HEAST	2.0E-04	MCL	5.4E-01	08-01-94
Hexachlorocyclopentadiene	77-47-4	7.00E-03	r	IRIS	5.0E-02	MCL	5.6E+02	08-01-94
Hexachloroethane	67-72-1	1.40E-02	c	IRIS	2.5E-03	DWEL	5.0E+01	08-01-94
Hexachlorophene	70-30-4	3.00E-04	r	IRIS	1.1E-02	DWEL	2.4E+01	08-01-94
Hexachloropropene	1888-71-7				N/C		N/C	

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
2-Hexanone	591-78-6				N/C		N/C	
Indeno(1,2,3-cd)pyrene	193-39-5	7.30E-01	c	EPA RPF	4.0E-04	MCL	9.6E-01	08-01-94
Isobutyl alcohol	78-83-1	3.00E-01	r	IRIS	1.1E+01	DWEL	2.4E+04	08-01-94
Isodrin	465-73-6				N/C		N/C	
Isophorone	78-59-1	9.50E-04	c	IRIS	3.7E-02	DWEL	7.4E+02	08-01-94
Isosafrole	120-58-1				N/C		N/C	
Kepone	143-50-0	1.80E+01	c	EPA Region III	1.9E-06	DWEL	3.9E-02	08-01-94
Lead	7439-92-1				1.5E-02	TT*	4.0E+02	09-12-94
Mercury	7439-97-6	3.00E-04	r	HEAST	2.0E-03	MCL	2.4E+01	08-01-94
Methacrylonitrile	126-98-7	1.00E-04	r	IRIS	3.5E-03	DWEL	8.0E+00	08-01-94
Methapyriline	91-80-5				N/C		N/C	
Methoxychlor	72-43-5	5.00E-03	r	IRIS	4.0E-02	MCL	4.0E+02	08-01-94
Methyl bromide; Bromomethane	74-83-9	1.40E-03	r	IRIS	4.9E-02	DWEL	1.1E+02	08-01-94
Methyl chloride; Chloromethane	74-87-3	1.30E-02	c*	HEAST	2.7E-02	DWEL	5.4E+02	09-14-94
3-Methylcholanthrene	56-49-5				N/C		N/C	
Methylene bromide	74-95-3	1.00E-02	r	EPA Region III	3.5E-01	DWEL	8.0E+02	09-14-94
Methylene chloride	75-09-2	7.50E-03	c	IRIS	4.7E-03	DWEL	9.3E+01	08-01-94
2-Butanone	78-93-3	6.00E-01	r	IRIS	2.1E+01	DWEL	4.8E+04	08-01-94
Methyl iodide; Iodomethane	74-88-4				N/C		N/C	
Methyl methacrylate	80-62-6	8.00E-02	r	HEAST	2.8E+00	DWEL	6.4E+03	09-14-94
Methyl methanesulfonate	66-27-3				N/C		N/C	
2-Methylnaphthalene	91-57-6				N/C		N/C	
Methyl parathion	298-00-0	2.50E-04	r	IRIS	8.8E-03	DWEL	2.0E+01	08-01-94
4-Methyl-2-pentanone; MIBK	108-10-1	8.00E-02	r	HEAST	2.8E+00	DWEL	6.4E+03	08-01-94
Naphthalene	91-20-3	4.00E-02	r	EPA Region III	1.4E+00	DWEL	3.2E+03	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
1,4-Naphthoquinone	130-15-4				N/C		N/C	
1-Naphthylamine	134-32-7				N/C		N/C	
2-Naphthylamine	91-59-8	1.30E+02	c	EPA Region III	2.7E-07	DWEL	5.4E-03	08-01-94
Nickel	7440-02-0	2.00E-02	r	IRIS	1.0E-01	DWEL	1.6E+03	08-01-94
o-Nitroaniline	88-74-4	6.00E-05	r	EPA Region III	2.1E-03	DWEL	4.8E+00	08-01-94
m-Nitroaniline	99-09-2	3.00E-03	r	EPA Region III	1.1E-01	DWEL	2.4E+02	08-01-94
p-Nitroaniline	100-01-6	3.00E-03	r	EPA Region III	1.1E-01	DWEL	2.4E+02	08-01-94
Nitrobenzene	98-95-3	5.00E-04	r	IRIS	1.8E-02	DWEL	4.0E+01	08-01-94
o-Nitrophenol	88-75-5				N/C		N/C	
4-Nitrophenol	100-02-7	6.20E-02	r	EPA Region III	2.2E+00	DWEL	5.0E+03	08-01-94
4-Nitroquinoline 1-oxide	56-57-5				N/C		N/C	
N-Nitroso-di-n-butylamine	924-16-3	5.40E+00	c	IRIS	6.5E-06	DWEL	1.3E-01	08-01-94
N-Nitrosodiethylamine	55-18-5	1.50E+02	c	IRIS	2.3E-07	DWEL	4.7E-03	08-01-94
N-Nitrosodimethylamine	62-75-9	5.10E+01	c	IRIS	6.9E-07	DWEL	1.4E-02	08-01-94
N-Nitrosodiphenylamine	86-30-6	4.90E-03	c	IRIS	7.1E-03	DWEL	1.4E+02	08-01-94
N-Nitrosodipropylamine	621-64-7	7.00E+00	c	IRIS	5.0E-06	DWEL	1.0E-01	08-01-94
N-Nitrosomethylethylamine	10595-95-6	2.20E+01	c	IRIS	1.6E-06	DWEL	3.2E-02	08-01-94
N-Nitrosomorpholine	59-89-2				N/C		N/C	
N-Nitrosopiperidine	100-75-4				N/C		N/C	
N-Nitrosopyrrolidine	930-55-2	2.10E+00	c	IRIS	1.7E-05	DWEL	3.3E-01	08-01-94
5-Nitro-o-toluidine	99-55-8				N/C		N/C	
Parathion	56-38-2	6.00E-03	r	HEAST	2.1E-01	DWEL	4.8E+02	08-01-94
Pentachlorobenzene	608-93-5	8.00E-04	r	IRIS	2.8E-02	DWEL	6.4E+01	08-01-94
Pentachloroethane	76-01-7				N/C		N/C	
Pentachloronitrobenzene	82-68-8	2.60E-01	c	HEAST	1.3E-04	DWEL	2.7E+00	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Pentachlorophenol	87-86-5	1.20E-01	c	IRIS	1.0E-03	MCL	5.8E+00	08-01-94
Phenacetin	62-44-2				N/C		N/C	
Phenanthrene	85-01-8				N/C		N/C	
Phenol	108-95-2	6.00E-01	r	IRIS	2.1E+01	DWEL	4.8E+04	08-01-94
p-Phenylenediamine	106-50-3	1.90E-01	r	HEAST	6.7E+00	DWEL	1.5E+04	08-01-94
Phorate	298-02-2	2.00E-04	r	HEAST	7.0E-03	DWEL	1.6E+01	08-01-94
2-Picoline	109-06-8				N/C		N/C	
Polychlorinated biphenyls (PCBs)	1336-36-3	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-01-94
PCB-1016	12672-11-2	7.00E-05	r	IRIS	5.0E-04	MCL	5.6E+00	08-12-94
PCB-1221	11104-28-2	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
PCB-1232	11141-16-5	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
PCB-1242	53469-21-9	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
PCB-1248	12672-29-6	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
PCB-1254	11097-69-1	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
PCB-1260	11096-82-5	7.70E+00	c	IRIS	5.0E-04	MCL	1.0E+00	08-12-94
Polychlorinated dibenzo-p-dioxins (PCDDs)					N/C		N/C	
Polychlorinated dibenzofurans (PCDFs)					N/C		N/C	
Pronamide	23950-58-5	7.50E-02	r	IRIS	2.6E+00	DWEL	6.0E+03	08-01-94
Propionitrile; Ethyl cyanide	107-12-0				N/C		N/C	
Pyrene	129-00-0	3.00E-02	r	IRIS	1.1E+00	DWEL	2.4E+03	08-01-94
Pyridine	110-86-1	1.00E-03	r	IRIS	3.5E-02	DWEL	8.0E+01	08-01-94
Safrole	94-59-7				N/C		N/C	
Selenium	7782-49-2	5.00E-03	r	IRIS	5.0E-02	MCL	4.0E+02	08-01-94
Silver	7440-22-4	5.00E-03	r	IRIS	1.8E-01	DWEL	4.0E+02	09-14-94
Silvex; 2,4,5-TP	93-72-1	8.00E-03	r	IRIS	5.0E-02	MCL	6.4E+02	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Styrene	100-42-5	2.00E-01	r	IRIS	1.0E-01	MCL	1.6E+04	08-01-94
Sulfide	18496-25-8			SW-846	N/C		5.0E+02	08-01-94
2,4,5-T	93-76-5	1.00E-02	r	IRIS	3.5E-01	DWEL	8.0E+02	09-14-94
2,3,7,8-TCDD; Dioxin	1746-01-6	1.56E+05	c	HEAST	3.0E-08	MCL	4.5E-06	08-01-94
1,2,4,5-Tetrachlorobenzene	95-94-3	3.00E-04	r	IRIS	1.1E-02	DWEL	2.4E+01	08-01-94
1,1,1,2-Tetrachloroethane	630-20-6	2.60E-02	c	IRIS	1.3E-02	DWEL	2.7E+02	08-01-94
1,1,2,2-Tetrachloroethane	79-34-5	2.00E-01	c	IRIS	1.8E-04	DWEL	3.5E+00	08-01-94
Tetrachloroethylene	127-18-4	5.20E-02	c	EPA Region III	5.0E-03	MCL	1.3E+01	08-01-94
2,3,4,6-Tetrachlorophenol	58-90-2	3.00E-02	r	IRIS	1.1E+00	DWEL	2.4E+03	08-01-94
Tetraethyl dithiopyrophosphate; Sulfotepp	3689-24-5	5.00E-04	r	IRIS	1.8E-02	DWEL	4.0E+01	08-01-94
Thallium	7440-28-0	8.00E-05	r	IRIS	2.0E-03	MCL	5.1E+00	08-01-94
Tin	7440-31-5	6.00E-01	r	HEAST	2.1E+01	DWEL	4.8E+04	08-01-94
Toluene	108-88-3	2.00E-01	r	IRIS	1.0E+00	MCL	1.6E+04	09-14-94
o-Toluidine	95-53-4				N/C		N/C	
Toxaphene	8001-35-2	1.10E+00	c	IRIS	3.0E-03	MCL	6.4E-01	09-14-94
1,2,4-Trichlorobenzene	120-82-1	1.00E-02	r	IRIS	7.0E-02	MCL	8.0E+02	08-01-94
1,1,1-Trichloroethane	71-55-6	9.00E-02	r	EPA Region III	2.0E-01	MCL	7.2E+03	08-01-94
1,1,2-Trichloroethane	79-00-5	5.70E-02	c	IRIS*	5.0E-03	MCL	1.2E+02	08-01-94
Trichloroethene	79-01-6	1.10E-02	c	EPA Region III	5.0E-03	MCL	6.4E+01	08-01-94
Trichlorofluoromethane	75-69-4	3.00E-01	r	IRIS	1.1E+01	DWEL	2.4E+04	08-01-94
2,4,5-Trichlorophenol	95-95-4	1.00E-01	r	IRIS	3.5E+00	DWEL	8.0E+03	08-01-94
2,4,6-Trichlorophenol	88-06-2	1.10E-02	c	IRIS	3.2E-03	DWEL	6.4E+01	08-01-94
1,2,3-Trichloropropane	96-18-4	7.00E+00	c	IRIS	5.0E-06	DWEL	1.0E-01	08-01-94
0,0,0-Triethyl phosphorothioate	126-68-1				N/C		N/C	
sym-Trinitrobenzene	99-35-4	5.00E-05	r	IRIS	1.8E-03	DWEL	4.0E+00	08-01-94

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Vanadium	7440-62-2	7.00E-03	r	HEAST	2.5E-01	DWEL	5.6E+02	08-01-94
Vinyl acetate	108-05-4	1.00E+00	r	HEAST	3.5E+01	DWEL	8.0E+04	08-01-94
Vinyl chloride	75-01-4	1.90E+00	c	HEAST	2.0E-03	MCL	3.7E-01	08-01-94
Xylene (total)	1330-20-7	2.00E+00	r	IRIS	1.0E+01	MCL	1.6E+05	08-01-94
Zinc	7440-66-6	3.00E-01	r	IRIS	5.0E+00	SMCL	2.4E+04	08-01-94
Calcium					N/C		N/C	
Iron					N/C		N/C	
Aluminum					N/C		N/C	
n-butyl Benzene	104-51-8	1.00E-02	r	EPA Region III	3.5E-01	DWEL	8.0E+02	09-19-94
1,2,4-Trimethyl benzene	95-63-6	5.00E-04	r	EPA Region III	1.8E-02	DWEL	4.0E+01	09-19-94
Corrosivity					2.5E+02		N/C	
Nitrate (NO_3)					1.0E+01		N/C	
Sulfate (SO_4)					N/C		N/C	
Phosphate (PO_4)					N/C		N/C	
Fluoride					N/C		N/C	
Chloride					N/C		N/C	
1,2,3-Trichlorobenzene	87-61-6				N/C		N/C	
Cis-1,3-Dichloropropene	10061-01-5				N/C		N/C	
Trans-1,3-Dichloropropene	10061-02-6				N/C		N/C	
m/p-Xylene					1.0E+01		1.6E+05	
o-Xylene	95-47-6				1.0E+01		1.6E+05	
1,2-Dichloroethene	540-59-0				7.20E+02		N/C	
1,4-Dichloro-2-butene	764-41-0				N/C		N/C	
Endrin Aldehyde	7421-93-4				N/C		N/C	
1,1-Dichloropropene					N/C		N/C	

Appendix IX Compound	CAS No.	RfD (r) CSF (c)		RFI Action Levels			Soil Level (mg/kg)	Date Last Revised
				Source[1]	Water Level (mg/L)	Source[1]		
Endrin Ketone	53494-70-5				N/C		N/C	
T-As	7440-38-2				N/C		5.00	
T-Ba	7440-39-3				N/C		100.00	
T-Cd	7440-43-9				N/C		1.00	
T-Cr	7440-47-3				N/C		5.00	
T-Pb	7439-92-1				N/C		5.00	
T-Hg	7439-97-6				N/C		0.20	
T-Se	7782-49-2				N/C		1.00	
T-Ag	7440-22-4				N/C		5.00	

Resource Conservation and Recovery Act facility investigation (RFI) action levels are concentrations above those that may require a corrective measures study.

[1]RFI Action Level Sources

DWEL = Drinking water equivalent level calculated from oral RfD or cancer slope factor

HEAST = U.S. Environmental Protection Agency Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information System

MCL = Safe Drinking Water Act (SDWA) Maximum Contaminant Levels

SMCL = Secondary Maximum Contaminant Level

RPF = Relative potency factor. This is used to calculate action levels for carcinogenic polycyclic aromatic hydrocarbons in relation to benzo(a)pyrene. From the "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (PAHs)," USEPA.

N/C = No criteria to develop action level.

Table E-2 (continued)
Noncarcinogenic toxicity action levels for National Fertilizer and Environmental Research Center (NFERC) and Power Service Center (PSC) soils were calculated using the formula:

$$C.A.L. = \frac{RfD \times BW}{I}$$

where:

C.A.L. = corrective action level

RfD = reference dose

BW = body weight (kg) assumed to be a 16 kg child

I = intake or amount of soil ingested daily (200 mg for 16 kg child)

Carcinogenic action levels for TVAERC and Power Service Center (PSC) soils were calculated using the formula:

$$C.A.L. = \frac{Risk\ (1 \times 10E\text{-}6) \times BW}{CSF} \times \frac{70\ kg}{I}$$

where:

C.A.L. = corrective action level

CSF = Carcinogenic slope factor

BW = body weight (kg) assumed to be a 70 kg adult

I = intake or amount of soil ingested daily (100 mg for 70 kg adult)

ED = exposure duration is 70 years

EF = exposure frequency is 70 years

Drinking water equivalent levels (DWELs) are calculated using the above equations

Substituting 2 liters per day for the daily intake and 70 kg for the body weight

Table E-3. Solid Waste Management Unit 108 Summary of July 1990 Groundwater Monitoring Data

Parameter	Units	W9	W11	W12	W13	W16	W18	PZ1A	PZ1C	PZ2B	PZ2D	PZ9B	PZ11A	PZ12B
Inorganic Chemistry Results														
Carbon, Total Organic	mg/L	2.5	12	25	18	2.5	1	1.3	1.3	1.8	5	3.4	1.6	2
Cyanide	mg/L	0	0	0.014	0.032	0	0	0	0.019	0	0	0	0	0
Nitrogen, Ammonia	mg/L	1.1	2.4	1.6	8	0.93	0.73	0.15	2.6	0	0	0.045	2.4	0.044
Nitrogen, Nitrate-Nitrite	mg/L	12	11	210	150	17	0.52	11	100	1.1	2.2	0.49	29	94
Phenolics	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus	mg/L	0.048	0.067	0.17	0.07	0	8.5	0.14	0.17	0.036	0.14	0.023	0.085	0
Organic Chemistry Results														
1,1,1-Trichloroethane	µg/L	33	0	0	0	0	0	0	0	0	0	0	0	0
Tetrachloroethene	µg/L	590	10	0	420	0	0	0	0	260	0	22	99	33
bis(2-Ethylhexyl) phthalate	µg/L	120	15	20	0	0	0	120	0	0	0	0	0	17
1,2-Dichloroethene	µg/L	0	0	0	150	0	0	0	0	0	0	0	0	0
Trichloroethene	µg/L	0	0	0	35	0	0	0	0	0	0	0	0	0
Carbon tetrachloride	µg/L	0	0	0	0	0	0	0	0	0	6	0	0	0
Chloroform	µg/L	0	0	0	0	0	0	0	0	0	0	0	0	22
Radioactivity Results														
Gross Alpha	pCi/L	0	3	3	132	23	14	2	4	0	0	0	3	8
Gross Beta	pCi/L	0	0	45	253	50	20	0	4	0	5	0	7	5
Radium	pCi/L	0	2	2	97	27	11	2	2	2	2	2	2	6

Table E-3 (continued)

Parameter	Units	W9	W11	W12	W13	W16	W18	PZ1A	PZ1C	PZ2B	PZ2D	PZ9B	PZ11A	PZ12B
Metal Analysis Results														
Aluminum	mg/L	0	0	0	1400	210	240	13	0.9	0.7	0.6	1.2	100	19
Barium	mg/L	0	0	0	1.8	0.8	0.6	0.1	0	0	0	0	0.6	0.2
Iron	mg/L	0.3	0.5	0.2	1100	89	300	7.5	2	1	1.2	1.2	72	12
Copper	mg/L	0	0	0.02	0.66	0.1	0.19	0	0.03	0	0	0	0.11	0.02
Manganese	mg/L	0.28	0.43	23	171	1.7	4	0.27	0.21	0.48	0.11	0.94	2.2	1.4
Mercury	mg/L	0	0	0	0.003	0.0008	0.0018	0	0	0	0	0	0.0013	0
Nickel	mg/L	0	0	0	0.97	0.16	0.19	0	0.82	0	0	0.04	0.94	0.08
Zinc	mg/L	0	0	0.17	3.9	0.37	0.61	0.03	0.03	0	0.04	0.082	0.7	0.15
Antimony	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	mg/L	0	0	0	0.5	0.032	0.081	0	0	0	0	0	0.039	0
Berylliun	mg/L	0	0	0	0.066	0.008	0.013	0	0	0	0	0	0.005	0
Cadmium	mg/L	0	0.003	0.003	0.006	0	0.002	0	0.002	0	0	0.003	0.002	0
Chromium	mg/L	0	0	0	1.6	0.14	0.6	0.015	0	0	0	0	0.23	0.02
Lead	mg/L	0.007	0.021	0.005	0.29	0.098	0	0.007	0.012	0.008	0.015	0.008	0.21	0.021
Selenium	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0
Silver	mg/L	0	0	0	0	0	0	0	0.022	0	0	0	0	0
Thallium	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0
Field Parameters														
Alkalinity	mg/L	142	185	20	84	108	119	20	191	17	49	47	50	41
Electrical Conductivity	µmhos/cm	585	770	3000	2790	2480	551	244	977	144	519	128	830	1240
Temperature	°C	17.8	18.8	20.3	22.0	17.9	17.6	18.9	18.5	18.8	18.0	20.6	20.7	22.8
Dissolved Oxygen	mg/L	1.3	0.1	1.3	0.4	4.5	0.1	0.9	1.2	1.5	4.4	1.2	2.8	3.7
pH		6.5	6.7	5.1	5.5	5.7	6.6	4.9	6.3	5.2	5.9	5.7	7.1	5.3

Source: Young, S. C., and H. E. Julian. 1991. *Assessment of Groundwater Impacts From Solid Waste Management Unit 108*. Norris, Tenn.: TVA Engineering Laboratory, TVA Report No. WR28-1-520-167.

Abbreviations:

µg/L = Micrograms per liter
µmhos/cm = Microhos per centimeter
°C = Degree Celsius
mg/L = Milligrams per liter
pCi/L = Pico-curies per liter

Table E-4. Solid Waste Management Unit 108 Summary of Predominant Volatile Organic Compounds 1987-1997

Well	North (feet)	East (feet)	Top Screen	Mid Screen	Bottom Screen	Tetrachloroethylene						Trichloroethylene				
						Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997	Feb 1987	July 1990	June 1991	Aug 1997	Nov 1997
PZ 1A	-646	1545	516.4	513.9	511.4			0.000		0.000	0.000		0.000		0.000	0.000
PZ 1B	-653	1550	491.4	488.9	486.4					0.000	0.000				0.000	0.000
PZ 1C	-654	1544	469.2	466.7	464.2			0.000		0.004	**0.007**		0.000		0.000	0.000
PZ 2A	-170	1514	524.1	521.6	519.1											
PZ 2B	-175	1512	514.1	511.6	509.1			**0.260**					0.000			
PZ 2C	-174	1521	484.1	481.6	479.1											
PZ 2D	-179	1518	468.5	466.0	463.5			0.000					0.000			
PZ 3A	-449	2017	518.5	516.0	513.5											
PZ 9A[1]	-1222	1540	509.5	507.0	504.5	**0.684**	**0.290**			**1.100**	**0.780**	0.000			**0.006**	**0.005**
PZ 9B[2]	-1228	1539	498.7	496.2	493.7	**0.550**		**0.022**		**2.000**	**2.200**	0.000	0.000		**0.007**	0.000
PZ 9C	-1221	1534	476.7	474.2	471.7					**0.200**	**0.520**				0.000	0.003
PZ 11A	-1423	1877	493.5	491.0	488.5	**0.014**	**0.300**	**0.099**		**4.500**	**2.200**	0.000	0.000		**0.014**	**0.019**
PZ 11B	-1415	1878	484.0	481.5	479.0	**0.011**				**0.094**	**0.110**	0.000			**0.008**	**0.008**
PZ 11C[3]	-1411	1886	468.8	466.3	463.8				**0.038**	**0.120**	**0.400**				**0.010**	**0.008**
PZ 11D	-1417	1900	473.6	463.6	453.6					0.001	**0.400**				0.000	0.003
PZ 12A	-975	2210	509.8	507.3	504.8	**0.012**	**0.021**			**0.041**	**0.120**	0.002			0.000	0.000
PZ 12B	-970	2214	499.6	497.1	494.6	**0.012**		**0.033**		**0.050**	**0.200**	0.002	0.000		0.000	0.000
PZ 12C[4]	-966	2217	484.6	482.1	479.6					**0.011**	**0.033**				0.000	0.000
PZ 12D	-968	2190	469.4	459.4	449.4					**0.020**	**0.100**				0.000	0.003
PZ 31A	-626	2319	514.2	504.2	494.2					0.000	0.000				0.000	0.000
PZ 31B	-621	2321	593.9	583.9	573.9					0.000	0.000				0.000	0.000
PZ 32A	-1106	1688	509.0	499.0	489.0					**9.500**	**14.000**				**0.016**	0.000
PZ 32B[5]	-1069	1710	496.7	486.7	476.7					**1.800**	**3.700**				**0.032**	**0.095**
PZ 33A[6]	-1447	1630	500.0	490.0	480.0					**8.500**	**2.600**				**0.006**	0.000
PZ 33B	-1438	1649	481.4	476.4	471.4					**20.000**	**0.008**				**0.078**	**0.067**
PZ 33C	-1430	1648	471.2	466.2	461.2					**6.800**	**3.700**				0.003	0.000

Table E-4 (continued)

Well	North (feet)	East (feet)	Top Screen	Mid Screen	Bottom Screen	Tetrachloroethylene						Trichloroethylene				
						Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997	Feb 1987	July 1990	June 1991	Aug 1997	Nov 1997
PZ 34A	-1190	2243	497.1	487.1	477.1					0.001	0.000				0.000	0.000
PZ 34B	-1183	2247	476.6	466.6	456.6					0.000	0.000				0.000	0.000
PZ 34C	-1190	2252	457.2	452.2	447.2					0.000	**0.013**				0.000	0.000
PZ 35A	-1084	2370	500.1	490.1	480.1					**0.007**	0.000				0.000	0.000
PZ 35B	-1075	2373	479.7	469.7	459.7					**0.007**	**0.008**				0.000	0.000
PZ 35C	-1071	2366	459.6	454.6	449.6					**0.008**	0.000				0.000	0.000
PZ 39A	-1674	1689	477.3	474.8	472.3						**0.005**					0.000
PZ 39B	-1675	1695	464.0	461.5	459.0						0.000					0.000
PZ 40A	-1590	1449	477.7	475.2	472.7						**0.013**					0.000
PZ 40B	-1588	1451	458.7	456.2	453.7						**0.008**					0.000

Miscellaneous Organic Detects:

[1]cis-1,2-Dichloroethylene = .016 mg/L (Aug. 1997)

[2]cis-1,2-Dichloroethylene = .006 mg/L (Aug. 1997)

[3]Dibromochloromethane = 0.004 mg/L (Aug. 1997)

[4]Ethylbenzene = .016 mg/L (Nov. 1997)

[5]cis-1,2 & trans-1,2-Dichloroethylene = .032 and .001 mg/L, respectively (Aug. 1997)

6cis-1,2 & trans-1,2-Dichloroethylene = .027 and .001 mg/L, respectively (Aug. 1997)

Table E-4 (continued)

Well	Carbon Tetrachloride						Chloroform					
	Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997	Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997
PZ 1A			0.000		0.000	0.000			0.000		0.000	0.000
PZ 1B					0.000	0.000					0.002	0.000
PZ 1C			0.000		0.000	0.000			0.000		0.000	0.000
PZ 2A												
PZ 2B			0.000						0.000			
PZ 2C												
PZ 2D			**0.006**						0.000			
PZ 3A								**0.160**				
PZ 9A[1]	**0.025**	**0.054**			**0.020**	**0.013**	0.003				0.003	0.000
PZ 9B[2]	**0.021**		0.000		**0.210**	**0.245**	0.002		0.000		0.012	0.011
PZ 9C					**0.009**	**0.030**					0.003	0.006
PZ 11A	**0.001**		0.000		**0.350**	**0.270**	0.001		0.000		**0.240**	**0.220**
PZ 11B	**0.001**				**0.015**	**0.011**	0.000				0.000	0.003
PZ 11C[3]					0.000	**0.059**					0.011	0.011
PZ 11D					0.000	**0.025**					0.000	0.006
PZ 12A	0.000				0.000	0.000	0.003				0.000	0.000
PZ 12B	0.000		0.000		0.000	**0.021**	**0.005**		0.022		0.000	0.000
PZ 12C[4]					0.000	0.000					0.000	0.000
PZ 12D					0.000	0.000					0.000	0.003
PZ 31A					0.000	0.000					0.000	0.000
PZ 31B					0.000	0.000					0.012	0.000
PZ 32A					**1.800**	**13.000**					**0.470**	**0.140**
PZ 32B[5]					**0.040**	**0.220**					0.015	0.014
PZ 33A[6]					**0.990**	**0.700**					0.015	0.009
PZ 33B					**2.400**	**10.500**					**2.600**	**2.000**

Table E-4 (continued)

Well	Carbon Tetrachloride						Chloroform					
	Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997	Feb 1987	June 1989	July 1990	June 1991	Aug 1997	Nov 1997
PZ 33C					**5.200**	**4.200**					**0.180**	**0.140**
PZ 34A					0.000	0.000					0.005	0.000
PZ 34B					0.000	0.000					0.000	0.000
PZ 34C					0.000	0.000					0.006	0.000
PZ 35A					0.000	0.000					0.000	0.000
PZ 35B					0.000	0.000					0.012	0.000
PZ 35C					0.000	0.000					0.000	0.000
PZ 39A						0.000						0.014
PZ 39B						0.000						0.000
PZ 40A						0.000						0.004
PZ 40B						0.000						0.000
Miscellaneous Organic Detects:												
[1]cis-1,2-Dichloroethylene = .016 mg/L (Aug. 1997)												
[2]cis-1,2-Dichloroethylene = .006 mg/L (Aug. 1997)												
[3]Dibromochloromethane = 0.004 mg/L (Aug. 1997)												
[4]Ethylbenzene = .016 mg/L (Nov. 1997)												
[5]cis-1,2 & trans-1,2-Dichloroethylene = .032 and .001 mg/L, respectively (Aug. 1997)												
6cis-1,2 & trans-1,2-Dichloroethylene = .027 and .001 mg/L, respectively (Aug. 1997)												

Source: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Table E-5. Solid Waste Management Unit 108 Summary of Nitrate Data 1989-1997

						Total Phosphorous				Total Phosphate			Nitrate+Nitrite											
Well	North (ft)	East (ft)	Top screen	Mid screen	Bottom screen	July 1990	May 1997	Aug 1997	Nov 1997	May 1997	Aug 1997	Nov 1997	June 1989	July 1990	July 1991	Dec 1991	June 1992	May 1993	Jan 1994	June 1994	Dec 1994	May 1997	Aug 1997	Nov 1997
PZ 1A	-646	1545	516.4	513.9	511.4	0.14	0.01	0.00	0.03	0.05	0.00	0.09	**12.80**	**11.00**	9.80			**12.70**	**12.00**	**13.00**	**12.00**	7.90	7.90	9.70
PZ 1B	-653	1550	491.4	488.9	486.4		0.05	0.00	0.14	0.15	0.00	0.43			1.40			1.94	2.00	1.70	2.10	1.60	2.00	2.20
PZ 1C	-654	1544	469.2	466.7	464.2	0.17	0.04	0.00	0.02	0.12	0.00	0.06		**100.00**	**96.10**			**99.90**	**110.00**	**108.00**	**120.00**	**110.00**	**100.00**	**84.00**
PZ 2A	-170	1514	524.1	521.6	519.1										2.70									
PZ 2B	-175	1512	514.1	511.6	509.1	0.04							1.10	1.10	2.20									
PZ 2C	-174	1521	484.1	481.6	479.1										0.70									
PZ 2D	-179	1518	468.5	466.0	463.5	0.14								2.20	1.80									
PZ 3A	-449	2017	518.5	516.0	513.5		0.02			0.06			10.60									2.70		
PZ 3B	-453	2013	493.5	491.0	488.5		0.04			0.12												9.00		
PZ 9A	-1222	1540	509.5	507.0	504.5		0.02	0.25	0.19	0.06	0.76	0.58			6.70			0.46	**56.00**	**52.00**	**46.00**	9.50	**53.00**	**19.00**
PZ 9B	-1228	1539	498.7	496.2	493.7		0.02	0.12		0.06	0.37			0.49	0.50			**57.60**	**11.00**	9.90	**11.00**	0.41	**14.00**	
PZ 9C	-1221	1534	476.7	474.2	471.7		0.03	0.01		0.09	0.03				**76.80**			9.31	0.45	0.46	0.31	34.00	0.44	
PZ 11A	-1423	1877	493.5	491.0	488.5	0.09	0.55	0.41	0.12	1.70	1.20	0.37	**51.10**	**29.00**	**23.00**	**34.00**	**71.47**	**70.60**	**85.00**	**77.00**	**140.00**	**99.00**	**94.00**	**130.00**
PZ 11B	-1415	1878	484.0	481.5	479.0		0.11	0.38	0.61	0.34	1.20	1.90			0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.17	0.10	0.00
PZ 11C	-1411	1886	468.8	466.3	463.8		0.03	0.05	0.05	0.09	0.15	0.15			1.20	0.00	0.15	0.00	0.00	0.13	0.04	0.26	0.18	0.09
PZ 11D	-1417	1900	473.6	463.6	453.6		0.43	0.07	0.45	1.30	0.21	1.38				**24.00**	**14.13**	**27.80**	**30.00**	**24.00**	**10.00**	**14.00**	**11.00**	**10.00**
PZ 12A	-975	2210	509.8	507.3	504.8		13.00	14.20	7.00	40.00	43.00	21.00	**253.00**		**208.00**	**188.00**	**165.30**	**165.00**	**220.00**	**130.00**	**150.00**	1.90	**120.00**	**65.00**
PZ 12B	-970	2214	499.6	497.1	494.6	0.00	2.00	2.80	2.90	6.10	8.60	8.90		**94.00**	**83.20**	**110.00**	**78.48**	**113.00**	**120.00**	**130.00**	**85.00**	**26.00**	**32.00**	3.50
PZ 12C	-966	2217	484.6	482.1	479.6		2.10	2.50	6.30	6.40	7.60	19.00			9.60	**28.00**	**26.80**	**27.30**	**24.00**	**23.00**	1.70	8.60	0.00	0.00
PZ 12D	-968	2190	469.4	459.4	449.4		6.50	0.70	1.60	21.00	2.10	4.90				**40.00**	**30.77**	**14.40**	**14.00**	6.70	**22.00**	1.70	**53.00**	**67.00**
PZ 31A	-626	2319	514.2	504.2	494.2		0.35	0.39	0.52	1.07	1.20	1.60										1.10	1.10	2.40
PZ 31B	-621	2321	593.9	583.9	573.9		3.00	0.08	0.10	9.20	0.24	0.30										1.00	2.30	2.50
PZ 32A	-1106	1688	509.0	499.0	489.0			0.03			0.09												**100.00**	
PZ 32B	-1069	1710	496.7	486.7	476.7			0.16			0.49												**82.00**	
PZ 33A	-1447	1630	500.0	490.0	480.0		0.06	0.04	0.04	0.18	0.12	0.12										**75.00**	**77.00**	**68.00**
PZ 33B	-1438	1649	481.4	476.4	471.4		0.22	0.05	0.00	0.67	0.15	0.00										6.20	0.97	2.00
PZ 33C	-1430	1648	471.2	466.2	461.2		0.05	0.00	0.01	0.15	0.00	0.03										3.40	1.60	1.80
PZ 34A	-1190	2243	497.1	487.1	477.1		0.64	0.00	0.01	2.00	0.00	0.03										3.30	3.40	4.00
PZ 34B	-1183	2247	476.6	466.6	456.6		0.04	0.05	0.03	0.12	0.15	0.09										0.04	0.00	1.00
PZ 34C	-1190	2252	457.2	452.2	447.2		0.17	0.01	0.08	0.52	0.03	0.24										0.40	0.43	**26.00**
PZ 35A	-1084	2370	500.1	490.1	480.1		11.00	0.01	0.26	33.00	0.03	0.80										0.00	1.50	2.50
PZ 35B	-1075	2373	479.7	469.7	459.7		0.14	0.01	0.12	0.43	0.03	0.37										0.17	0.43	1.10
PZ 35C	-1071	2366	459.6	454.6	449.6		0.20	0.05	0.13	0.61	0.15	0.40										**16.80**	**16.80**	5.60

Source: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Table E-6. Solid Waste Management Unit 108 Cadmium and Lead Monitoring Results 1997

Well	May 7-28				August 12-14				06-Nov			
	Cd	Dissolved Cd	Pb	Dissolved Pb	Cd	Dissolved Cd	Pb	Dissolved Pb	Cd	Dissolved Cd	Pb	Dissolved Pb
PZ-1A	0.0005		< 0.001		0.0003	0.0002	0.001	< 0.001	0.0005		0.002	
PZ-1B	< 0.0001		0.007		0.0006	0.0005	0.003	0.001	0.001		0.006	
PZ-1C	0.0008		0.006		0.0009	0.0009	< 0.001	< 0.001	0.0008		0.002	
PZ-3A	0.0004		< 0.001									
PZ-3B	**0.005**		0.003									
PZ-9A	< 0.0001	< 0.0001	< 0.001	< 0.001	0.0004	0.0002	0.001	< 0.001	0.003	0.0026	0.002	< 0.001
PZ-9B	0.0003	< 0.0001	< 0.001	< 0.001	0.0006	0.0006	0.006	< 0.001	0.0029	0.0029	0.002	< 0.001
PZ-9C	0.0004		< 0.001		0.0005		< 0.001		0.0007	< 0.0001	0.002	< 0.001
PZ-11A	< 0.0001		0.012		0.001		0.008		0.0013		< 0.001	
PZ-11B	< 0.0001		0.002		0.0004		0.002		< 0.0001		< 0.001	
PZ-11C	0.0002		0.001		0.0006		0.003		0.0004		< 0.001	
PZ-11D	0.0007		0.006		0.0008		0.005		0.0006		0.006	
PZ-12A	0.0011	0.0009	0.011	0.007	0.0007	0.0002	0.004	< 0.001	0.0003	< 0.0001	0.01	< 0.001
PZ-12B	< 0.0001	< 0.0001	0.002	0.002	0.0008	< 0.0001	**0.029**	< 0.001	< 0.0001	< 0.0001	0.009	< 0.001
PZ-12C	0.0003		**0.025**		0.0002		0.008		0.0004		**0.018**	
PZ-12D	**0.005**		**0.065**		0.0036		0.006		**0.0052**		**0.026**	
PZ-31A	< 0.0001		< 0.001		< 0.0001	< 0.0001	< .001	< 0.001	< 0.0001		0.001	
PZ-31B	0.0045		**0.032**		0.0017	0.0015	0.003	< 0.001	0.0007		0.004	
PZ-32A					0.001	0.0009	< 0.001	< 0.001	0.001	0.0006	0.005	< 0.001
PZ-32B					0.0009	0.0003	0.004	< 0.001	0.0006	0.0006	0.003	< 0.001

Well	May 7-28				August 12-14				06-Nov			
	Cd	Dissolved Cd	Pb	Dissolved Pb	Cd	Dissolved Cd	Pb	Dissolved Pb	Cd	Dissolved Cd	Pb	Dissolved Pb
PZ-33A	0.0004	0.0004	< 0.001	< 0.001	0.0003	0.0002	0.001	< 0.001	< 0.0001	< 0.0001	< 0.001	< 0.001
PZ-33B	0.0028	0.002	0.003	0.002	0.0004	0.0004	0.001	< 0.001	0.0006	0.0005	0.003	0.001
PZ-33C	0.0007		< 0.001		0.0004		< 0.001		< 0.0001		< 0.001	
PZ-34A	**0.012**		**0.018**		0.0003		< 0.001					
PZ-34B	**0.011**		**0.018**		0.0005		0.007					
PZ-34C	0.0014		0.004		0.0005		0.003					
PZ-35A					0.0029		**0.028**					
PZ-35B					0.0003		0.001					
PZ-35C					0.0013		0.001					

Source: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Table E-7. Historical Groundwater Measurements at Concentrations in Excess of Resource Conservation and Recovery Act Action Limits Through June 1997

Date	Parameter	Highest Measured Concentration	Units	RCRA Action Limit (mg/L)	Location
1987	Volatile Organics				
	Carbon tetrachloride	25	μg/L	0.005	W9
	Chloroform	5	μg/L	18.0	W12
	Tetrachloroethylene	684	μg/L	N/C	W9
	Radioactive Elements				
	Radium-226	5.7	pCi/L	*	W10
	Radium-228	8.4	pCi/L	*	W10
1989	Volatile Organics				
	Carbon tetrachloride	54	μg/L	0.005	PZ-9A
	Chloroform	160	μg/L	0.1	PZ-3A
	Dibromochloromethane	310	μg/L	0.00042	PZ-11A
	Dioctylphthalate	13	μg/L	*	PZ-12A
	Tetrachloroethylene	300	μg/L	0.005	PZ-11A
	Inorganics				
	Iron	7.0	mg/L	N/C	PZ-1A
	Manganese	6.9	mg/L	*	PZ-12A
	Nitrate-N	243	mg/L	10.0	PZ-12A
	Silver	0.08	mg/L	18.0	PZ-1A
	Sulfate	253	mg/L	N/C	PZ-12A
1990	Volatile Organics				
	1,1,1-Trichloroethane	33	μg/L	0.2	W9
	1,2-Dichloroethane	150	μg/L	720	W13
	Bis(2-ethylhexyl)phthalate	120	μg/L	0.006	W9
	Carbon tetrachloride	6	μg/L	0.005	PZ-2D
	Chloroform	22	μg/L	0.1	PZ-12B
	Tetrachloroethylene	590	μg/L	0.005	W9
	Trichloroethylene	35	μg/L	0.005	W13
	Inorganics				
	Aluminum	1400	mg/L	N/C	W13
	Arsenic	0.50	mg/L	0.05	W13
	Beryllium	0.066	mg/L	0.004	W13
	Cadmium	0.06	mg/L	0.005	W13
	Chromium	1.6	mg/L	0.1	W13
	Iron	1100	mg/L	N/C	W13
	Lead	0.29	mg/L	0.015	W13
	Manganese	23	mg/L	*	W12
	Mercury	0.003	mg/L	0.002	W13
	Nitrate-N	210	mg/L	10	W12

Date	Parameter	Highest Measured Concentration	Units	RCRA Action Limit (mg/L)	Location
1991	Volatile Organics				
	Bis(2-ethylhexyl)phthalate	5	μg/L	0.006	W9
	Carbon tetrachloride	26	μg/L	0.005	W9
	Tetrachloroethylene	600	μg/L	0.005	W9
	Vinyl chloride	110	μg/L	0.002	W9
	Inorganics				
	Nitrate-N	218	mg/L	10	W12
1992	Inorganics				
	Nitrate-N	165	mg/L	10	PZ-12A
1997	Volatile Organics				
	Carbon tetrachloride	13	mg/L	0.005	PZ-32A
	Chloroform	2	mg/L	0.1	PZ-33B
	Tetrachloroethylene	14	mg/L	0.005	PZ-32A
	Trichloroethylene	0.095	mg/L	0.005	PZ-32B
	Inorganics				
	Cadmium	0.008	mg/L	0.005	PZ-1C
	Lead	0.026	mg/L	0.02	PZ-12D
	Nitrate+Nitrite	130	mg/L	10	PZ-11A

*No RCRA action limit established for this parameter

Adapted from: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Abbreviations:

μg/L = Micrograms per liter
mg/L = Milligrams per liter
pCi/L = Pico-curies per liter

APPENDIX F – VOLATILE ORGANIC COMPOUND COMPLIANCE FOR SOLID WASTE MANAGEMENT UNIT 108

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Table F-1. Solid Waste Management Unit 108 Action Limits Action Levels for Point-of-Compliance Monitoring Wells and Surface Water

Analyte	CAS No.	MCL[a] (mg/L)	POC Action Level (mg/L)	Surface Water Action Level[c] (mg/L)
Tetrachloroethylene	127-18-4	0.005	0.05	0.019
Carbon tetrachloride	56-23-5	0.005	0.05	0.010
Chloroform[b]	67-66-3	0.08	0.8	1.020
Trichloroethylene	79-01-6	0.005	0.05	0.175
Cis-1,2-dichloroethylene	156-59-2	0.07	0.7	0.684
Trans-1,2-dichloroethylene	156-60-5	0.1	1.0	0.684
Chlorodibromomethane[b]	124-48-1	0.08	0.8	0.048
Vinyl Chloride	75-01-4	0.002	0.02	0.014
Phosphorus (White)[b]	7723-14-0	0.00073	0.0073	0.0073

Abbreviations:

CAS = Chemical Abstracts Service, a division of the American Chemical Society
MCL = Maximum contaminant level
mg/L = Milligrams per liter
POC = Point of compliance

[a]U.S. Environmental Protection Agency (USEPA) National Primary Drinking Water Standards MCL.

[b]No MCL is promulgated for the contaminant. Action Level from USEPA Region IX Preliminary Remediation Goal; per USEPA Region IV guidance.

[c]Alabama Department of Environmental Management Ambient Water Quality Criteria Code: 335-6-10-.07, Equations 16 and 18. MCL used if higher.

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

Table F-2. 2003-09 Summary of Volatile Organic Compounds Monitoring Data at Solid Waste Management Unit 108

	PZ1B	PZ1C	PZ2C	PZ2D	PZ3A	PZ3B	PZ32A	PZ32B	POC1A	POC1B	POC2A	POC2B	POC3A	POC3B	SW3	SW4	SW5
Aug-2003																	
Carbon tetrachloride	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.2**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chlorodibromomethane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01	**0.12**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.11**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methylene chloride	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.2**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tetrachloroethylene	<0.01	<0.01	**0.13**	<0.01	<0.01	<0.01	<0.01	**6**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.015**	<0.01	<0.01
trans-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Trichloroethylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.04**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vinyl chloride	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Oct-2003																	
Carbon tetrachloride	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**3.9**	**0.22**	<0.01	<0.01	<0.01	<0.01	**0.014**	<0.01	<0.01	<0.01	<0.01
Chlorodibromomethane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01	**0.13**	**0.01**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
cis-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.11**	**0.1**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tetrachloroethylene	<0.01	<0.01	**0.13**	<0.01	<0.01	<0.01	<0.01	**3.9**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.02**	<0.01	**0.01**
trans-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Trichloroethylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.02**	**0.04**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vinyl chloride	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Feb-2004																	
Carbon tetrachloride	<0.001	<0.001	<0.001	**0.004**	<0.001	<0.001	**0.3**	**0.03**	<0.001	**0.004**	<0.001	**0.006**	**0.012**	<0.001	<0.001	dry	dry
Chlorodibromomethane	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	dry	dry
Chloroform	**0.0013**	**0.0008**	**0.0006**	**0.0014**	**0.0007**	**0.12**	<0.0005	<0.0005	<0.0005	**0.0044**	<0.0005	**0.0033**	**0.0028**	<0.0005	<0.0005	dry	dry
cis-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.04**	**0.05**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	dry	dry
1,1-Dichloroethylene	<0.001	<0.001	**0.004**	<0.001	<0.001	<0.001	<0.001	<0.001							<0.001	dry	dry
Tetrachloroethylene	<0.0005	**0.0017**	**0.14**	**0.0052**	<0.0005	<0.0005	**1.6**	**0.5**	<0.0005	**0.0066**	<0.0005	**0.0047**	**0.001**	<0.0005	<0.0005	dry	dry
trans-1,2-Dichloroethene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	dry	dry
Trichloroethylene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.008**	**0.01**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	dry	dry
Vinyl chloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	dry	dry
May-2004																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.004**	< 0.001	< 0.001	**1**	**0.11**	< 0.001	**0.005**	< 0.001	**0.008**	**0.011**	**0.007**	< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloroform	< 0.0005	< 0.0005	< 0.0005	**0.001**	**0.001**	**0.071**	< 0.0005	< 0.0005	**0.002**	**0.005**	< 0.0005	**0.005**	**0.003**	**0.004**	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	< 0.0005	**0.002**	**0.053**	**0.004**	< 0.0005	< 0.0005	**3**	**0.84**	**0.001**	**0.008**	**0.002**	**0.007**	**0.004**	**0.006**	**0.014**	**0.005**	**0.004**
trans-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.002**	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

All units mg/L

Values in red represent detectable measurements

Table F-2 (continued)

	PZ1B	PZ1C	PZ2C	PZ2D	PZ3A	PZ3B	PZ32A	PZ32B	POC1A	POC1B	POC2A	POC2B	POC3A	POC3B	SW3	SW4	SW5
Aug-2004																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.005**	< 0.001	< 0.001	**0.7**	**0.1**	< 0.001	**0.005**	< 0.001	**0.008**	**0.02**	**0.006**	< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloroform	< 0.0005	< 0.0005	< 0.0005	**0.001**	< 0.0005	**0.1**	**0.015**	**0.009**	< 0.0005	**0.0049**	< 0.0005	**0.0047**	< 0.0005	**0.0035**	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-Dichloroethylene	< 0.001	< 0.001	**0.006**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.0005	**0.004**	**0.2**	**0.007**	< 0.0005	< 0.0005	**2.5**	**0.9**	**0.0012**	**0.0085**	**0.002**	**0.0074**	**0.001**	**0.0076**	**0.005**	< 0.0005	< 0.0005
trans-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.03**	**0.05**	< 0.001	< 0.001	< 0.001	< 0.001	**0.005**	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	**0.005**	**0.003**	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Nov-2004																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.004**	< 0.001	< 0.001	**3.7**	**0.31**	< 0.001	**0.005**	< 0.001	**0.007**	**0.012**		< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001
Chloroform	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.12**	**0.014**	**0.01**	< 0.0005	**0.005**	< 0.0005	**0.004**	**0.003**		< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.14**	**0.16**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001
1,1-Dichloroethylene	< 0.001	< 0.001	**0.004**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.0005	**0.0031**	**0.19**	**0.008**	< 0.0005	< 0.0005	**10**	**8.4**	< 0.0005	**0.011**	< 0.0005	**0.008**	**0.004**		< 0.0005	< 0.0005	< 0.0005
trans-1,2-Dichloroethene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.004**	**0.006**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		< 0.001	< 0.001	< 0.001
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.032**	**0.06**	< 0.001	< 0.001	< 0.001	< 0.001	**0.004**		< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002		< 0.002	< 0.002	< 0.002
Feb-2005																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**2.4**	**0.19**	< 0.001	**0.005**	< 0.001	**0.007**	**0.007**	**0.006**	< 0.001	< 0.001	< 0.001
Chloroform	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.08**	**0.013**	**0.0059**	< 0.0005	**0.0037**	< 0.0005	**0.0028**	**0.0012**	**0.00225**	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.1**	**0.1**	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-Dichloroethylene	< 0.001	< 0.001	**0.007**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.0005	**0.0036**	**0.195**	**0.009**	< 0.0005	**0.001**	**5.7**	**3.3**	**0.003**	**0.01**	**0.0027**	**0.0089**	**0.015**	**0.005**	**0.0205**	**0.0058**	< 0.0005
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.022**	**0.041**	< 0.001	< 0.001	< 0.001	< 0.001	**0.002**	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	**0.003**	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
May-2005																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.002**	< 0.001	< 0.001	**0.6**	**0.09**	< 0.001	**0.003**	< 0.001	**0.004**	**0.004**	**0.003**	< 0.001	< 0.001	< 0.001
Chloroform	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	**0.05**	**0.01**	**0.01**	< 0.0005	**0.003**	< 0.0005	**0.002**	**0.001**	**0.002**	< 0.0005	< 0.0005	< 0.0005
cis-1,2-Dichloroethene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.0005	< 0.0005	**0.12**	**0.0055**	< 0.0005	< 0.0005	**1.3**	**0.58**	**0.001**	**0.007**	**0.002**	**0.002**	**0.007**	**0.005**	**0.005**	**0.002**	**0.004**
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.016**	**0.03**	< 0.001	< 0.001	< 0.001	< 0.001	**0.002**	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

All units mg/L

Values in red represent detectable measurements

Table F-2 (continued)

	PZ1B	PZ1C	PZ2C	PZ2D	PZ3A	PZ3B	PZ32A	PZ32B	POC1A	POC1B	POC2A	POC2B	POC3A	POC3B	SW3	SW4	SW5
Aug-2005																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**1.2**	**0.16**	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
Chloroform	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.072**	**0.01**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
cis-1,2-Dichloroethene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
1,1-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.08**	**0.09**	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
Tetrachloroethylene	< 0.001	< 0.001	**0.22**	**0.01**	< 0.001	< 0.001	**4.5**	**1.6**	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	**0.01**	< 0.001
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.03**	**0.4**	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
Vinyl chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	dry	< 0.001	< 0.001
Aug-2006																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.005**	< 0.001	< 0.001	**1.035**	**0.16**	< 0.001	**0.005**	**0.002**	**0.008**	**0.015**	**0.008**	dry	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	< 0.001
Chloroform	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.079**	**0.012**	**0.008**	< 0.005	**0.005**	< 0.001	**0.005**	< 0.005	**0.005**	dry	< 0.005	< 0.005
Cis-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.075**	**0.1**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	< 0.001
Trans-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.079**	**0.098**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	< 0.001
Tetrachloroethylene	< 0.001	**0.002**	< 0.001	**0.009**	< 0.001	< 0.001	**3.65**	**1.4**	**0.002**	**0.011**	< 0.001	**0.01**	**0.004**	**0.008**	dry	< 0.001	**0.006**
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.024**	**0.045**	< 0.001	< 0.001	< 0.005	< 0.001	**0.005**	< 0.001	dry	< 0.001	< 0.001
Vinyl chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.003**	**0.003**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	dry	< 0.001	< 0.001
Aug-2007																	
Carbon tetrachloride	< 0.001	< 0.001	< 0.001	**0.0036**	< 0.001	< 0.001	**1**	**0.155**	< 0.001	**0.0042**	< 0.001	**0.0082**	**0.0022**	**0.0078**	< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloroform	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.12**	< 0.025	**0.00755**	< 0.005	< 0.005	< 0.005	**0.0057**	< 0.005	**0.0056**	< 0.005	< 0.005	< 0.005
Cis-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.11**	**0.12**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Trans-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	**0.00475**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.001	**0.003**	**0.29**	**0.01**	< 0.001	< 0.001	**3.1**	**1.35**	**0.00145**	**0.008**	< 0.001	**0.0087**	< 0.001	**0.0056**	< 0.001	< 0.001	**0.0017**
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.024**	**0.042**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	**0.00315**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Aug-2008																	
Carbon Tetrachloride	< 0.001	< 0.001	< 0.001	**0.0021**	< 0.001	< 0.001	**0.71**	**0.2**	< 0.001	**0.0042**	< 0.001	**0.0067**	**0.00415**	**0.0052**	< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloroform, total	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.093**	**0.011**	**0.00705**	< 0.005	**0.0052**	< 0.005	**0.0066**	**0.0053**	**0.0051**	< 0.005	< 0.005	< 0.005
Cis-1,2-Dichloroethylene	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	**0.1**	**0.11**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Trans-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.0041**	**0.00415**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	< 0.001	**0.0022**	**0.29**	**0.013**	< 0.001	< 0.001	**2.8**	**1.6**	**0.0014**	**0.007**	< 0.001	**0.0073**	**0.0033**	**0.0051**	< 0.001	< 0.001	**0.0011**
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.025**	**0.0395**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.003**	**0.00295**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

All units mg/L

Values in red represent detectable measurements

Table F-2 (continued)

	PZ1B	PZ1C	PZ2C	PZ2D	PZ3A	PZ3B	PZ32A	PZ32B	POC1A	POC1B	POC2A	POC2B	POC3A	POC3B	SW3	SW4	SW5
Aug-2009																	
Carbon Tetrachloride	< 0.001	< 0.001	< 0.001	**0.0025**	< 0.001	< 0.001	**0.69**	**0.2**	< 0.001	**0.003**	< 0.001	**0.0049**	< 0.001	0.0051	< 0.001	< 0.001	< 0.001
Chlorodibromomethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloroform, total	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.036**	**0.0066**	**0.0062**	< 0.005	< 0.005	< 0.005	**0.0051**	< 0.005	**0.0051**	< 0.005	< 0.005	< 0.005
Cis-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.076**	**0.11**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Trans-1,2-Dichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.0027**	**0.0036**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Tetrachloroethylene	**0.0016**	**0.0027**	**0.43**	**0.0235**	< 0.001	< 0.001	**2.8**	**1.6**	**0.0043**	**0.01**	**0.0013**	**0.0075**	< 0.001	**0.0051**	< 0.001	< 0.001	**0.003**
Trichloroethylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.018**	**0.038**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**0.0021**	**0.002**	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

All units mg/L

Values in red represent detectable measurements

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

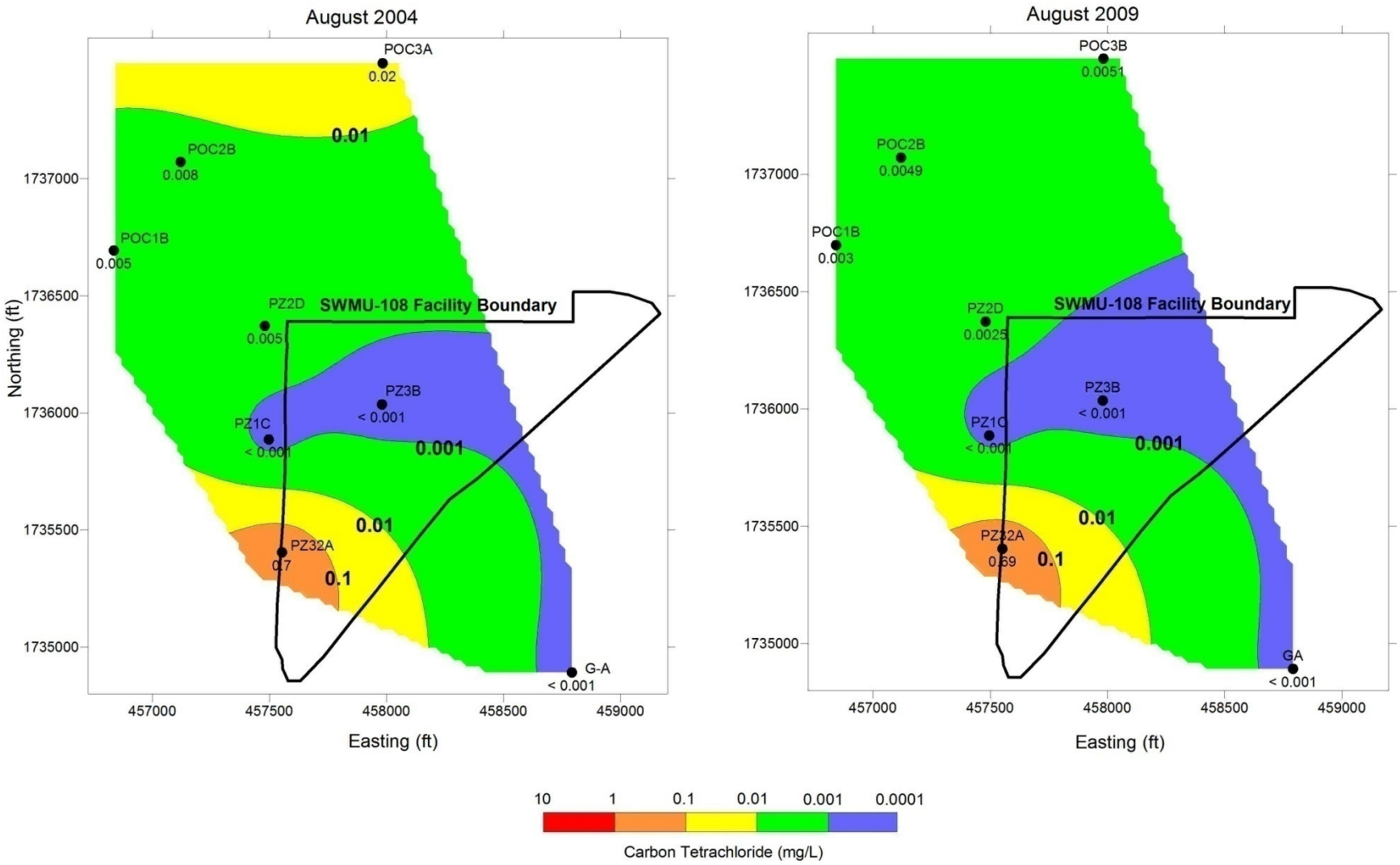

Figure F-1. Carbon Tetrachloride Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

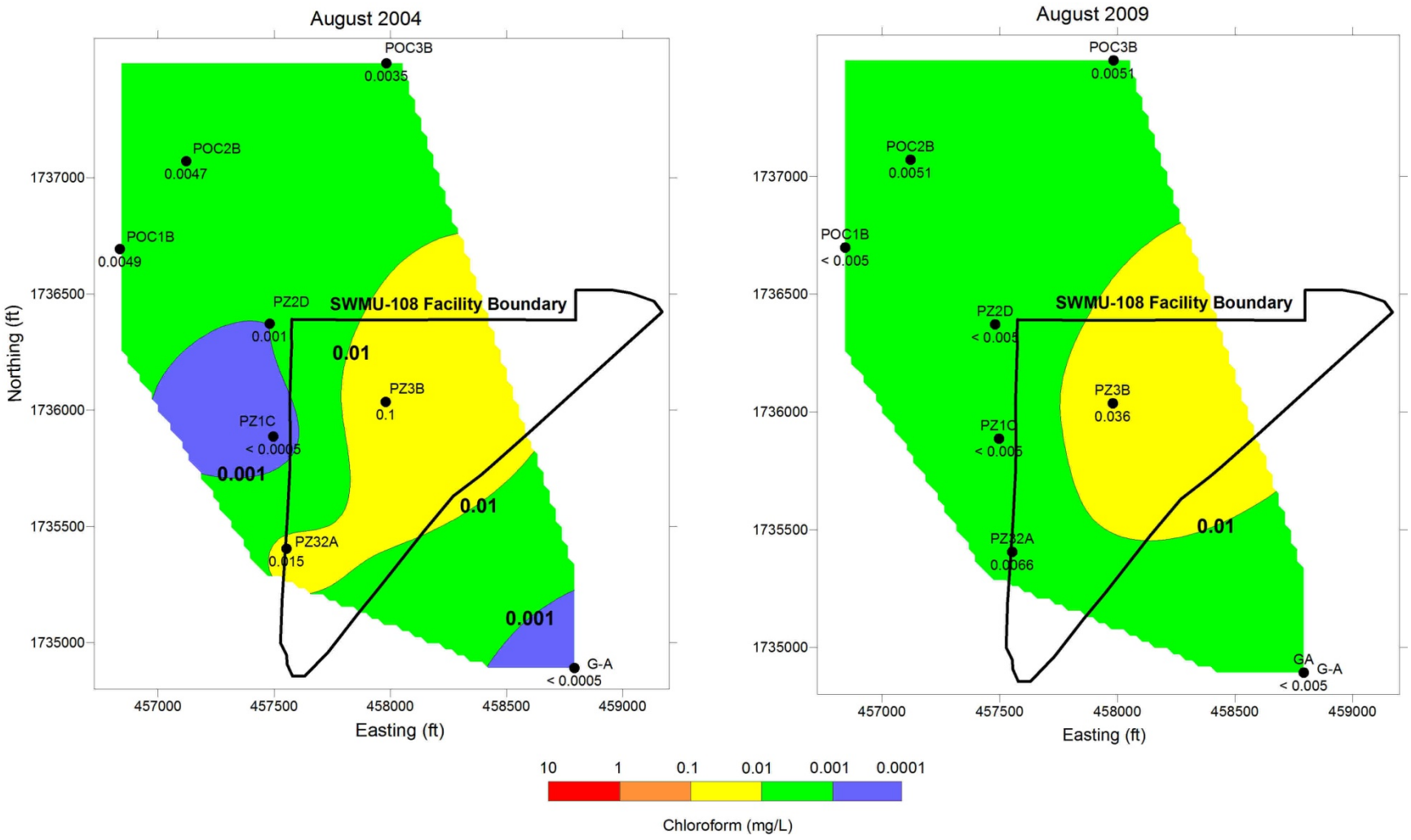

Figure F-2. Chloroform Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

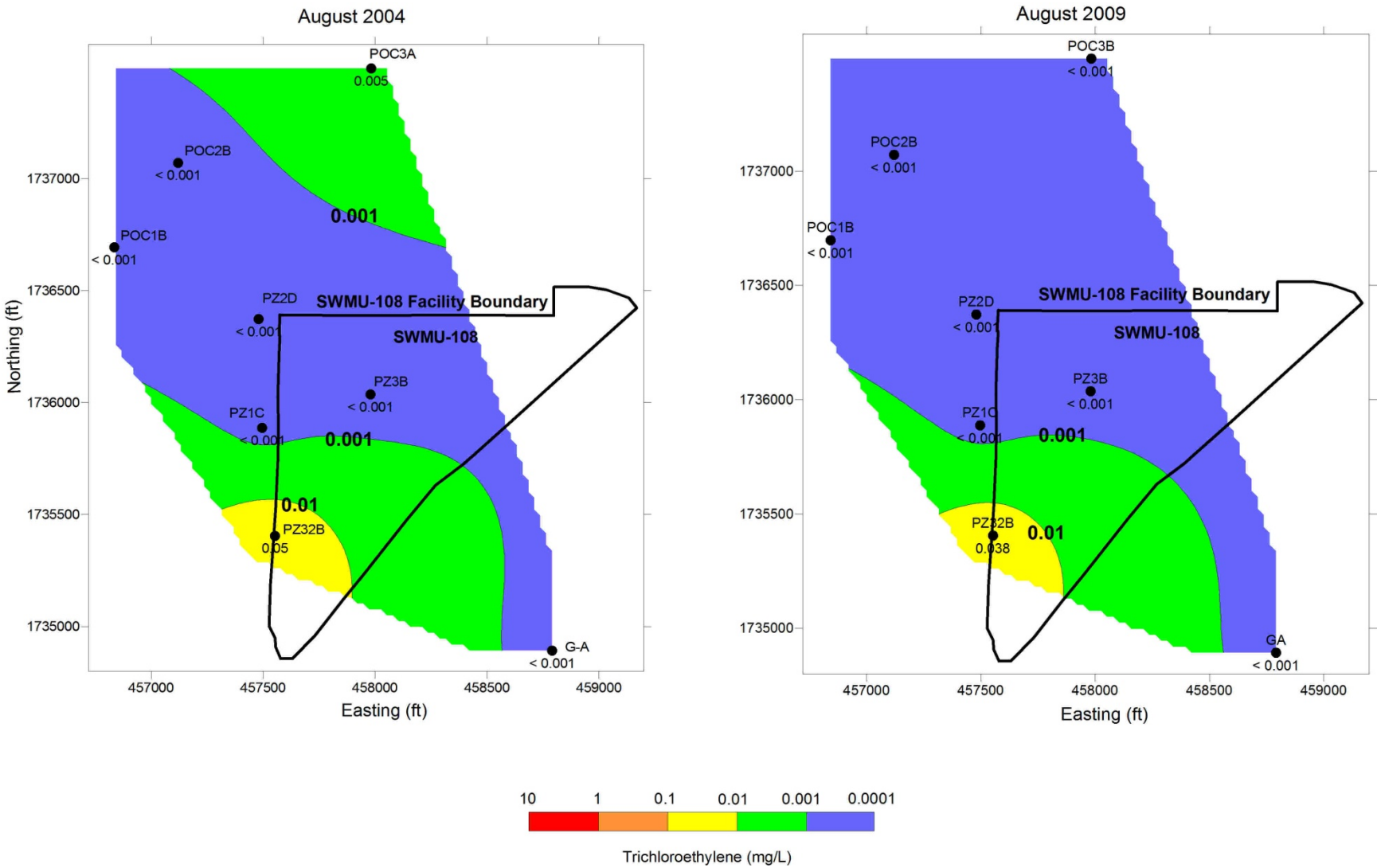

Figure F-3. Trichloroethylene Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

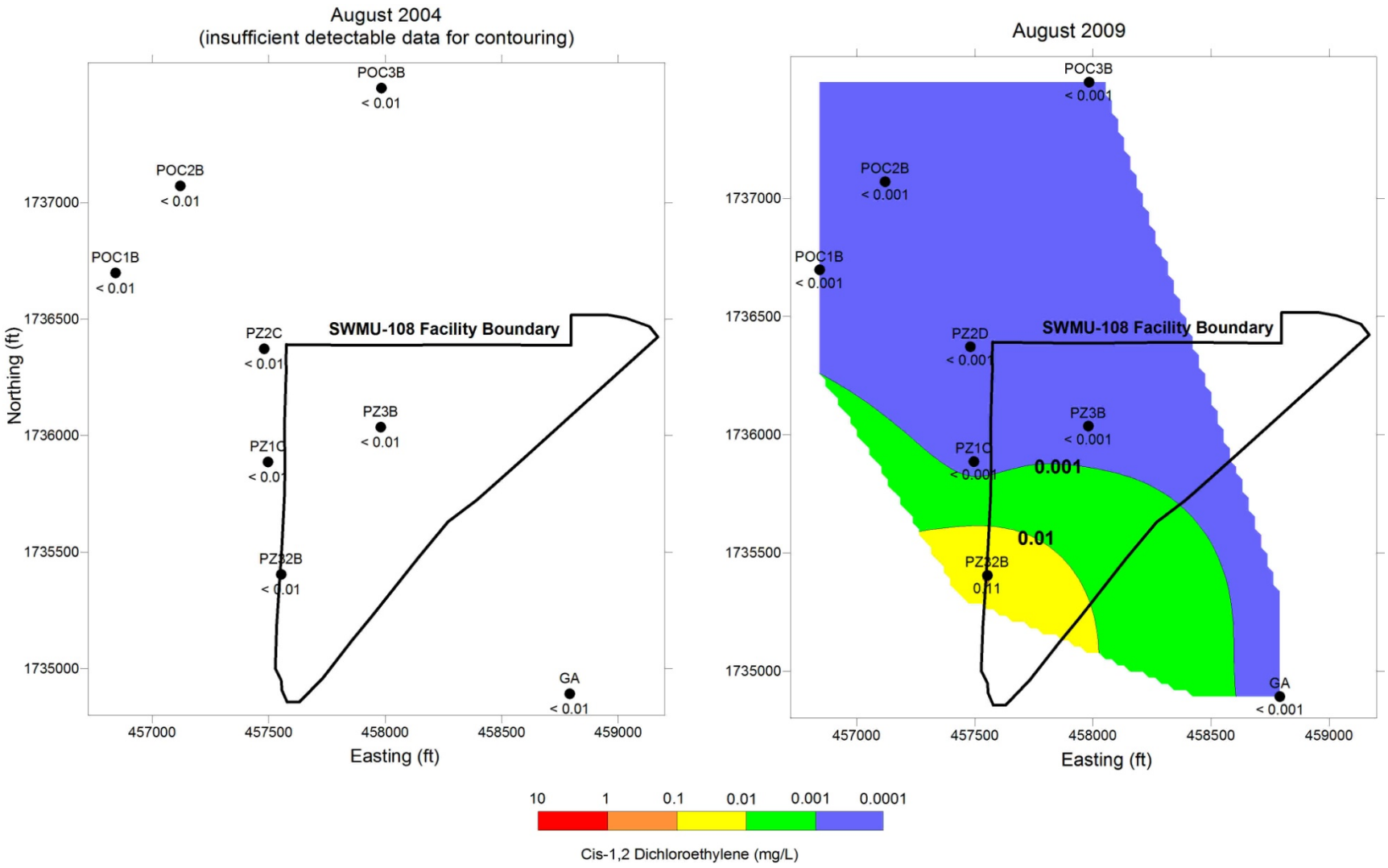

Figure F-4. Cis-1,2 Dichloroethylene Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

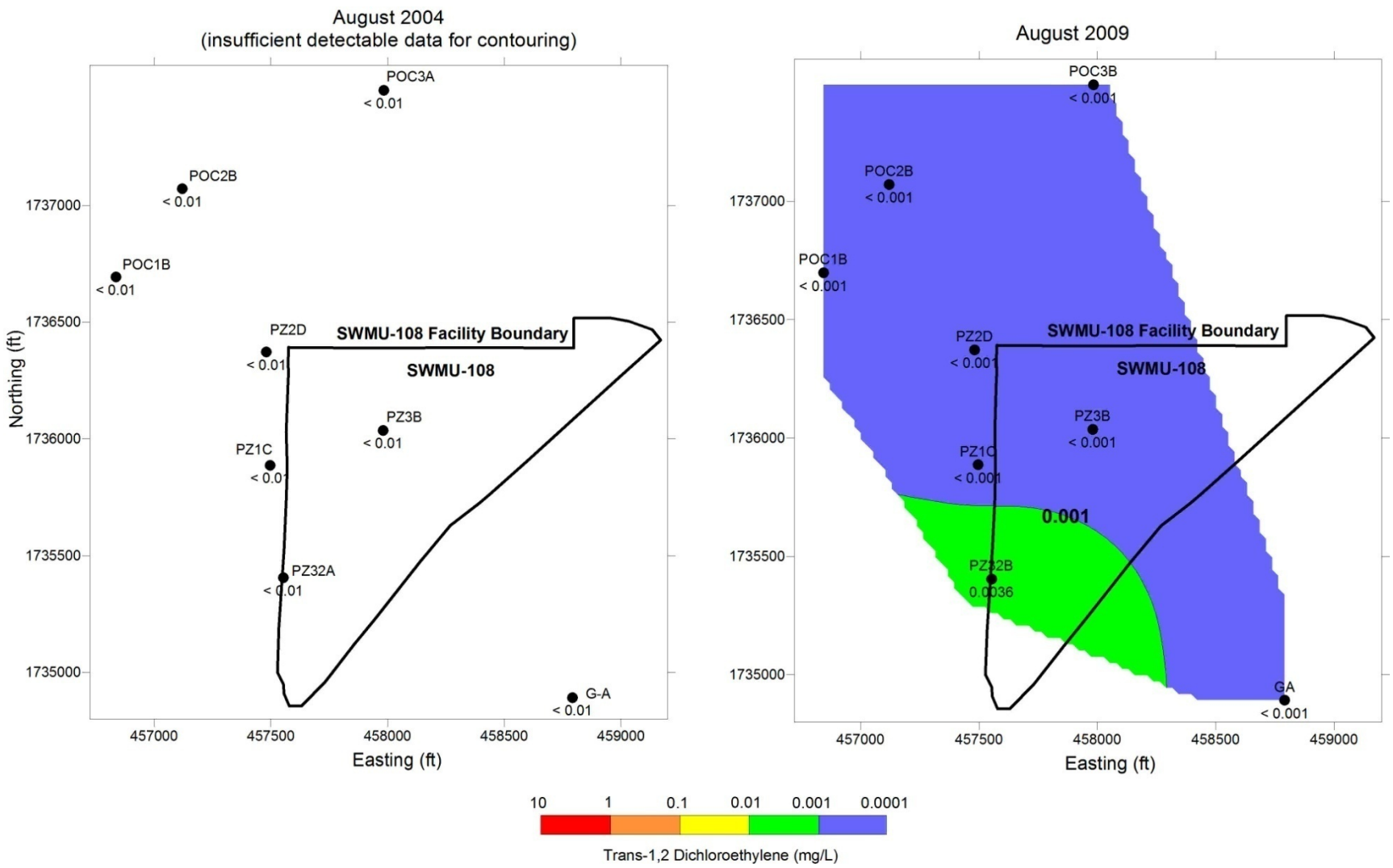

Figure F-5. Trans-1,2 Dichloroethylene Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

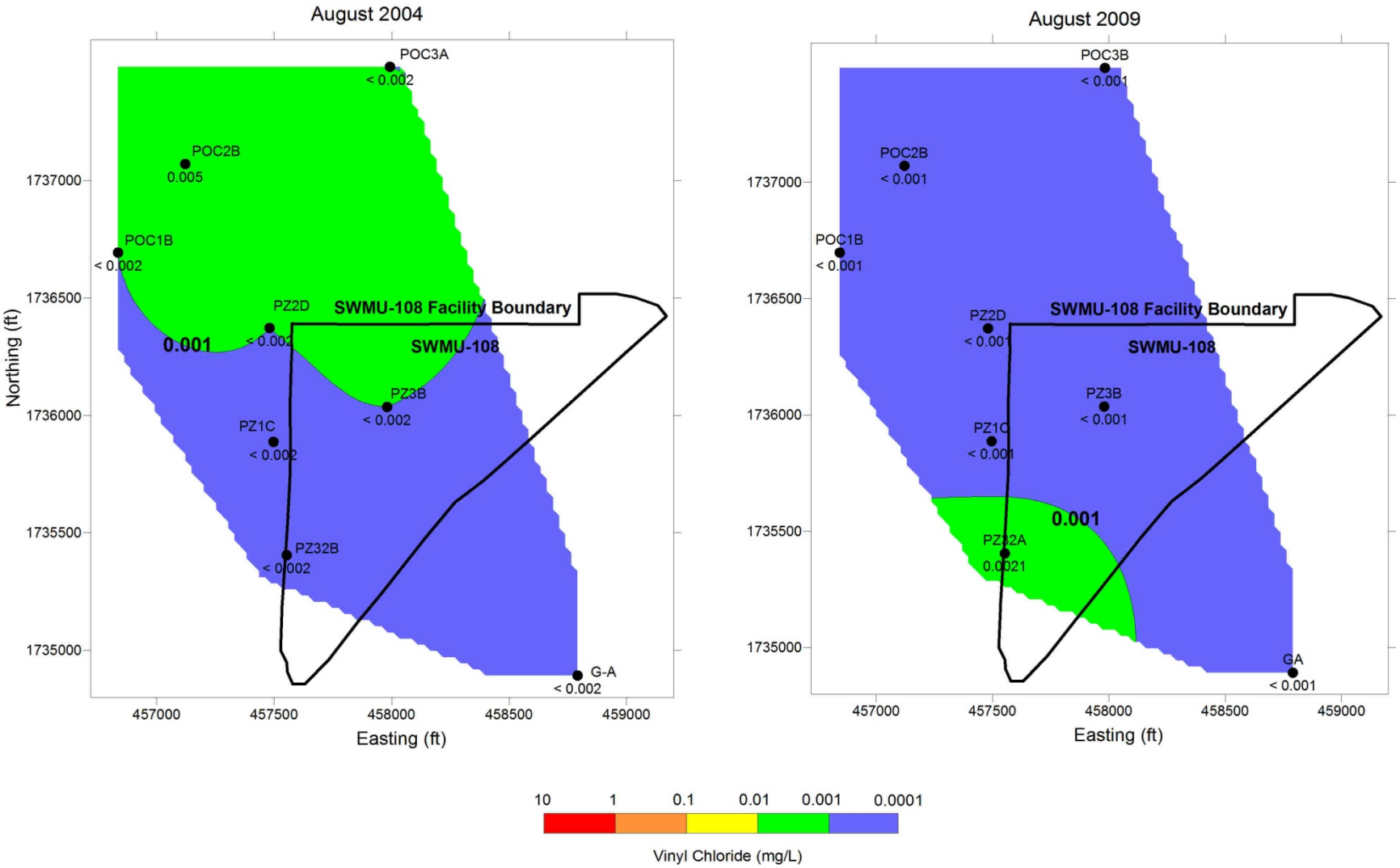

Figure F-6. Vinyl Chloride Concentration Horizontal Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

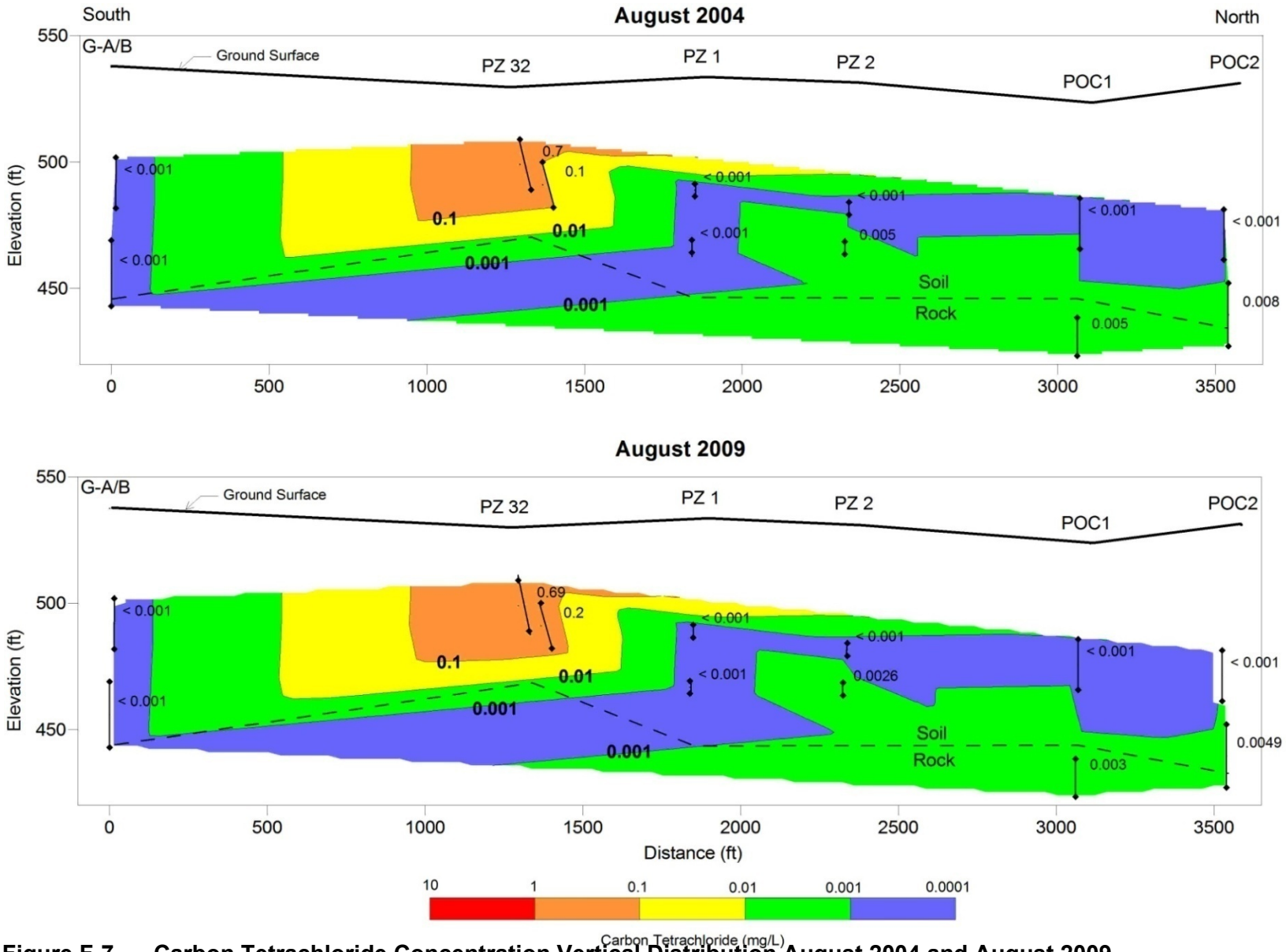

Figure F-7. Carbon Tetrachloride Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

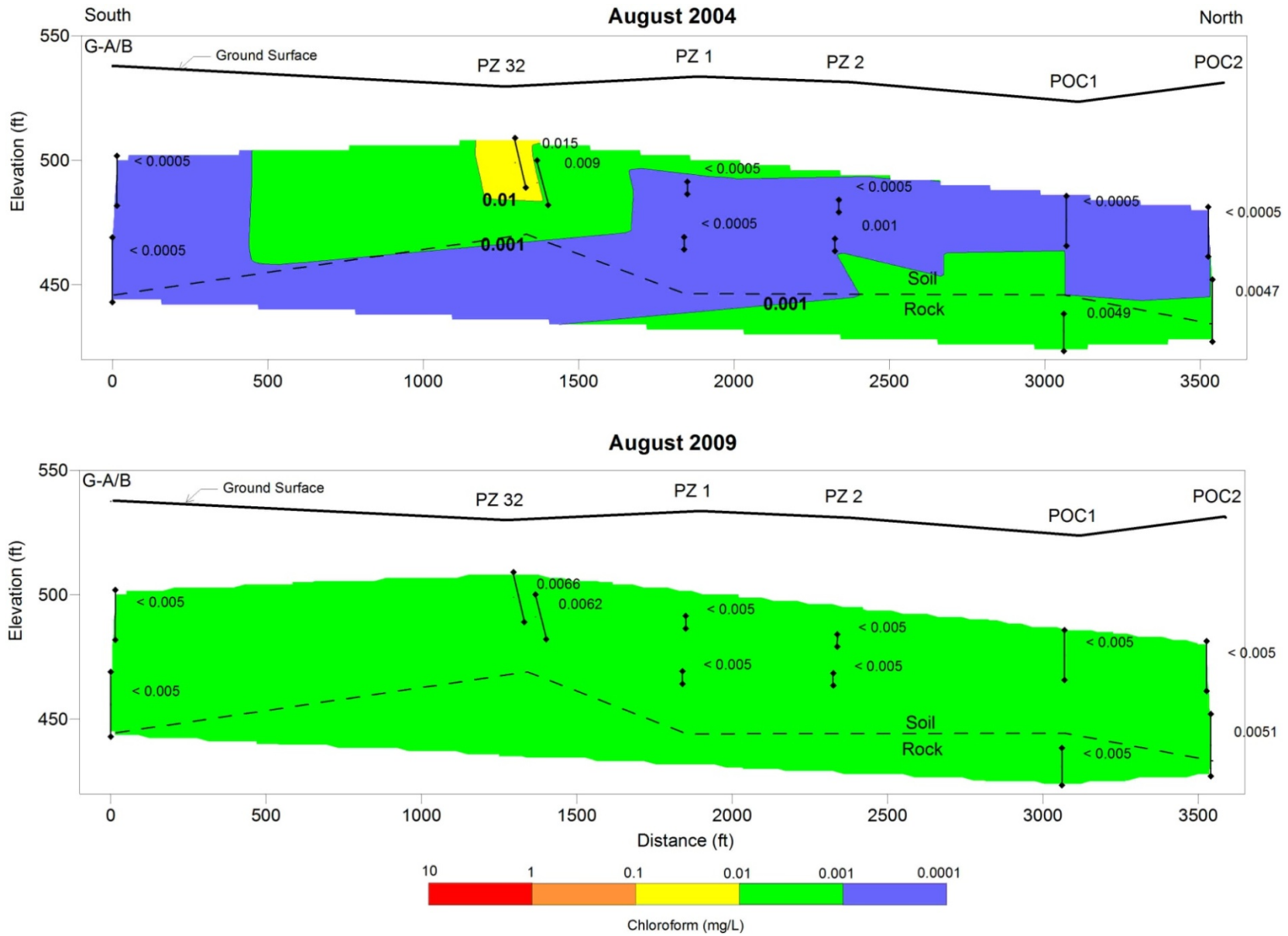

Figure F-8. Chloroform Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

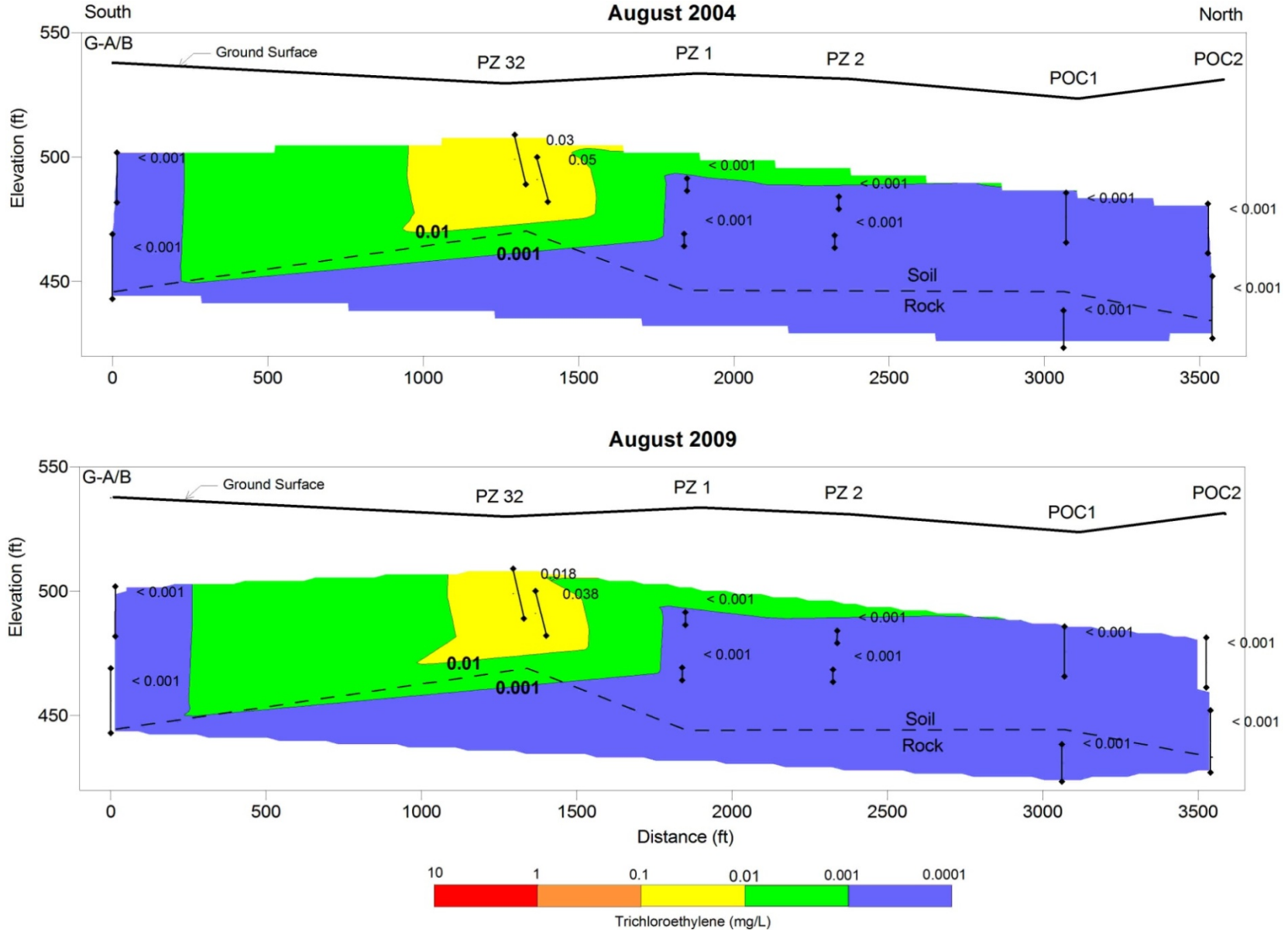

Figure F-9. Trichloroethylene Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

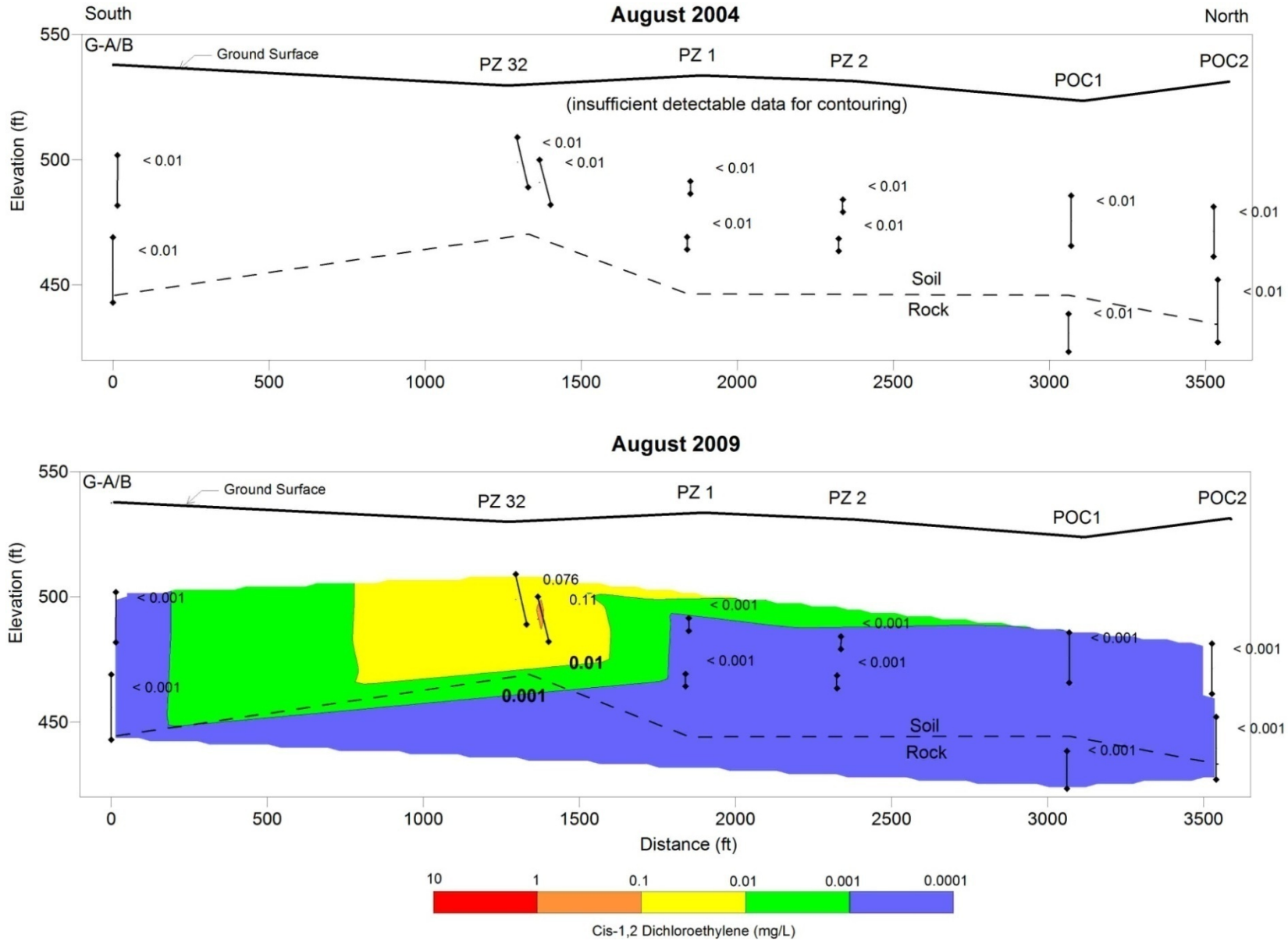

Figure F-10. Cis-1,2 Dichloroethylene Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

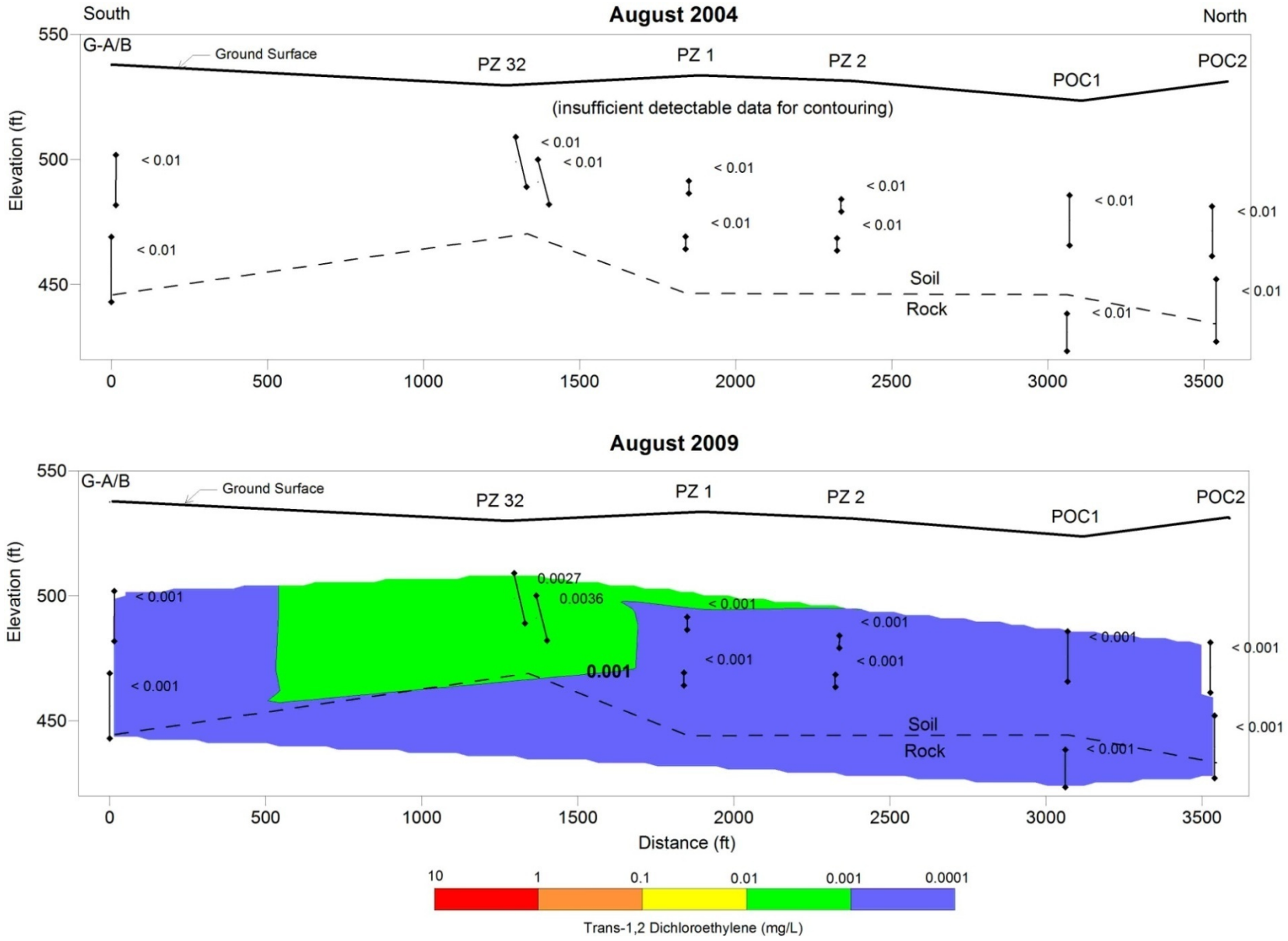

Figure F-11. Trans-1,2 Dichloroethylene Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

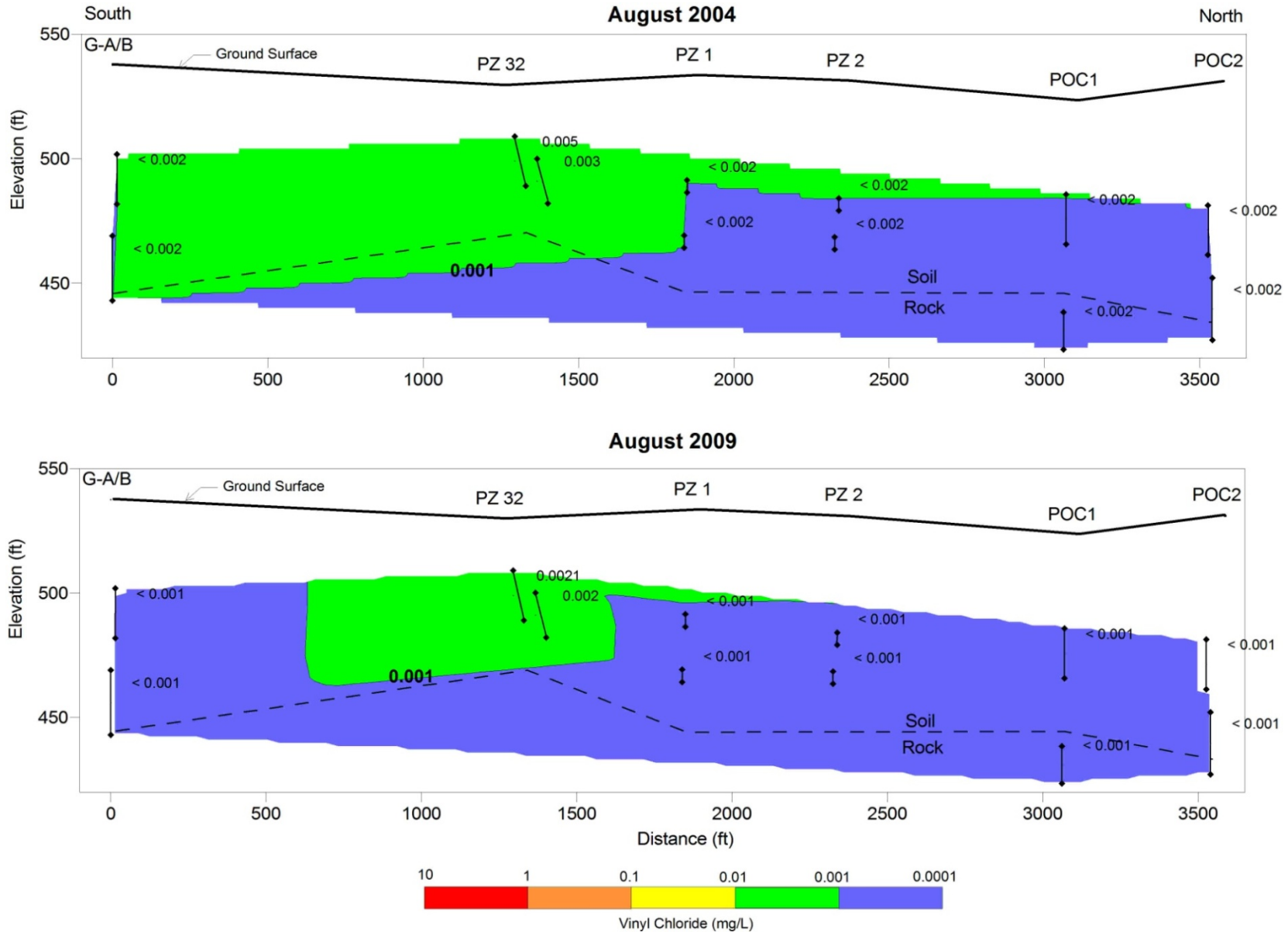

Figure F-12. Vinyl Chloride Concentration Vertical Distribution August 2004 and August 2009

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

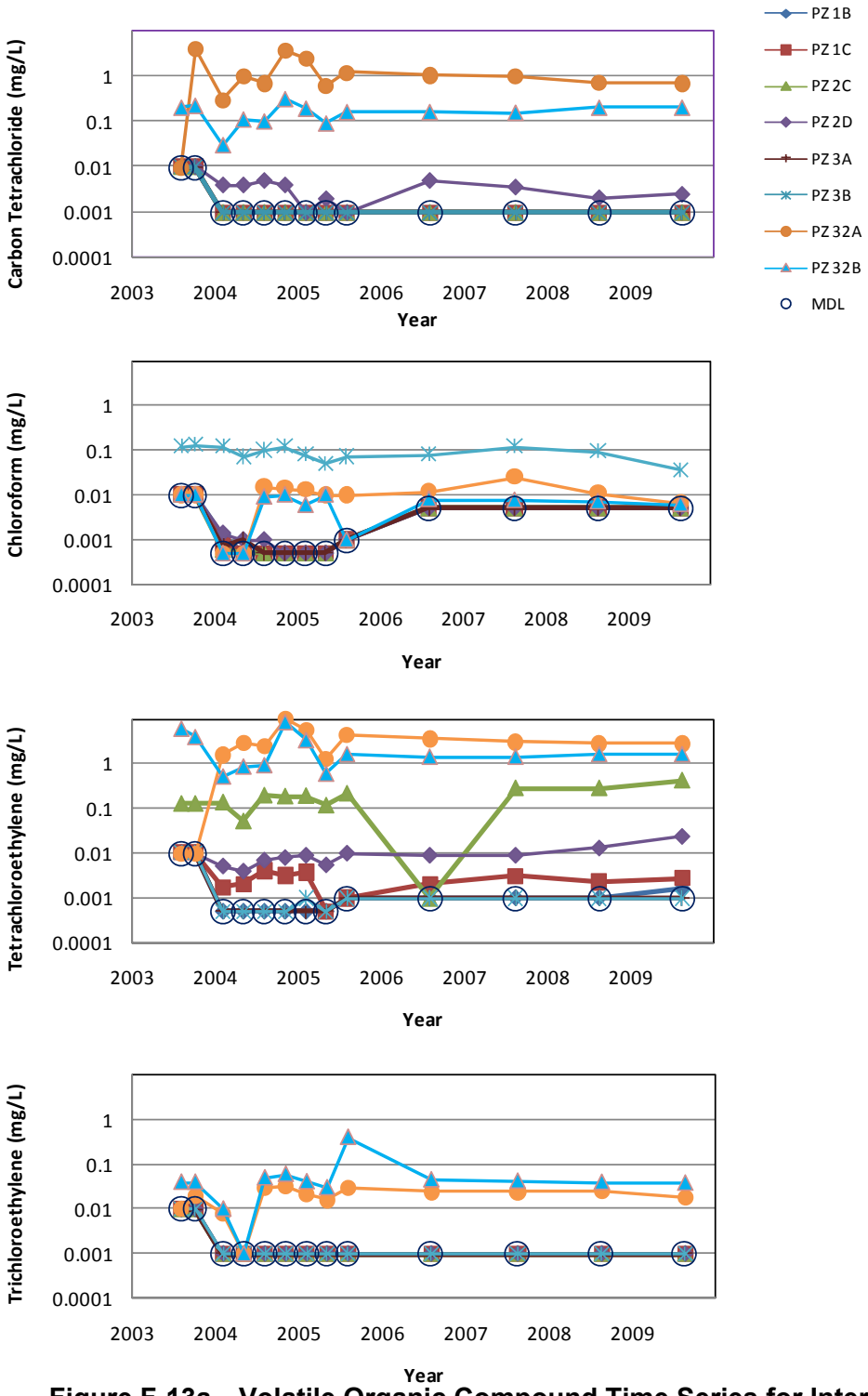

Figure F-13a. Volatile Organic Compound Time Series for Interior Monitoring Wells

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

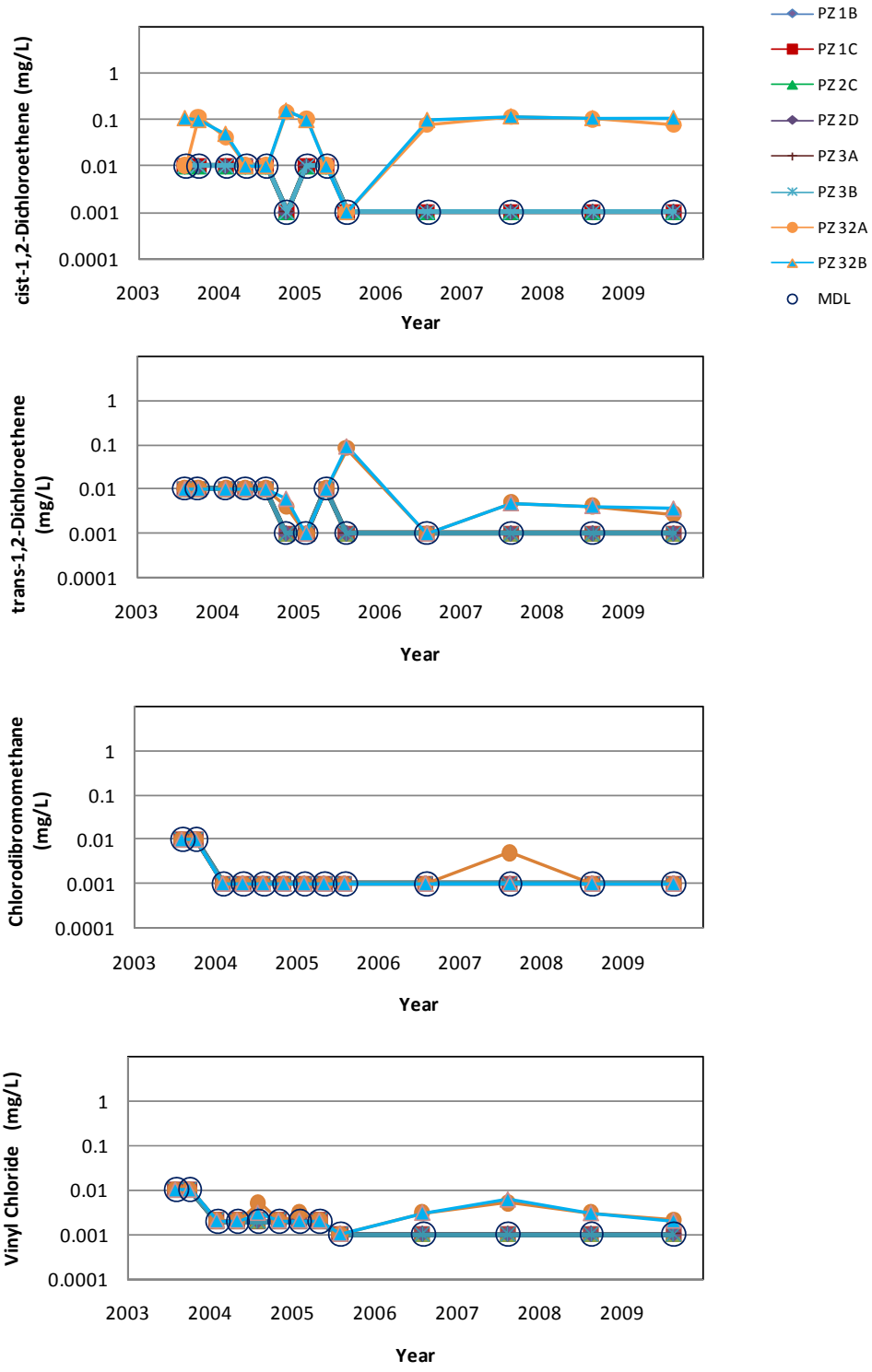

Figure F-13b. Volatile Organic Compound Time Series for Interior Monitoring Wells

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

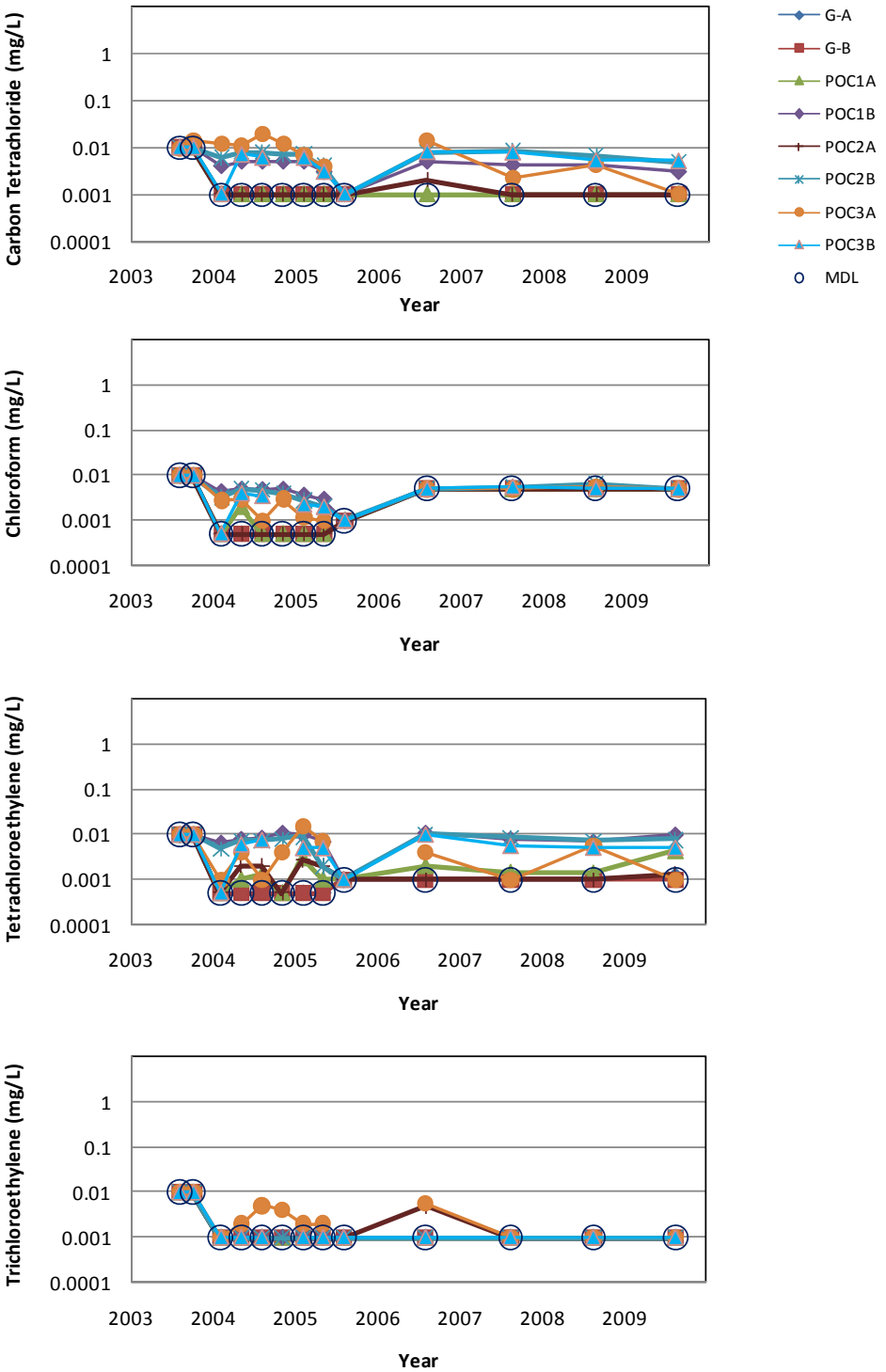

Figure F-14a. Volatile Organic Compound Time Series for Upgradient and Point of Compliance Wells

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

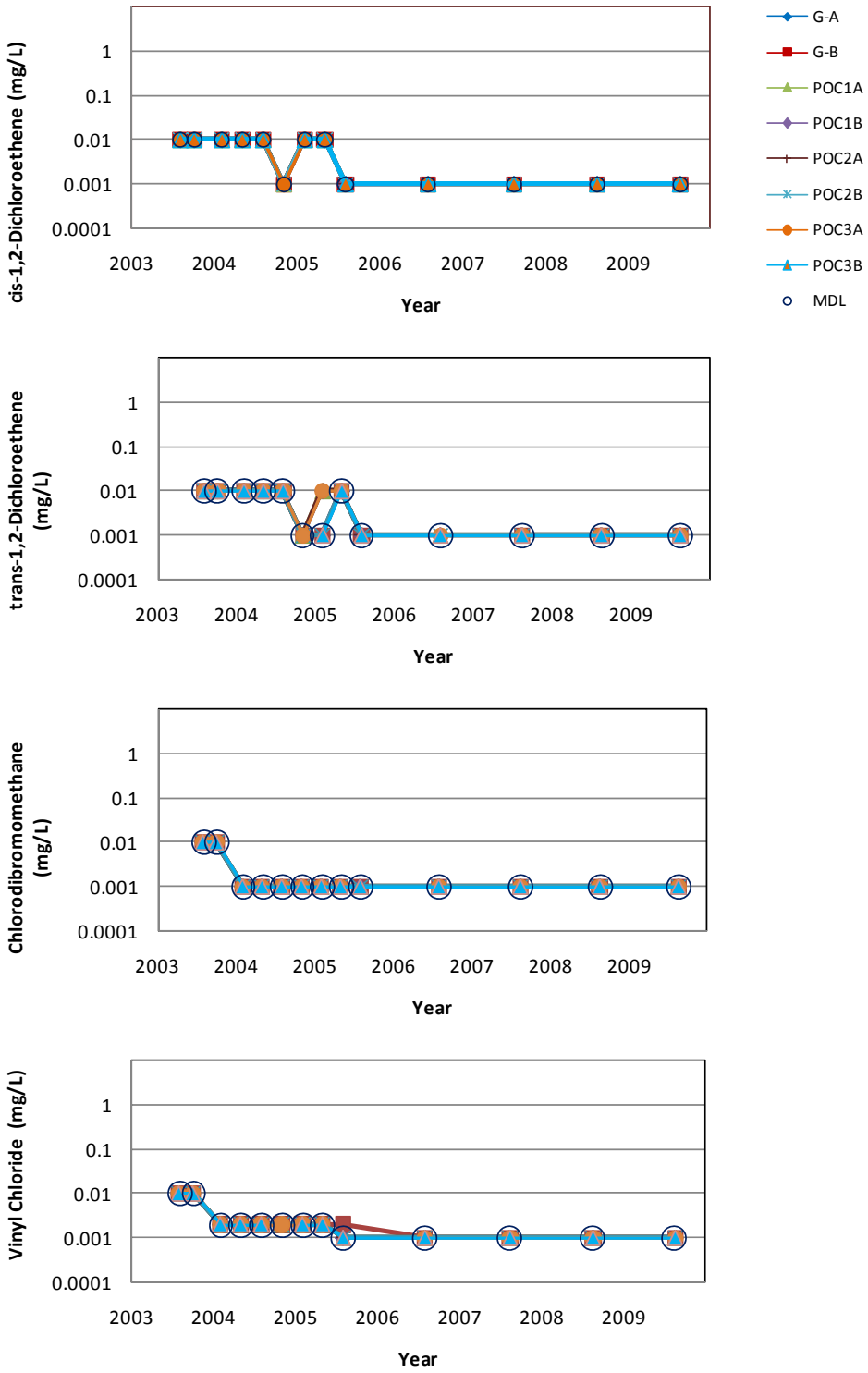

Figure F-14b. Volatile Organic Compound Time Series for Upgradient and Point of Compliance Wells

Source: Tennessee Valley Authority. 2009. *Environmental Research Center Post-Closure 2009 Annual Monitoring Report.* November 2009.

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APPENDIX G – WHITE PHOSPHOROUS SAMPLING FOR SOLID WASTE MANAGEMENT UNIT 104

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Table G-1. White Phosphorus Data for Solid Waste Management Unit 104 and Phosphorus Entombments

Location Identification	Sample Date	Lab Identification	Elemental Phosphorus (µg/L)
POC4A	08/19/2003	05A	<0.1
POC4A	10/15/2003	01A	<0.1
POC4A	10/15/2003	02A-dup	<0.1
POC4A	02/24/2004	UNK_61GW	<0.1
POC4A	05/17/2004	0405026-01A	<0.1
POC4A	11/08/2004	0411006-01A	<0.1
POC4A	02/14/2005	UNK_81GW	<0.1
POC4A	02/14/2005	UNK_81GWD	<0.1
POC4A	05/16/2005	UNK_89GW	<0.1
POC4A	08/16/2005	UNK_95GW	<0.1
POC4A	08/14/2006	0608004-07A	<0.25
POC4A	08/20/2007	070800401A	<0.25
POC4A	08/25/2008	0808001-01	<0.19
POC4A	08/25/2008	0808001-02	<0.19
POC4A	09/15/2009	0809-01	<0.023
POC4A	09/15/2009	0809-02	<0.023
POC4B	08/19/2003	06A	<0.1
POC4B	10/15/2003	03A	<0.1
POC4B	02/24/2004	UNK_62GW	<0.1
POC4B	02/24/2004	UNK_62GWD	<0.1
POC4B	05/17/2004	0405026-02A	<0.1
POC4B	11/08/2004	0411006-02A	<0.1
POC4B	02/14/2005	UNK_82GW	<0.1
POC4B	05/16/2005	UNK_90GW	<0.1
POC4B	08/16/2005	UNK_96GW	<0.1
POC4B	08/14/2006	0608004-08A	<0.25
POC4B	08/20/2007	070800402A	<0.25
POC4B	08/20/2007	070800403A	<0.25
POC4B	08/25/2008	0808001-03	<0.19
POC4B	09/15/2009	0809-03	<0.023
POC5	08/19/2003	01A	<0.1
POC5	10/15/2003	11A	<0.1
POC5	02/24/2004	UNK_9GW	<0.1
POC5	02/24/2004	UNK_9GWD	<0.1
POC5	05/18/2004	0405026-11A	<0.1

Location Identification	Sample Date	Lab Identification	Elemental Phosphorus (µg/L)
POC5	08/30/2004	0408052-01A	<0.1
POC5	08/30/2004	0408052-02A	<0.1
POC5	11/09/2004	0411006-12A	<0.1
POC5	11/09/2004	0411006-13A	<0.1
POC5	02/15/2005	UNK_28GW	<0.1
POC5	05/17/2005	UNK_33GW	<0.1
POC5	05/17/2005	UNK_33GWD	<0.1
POC5	08/16/2005	UNK_36GW	<0.1
POC5	08/16/2005	UNK_36GWD	<0.1
POC5	08/15/2006	0608004-01A	<0.25
POC5	08/15/2006	0608004-02A-DUP	<0.25
POC5	08/21/2007	070800413A	<0.25
POC5	08/25/2008	0808001-13	<0.19
POC5	09/16/2009	0809-12	<0.023
POC5	09/16/2009	0809-13	<0.023
POC6	08/19/2003	02A	<0.1
POC6	10/15/2003	12A	<0.1
POC6	02/24/2004	UNK_10GW	<0.1
POC6	05/17/2004	0405026-10A-DUP	<0.1
POC6	05/18/2004	0405026-09A	<0.1
POC6	08/30/2004	0408052-03A	<0.1
POC6	11/09/2004	0411006-14A	<0.1
POC6	02/15/2005	UNK_29GW	<0.1
POC6	02/15/2005	UNK_29GWD	<0.1
POC6	05/17/2005	UNK_34GW	<0.1
POC6	08/16/2005	UNK_37GW	<0.1
POC6	08/15/2006	0608004-03A	<0.25
POC6	08/21/2007	070800414A	<0.25
POC6	08/21/2007	070800415A	<0.25
POC6	08/25/2008	0808001-14	<0.19
POC6	08/25/2008	0808001-15	<0.19
POC6	09/16/2009	0809-14	<0.023
W23	08/19/2003	09A	<0.1
W23	10/15/2003	05A	<0.1
W23	02/24/2004	UNK_64GW	<0.1
W23	05/17/2004	0405026-05A	<0.1
W23	11/08/2004	0411006-03A	<0.1
W23	02/14/2005	UNK_83GW	<0.1

Location Identification	Sample Date	Lab Identification	Elemental Phosphorus (µg/L)
W23	05/16/2005	UNK_91GW	<0.1
W23	08/16/2005	UNK_99GW	<0.1
W23	08/14/2006	0608004-12A	<0.25
W23	08/14/2006	0608004-13A-DUP	<0.25
W23	08/21/2007	070800407A	<0.25
W23	08/25/2008	0808001-07	<0.19
W23	09/15/2009	0809-07	<0.023
W24	08/19/2003	08A	<0.1
W24	10/15/2003	04A	<0.1
W24	02/24/2004	UNK_63GW	<0.1
W24	05/17/2004	0405026-03A	<0.1
W24	05/17/2004	0405026-04A-DUP	<0.1
W24	11/08/2004	0411006-04A	<0.1
W24	02/14/2005	UNK_84GW	<0.1
W24	05/16/2005	UNK_92GW	<0.1
W24	08/16/2005	UNK_100GW	<0.1
W24	08/14/2006	0608004-14A	<0.25
W24	08/20/2007	070800408A	<0.25
W24	08/25/2008	0808001-08	<0.19
W24	09/15/2009	0809-08	<0.023
W25A	08/19/2003	07A	<0.1
W25A	10/15/2003	06A	<0.1
W25A	02/24/2004	UNK_65GW	<0.1
W25A	05/17/2004	0405026-08A	<0.1
W25A	11/08/2004	0411006-05A	<0.1
W25A	11/08/2004	0411006-06A	<0.1
W25A	02/14/2005	UNK_87GW	<0.1
W25A	05/16/2005	UNK_93GW	<0.1
W25A	05/16/2005	UNK_93GWB	<0.1
W25A	08/16/2005	UNK_101GW	<0.1
W25A	08/16/2005	UNK_101GWD	<0.1
W25A	08/14/2006	0608004-15A	<0.25
W25A	08/20/2007	070800409A	<0.25
W25A	08/25/2008	0808001-09	<0.19
W25A	09/15/2009	0809-09	<0.023

µg/L = Micrograms per liter

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APPENDIX H – MONITORING RESULTS FOR SOLID WASTE MANAGEMENT UNIT 112

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Table H-1. Solid Waste Management Unit 112 Summary of Resource Conservation and Recovery Act Action Limit Exceptions for Metals in April 1997 Groundwater Samples

Sample Type	Analyte	Number of Samples	Number of Detects	Analytical Concentration		Sample Mean	Action Level	Number Above Action Level
				Minimum	Maximum			
Well 36 Groundwater[d]	Lead	2	0	< 0.001	< 0.001	< 0.001	0.015	0
	Phosphorus	1	0	< MDL	< MDL	< MDL	0.00073	0
	Tin	2	0	< 0.002	< 0.002	< 0.002	0.002	0
Well 37 Groundwater[d]	Lead	4	0	< 0.001	< 0.001	< 0.001	0.015	0
	Phosphorus	2	0	< MDL	< MDL	< MDL	0.00073	0
	Tin	4	0	< 0.002	< 0.002	< 0.002	0.002	0
Well 38 Groundwater[d]	Lead	2	1	0.001	0.34	0.1705	0.015	1
	Phosphorus	1	0	< MDL	< MDL	< MDL	0.00073	0
	Tin	2	1	< 0.002	0.004	0.003	0.002	1

Adapted from: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

MDL = Method detection limit

Table H-2. Summary of Radionuclide Analytical Results

Well #	Parameter	Units	LLD[1]	PRG[2]	Result
36	Uranium (U) Total	pCi/L	0.7	0.5870	<0.7
36	Uranium (U) Total	μg/L	1.0		<1.0
36	Lead-210, LLD Total	pCi/L		0.0705	1.9
36	Polonium-210, LLD Total	pCi/L		0.1461	1.3
36	Potassium-40, activity Total	pCi/L		3.8095	1.4
36	Radon-222 Total	pCi/L			1790
36	TOTAL RADIUM ACTIVITY Total	pCi/L		0.1609	3.4
36	Gross alpha Total	pCi/L			4.2
36	Gross beta Total	pCi/L			2.4
37	Uranium (U) Total	pCi/L	0.7	0.5870	73.1
37	Uranium (U) Total	μg/L	1.0		106
37	Lead-210, LLD Total	pCi/L		0.0705	1.9
37	Polonium-210, LLD Total	pCi/L		0.1461	2.4
37	Potassium-40, activity Total	pCi/L		3.8095	51.0
37	Radon-222 Total	pCi/L			2130
37	TOTAL RADIUM ACTIVITY Total	pCi/L		0.1609	8.1
37	Gross alpha Total	pCi/L			37.0
37	Gross beta Total	pCi/L			104
37 DUP[3]	Uranium (U) Total	pCi/L	0.7	0.5870	77.5
37 DUP	Uranium (U) Total	μg/L	1.0		112
37 DUP	Lead-210, LLD Total	pCi/L		0.0705	1.9
37 DUP	Polonium-210, LLD Total	pCi/L		0.1461	2.1
37 DUP	Potassium-40, activity Total	pCi/L		3.8095	50.0
37 DUP	Radon-222 Total	pCi/L			2490
37 DUP	TOTAL RADIUM ACTIVITY Total	pCi/L		0.1609	8.5
37 DUP	Gross alpha Total	pCi/L			37.9
37 DUP	Gross beta Total	pCi/L			91.5
38	Uranium (U) Total	pCi/L	0.7	0.5870	2.1
38	Uranium (U) Total	μg/L	1.0		3.1
38	Lead-210 Total	pCi/L		0.0705	2.7
38	Polonium-210, LLD Total	pCi/L		0.1461	2.5
38	Potassium-40, activity Total	pCi/L		3.8095	26.0
38	Radon-222 Total	pCi/L			1060
38	TOTAL RADIUM ACTIVITY Total	pCi/L		0.1609	38.2
38	Gross alpha Total	pCi/L			1790
38	Gross beta Total	pCi/L			877

Adapted from: Tennessee Valley Authority. 1998. *TVA Environmental Research Center, RCRA Facility Investigation Final Report, EPA ID No. AL3-6i40-090-004.* Muscle Shoals, Ala.: Tennessee Valey Authority, Environmental Research Center, May 1998.

Abbreviations: μg/L = Micrograms per liter pCi/L = Pico-curies per liter

[1]LLD = Lower limit of detection

[2]PRG = Preliminary remedial goal

[3]Duplicate sample from Well 37

APPENDIX I – SAMPLING RESULTS FOR SOLID WASTE MANAGEMENT UNIT 114 PHOSPHATE SLAG STORAGE AREA

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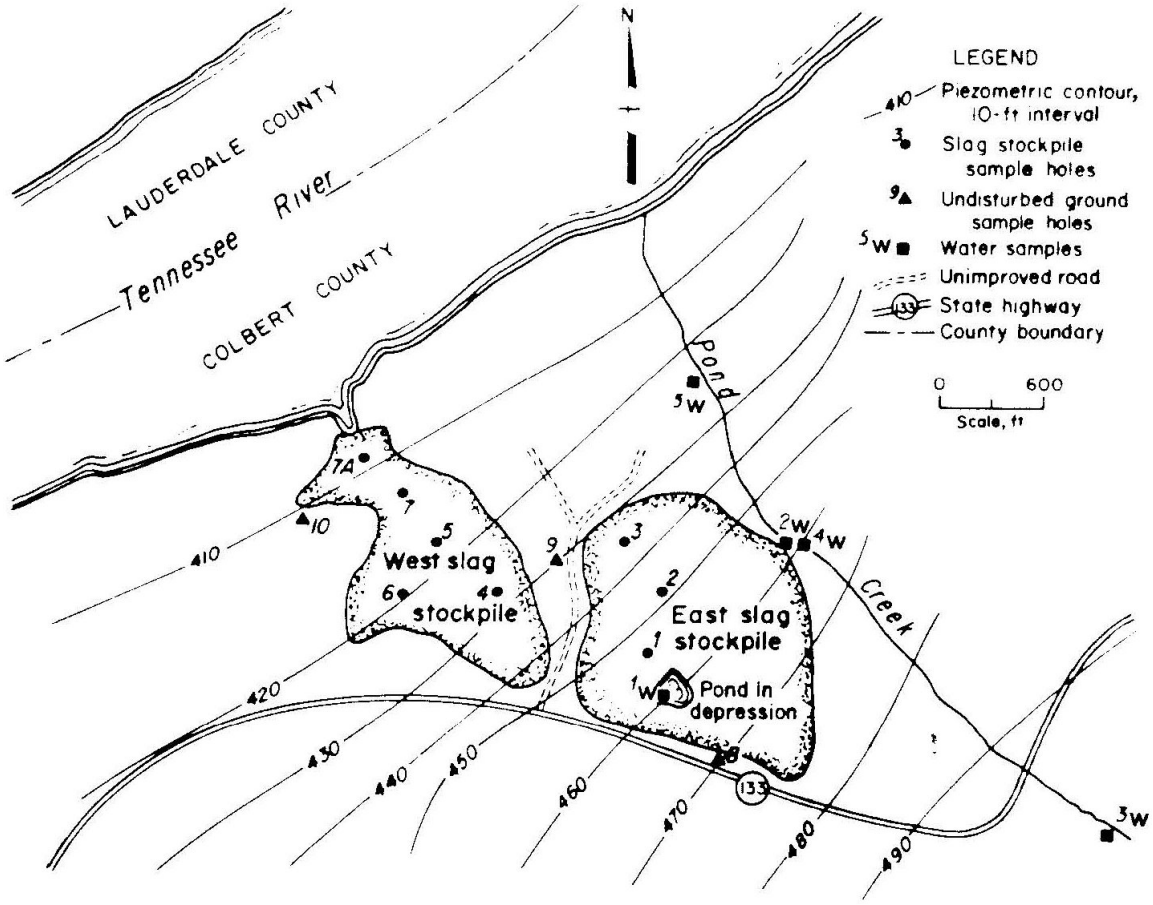

Figure I-1. Solid Waste Management Unit 114 Phosphate Slag Storage Area Groundwater Potentiometric Map and Sampling Locations

Source: May, A., and J. R. Boyle. 1990. *Assessment of Ra226 and Toxic Element Distribution at Tennessee Valley Authority Phosphate Slag Stockpiles, Muscle Shoals, Alabama.* U.S. Burear of Mines Report of Investigations 9288.

Table I-1. Water Analyses in Milligrams per Liter

Parameter	Sampling Location					
	1W	2W	3W	4W	5W	S
Silver	<0.050	<0.050	<0.050	<0.050	<0.050	0.05
Arsenic	<.005	<.005	<.005	<.005	<.005	.05
Barium	<.010	.170	.020	.030	.040	1
Cadmium	<.004	.010	<.004	<.004	<.004	.010
Chromium	<.040	[1].060	<.040	<.040	<.040	.05
Mercury	[1].004	[1].006	.001	[1].004	.001	.002
Lead	<.010	.010	<.010	<.010	<.010	.05
Selenium	.001	.001	<.001	<.001	<.001	.01
Bicarbonate, as $CaCO_3$	8	0	139	100	62	NA
Carbonate, as $CaCO_3$	0	0	0	0	7	NA
Chloride	1	1	47	35	33	NA
Fluoride	[1]31	[1]11	1	1	1	4.0
Hardness, as $CaCO_3$	93	430	74	78	130	NA
Sulfate	13	45	13	27	25	NA
pH	6.2	3.7	8.0	8.3	9.1	NA
Adapted from May and Boyle 1990						
NA Not applicable						
1W Depression pond in east slag stockpile						
2W Seepage from east slag stockpile						
3W Pond Creek, upstream from east slag stockpile						
4W Pond Creek, at east slag stockpile						
5W Pond Creek, downstream from east slag stockpile						
S Primary drinking water standards (8). For noncompliance with these standards, the maximum contaminant levels must be exceeded, rounded 10 the digits indicated.						
[1]Noncompliance with primary drinking water standards						

APPENDIX J – GEOLOGICAL SURVEY OF ALABAMA AND ALABAMA OFFICE OF WATER RESOURCES DATA

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Table J-1. Geological Survey of Alabama Data

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
Lucky Minnow Farm	G	3S	11W	33	ND	Sheffield	200	ND	C	1955	<50	yes
Lucky Minnow Farm	G	3S	11W	33	ND	Sheffield	215	ND	C	1955	>50	yes
Lucky Minnow Farm	G	3S	11W	33	ND	Sheffield	200	ND	C	1955	>50	yes
(unknown)	G	3S	11W	28	ND	ND	155	ND	Ind	ND	>50	yes
(unknown)	G	3S	11W	33	ND	Sheffield	150	ND	Ind	ND	>50	yes
Charlie Brown	G	3S	11W	35	Crestview Dr.	Muscle Shoals	85	ND	Irr	1992	>50	yes
Janice Anderson	G	3S	11W	36	2203 Lisa	Muscle Shoals	120	ND	Irr	2003	>50	yes
Noel Counce	G	3S	11W	36	2202 John Ave.	Muscle Shoals	103	ND	Irr	2002	>50	yes
Human Shoals Hospital	G	3S	11W	34	Woodward Ave.	Muscle Shoals	150	ND	P	1990	<50	yes
Sam Alexander	G	3S	11W	29	ND	Sheffield	100	ND	P	1988	<50	no
Ala-Tenn Nat. Gas	H	3S	10W	32	ND	Muscle Shoals	153	ND	Ind	1956	>50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	ND	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	ND	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	Fort Payne	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	ND	Ind	1952	>50	yes

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	Fort Payne	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	Fort Payne	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	Listerhill	250	Fort Payne	Ind	1952	<50	yes
Reynolds Alloys Co.	H	3S	10W	28	ND	ND	250	ND	Ind	1954	<50	yes
Tony Gargis	H	3S	10W	32	Route 3	Leighton	200	ND	Irr	1992	<50	yes
Bonnie Burgess, Jr.	H	3S	10W	22	Route 1	Sheffield	80	ND	P	1974	>50	yes
Bonnie C. Burgess	H	3S	10W	22	Route 1	Sheffield	100	ND	P	1973	>50	yes
D. N. White	H	3S	10W	16	Route 1	Sheffield	75	ND	P	1975	<50	yes
Dr. Tray B. Bohannon	H	3S	10W	9	ND	Sheffield	80	ND	P	1975	<50	yes
Mike Askew	H	3S	10W	16	Route 1	Sheffield	100	ND	P	1975	>50	yes
Paul Adkins	H	3S	10W	14	Route 1	Sheffield	80	ND	P	1975	>50	yes
Paul Osborn	H	3S	10W	26	Route 1	Sheffield	75	ND	P	1973	>50	yes
Terrel Copeland	H	3S	10W	23	Route 1	Sheffield	100	ND	P	1974	<50	yes
Woodrow C. Craft	H	3S	10W	35	Route 1	Sheffield	75	ND	P	1973	>50	yes
(unknown)	H	3S	10W	11	P.O. Box 752	Sheffield	100	ND	P	1975	>50	no
C. Streit	H	3S	10W	13	Route 1	Sheffield	90	ND	P	1975	>50	no
E. D. Milton	H	3S	10W	11	513 Highland Circle	Florence	100	ND	P	1974	<50	no
George Jones	H	3S	10W	2	Route 1	Sheffield	75	ND	P	1975	<50	no

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
George R. & Eva L. Renegar	H	3S	10W	11	1500 Pinehurst Blvd.	Sheffield	75	ND	P	1975	<50	no
Joe Davis	H	3S	10W	11	911 Buena Vista	Muscle Shoals	80	ND	P	1975	<50	no
Katherine Miller	H	3S	10W	36	Route 2	Sheffield	110	ND	P	1975	<50	no
Kenneth Johns	H	3S	10W	1	Route 1, Box 121A	Sheffield	100	ND	P	1975	<50	no
Emmett Ricks	L	4S	10W	4	Route 1	Leighton	80	ND	P	1974	<50	yes
Royal Homes	L	4S	10W	23	201 East Reader St.	Florence	100	ND	C	1974	<50	no
A. L. Keenum	L	4S	10W	19	3 Mile Lane	Tuscumbia	77	ND	Irr	1955	>50	no
(unknown)	L	4S	10W	35	ND	Leighton	ND	ND	ND	1992	>50	no
Bill Kimbrough	L	4S	10W	28	Route 2	Leighton	150	ND	P	1974	<50	no
Curtis Campbell	L	4S	10W	33	ND	Leighton	70	ND	P	1973	<50	no
E. D. Ford	L	4S	10W	34	Route 2	Leighton	150	ND	P	1976	>50	no
Jimmy Stanley	L	4S	10W	33	Route 2	Leighton	50	ND	P	1973	<50	no
Larry Kimsey	L	4S	10W	21	Route 4	Tuscumbia	100	ND	P	1977	<50	no
Nolan Moore	L	4S	10W	28	607 E. Third Street	Tuscumbia	175	ND	P	1975	>50	no
Oneal Sockwell	L	4S	10W	28	Route 2	Leighton	100	ND	P	1974	>50	no
Sammie Dennis	L	4S	10W	21	Route 4	Tuscumbia	100	ND	P	1973	<50	no
Robins Mfg. Co.	M	4S	11W	3	ND	Tuscumbia	105	ND	C	ND	<50	yes

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
Robins Rubber	M	4S	11W	3	ND	Muscle Shoals	ND	ND	C	1956	<50	yes
Tuscumbia Ice Co.	M	4S	11W	8	ND	Tuscumbia	66	ND	C	1955	<50	yes
Robbins Tile Mfg. Co.	M	4S	11W	3	ND	Tuscumbia	189	ND	Ind	1955	<50	yes
Robbins Tile Mfg. Co.	M	4S	11W	3	ND	Tuscumbia	89	ND	Ind	1955	<50	yes
Robbins Tile Mfg. Co.	M	4S	11W	3	ND	Tuscumbia	181	ND	Ind	1955	<50	yes
Fennel Farm	M	4S	11W	13	Route 3	Glendale	200	ND	Irr	1992	<50	yes
Gary Mansell	M	4S	11W	12	6 St.	Muscle Shoals	130	ND	Irr	2003	<50	yes
Jack B. Underwood	M	4S	11W	15	1809 Maclin Drive	Tuscumbia	100	ND	Irr	1990	>50	yes
Louis Garner	M	4S	11W	8	101 Inglewood Dr.	Tuscumbia	100	ND	Irr	2009	<50	yes
Al Wilhite	M	4S	11W	15	Route 1	Tuscumbia	125	ND	P	1975	>50	yes
Bradley Blackburn	M	4S	11W	13	ND	ND	90	ND	P	1975	>50	yes
Carlton Graves	M	4S	11W	13	Route 3	Tuscumbia	100	ND	P	1978	>50	yes
Charles J. King	M	4S	11W	13	603 E. Ford Ave.	Muscle Shoals	100	ND	P	1975	>50	yes
Earnest Bechard	M	4S	11W	8	ND	Richmond Hills	100	ND	P	1990	<50	yes
Gene Crump	M	4S	11W	11	1002 Benjamhan Court	Muscle Shoals	120	ND	P	1995	<50	yes
Hugh W. Pritchitt	M	4S	11W	10	1119 Hildendale Dr.	Tuscumbia	100	ND	P	1978	<50	yes

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
Joe Whitfield	M	4S	11W	3	Route 3	Tuscumbia	100	ND	P	1976	<50	yes
John Dutton	M	4S	11W	11	1003 Benjamhan Court	Muscle Shoals	120	ND	P	1995	<50	yes
John Dutton	M	4S	11W	11	1003 Benjamhan Court	Muscle Shoals	120	ND	P	1995	<50	yes
John Kennemer	M	4S	11W	15	1808 Maclin Drive	Tuscumbia	120	ND	P	1991	<50	yes
Tuscumbia Spring	M	4S	11W	9	ND	ND	ND	Tuscumbia -Fort Payne	Pub	NA	NA	yes
Southern Wood	M	4S	11W	23	P.O. Box 2739	Muscle Shoals	150	ND	Ind	2004	<50	no
J. T. Kirk	M	4S	11W	24	ND	ND	ND	ND	ND	1955	>50	no
Janson	M	4S	11W	29	ND	ND	ND	ND	ND	1992	<50	no
Betty Sue Ussery	M	4S	11W	29	Route 3	Tuscumbia	200	ND	P	1976	>50	no
Bud Striet	M	4S	11W	36	Route 4	Tuscumbia	100	ND	P	1975	>50	no
Cooney Huggins	M	4S	11W	27	Route 3	Tuscumbia	100	ND	P	1974	<50	no
Douglas Isbell	M	4S	11W	34	Route 6, Box 350	Tuscumbia	125	ND	P	1987	<50	no
Q. M. Tidwell	M	4S	11W	27	Route 3	Tuscumbia	100	ND	P	1975	>50	no
City of Tuscumbia	M	4S	11W	9	ND	Tuscumbia	250	Tuscumbia -Fort Payne	U-Pub	1955	>50	yes
City of Tuscumbia	M	4S	11W	9	ND	Tuscumbia	ND	Tuscumbia -Fort Payne	U-Pub	ND	>50	yes

Owner	GSA Town-ship Code	Town-ship	Range	Section	Street Address	City	Well Depth (feet)	Source Aquifer	Well Use	Year Installed	Well Capacity (GPM)	Within 5-Mile Survey Area?
Town of Muscle Shoals	M	4S	11W	1	ND	Muscle Shoals	235	Tuscumbia-Fort Payne	U-Pub	1961	>50	yes
Town of Muscle Shoals	M	4S	11W	1	ND	Muscle Shoals	200	Tuscumbia-Fort Payne	U-Pub	1955	<50	yes

Abbreviations:

ND = Not determined
C = Commercial
GPM = Gallons per minute
Ind = Industrial
Irr = Irrigation
P = Private
Pub = Public
U-Pub = Unused-public

Table J-2. Alabama Office of Water Resources Data for Tuscumbia - Fort Payne Aquifer Groundwater Resources in Colbert County

Owner	User Type	Water Resource Name	Well Depth (feet)	2005 Average Annual Use (MGD)	T-R-Section	Within 5-Mile Survey Radius?
Hawk Pride Mountain Water System	Pub	Well No. 1	115	0.5344	ND	no
Hawk Pride Mountain Water System	Pub	Well No. 2	112	0.5432	ND	no
Leighton Water & Sewer Board	Pub	Well No. 1	380	0.2292	ND	no
Wise Alloys LLC	Ind	Deep Well No. 10	0	0.1667	3S-10W-28	yes
Wise Alloys LLC	Ind	Deep Well No. 5	250	0.0000	3S-10W-28	yes
Wise Alloys LLC	Ind	Deep Well No. 7	250	0.4083	3S-10W-28	yes
Wise Alloys LLC	Ind	Deep Well No. 8	250	0.1000	3S-10W-28	yes
Wise Alloys LLC	Ind	Deep Well No. 9	0	0.1917	3S-10W-28	yes
Grassland Nursery Inc.	Irr	Well No. 1	110	0.0237	4S-11W-02	yes
Fennel Farms	Irr	Well No. 1	150	0.1250	4S-11W-13	yes
Isbell Farms	Irr	Fish Pond	170	0.1080	4S-11W-02	yes
Isbell Farms	Irr	Silo Well No. 1	150	0.2880	4S-11W-02	yes
Isbell Farms	Irr	Walters	200	0.1260	4S-11W-02	yes
Isbell Farms	Irr	Woodmont Drive	175	0.3840	4S-11W-11	yes
Whitesell Enterprises/Cypress Lakes GC	Irr	Well No. 17	100	0.0630	4S-11W-11	yes
Whitesell Enterprises/Cypress Lakes GC	Irr	Well No. 2	112	0.1230	4S-11W-12	yes

Ind = Industrial
Irr = Irrigation
MGD = Millions of gallons per day
ND = Not determined
Pub = Public

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APPENDIX K – STATE HISTORIC PRESERVATION OFFICER AND TRIBAL CORRESPONDENCE

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STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

FRANK W. WHITE
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

July 22, 2009

Eric Howard
Manager (Interim)
Cultural Resources
TVA
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: Investigations at the Cuba Cemetery
Muscle Shoals Reservation
Colbert County

Dear Mr. Howard:

Thank you for the excellent report on the Cuba Cemetery. We applaud TVA's efforts towards their Section 110 responsibilities under the National Historic Preservation Act. We will add this information to our files.

We appreciate your commitment to helping us preserve Alabama's non-renewable resources. Should you have any questions, the point of contact for this matter is Amanda Hill at 334-230-2692. Please have the AHC tracking number referenced above available and include it with any correspondence.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/AMH/amh

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

June 30, 2009

Ms. Elizabeth Brown
Deputy State Historic Preservation Officer
Alabama Historical Commission
468 S. Perry St.
Montgomery, Alabama 36130-0900

INVESTIGATION OF THE CUBA CEMETERY IN TVA's MUSCLE SHOALS RESERVATION, COLBERT COUNTY, ALABAMA

Dear Ms. Brown:

The Tennessee Valley Authority (TVA) is involved in the preparation of an Environmental Impact Statement regarding the potential redevelopment of that area south of Reservation Road on the Muscle Shoals Reservation. In preparation, TVA has been involved in a multi-year inventory of the cultural resources at Muscle Shoals. Recently, TVA investigated cemeteries reported to be on the Muscle Shoals Reservation. TVA has rediscovered the Cuba Cemetery, but has not found evidence of a mass grave for victims of the 1918 influenza pandemic.

Enclosed please find two copies of a report entitled, *Investigations at the Cuba Cemetery in Anticipation of Redevelopment within the Muscle Shoals Reservation in Colbert County, Alabama* by James J. D'Angelo of TRC. At this time, TVA has no specific undertaking for the Cuba Cemetery area. So we are providing these reports to you for information purposes. If you have any questions please contact Tom Maher at 865-632-7458 or tomaher@tva.gov.

Sincerely,

A. Eric Howard
Manager (Interim)
Cultural Resources
WT 11D-K

TOM:IKS
Enclosures
cc: EDMS, WT 11D-K

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

FRANK W. WHITE
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

July 21, 2009

Eric Howard
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: AHC 08-0002
Phase II Testing of Site 1Ct574
Muscle Shoals Reservation
Colbert County, Alabama

Dear Mr. Howard:

Upon review of the Phase II testing report conducted by TRC, we have determined that we agree with the author. Site 1Ct574 is not eligible for the National Register of Historic Places (NRHP) and the project may proceed.

We appreciate your efforts on this project. Should you have any questions, please contact Greg Rhinehart at (334) 230-2662. Please have the AHC tracking number referenced above available and include it with any correspondence.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/SGH/GCR/gcr

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

June 24, 2009

Ms. Stacye Hathorn
State Archaeologist
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

AHC 08-0002
A PHASE II TEST OF SITE 1CT574; MUSCLE SHOALS RESERVATION, COLBERT COUNTY, ALABAMA

Dear Ms. Hathorn,

The Tennessee Valley Authority (TVA) is considering the redevelopment of the Muscle Shoals Reservation south of Reservation Road in Colbert County, Alabama. Archaeological site, 1CT574, was identified and recommended potentially eligibility for the National Register of Historic Places (NRHP) as a result of a 2006 Phase I survey which you have previously reviewed. Although site 1CT574 had no diagnostic artifacts, the 2006 surveyors believed the lithics recovered in shovel test pits may have come from a stratum below the plow zone.

TVA engaged TRC to evaluate the NRHP status of site 1CT574 in May of 2009. Enclosed are two copies of *Phase II Testing of 1CT574 on the TVA Muscle Shoals Reservation, Colbert County, Alabama* by James J. D'Angelo. During the field work, TRC made minor modification to the location of the seven 1 x 1 meter units described in their research proposal because of field conditions. TVA consulted with TRC in the field and approved these modifications.

No archaeological features were identified in the seven excavation units. No intact cultural strata were identified and all artifacts were obtained from the plow zone. On the basis of these results, TVA has determined that site 1CT574 is not eligible for the NRHP. Pursuant to 36CFR Part 800, TVA seeks your concurrence with this determination. If you have any questions please contact Tom Maher at 865-632-7458 or tomaher@tva.gov.

Sincerely,

A. Eric Howard
Manager (Interim)
Cultural Resources
WT 11-D-K

Enclosures

ALABAMA-COUSHATTA TRIBE OF TEXAS
571 State Park Rd 56 • Livingston, Texas 77351 • (936) 563-1100

May 19, 2010

Tennessee Valley Authority
Attn: Pat Bernard Ezzell
400 West Summit Hill Drive
Knoxville, TN 37902-1499

Dear Mrs. Ezzell:

On behalf of Mikko Oscola Clayton Sylestine and the Alabama-Coushatta Tribe, our appreciation is expressed on your efforts to consult us regarding the Phase II evaluation of 1CT331 and the Muscle Shoals redevelopment proposal in Colbert County.

Our Tribe maintains ancestral associations throughout the state of Alabama despite the absence of written records to completely identify Tribal activities, villages, trails, or grave sites. However, it is our objective to ensure significances of Native American ancestry including the Alabama-Coushatta Tribe are administered with the utmost regard.

Upon review of your April 14, 2010 submission, we have no objections to your recommendations based upon the level of disturbances to the site. However, we do express concern regarding the investigators' determination that 1CT331 may consist of a larger site, which may or may not have been previously impacted or discovered.

Since no National Register eligible properties were discovered, we are aware protections for the site will be diminished. However, in the event the site is included into non-federal land transitions, the recipient should be advised of potential inadvertent discoveries that may occur near the site.

Should you require additional assistance, please do not hesitate to contact us.

Respectfully submitted,

Bryant J. Celestine
Historic Preservation Officer

Telephone: 936 – 563 – 1181 celestine.bryant@actribe.org Fax: 936 – 563 – 1183

Date Rec'd.: 5/3/10
Saved: Muscle Shoals
Sent to: TDM, PRE
File: ✓

SEMINOLE TRIBE OF FLORIDA
TRIBAL HISTORIC PRESERVATION OFFICE

TRIBAL HISTORIC
PRESERVATION OFFICE

SEMINOLE TRIBE OF FLORIDA
AH-TAH-THI-KI MUSEUM

HC-61, BOX 21A
CLEWISTON, FL 33440

PHONE: (863) 983-6549
FAX: (863) 902-1117

Pat Bernard Ezzell
Native American Liaison and Historian
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

THPO: 005708

April 27, 2010

Subject: Assessment of Effects for the Redevelopment of the Muscle Shoals Reservation (MSR) in Colbert County, Tennessee

Dear Ms. Ezzell,

The Seminole Tribe of Florida's Tribal Historic Preservation Office (STOF-THPO) has received the TVA's correspondence concerning the aforementioned project. The STOF-THPO has no objection to your findings at this time. However, the STOF-THPO would like to be informed if cultural resources that are potentially ancestral or historically relevant to the Seminole Tribe of Florida are inadvertently discovered during the construction process. We thank you for the opportunity to review the information that has been sent to date regarding this project. Please reference ***THPO-005708*** for any related issues.

We look forward to working with you in the future.

Sincerely,

Direct routine inquiries to:

Willard Steele,
Tribal Historic Preservation Officer
Seminole Tribe of Florida

Anne Mullins,
Compliance Review Supervisor
annemullins@semtribe.com

Ah- Tah- Thi- Ki Museum, HC-61, Box 21-A, Clewiston, Florida 33440
Phone (863) 902-1113 ♦ Fax (863) 902-1117

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

March 10, 2010

Ms. Elizabeth Ann Brown
Deputy State Historic Preservation Officer
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Ms. Brown:

MUSCLE SHOALS RESERVATION (MSR) – ADAPTIVE REUSE STUDY AND RE-DEVELOPMENT OF A PORTION OF THE MUSCLE SHOALS RESERVATION – COLBERT COUNTY, ALABAMA - AHC 2008-0002

The Tennessee Valley Authority (TVA) manages approximately 3025 acres at Muscle Shoals, Alabama. Located on this property are a number of buildings, structures, and objects which are eligible for listing in the National Register of Historic Places (NRHP). In 2009, TVA issued a Notice of Intent for the disposal of a portion of the property at Muscle Shoals. For the purposes of reducing business costs and encouraging economic development in the area, TVA proposes to dispose of approximately 1380 acres of property at Muscle Shoals. This disposal would include approximately 53 buildings and structures which are eligible for listing on the NRHP.

In preparation of Section 106 consultation on this undertaking, TVA commissioned Lord, Aeck, Sargent Architects to prepare an Adaptive Reuse Study (Study). The Study focused on three broad areas, evaluating about 45 buildings within the immediate Study area:

- Existing architectural and structural conditions of each building and the flexibility of each building for uses other than their original function;
- Viability of the buildings based on current and foreseeable market trends in the region;
- Development of a draft concept plan illustrating examples of how the historic buildings might be used in a larger redevelopment effort.

The resulting Study is comprised of four volumes: the Planning Document, Architectural Conditions, Structural Conditions, and a Market Assessment.

Upon evaluation of the Study, TVA considered two architectural periods of significance:

- United States Nitrate Plant No. 2 (1918-1933)
- The Tennessee Valley Authority (1933-present)

Ms. Elizabeth Ann Brown
Page 2
March 10, 2010

The National Register Criteria for Evaluation were applied, considering these two architectural periods of significance, whereby TVA developed the strategy for removing and promoting buildings and structures for adaptive reuse enumerated in the enclosed presentation.

Pursuant to the requirements of Section 106 of the *National Historic Preservation Act* and its implementing regulations at 36 CFR Part 800, TVA's Historic and Archaeological Permitting and Compliance staff seeks your office's comments on:

- The Study completed by Lord, Aeck, Sargent Architects (two hard copies enclosed)
- The Area of Potential Effect, as proposed (enclosed)
- A change in the eligibility of four (4) buildings - the Office Service Warehouse, Substation No. 1, the Phosphate Development Works Warehouse, and the 2A Nitrate House
- Removal of 26 buildings and structures which are eligible for listing in the NRHP, but are not suitable for adaptive re-use
- Promotion of 27 buildings and structures which are eligible for listing in the NRHP for adaptive reuse to maintain the physical expression of the two periods of architectural significance
- Transfer of approximately 1380 acres from Federal ownership
- Subsequent use of the MSR property as Industrial, Commercial/Retail, Residential, or Mixed-Use

Based on previous reports from 2002 and 2007 submitted by TRC and letters of concurrence from your office dated October 30, 2007, TVA finds that these associated actions would adversely affect properties eligible for listing in the NRHP.

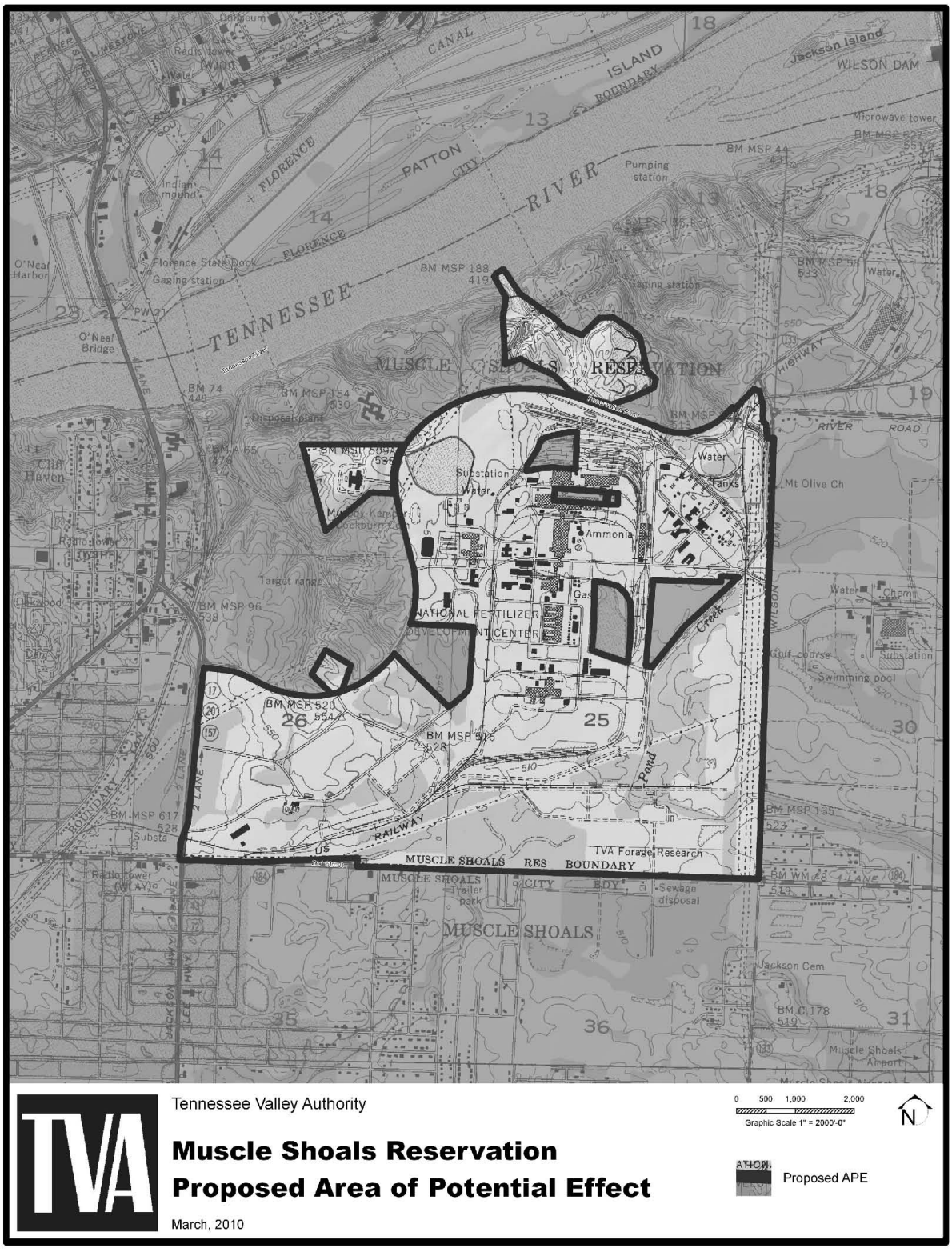
We have requested that the City of Sheffield Historical Commission and the Northwest Alabama Cooperative District participate as consulting parties and have provided them the documentation of adverse effects. After consulting with your office and the other parties, TVA will develop alternatives to resolve the adverse effects of this undertaking.

If you have questions concerning this action please contact Jon C. Riley by telephone at (256) 386-2750 or by e-mail at jcriley@tva.gov.

Sincerely,

A. Eric Howard
Federal Preservation Officer

Enclosures



STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

FRANK W. WHITE
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

June 14, 2010

Mr. Eric Howard
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

Re: AHC 08- 0002, Muscle Shoals Redevelopment

Dear ~~Mr. Howard:~~ Eric:

Thank you for the opportunity to work with TVA on the redevelopment of the Muscle Shoals Reservation. It is exciting to be involved in a project that has the potential to have such a positive impact on Alabama. We especially want to compliment you on the quality of the research and materials you have prepared for this project, materials which should make the process going forward have a better opportunity for success. We believe the research has identified an area of potential effect which is appropriate for evaluating the historic properties in this undertaking.

First, let me make sure we have a clear understanding of the two lists of buildings we are considering. You have delineated two lists of buildings, one which will be considered a part of the MOA on this project, and another that will be removed from the MOA. "Removed," in this case, means removed from the MOA, not demolished, and these buildings could be redeveloped if there is a market, but will not be a part of the MOA process. Is this correct?

As far as buildings which are part of the MOA, we have substantial agreement on the list but have asked for reconsideration of building 48, the paint storage building; building 53, the tin shop; buildings 68, 72a, and 74a, three substations. All of these are located in areas of buildings which will be reused, and could be a part of a rehabilitation plan which includes studios, work/live spaces, and smaller retail outlets for studios or manufacturing businesses that might operate there.

We also asked for reconsideration of the bus bar terminal, and to understand the extent of the narrow-gauge rail, and whether the rail bed was a resource which could enhance the adaptability and usability of the project.

We had concerns about eligibility on several buildings in the report, but after our site visit we concur with you that buildings 4, 15, 86, and 134 are not eligible for the National Register of Historic Places. We asked for information about eligibility of the Quonset hut, which we understand you are assembling.

Thank you for the explanation of TVA's history in growing trees and crops, and the relation of this effort to the American Chestnut tree research grove. Our understanding is that TVA had a tree and vine nurseries which were started using CCC labor in the 1930's. Trees and vines were grown and given away free to fight erosion and support re-forestation. With the advent of WWII, trees were phased out and crops were planted to support the war effort. Although the planting of the American Chestnut trees is in keeping with the spirit of supporting agriculture by the TVA, we concur with you that it does not follow programmatically with the federally-supported erosion-control and war-support activities undertaken by TVA. The trees are important, but we concur with you that they are not a cultural resource.

Archaeology has been conducted to identify sites on the area in question, and sites associated with the construction of Wilson Dam II have been identified. We have discussed an oral history project with people who lived in the villages as mitigation for these sites, and understand that you are moving forward with finding someone for that project. That should complete our concerns about archaeology in this project.

Since we met, Lee Anne Wofford and Chloe Mercer have met on site with you and explored the cemeteries. Their understanding from the meeting was that the cemeteries would be mapped to determine the extent of the boundaries, cleaned up, the Cuban cemetery would be fenced, and then no further work would take place. We do not think this is a sufficient effort, and that local efforts need to be made to continue to monitor the cemeteries. We would like to work with you and the local governments to set up a cemetery authority or local group which would accept a broader role in cemetery care into the future.

Thank you again for the opportunity to work with you on this project.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

April 12, 2010

Ms. Stacye Hathorn
State Archaeologist
Alabama Historical Commission
468 S. Perry Street
Montgomery, Alabama 36130

Re: AHC 10-0193
Phase II report on
Site 1Ct331
Colbert County, Alabama

Dear Ms. Hathorn,

Enclosed please find one hard copy and one digital copy on Compact Disc of the report, *Phase II Testing of 1CT331 on the TVA Muscle Shoals Reservation, Colbert County, Alabama* by P.K. Laird, L.A. Thomas, and J.L. Holland. The authors present the results of deep testing of archaeological site 1CT331 to determine its eligibility for listing on the National Register of Historic Places (NRHP). This site is within the Muscle Shoals redevelopment area, and the land is proposed to be transferred out of federal ownership as part of that project.

Limited, but deep excavations at 1CT331 revealed that most of this site was highly disturbed by the construction, operation, and demolition of the 1918 steam-generated electrical plant. A small, 10 x 10 meter, portion of this site showed relatively less disturbance and was the focus of excavations to two meters below surface.

No features, midden or buried A-horizon soils were encountered during these deep excavations. There is, however, some evidence of the stratification of lithic material at this site. The authors conclude that given the lack of *in situ* features or buried A-horizon soils, site 1CT331 does not contain significant information on the prehistory of this area. TVA recommends that site 1CT331 is not eligible for listing on the NRHP.

Following 36 CFR Part 800, TVA seeks concurrence from the Alabama State Historic Preservation Office that archaeological site 1CT331 is not eligible for the NRHP. If you have any questions please contact Tom Maher at 865-632-7458 or tomaher@tva.gov.

Sincerely,

A. Eric Howard
Federal Preservation Officer

TOM:IKS
Enclosures
cc: Kimberly Hodges (EDMS), LP 2V-C

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

FRANK W. WHITE
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

May 7, 2010

A. Eric Howard
TVA
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: AHC 10-0193
Phase II Testing Report
Site 1Ct331
Colbert County, Alabama

Dear Mr. Howard:

Upon review of the Phase II Report for 1Ct331 conducted by TRC, we have determined that we agree with the author's findings. Site 1Ct331 is not eligible for the National Register of Historic Places (NRHP) and no further investigations are warranted at this site.

We appreciate your efforts on this project. Should you have any questions, please contact Greg Rhinehart at (334) 230-2662. Please have the AHC tracking number referenced above available and include it with any correspondence.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/SGH/gcr

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

April 14, 2010

Those listed

TVA, MUSCLE SHOALS REDEVELOPMENT, PHASE II REPORT, 1CT331, COLBERT COUNTY, ALABAMA

The Tennessee Valley Authority (TVA) is proposing to redevelop portions of the Muscle Shoals Reservation (MSR) in Colbert County, Alabama. Proposed redevelopment could result in the transfer of portions of MSR from federal to local or private control. An Environmental Impact Statement is being prepared to assess the impacts of the disposal and alternative future uses of land on the MSR.

Following the *National Historic Preservation Act of 1966,* as amended, TVA has identified the historic properties within the area of potential effect (APE) through surveys of the MSR in 2002 and 2007. The enclosed map illustrates eligible or potentially eligible sites in the project area. Only 1CT331 has been identified as a prehistoric, Native American site. The other identified sites are historic and relate to the construction of Wilson Dam and Nitrate Plant #2 during the early 20th century.

Prehistoric site 1CT331, first identified in the 1990s, was re-evaluated in 2002 and deemed potentially eligible for listing in the National Register of Historic Places (NRHP). This site is within an area north of Reservation Road that is part of the project area. This site's eligibility for the NRHP must be evaluated before it could be transferred out of federal control.

TVA contracted with TRC to conduct a phase II evaluation of site 1CT331 in January and February 2010. A digital copy of the phase II report is available at TRC's download FTP site. You can access this file (*Phase II Testing of 1CT331 on the TVA Muscle Shoals Reservation, Colbert County, Alabama TRC.pdf)* by going to their web site http://www.trcsolutions.com . At the top right of the web page, there is a "Secure Logon" link. Click on this link. You will be directed to the TRC portal. To logon, use this information:

User name: tva@tva.gov

Password: tvatribal

You will see a list of TVA reports. If you wish to download the file, right click on its name and choose download. You can also left click on the file name and it will open in PDF.

Limited, but deep excavations at 1CT331 revealed that most of this site was highly disturbed by the construction, operation and demolition of the 1918 steam-generated electrical plant. A small, 10 x 10 meter, portion of this site showed relatively less disturbance and was the focus of excavations to two meters below surface.

No features, midden or buried A-horizon soils were encountered during these deep excavations. There is some evidence of the stratification of lithic material at this site. The authors conclude that given the lack of *in situ* features or buried A-horizon soils, site 1CT331 does not contain significant information on the prehistory of this area. TVA has determined that site 1CT331 is not eligible for listing in the NRHP.

TVA is consulting with the following federally recognized Indian tribes regarding this undertaking: Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, The Chickasaw Nation, Jena Band of Choctaw Indians, Muscogee (Creek) Nation of Oklahoma, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Kialegee Tribal Town, Thlopthlocco Tribal Town, Poarch Band of Creek Indians, Absentee Shawnee Tribe of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe of Oklahoma, Seminole Tribe of Oklahoma, and Seminole Tribe of Florida.

By this letter, TVA is providing notification of these findings and is seeking your comments regarding this undertaking and any properties that may be of religious and cultural significance and may be eligible for the NRHP pursuant to 36 CFR Part 800.2(c)(2)(ii), 800.3(f)(2), and 800.4(a)(4)(b).

If you have any questions, please contact me at 865-632-6461 or pbezzell@tva.gov.

Sincerely,

Pat Bernard Ezzell

Patricia Bernard Ezzell
Native American Liaison and Historian

TOM:PBE:IKS
Enclosure
cc: Kimberly Hodges (EDMS), LP 2V-C

THOSE LISTED:

Dr. Richard Allen
Policy Analyst
Cherokee Nation
Post Office Box 948
Tahlequah, Oklahoma 74465

Governor Bill Anoatubby
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

Ms. Augustine Asbury
Cultural Preservation Coordinator
Alabama Quassarte Tribal Town
Post Office Box 187
Wetumka, Oklahoma 74883

Second Chief Alfred Berryhill
Muscogee (Creek) Nation
Office of the Principal Chief
Post Office Box 580
Okmulgee, Oklahoma 74447

cc: Ms. Joyce Bear
Historic Preservation Officer
Muscogee (Creek) Nation of Oklahoma
Post Office Box 580
Okmulgee, Oklahoma 74447

Mr. Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd. 56
Livingston, Texas 77351

Mr. Charles Coleman
NAGPRA Representative
Thlopthlocco Tribal Town
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Weleetka, Oklahoma 74880

Ms. Natalie Deere
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
Post Office Box 1498
Wewoka, Oklahoma 74884

Ms. Robin DuShane
Cultural Preservation Director
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

Mr. Henry Harjo
Environmental Director
Kialegee Tribal Town
Post Office Box 332
Wetumka, Oklahoma 74883

Mr. Tyler Howe
Historic Preservation Specialist
Eastern Band of the Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

cc: Mr. Russ Townsend
Tribal Historic Preservation Officer
Eastern Band of the Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

Ms. Karen Kaniatobe
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper
Shawnee, Oklahoma 74801

Ms. Lisa C. LaRue
Director, Language, History and Culture &
Acting Tribal Historic Preservation Officer
United Keetoowah Band
of Cherokee Indians in Oklahoma
Post Office Box 746
Tahlequah, Oklahoma 74464

Mr. Kirk Perry
Administrator
Division of Policy and Standards
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

Ms. Jennifer Pietarila
Archaeological Data Analyst
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61 Box 21-A
Clewiston, Florida 33440

cc: Ms. Anne Mullins
Project Coordinator
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

cc: Mr. Willard Steele
Tribal Historic Preservation Officer
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

Ms. Julie Ray
Preservation & Repatriation Manager
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

cc: Ms. Virginia (Gingy) Nail
Tribal Historic Preservation Officer
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

Mr. Ron Sparkman
Chairman
Shawnee Tribe
Post Office Box 189
Miami, Oklahoma 74355

cc: Ms. Kim Jumper
Tribal Historic Preservation Officer
Shawnee Tribe
Post Office Box 189
Miami, Oklahoma 74355

Mr. Mike Tarpley
Jena Band of Choctaw Indians
Post Office Box 14
Jena, Louisiana 71342

Mr. Robert Thrower
Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, Alabama 36502

Mr. Elliot York
Archaeological Data Analyst
Seminole Tribe of Florida
Ah-Tah-Thi-Ki Museum
HC-61, Box 21-A
Clewiston, Florida 33440

Chief Glenna J. Wallace
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

October 1, 2007

Ms. Elizabeth Ann Brown
Deputy State Historic Preservation Officer
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Ms. Brown,

The Tennessee Valley Authority wishes to consult with you on the results of a Cultural Resource Assessment of 1,040 acres of the Muscle Shoals Reservation. Completed in 2006 by TRC, this assessment was intended to complete a review of all of TVA's fee-owned land associated with both the Wilson Hydroelectric Unit and the Muscle Shoals reservation. Pietak, et. al (2002) presented the findings of a cultural resource assessment of an area roughly north of Reservation Road. Your office reviewed this report as part of a development plan proposed by the Retirement Systems of Alabama at that time. The enclosed report deals with an area roughly south of Reservation Road.

During the cultural resources survey performed in August of 2006, TRC identified three (3) archaeological sites: 1CT573, 1CT574, and 1CT575. TRC describes site 1CT573 as an extensive historic trash scatter which is ephemeral in nature. Site 1CT574 is described as a large prehistoric lithic scatter and small historic artifact scatter possibly containing intact buried deposits. Site 1CT575 is the remains of a picnic pavilion built by Civilian Conservation Corps labor and is considered part of the Wilson Dam Village No. 2 Complex. TRC recommends site 1CT573 as ineligible, site 1CT574 as potentially eligible, and site 1CT575 as eligible due to its contribution to the Muscle Shoals Historic District (MSHD). One historic cemetery called the Murphy-Kemper-Cockburn Cemetery was identified within the APE.

Cultural Resource	Description	NRHP Eligibility
1CT573	Historic Refuse Scatter	Ineligible
1CT574	Large Prehistoric Lithic Scatter	Potentially Eligible
1CT575	Wilson Dam Village No. 2 Picnic Pavilion Remains	Eligible
Murphy-Kemper-Cockburn Cemetery	Historic Cemetery	Ineligible

In addition to the archaeological sites, TRC recorded thirteen (13) isolated finds all of which are recommended ineligible as they are not associated with substantial archaeological resources.

In addition to eligibility recommendations, TRC provided recommendations for further assessing archaeological resources. Site 1CT573 requires no further work. Site 1CT574 requires further evaluation to determine its National Register of Historic Places (NRHP) eligibility. Site 1CT575 is considered eligible as a contributing element to the MSHD and will require mitigation if disturbance is necessary. TRC recommends the

Murphy-Kemper-Cockburn Cemetery be avoided or removed in accordance with Alabama's cemetery removal and relocation laws.

TRC also carried out surveys of the architectural resources within the 1,040 acre project site. The 2006 survey included an update of the previous survey, completed in 2002. Two architectural resources were identified within the project area, in addition to the four previously identified resources.

TRC recommends the Quonset Hut (TRC-1), and the Phosphate Development Works Warehouse (TRC-2) as eligible for listing in the NHRP both individually and as a contributing resource of the MSHD. The Quonset Hut (TRC-1) is recommended as individually eligible for listing in the NRHP under Criterion A. The Phosphate Development Works Warehouse (TRC-2) is recommended as individually eligible under Criterion C.

Architectural Resource	Description	NRHP Eligibility
TRC-1 (Quonset Hut)	Structure	Eligible
TRC-2 (Warehouse)	Building	Eligible
National Fertilizer Development Center*	Building – Complex	Eligible
TVA Greenhouse Research Complex*	Building – Complex	Eligible
TVA Environmental Research Center*	Building – Complex	Eligible
Muscle Shoals Historic District (MSHD)*	Historic District	Eligible

**Originally recommended in the 2002 TRC report*

TRC acknowledged that there were additional above ground properties within the proposed MSHD that were non-contributing, based on their dates of construction (D'Angelo, et al. 2007:84).

TVA has two undertakings that relate to the information in the 2002 and 2007 reports. The immediate undertaking is the proposed demolition of 21 structures on the Muscle Shoals Reservation. These building are no longer in use and present a safety liability that TVA does not wish to maintain. We have determined these buildings not to be contributing members of the MSHD primarily because they were constructed less than 50 years ago. Enclosed, you will find a description of each of the buildings that TVA intends to demolish in fiscal year 2008 and our reasons for considering them not part of the district. We seek your concurrence and comments regarding this immanent undertaking.

The second undertaking is multi-year in nature. TVA is undertaking a re-development of the Muscle Shoals Reservation south of Reservation Road. It is our desire to partner with local government and, with support of the north Alabama congressional delegation, to develop this area for the benefit of the north Alabama economy and local job growth. Currently we do not have specific plans for development, but we cannot rule out demolition of buildings that do contribute to the MSHD in the future. We would, therefore, like to enter into formal consultations leading to a Memorandum of Agreement

on the disposition of buildings south of Reservation Road. Specifically, we would like to discuss what would be appropriate mitigation for the demolition of buildings associated with the defunct National Fertilizer Development Center and the Greenhouse Research Complex.

In summary, TVA has determined that archaeological site 1Ct573 is not eligible for the NRHP. Site 1Ct 574 is potentially eligible for the NRHP. It will be either avoided or a phase II survey will be completed to determine its NRHP eligibility. TVA will consult with the AL-SHPO on a phase II proposal for this site. Archaeological site 1Ct575 is eligible for the NRHP. It will be avoided or TVA will consult with the AL-SHPO on appropriate data recovery methods to mitigate any adverse effect. TRC also identified two individual structures eligible for the NRHP, the Quonset Hut and the Phosphate Development Works Warehouse. Three building complexes within the MSHD were also identified as eligible for the NRHP, the National Fertilizer Development Center, the TVA Greenhouse Research Complex, and the TVA Environmental Research Center. Pursuant to 36 CFR § 800.4 of the Advisory Council's regulations, TVA is seeking your office's concurrence on TVA Cultural Resources' determinations and findings.

If you have any questions or wish to discuss any part of the enclosed materials please contact me at 865-632-7452 (tomaher@tva.gov) or Jon Riley at 256-386-2750 (jcriley@tva.gov).

Sincerely,

Thomas O. Maher, Ph.D.
Manager
Cultural Resources

Enclosures

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

COLONEL (RET.) JOHN A. NEUBAUER
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

October 30, 2007

Thomas O. Maher, Ph.D.
TVA
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: AHC 08-0002
Current Demolitions and Multi-Year Re-Development
Muscle Shoals Reservation, South of Reservation Road
Colbert County, Alabama

Dear ~~Dr. Maher~~ Tom:

Upon review of the cultural resource assessment for the Muscle Shoals LUP tract conducted by TRC and review of the *Muscle Shoals Non Eligible and Non Contributing Structures* report submitted by your office, we have determined the following:

1. We agree with the National Register of Historic Places (NRHP) non-eligible and non-contributing determinations for the 21 structures presented in the TVA report. Therefore, we concur with the demolition of these structures.
2. We agree with TRC's and TVA's NRHP determinations regarding the archaeological sites and the cemetery.
   A. Site 1Ct573, a historic refuse scatter is not eligible for the NRHP and no further investigation is warranted.
   B. Site 1Ct574, a large prehistoric lithic scatter is potentially eligible for the NRHP and Phase II archaeological testing to determine the site's eligibility would be required if disturbance is necessary.
   C. Site 1Ct575, the Wilson Dam Village No. 2 Picnic Pavilion remains are eligible for the NRHP and mitigation will be required if disturbance is necessary.
   D. The Murphy-Kemper-Cockburn historic cemetery is not eligible for the NRHP but should be avoided. However, if disturbance is unavoidable, removal and relocation will have to take place in accordance with Alabama law.
3. We agree with TRC's and TVA's NRHP determinations of the structures and building complexes on the property.
   A. TRC-1, the Quonset Hut structure, is eligible for the NRHP.
   B. TRC-2, the warehouse building, is eligible for the NRHP.
   C. The National Fertilizer Development Center building complex is eligible for the NRHP.
   D. The TVA Greenhouse Research Complex is eligible for the NRHP.

E. The TVA Environmental Research Center complex is eligible for the NRHP.
F. The Muscle Shoals Historic District (MSHD) is eligible for the NRHP.

Finally, we believe there should be close coordination between our offices involving future use or re-development within the Muscle Shoals Historic District. While there are many significant structures and complexes within the MSHD, adaptive re-use may not always be an alternative due to decay, contaminants, or other issues. We should be prepared to evaluate these buildings and sites and determine their possible re-use or levels of documentation and recording that may be necessary if re-use is not feasible.

We hope our comments have addressed the issues in your letter. We look forward to working with you as plans are developed. Should you have any questions, the point of contact for this matter is Amanda Hill at (334) 230-2692. Please have the AHC tracking number referenced above available and include it with any correspondence.

Truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/GCR/gcr

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APPENDIX L – HISTORICAL SIGNIFICANCE OF THE ENVIRONMENTAL RESEARCH CENTER

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BUILT FOR THE PEOPLE OF THE UNITED STATES
The Environmental Research Center Building
(Formerly The Chemical Engineering Building)
Muscle Shoals, Alabama

In a November 12, 1950 letter addressed to the editor of the *Florence Times*, Charles H. Young, Director of TVA's Division of Chemical Engineering, invited the public to attend an open house to inspect TVA's new Chemical Engineering Building, now known as the Environmental Research Center. "This fine new laboratory and office building, designed primarily for functional efficiency, has long been needed to consolidate the research, engineering, and administrative staffs which formerly were housed in widely scattered laboratories and offices. We—my staff and I—are proud of this splendid new building, and we are looking forward to the opportunity of showing you the many unusual features which make it in our opinion one of the best equipped and most attractive work places in the southeastern United States." (*Florence [AL] Times*, November 12, 1950)

The *Florence-Times*, in an accompanying article, encouraged attendance at the open house. They wrote that those who attended the event were "due for an eye-opening treat for they will see scientific equipment as advanced as any in the field of chemistry today." The article pointed out that the "modern, architecturally attractive new building houses scientific apparatus which would excite the admiration of a Buck Rogers or a Flash Gordon." But the article goes on to point out the purpose of the new laboratory is essentially practical. In fact, Chief of TVA's Research and Engineering Branch summed up the importance of the new lab: "Today's research feeds tomorrow's hunger." (*Florence [AL] Times*, "Eye-Opening Treat In Store – TVA's Open House Wed., November 13, 1950)

By the time the Division of Chemical Engineering occupied their new building, TVA had accumulated a substantial pool of chemical research, process development, and chemical plant design facilities and skills. It probably had more "know-how" in electric phosphorus furnace technology than any other organization in the United States. TVA's technical and production resources were called upon for national defense, both during World War II and in the 1950s for the Korean Conflict. TVA supplied more than sixty percent of the elemental phosphorus required by our armed forces during World War II for use in smoke and incendiary bombs, shells, tracer bullets and other munitions.

Post-war development resulted in the rapid growth of fertilizer technology. TVA created a fertilizer and agriculture program that was national, and eventually, international in scope. In 1963, TVA's fertilizer and munitions facility changed its name to the National

Fertilizer Development Center (NFDC) to better reflect TVA's achievements. In 1988 the NFDC announced its Environmental Initiative, placing top priority on environmentally-related research, development and demonstration programs with emphasis on pollution prevention. In 1990 the NFDC was renamed the National Fertilizer and Environmental Research Center to better reflect corporate changes and program emphasis on environmental problems facing agriculture, agribusiness and industry. This same year, TVA closed its large-scale fertilizer production facilities. TVA renamed the facility the Environmental Research Center (ERC) in 1994.

TVA's fertilizer program stands as one of the agency's great successes. TVA's inventiveness contributed to our nation's bountiful food supply, as well as that of the world. Many, including Dr. Norman Borlaug, Nobel Prize winner and Father of the Green Revolution, credit TVA with being responsible for many countries' self-sufficiency in food production. Much of this world-renowned work took place at the Chemical Engineering Building (Environmental Research Center).

While the work conducted at this facility is important on a regional, national, and international level, the building is significant, too. Whether you prefer to call it the Chemical Engineering Building, the Rotunda Building, or the ERC, it was described at its opening as "the finest of its kind" and "one of the most interesting buildings in the world." It was the first TVA architectural project designed by an outside firm. The New York City firm of Alfred Fellheimer & Steward Wagner, Architects and Engineers, designed the building in 1944. Best known for their design of train stations, including the Art Deco-styled Cincinnati Union Terminal and the Buffalo, New York, Terminal, they held a reputation for creating handsome structures with a strong sense of function and practicality. While an outside firm designed the structure, TVA constructed the building beginning in 1946. Employees moved into the building in 1950.

Principal design features were established by Roland Wank, an employee of Fellheimer & Wagner at the time of design. Before joining this private practice, Wank held the position of TVA's Chief Architect. By all accounts, the structure was architecturally impressive. Featured in *Progressive Architecture* in November 1951, the magazine highlighted the structural design and architectural features of the Chemical Engineering Building including the circular entrance hall with its two-story window wall and transparent plastic stair-rail panels and its laboratories with the most modern features of the time.

One of the most amazing features of the new lab was a system of vertical service shafts extending from basement to penthouse on both sides of the laboratory wing corridors. Each shaft carries a complete set of services needed for lab workers including gas, vacuum, air under pressure, hot and cold water, steam, several types of electrical and communications current and chemical drains. The architects, with a respectful gesture to the rapid strides of science, included additional piping for services that might be useful in the future.

TVA was proud of this new building. In a brochure, most likely produced for the open house, TVA touts the "permanence and ease of maintenance evident in features such as tile walls, terrazzo floors, plastic panels, and aluminum fittings. Excellent lighting is provided by the high, double-pane windows and rows of fluorescent lights." The *Florence Times* pronounced that "the exterior of buff, smooth-faced brick strikes a refreshing note in an industrial area, while the careful use of pleasing and varied colors in walls, floors, and entrance hall;

splendidly-equipped locker rooms and lavatories; acoustical tile for laboratory and office ceilings; air-conditioning and attention paid to safety and fire protection—all contribute to making the new building one of the pleasantest places to work in the southeast." (*Florence [AL] Times*, "Muscle Shoals Residents Invited to Attend Chemical Engineering Building Open House," November 12, 1950)

TVA's new building attracted much attention and with its large auditorium, it hosted many chemical and engineering conferences.

But one of the most important events to take place at the Chemical Engineering Building was the celebration of TVA's 30th Anniversary. On May 18, 1963, President John F. Kennedy, standing in front of the Chemical Engineering Building, addressed a crowd of 15,000. He remarked on the prosperity

TVA had brought to the region and to the nation. As part of this trip, President Kennedy also spoke at Vanderbilt University's 90th anniversary celebration and, to promote his fledgling space program, at Redstone Arsenal in Huntsville, Alabama.

Besides these very public events, there was another reason that President Kennedy traveled to the South on that spring day. By 1963, the civil rights movement was at the forefront of national issues. Two weeks prior, Birmingham, Alabama's Commissioner of Public Safety, Eugene "Bull" Connor, had turned fire hoses and dogs on civil rights demonstrators in Birmingham. Around the same time, Alabama Governor George Wallace issued his threat to "stand in the schoolhouse door" to keep black students from enrolling at the University of Alabama. President Kennedy's visit to the south was an opportunity to celebrate high profile milestones publicly while speaking privately with Wallace.

President Kennedy never spoke the words "civil rights" in his speeches that day. His remarks were much more subtle. At Vanderbilt he stated: "We live in an age of movement and change, both evolutionary and revolutionary, both good and evil . . . A special burden rests on the educated men and women of our country—to reject the temptations of prejudice and violence, and to reaffirm the values of freedom and law on which our society depends." He went on to say that [the educated citizen] knows that for one man to defy a law or court order he does not like is to invite others to defy those which they do not like, leading to a breakdown of all justice and order. He knows, too, that every fellow man is entitled to be regarded with decency and treated with dignity."

Kennedy's trip to Alabama brought him into a rather cold, face-to-face meeting with Wallace. The Governor had been extremely critical of the President for sending 3,000 federal troops into Alabama earlier in the month when rioting swept through Birmingham. It was widely reported that, during the helicopter flight from Muscle Shoals to Huntsville, the President and the Governor had what was described as "a brief discussion" touching on racial matters and the growing tensions in Birmingham. (*St. Louis [MO] Post-Dispatch*, "Appeal in Tennessee; Omits It in Alabama: Says Southern Leaders Must Be Responsible, Avoid Violence," May 19, 1963)

Less than one month later, on June 11, 1963, Wallace stood in the door-way to block the attempt of two black students, Vivian Malone and James Hood, to register at the University of Alabama. President Kennedy federalized the Alabama National Guard, and ordered its units to the university campus. Wallace then stepped aside and returned to Montgomery allowing the students to enter.

It has been demonstrated that the Chemical Engineering Building has played a role in our nation's history, and it is a significant historic structure. The National Register of Historic Places (NRHP) lists our nation's cultural resources worthy of preserving. To be eligible for listing in the NRHP, a historic property must meet one of four criteria:

(1) associated with events that have made a significant contribution to the broad patterns of our history;
(2) associated with the lives of persons significant in our past;
(3) embody distinctive characteristics of a type, a period, or method of construction, or that represent the work of a master, or that possess high artistic values; and
(4) have yielded, or are likely to yield information important in prehistory or history.

The Chemical Engineering Building meets three of the four criteria. TVA, as a federal agency, is required by law to preserve its historic properties [National Historic Preservation Act, Section 110(a)(1)]. Executive Order 13827 (Preserve America) is an effort by the Bush Administration to improve the stewardship of federal real property assets. This Executive Order's guidelines instruct federal agencies to provide leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties of the Federal Government and to increase their knowledge of historic properties under their care and to enhance the management of these assets.

The Preserve America initiative also offers grants for federal-community partnerships. When the Chemical Engineering Building opened in 1950, the community, and TVA, celebrated this state-of-the-art building. With its use as a lab and its role in the Green Revolution, there may be a possibility of a community partnership involving the sciences. Alabama has a Civil Rights Trail, a heritage tourism effort, and this structure could be a stop on that trail interpreting the meeting between Kennedy and Wallace. There are many opportunities that could be pursued other than the current proposal to mothball this truly historic property.

APPENDIX M – SOIL DESCRIPTIONS

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For purposes other than farming, soils have three ratings based on the inherent limitations of the soil. These ratings are slight, moderate, and severe. *Slight* means the soil properties are generally favorable, and limitations are easily overcome. *Moderate* means limitations can be overcome with planning, design, or special maintenance. *Severe* means the soil properties are unfavorable, and limitations can only be overcome with costly corrections, special designs, intensive maintenance, or a combination of these measures.

Decatur Silt Loam (DaB)

The most common soil on the Muscle Shoals Reservation is **Decatur silt loam, 2 to 6 percent slope** (map symbol is DaB). This soil is located in the nearly level (gently sloping) areas surrounding the urban (developed) area in the central part of the environmental impact statement (EIS) study area. This soil was formed from weathered cherty limestone and limestone rock. It is primarily residuum, residual soil material from weathered stone that has not been transported. In some areas, Decatur silt loam contains alluvium (soil deposited on land by streams). It is a deep, well-drained soil that lies on broad convex ridges. Important soil properties and ratings are shown in Table K-1 below.

Table M-1. Decatur Silt Loam – Rating of Important Soil Properties

Soil Properties	Ratings
Permeability	0.6–2.0 inches water/hour
Available water capacity	9–12 inches
Soil reaction	pH of 4.5–6.0
Organic matter content	Moderately low
Natural fertility	Medium
Depth to bedrock	More than 60 inches
Root zone	More than 60 inches
Depth to water table	More than 6 feet
Flooding	None

Decatur silt loam is well suited for pasture and for growing cotton, corn, soybeans, and small grains. Most areas of Decatur soil are used to grow cultivated crops or pasture. Its susceptibility to erosion is its primary limitation.

Decatur silt loam areas are well suited for recreational development. For playground use, some areas may require leveling. Decatur silt loam soils are moderately suitable for building site development due to several factors. These soils may be too clayey for shallow excavations, and they may shrink and swell excessively with changes in moisture, which limits their suitability for supporting buildings. For supporting roads and streets, these soils lack strength.

The land classification occupying the second-largest part of the study area is urban. About 290 acres or around 21 percent of the site is urban. This area is predominantly covered by roads, parking areas, and buildings.

Chenneby Silt Loam (CbA)

The second most common soil type on the study area is **Chenneby silt loam, 0 to 2 percent slopes, occasionally flooded** (map symbol CbA). This soil is located predominantly in the southern part of the study area. The Chenneby silt loam surrounds the Decatur silt loam and borders it on the west, south, and east. It is a very deep, poorly drained soil formed in alluvium and lies in floodplains. Important soil properties and ratings are shown in Table K-2 below.

Table M-2. Chenneby Silt Loam – Rating of Important Soil Properties

Soil Properties	Ratings
Permeability	0.6–2.0 inches water/hour
Available water capacity	9–12 inches
Soil reaction	pH of 4.5–6.0
Organic matter content	Moderately low
Natural fertility	Medium
Depth to bedrock	More than 60 inches
Root zone	More than 60 inches
High water table	At a depth of 1 to 2.5 feet from January through March
Flooding	Occasionally

Source: Bowen, C. D. 1994. *Soil Survey of Colbert County, Alabama.* USDA Soil Conservation Service, in cooperation with Alabama Agricultural Experiment Station and Alabama Soil and Water Conservation Committee. Available from Natural Resources conservation Service's Web Soil Survey <http://soils.usda.gov/survey/online_surveys/alabama>.

Aside from high moisture and flooding potential, this soil is similar to the Decatur soil. Chenneby silt loam can be used for cultivated crops, but its wet, cold nature often delays planting. Consequently, it is mostly used for woodland or pasture (current land use).

This soil is severely limited for supporting buildings or roads due to its flooding potential, wetness, and poor strength. The wetness and flooding potential make the Chenneby silt loam moderately limited for recreational use.

Guthrie Silt Loam (GuA)

The third most common soil in the study area is **Guthrie silt loam, 0 to 2 percent slopes**, frequently flooded (map symbol GuA). This soil covers about 99.4 acres or 7.1 percent of the study area. It lies along the southern boundary and along Pond Creek southeast of the urban area of the Environmental Research Center complex. Like the Chenneby silt loam, it is a very deep and poorly drained soil formed in alluvium on upland flats and depressions. It has more clay in the subsoil than the Chenneby silt loam and is more prone to flooding and more severely limited for most uses. It also contains a fragipan, a subsurface layer that has low porosity, is brittle, and restricts root growth. Important soil properties and ratings are shown in Table K-3.

Table M-3. Guthrie Silt Loam – Rating of Important Soil Properties

Soil Properties	Ratings
Permeability	0.6–2.0 inches water/hour above the fragipan and 0.06–0.2 inches water/hour in the fragipan
Available water capacity	9–12 inches
Soil reaction	pH of <4.5–5.0
Organic matter content	Moderately low
Natural fertility	Low
Depth to bedrock	More than 60 inches
Root zone (depth to fragipan)	20 to 40 inches
High water table	Perched at a depth of 0.5 to 1 foot from January through April
Flooding	Frequent

Source: Bowen, C. D. 1994. *Soil Survey of Colbert County, Alabama.* USDA Soil Conservation Service, in cooperation with Alabama Agricultural Experiment Station and Alabama Soil and Water Conservation Committee. Available from Natural Resources conservation Service's Web Soil Survey <http://soils.usda.gov/survey/online_surveys/alabama>.

Fullerton-Bodine Complex (FbF)

The fourth most common soil in the study area is the **Fullerton-Bodine complex, 15 to 45 percent slopes** (map symbol FbF). This complex consists of two soils that are so intricately mixed that they cannot be mapped separately. Most of this Fullerton-Bodine soil lies north of Reservation Road where the rough terrain ultimately drops to the level of the Pickwick Reservoir. There are four areas located south of Reservation Road, the largest of which lies on steep slopes along Pond Creek. These soils were made from weathered cherty limestone and limestone like the Decatur soil, but they have no alluvium. They also have a large amount of small cherty stones. This soil is not suited for cultivated crops and mostly supports mixed hardwoods and pine. Like other soils in the study area, the Fullerton and Bodine soils are low in fertility and are acidic and deep. However, unlike the more level soils previously discussed, these soils have low water-holding capacity and no flood risk.

Due to their steep slope, these soils are severely limited for building purposes. They are too steep for subsurface sewage disposal and are poorly suited for vegetation where deep cuts have been made for home sites or roads. These soils are often used for fill material and as a base for roads. Steep slope and the high number of small stones severely limit the suitability of these soils for recreational use.

Pruitton/Sullivan Silt Loam (PUA)

The fifth most common soil in the study area is also a complex of two soils. It is mapped as **Pruitton and Sullivan silt loams, 0 to 2 percent slopes, occasionally flooded** (map symbol PUA). These soils were formed from alluvium. Like the Fullerton-Bodine complex, these areas consist of two different soils. They are not intricately mixed like the Fullerton and Bodine soils and could have been mapped separately, but were combined because their characteristics and uses are so similar. The four areas that contain the Pruitton and Sullivan silt loams are in the southern part of the study area and lie between the Chenneby silt loam and Guthrie silt loam. As floodplain soils that are prone to flooding, the Pruitton and Sullivan silt loams are similar to the Guthrie and Chenneby silt loams, but actually have a greater depth to the water table. Outside of the study area, these soils are primarily used for cultivated crops.

These soils have poor potential for building site development due to flooding. They are slightly limited for picnic areas and severely limited for camping areas due to flooding.

Decatur-Urban Land Complex (DeB)

This complex is actually a mixture of soil and urban areas. It is mapped as **Decatur-Urban land complex, 2 to 8 percent slopes** (map symbol DeB). These areas consist of gently sloping, deep, well-drained Decatur and similar soils and urban areas. In the study area, this complex is located along Hatch Boulevard, the western border, and along 2nd Street, the southern border. These areas have about equal parts of urban land and upland soil. This particular soil and urban complex covers about 51.9 acres or 3.7 percent of the study area. These areas are primarily used for residential, commercial, and industrial development. The properties of the soil are identical to those listed for the Decatur silt loam, 2 to 6 percent slope. Like the Decatur silt loam, this soil-urban complex is slightly limited for building purposes due to its shrink-swell potential and low strength. It is less than ideal for septic systems due to its moderate permeability.

Dumps (Dp)

The phosphorus slag pile or **Dumps** as it is defined by the Natural Resources Conservation Service soil survey covers about 46 acres in the northernmost section of the study area. It is considered suitable for industrial purposes, but has practically no value as farmland. Soil

capability classes range from Class I for highest capability to Class VIII for lowest capability. The dumps' capability subclass is Class VIIIs, which means it has limitations that nearly preclude its use for crop production. The suffix "s" denotes that the soil is limited because it is shallow, droughty, or stony.

Fullerton Cherty Silt Loam (FaB)

Fullerton cherty silt loam, 2 to 6 percent slopes (FaB map symbol) soil is located along Reservation Road in the western part of the study area. Most of this gently sloping Fullerton soil type is on the level portions of the Multipurpose Building Complex (MPB). This soil was probably surveyed before the MPB complex was built in the early 1980s. The photograph in Figure 3-7 of Volume I of this EIS reveals that about half of the area labeled FaB is covered by buildings and pavement. Like the Decatur soil, this soil is gently sloping, very deep, and well drained. Fullerton cherty silt loam was formed from weathered cherty limestone, limestone and alluvium. This soil has the same limitations as the Decatur soil. It is slightly limited for building sites due to its shrink-swell properties and low strength. It is severely limited for recreational purposes due to the large amount of small stones.

Decatur Silt Loam (DaC2)

The **Decatur silt loam, 6 to 10 percent slopes, eroded** (DaC2) soil is adjacent to and southeast of the Environmental Research Center complex. This soil has properties that are similar to the more level Decatur silt loams; however, its use for building purposes is more limited due to its slope. Due to a clayey surface layer, it is severely limited for most kinds of recreational development.

Other Soil Types

There are five other soil types in the study area that cover a total of about 50 acres. The **Fullerton cherty silt loam, 6 to 15 percent slopes** (FaD) is located near the phosphate slag pile and along Reservation Road near the northeastern corner of the study area. Like the other Fullerton soils, it contains many small stones that limit its use for recreational development. Its relatively steep slope, low strength, and shrink-swell potential limit its use for building sites. Proper design and installation can be used to overcome these limitations.

Etowah silt loam, 2 to 6 percent slopes (EtB) soil occurs in the southern part of the study area between the Pruitton and Sullivan silt loams (PUA) and the Chenneby silt loam (CbA). The Etowah silt loam soil is similar to the Decatur silt loam, but its surface is browner, less red in color, and has brown mottles in the subsoil, indicative of poor drainage. Outside of the study area, this soil is used mainly for cultivated crops and pasture. Low strength and moderate permeability limit its use for building sites. Low strength also limits its use for roads. This soil has good potential for recreational development. Slope and the presence of small stones may limit its use for playgrounds.

Emory silt loam, 0 to 2 percent slopes, ponded (EmA) soil occurs in the southern section of the study area near Wilson Dam Road that forms the eastern boundary. The areas are actually depressions in an area of Decatur silt loam, 2 to 6 percent slope and Chenneby silt loam, 0 to 2 percent slope. Emory silt loam is a floodplain soil that contains alluvium like the Guthrie and Chenneby silt loams; however, unlike these soils, it has a buried surface layer of dark reddish brown silt. Consequently, it has a higher water table than these other two soils. From December through April, the water table can be perched at the surface to 1 foot above the surface. It has a high capability for growing crops if it is drained. Its use for building sites is

severely limited due to the poor drainage and low strength. For recreational purposes, it is also severely limited unless surface or subsurface drainage is used.

The **Dickson silt loam, 0 to 3 percent slopes** (map symbol DkA) soil occurs on a slightly convex area between three floodplain soils (the Guthrie, Pruitton, and Sullivan silt loams) in the southeast corner of the study area along 2nd Street. The Dickson silt loam is similar to the Guthrie silt loam. It also has a buried surface layer called a fragipan that has low permeability. Since this soil is either gently sloped or convex, it has much better drainage than the Guthrie, and its water table is below 2 feet in the wettest time of the year (January through April). Like the other floodplain soils, the Dickson silt loam is moderately limited for building sites due to moisture. It is severely limited for dwellings with basements. It is moderately limited for camping areas and slightly limited for use as trails or paths.

The soil type occupying the smallest part of the study area is **Emory-Urban land complex 0 to 1 percent slopes**. This small section of land, covering less than an acre, is located in the center of the southern boundary along 2nd street and is adjacent to an area defined as Decatur-Urban land complex. Like the Decatur-Urban complex, it is a mixture of soil and urban land. Unlike the Decatur-Urban complex, the Emory-Urban complex occurs in concave areas and, therefore, has a higher water table in the winter months and is more limited for use as building sites and roads.

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APPENDIX N – PRIME FARMLAND CONVERSION

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U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 4/12/10
Name Of Project TVA Muscle Shoals Reservation Re-development	Federal Agency Involved Tennessee Valley Authority
Proposed Land Use Commercial, Industrial, Residential	County And State Colbert County, Alabama
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? Yes ☑ No ☐ Acres Irrigated: Average Farm Size: 230
(If no, the FPPA does not apply -- do not complete additional parts of this form).

Major Crop(s): COTTON SOYBEAN CORN	Farmable Land In Govt. Jurisdiction Acres: 191984 % 51	Amount Of Farmland As Defined in FPPA Acres: 108156 % 57
Name Of Land Evaluation System Used: LESA	Name Of Local Site Assessment System: NONE	Date Land Evaluation Returned By NRCS: 4/28/10

PART III *(To be completed by Federal Agency)*	Alternative Site Rating: Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	1,400.0			
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	1,400.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	746			
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	.69			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	40			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	55	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	3			
2. Perimeter In Nonurban Use	10	3			
3. Percent Of Site Being Farmed	20	1			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	0			
6. Distance To Urban Support Services	15	0			
7. Size Of Present Farm Unit Compared To Average	10	10			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	10			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	2			
TOTAL SITE ASSESSMENT POINTS	160	34	0	0	0
ART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	55	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	34	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	89	0	0	0

Selected: Date Of Selection: Was A Local Site Assessment Used? Yes ☐ No ☐

son For Selection: THE COMPLETION OF THIS REPORT AS DIRECTED BY FARMLAND POLICY PROTECTION ACT GUIDELINES ALSO MEETS REQUIREMENTS DIRECTED BY DEPARTMENTAL REGULATION 9500-3 LAND USE POLICY GUIDELINES

Milton Tuck RSS 4/28/10

Instructions on reverse side)

Form AD-1006 (10-83)

rm was electronically produced by National Production Services Staff

Figure N-1. Form AD 1006 for Farmland Conversion Impact Rating

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APPENDIX O – ANIMALS OBSERVED WITHIN THE MUSCLE SHOALS RESERVATION STUDY AREA

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Table O-1. Birds Observed Within the Muscle Shoals Reservation Study Area

Common Name (Scientific Name)	
Snow goose (*Chen caerulescens*)	Bonaparte's gull (*Chroicocephalus philadelphia*)
Canada goose (*Branta canadensis*)	Ring-billed gull (*Larus delawarensis*)
Wood duck* (*Axis sponsa*)	Herring gull (*Larus argentatus*)
Gadwall (*Anas strepera*)	Rock pigeon* (*Columba livia*)
American wigeon (*Anas americana*)	Eurasian collared-dove (*Streptopelia decaocto*)
American black duck** (*Anas rubripes*)	Mourning dove* (*Zenaida macroura*)
Mallard* (*Anas platynchos*)	Yellow-billed cuckoo* (*Coccyzus americanus*)
Blue-winged teal (*Anas discors*)	Black-billed cuckoo (*Coccyzus erythropthalmus*)
Northern shoveler (*Anas clypeata*)	Barn owl (*Tyto alba*)
Northern pintail (*Anas acuta*)	Eastern screech-owl* (*Megascops asio*)
Green-winged teal (*Anas crecca*)	Great horned owl* (*Bubo virginianus*)
Canvasback (*Aythya valisineria*)	Barred owl* (*Strix varia*)
Redhead (*Aythya americana*)	Common nighthawk* (*Chordeiles minor*)
Ring-necked duck (*Aythya collaris*)	Chuck-will's-widow (*Caprimulgus carolinensis*)
Greater scaup (*Aythya marila*)	Chimney swift* (*Chaetura pelagica*)
Lesser scaup (*Aythya affinis*)	Ruby-throated hummingbird* (*Archilochus colubris*)
Surf scoter (*Melanitta perspicillata*)	Belted kingfisher (*Megaceryle alcyon*)
Bufflehead (*Bucephala albeola*)	Red-headed woodpecker* (*Melanerpes erthrocephalus*)
Common goldeneye (*Bucephala clangula*)	Red-bellied woodpecker* (*Melanerpes carolinus*)
Hooded merganser (*Lophodytes cucullatus*)	Yellow-bellied sapsucker (*Sphyrapicus varius*)
Ruddy duck (*Oxyura jamaicensis*)	Downy woodpecker* (*Picoides pubescens*)
Northern bobwhite* (*Colinus virginianus*)	Hairy woodpecker* (*Picoides villosus*)
Wild Turkey* (*Meleagris gallopavo)*	Northern flicker* (*Colaptes auratus*)
Pied-billed grebe (*Podilymbus podiceps*)	Pileated woodpecker* (*Dryocopus pileatus*)
Horned grebe (*Podiceps auritus*)	Olive-sided flycatcher (*Contopus cooperi*)
Double-crested cormorant (*phalacrocorax auritus*)	Great blue heron (*Ardea Herodias*)

Common Name (Scientific Name)	
Great egret (*Ardea alba*)	Yellow-bellied flycatcher (*Empidonax flaviventris*)
Green heron (*Butorides striata*)	Acadian flycatcher (*Empidonax virescens*)
Black vulture (*Coragypas atratus*)	Alder flycatcher (*Empidonax alnorum*)
Turkey vulture (*Cathartes aura*)	Willow flycatcher (*Empidonax traillii*)
Osprey (*Pandion haliaetus*)	Least flycatcher (*Empidonax minimus*)
Bald eagle (*Haliaeetus leucocephalus*)	Eastern phoebe* (*Sayornis phoebe*)
Sharp-shinned hawk (*Accipiter striatus*)	Great crested flycatcher* (*Myiarchus crinitus*)
Cooper's hawk* (*Accipiter cooperii*)	Eastern kingbird* (*Tyrannus tyrannus*)
Red-shouldered hawk (*Buteo lineatus*)	White-eyed vireo* (*Vireo griseus*)
Broad-winged hawk (*Buteo platypterus*)	Bell's vireo (*Vireo bellii*)
Red-tailed hawk* (*Buteo jamaicensis*)	Yellow-throated vireo (*Vireo flavifrons*)
American kestrel* (*Falco sparverius*)	Blue-headed vireo (*Vireo solitarius*)
Merlin (*Falco columbarius*)	Warbling vireo (*Vireo gilvus*)
Peregrine falcon (*Falco peregrines*)	Philadelphia vireo (*Vireo philadelphicus*)
American coot (*Fulica americana*)	Red-eyed vireo* (*Vireo olivaceus*)
Killdeer* (*Charadrius vociferous*)	Blue jay* (*Cyanocitta cristata*)
Spotted sandpiper (*Actitis macularius*)	American crow* (*Corvus brachyrhynchos*)
Solitary sandpiper (*Tringa solitaria*)	Fish crow (*Corvus ossifragus*)
Greater yellowlegs (*Tringa melanoleuca*)	Purple martin* (*Progne subis*)
Lesser yellowlegs (*Tringa flavipes*)	Tree swallow* (*Tachycineta bicolor*)
Upland sandpiper (*Bartramia longicauda*)	Northern rough-winged swallow* (*Stelgidopteryx serripennis*)
Least sandpiper (*Calidris minutilla*)	Bank swallow (*Riparia riparia*)
Pectoral sandpiper (*Calidris melanotos*)	Cliff swallow (*Petrochelidon pyrrhonota*)
Wilson's snipe (*Callinago delicate*)	Barn swallow* (*Hirundo rustica*)
American woodcock** (*Scolopax minor*)	Carolina chickadee* (*Poecile carolinensis*)
Tufted titmouse* (*Baeolophus bicolor*)	Swainson's warbler* (*Limnothylpis swainsonii*)
Eastern wood-pewee* (*Contopus virens*)	Red-breasted nuthatch (*Sitta canadensis*)

Common Name (Scientific Name)	
White-breasted nuthatch* (*Sitta carolinensis*)	Northern waterthrush* (*Parkesia noveboracensis*)
Brown creeper (*Certhia americana*)	Louisiana waterthrush (*Parkesia motacilla*)
Carolina wren* (*Thryothorus ludovicianus*)	Kentucky warbler** (*Oporornis formosus*)
House wren* (*Troglodytes aedon*)	Connecticut warbler (*Oporornis agilis*)
Winter wren (*Troglodytes hiemalis*)	Mourning warbler (*Oporornis philadelphia*)
Golden-crowned kinglet (*Regulus satrapa*)	Common yellowthroat* (*Geothlypis trichas*)
Ruby-crowned kinglet (*Regulus calendula*)	Hooded warbler* (*Geothlypis nelsoni*)
Blue-gray gnatcatcher* (*Polioptila caerulea*)	Wilson's warbler (*Wilsonia pusilla*)
Eastern bluebird* (*Sialia sialis*)	Canada warbler (*Wilsonia canadensis*)
Veery (*Catharus fuscescens*)	Yellow-breasted chat* (*Icteria virens*)
Gray-cheeked thrush (*Catharus minimus*)	Eastern towhee* (*Pipilo erythrophthalmus*)
Swainson's thrush (*Catharus ustulatus*)	Chipping sparrow* (*Spizella passerine*)
Hermit thrush (*Catharus guttatus*)	Field sparrow* (*Spizella pusilla*)
Wood thrush** (*Hylocichla mustelina*)	Vesper sparrow (*Pooecetes gramineus*)
American robin* (*Turdus migratorius*)	Lark sparrow (*Chondestes grammacus*)
Gray catbird* (*Dumetella carolinensis*)	Savannah sparrow (*Passerculus sandwichensis*)
Northern mockingbird* (*Mimus polyglottos*)	Grasshopper sparrow (*Ammodramus savannarum*)
Brown thrasher* (*Toxostoma rufum*)	Henslow's sparrow** (*Ammodramus henslowii*)
European starling* (*Sturnus vulgaris*)	LeConte's sparrow (*Ammodramus leconteii*)
American pipit (*Anthus rubescens*)	Fox sparrow (*Passerella iliaca*)
Cedar waxwing (*Bombycilla cedrorum*)	Song sparrow* (*Melospiza melodia*)
Blue-winged warbler (*Vermivora cyanoptera*)	Lincoln's sparrow (*Melospiza lincolnii*)
Golden-winged warbler (*Vermivora chrysoptera*)	Swamp sparrow (*Melospiza georgiana*)
Tennessee warbler (*Oreothlypis peregrina*)	White-throated sparrow (*Zonotrichia albicollis*)
Orange-crowned warbler (*Oreothlypis celata*)	White-crowned sparrow (*Zonotrichia leucophrys*)
Nashville warbler (*Oreothlypis ruficapilla*)	Dark-eyed junco (*Junco hyemalis*)
Ovenbird (*Seiurus aurocapilla*)	Northern parula* (*Parula americana*)

Common Name (Scientific Name)	
Yellow warbler* (*Dendroica petechia*)	Summer tanager* (*Piranga rubra*)
Chestnut-sided warbler (*Dendroica pensylvanica*)	Scarlet tanager (*Piranga olivacea*)
Magnolia warbler (*Dendroica magnolia*)	Northern cardinal* (*Cardinalis cardinalis*)
Cape May warbler (*Dendroica tigrina*)	Rose-breasted grosbeak (*Pheucticus ludovicianus*)
Yellow-rumped warbler (*Dendroica coronate*)	Blue grosbeak* (*Passerina caerulea*)
Black-throated green warbler (*Dendroica nigrescens*)	Indigo bunting* (*Passerina cyanea*)
Blackburnian warbler (*Dendroica fusca*)	Dickcissel* (*Spiza americana*)
Yellow-throated warbler (*Dendroica dominica*)	Bobolink (*Dolichonyx oryzivorus*)
Pine warbler* (*Dendroica pinus*)	Red-winged blackbird* (*Agelaius phoeniceus*)
Prairie warbler* (*Dendroica discolor*)	Brewer's Blackbird* (*Euphagus cyanocephalus*)
Palm warbler (*Dendroica palmarum*)	Eastern meadowlark* (*Sturnella magna*)
Bay-breasted warbler (*Dendroica castanea*)	Common grackle* (*Quiscalus quiscula*)
Blackpoll warbler (*Dendroica striata*)	Brown-headed cowbird* (*molothrus ater*)
Cerulean warbler** (*Dendroica cerulea*)	Orchard oriole* (*Icterus spurius*)
Black-and-white warbler* (*Mniotilta varia*)	Baltimore oriole (*Icterus galbula*)
American redstart (*Setophaga ruticilla*)	Purple finch (*Carpodacus purpureus*)
Black-throated blue warbler* (*Setophaga caerulescens*)	House finch* (*Carpodacus mexicanus*)
Prothonotary warbler* (*Protonotaria citrea*)	American goldfinch* (*Spinus tristis*)
Worm-eating warbler** (*Helmitheros vermivorum*)	House sparrow* (*Passer domesticus*)

*Species breeds within study area
**Conservation Concern

Table O-2. Mammals Found Within the Muscle Shoals Reservation Study Area

Common Name (Scientific Name)	
Virginia opossum (*Didelphis virginiana*)	Gray fox (*Urocyon cinereroargenteus*)
Least shrew (*Cryptotis parva*)	Bobcat (Lynx rufus)
Shorttail shrew (*Blarina brevicauda*)	Groundhog (*Marmota monax*)
Eastern mole (*Scalopus aquaticus*)	Eastern chipmunk (*Tamias striatus*)
Little brown myotis (*Myotis lucifugus*)**	Eastern gray squirrel (*Sciurus carolinensis*)
Gray bat (*Myotis grisescens*)**	Eastern fox squirrel (*Sciurus niger*)
Indiana bat (*Myotis sodalis*)**	Southern flying squirrel (*Glaucomys volans*)
Silver-haired bat (*Lasionycteris noctivagans*)	Beaver (*Castor canadensis*)
Eastern pipistrelle (*Perimyotis subflavus*)	Eastern harvest mouse (*Reithrodontomys humulis*)
Eastern red bat (*Lasiurus borealis*)	White-footed mouse (*Peromyscus leucopus*)
Big brown bat (*Eptesicus fuscus*)	Deer mouse (*Peromyscus maniculatus*)
Hoary bat (*Lasiurus cinereus*)	Cotton mouse (*Peromyscus gossypinus*)
Evening bat (*Nycticeius humeralis*)	Golden mouse (*Peromyscus nuttali*)
Rafinesque's big-eared bat (*Corynorhinus rafinesquii*)**	Eastern woodrat (*Neotoma floridana*)
Raccoon (*Procyon lotor*)	Hispid cotton rat (*Sigmodon hispidus*)
Longtail weasel (*Mustela frenata*)	Pine vole (*Pitymys pinetorum*)
Mink (*Mustela vison*)	Muskrat (Ondatra zibethica*)*
River otter (*Lontra canadensis*)	Norway rat (*Rattus norvegicus*)
Spotted skunk (*Spilogale putorius*)**	House mouse (*Mus musculus*)
Striped skunk (*Mephitis mephitis*)	Eastern cottontail (*Sylvilagus floridanus*)
Coyote (*Canis latrans*)	Swamp rabbit (*Sylvilagus aquaticus*)
Red fox (*Vulpes fulva*)	White-tailed deer (*Odocoileus virginianus*)
Nine-banded Armadillo (*Dasypus novemcinctus*)	

**Conservation Concern

Table O-3. Reptiles Found Within the Muscle Shoals Reservation Study Area

Common Name (Scientific Name)			
Common snapping turtle (*Chelydra serpentina*)	Eastern box turtle *(Terrapene carolina)*	Midland water snake (*Nerodia sipedon*)	Corn snake (*Elaphe guttata*)
Stinkpot (*Sternotherus adoratus*)	Smooth softshell turtle *(Deirochelys reticularia)*	Eastern garter snake (*Thamnophis sirtalis*)	Scarlet king snake (*Cemophora coccinea*)
Stripe-necked musk turtle (*Sternotherus minor peltifer*)	Spiny softshell turtle (*Apalone spinifera*)	Eastern ribbon snake (*Thamnophis sauritus*)	Eastern milk snake (*Lampropeltis triangulum*)
Eastern mud turtle (*Kinosternon subrubrum*)	Green anole (*Anolis carolinensis*)	Rough earth snake (*Heterodon platyrhinos*)	Mole snake (*Lampropeltis calligaster*)
False map turtle (Graptemys pseudogeographica)	Eastern fence lizard (*Sceloporus undulates*)	Eastern worm snake (*Carphophis amoenus*)	Black king snake (*Lampropeltis getulus niger*)
Map turtle (Graptemys geographica)	Ground skink (*Scincella lateralis*)	Ringneck snake (*Diadophis punctatus*)	Copperhead (*Agkistrodon contortrix*)
Southern painted turtle (Chrysemys picta)	Five-lined skink (*Emeces fasciatus*)	Rough green snake (*Opheodrys aestivus*)	Timber rattlesnake (*Crotalus horridus*)
Slider (Chrysemys concinna hieroglyphica)	Broadhead skink (*Eumeces laticeps*)	Black racer (*Coluber constrictor*)	-
River cooter (*C. concinna concinna*)	Southern five-lined skink (*Eumeces inexpectatus*)**	Northern pine snake (*Pituophis melanoleucus*)	-
Red-eared slider *(Chrysemys scripta*)	Slender glass lizard (*Ophisaurus attenuates*)	Gray rat snake (*Elaphe obsoleta*)	-

**Conservation Concern

Table O-4. Amphibians Found Within the Muscle Shoals Reservation Study Area

Common Name (Scientific Name)		
Red spotted newt *(Notophthalmus viridescens)*	Two-lined salamander (*Eurycea bislineata*)	Upland chorus frog *(Pseudacris feriarum feriarum)*
Dusky salamander (*Desmognathus fuscus*)	Narrow-mouth toad (*Gastrophryne carolinensis*)	Cricket frog (*Acris crepitans*)
Spring salamander (*Gyrinophilus porphyriticus*)	American toad (*Bufo americanus*)	Green frog *(Rana clamitans)*
Red salamander (*Pseudotriton ruber*)	Fowler's toad (*Bufo woodhousei*)	Bullfrog (*Rana catesbeiana*)
Slimy salamander (*Plethodon glutinosus*)	Spring peeper *(Pseudacris crucifer)*	Southern leopard frog *(Rana sphenocephala utricularia)*
Zigzag salamander (*Plethodon dorsalis*)	Green treefrog *(Hyla cinerea)*	Pickerel frog *(Rana palustris)*

APPENDIX P – SCENIC VALUE CRITERIA

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TVA VISUAL RESOURCES

SCENIC VALUE CRITERIA FOR SCENERY INVENTORY AND MANAGEMENT

The criteria for classifying the quality and value of scenery has been adapted from a scenic management system developed by the U.S. Forest Service and integrated with current planning methods used by the Tennessee Valley Authority. The classification process is also based on fundamental methodology and descriptions adapted from Landscape Aesthetics, A Handbook for Scenery Management, Agriculture Handbook Number 701, U.S. Forest Service, U.S.D.A. 1995.

The process and criteria are used to compare the value of scenery to other resource values during inventory and land planning tasks. They are also used to evaluate the extent and magnitude of visual changes that could result from proposed projects, as part of the environmental review required under NEPA. In addition they can be useful to help establish management objectives for improving or maintaining the scenic quality of managed lands.

Scenic Attractiveness - 3 levels

Attractiveness is a measure of scenic quality based on human perceptions of intrinsic beauty as expressed in the forms, colors, textures, and visual composition of each landscape. The combination of rock outcrops, water bodies, landforms, vegetation patterns, and other natural features that shape landscape character also help define scenic importance. The presence or absence of these features, along with valued attributes such as variety, uniqueness, mystery, pattern, order, vividness, harmony, and balance are used to classify the scenic attractiveness of a landscape.

Category 1: Distinctive - Areas where the variety of land forms, rock, vegetation patterns, water, and other features have outstanding or unique visual quality. These areas have strong, positive attributes that are relatively uncommon in the characteristic landscape. This category also includes areas in visually strategic locations that have somewhat more common attributes.

Category 2: Common - Areas where the land forms, rock, vegetation patterns, water, and other features have ordinary or common visual quality. These areas have generally positive but typical attributes, with a basic variety of forms, colors, and textures that are normally seen throughout the characteristic landscape.

Category 3: Minimal - Areas where the natural features have little change in form, line, color or texture resulting in low visual quality. Rock forms and vegetation patterns of any consequence are often not present, and these areas generally have weak or missing attributes. All areas not classified as 1 or 2 are included in this category.

Scenic Integrity - 4 levels

Integrity is a measure of scenic importance based on the degree of visual unity and wholeness of the natural landscape character. Human alteration can sometimes raise integrity, such as an impounded water body that unifies the landscape while adding variety, mystery, harmony, and balance. Most often scenic integrity is lowered by human alteration and the addition of visually disruptive elements. The presence and degree of discordant alteration is used to classify the scenic integrity of a landscape.

High: Areas where the valued landscape character appears to be intact and unaltered, with very minor deviation. Any deviation present must repeat the form, line, color, texture and pattern of the landscape so closely and at such a scale that they are not evident.

Moderate: Areas where the valued landscape character appears to be slightly altered. Noticeable deviations must be visually subordinate to the landscape being viewed, and borrow much of the natural form, line, color, texture and pattern.

Low: Areas where the valued landscape character appears to be modestly altered. Deviations begin to dominate the landscape being viewed, but the alterations should share natural color, shape, edge pattern, and vegetation characteristics in order to remain compatible or complimentary.

Very Low: Areas where the valued landscape character appears to be heavily altered. Deviations strongly dominate the landscape and may not share any of the visual attributes. The alterations may be visually disruptive and provide significant negative contrast to the natural landscape characteristics.

Scenic Visibility - 2 parts, 3 levels each

Landscape visibility is a measure of scenic importance based on several essential interrelated considerations which include viewer context and sensitivity, number of viewers, frequency and duration of view, level of detail seen, and seasonal variation. A large number of highly concerned viewers who view the landscape for a long time period may raise the scenic importance significantly. The importance may be much lower when only a few viewers with low concern see the landscape for a brief period. These considerations are combined in two parts which are used to classify the scenic visibility of a landscape.

Sensitivity: The level of scenic importance based on expressed human concern for the scenic quality of land areas viewed. Sensitivity may be derived/confirmed by resident and visitor surveys.

Level 1: High - Areas seen from the reservoir, lake shore residents, and lake view residents, where the number of viewers and concern for scenic quality are normally quite high.

Level 2: Moderate - Areas seen from principle roadways, use areas, and other public viewing areas. Concern for scenic quality is generally high while the number of viewers, view frequency and duration are moderate.

Level 3: Low - Areas seen from secondary travel routes, use areas, and any not included in the other levels. Concern may be high in some areas, but number of viewers is generally low.

View Distance: A principal indicator of scenic importance based on the distance an area can be seen by observers, and the degree of visible detail within that zone.

Foreground: From 0 feet to ½ mile. A distance zone where the individual details of specific objects are important and easily distinguished. Details are most significant within the immediate foreground, 0 - 300 feet.

Middleground: From ½ mile to 4 miles. The zone where most object characteristics are distinguishable, but their details are weak and they tend to merge into larger patterns. When landscapes are viewed in this zone they are seen in broader context. Human alteration may contrast strongly with the larger patterns and make some middleground landscapes more sensitive than the foreground.

Background: From 4 miles to the horizon. The distant landscape, where specific features are not normally discernible unless they are especially large, standing alone, or have a substantial color contrast. Details are generally not visible and colors are lighter.

Scenic Value Class - 4 levels

The value class of a landscape is determined by combining the levels of scenic attractiveness, scenic integrity and visibility. The selection matrix below shows the various combinations and the resulting scenic class. It is a guide that is intended to complement both a thorough field analysis and careful review of the visual absorption capacity.

Excellent: Areas with outstanding natural features that appear unaltered. Very minor deviations may be present but are generally unnoticeable even in the foreground. These areas are highly visible in the foreground and middleground from both land and water. Unaltered areas that may be less outstanding but are in a visually strategic location are also classified as excellent scenic value.

Good: Areas with attractive but common scenic quality and no distinctive natural features. Minor human alteration may be seen in the foreground but is barely noticeable in the middleground. These areas have relatively high visibility from both land and water.

Fair: Areas of common or minimal scenic quality with little or no interesting features. Moderate human alteration provides discordant contrast that is seen in the foreground but is less distinct in the middleground due to compatible form and color. These areas have relatively high visibility from both land and water.

Poor: Areas that have very little scenic importance and/or visually significant disturbances resulting from human activity. The alterations provide discordant contrast in the natural landscape due to incompatible size, shape, color, and material. The areas are clearly visible in the foreground and middleground, and have relatively high visibility from both land and water.

Severity of impact

The threshold of significance is the extent or magnitude of alteration to the existing landscape that is sufficient to change the Scenic Value Class by two levels or more.

SCENIC VALUE CLASS SELECTION MATRIX													
Visibility: **Sensitivity Level** / **View Distance**		**1** **foreground**			**1** **middleground**			**2** **foreground**			**2** **middleground**		
Scenic Attractiveness Categories		**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Scenic Integrity Levels	**High**	E	G	F	E	E	G	E	G	F	E	E	G
	Moderate	G	G	F	E	G	F	G	G	F	E	G	F
	Low	F	F	P	F	F	P	F	F	P	F	F	P
	Very low	P	P	P	F	P	P	P	P	P	F	P	P
		Scenic Value Class: **E** = Excellent; **G** = Good; **F** = Fair; **P** = Poor											

Visual Absorption Capacity

Absorption capacity indicates the relative ability of a landscape to accept human alteration with the least loss of landscape character and scenic value. These indicators are useful to help predict potential difficulty or success with proposed development and scenic management. They are based on characteristics of the physical factors found in a landscape. Each characteristic has a capacity range from less to more, and the primary ones are shown in the list below. Visual absorption is also affected by the variety of landscape patterns, and the amount of screening provided by landforms, rock, water bodies, and vegetation.

Factor	Least Capacity to Absorb Change	Greatest Capacity to Absorb Change
Slope	Steep Unstable geology	Level Stable geology
Vegetation	Sparse cover Low cover, grasses and shrubs Few species, little or no pattern	Dense cover Tall cover, trees Multiple species, diverse pattern
Landforms	Simple shape	Diverse shapes, heavily dissected
Soils	Easily eroded Poor; slow re-vegetation	Erosion resistant Rich; fast re-vegetation
Shoreline	Simple line, little or no interruption	multiple interruptions, diverse features
Color	Narrow range of indigenous colors	Broad range of indigenous colors

Desired Landscape Character

Scenic attractiveness and the existing level of scenic integrity serve as the foundation for selecting the preferred landscape character. Lake adjacency and ecosystem trends should be considered along with the historic visual character to help any changes be more complete, attractive, and sustainable. Several types of landscape character and the related long range objectives for scenic integrity are described below.

Natural Evolving landscape character expressing the natural change in ecological features and processes with very limited human intervention.

Natural Appearing landscape character that expresses predominantly natural qualities but includes minor human interaction along with cultural features and processes that are relatively unobtrusive.

Pastoral landscape character expressing dominant human developed pasture, range, and meadow, along with associated structures, reflecting historic land uses, values, and lifestyles.

Rural landscape character that expresses sparse but dominant human residential and recreational development, along with associated structures and roadways that reflect current lifestyles.

Urban landscape character expressing concentrations of human activity in the form of commercial, residential, cultural, and transportation, facilities, along with supporting infrastructure.

Visual Management Objectives

Based on the scenic value class, management objectives may be developed to accomplish or maintain the visual character desired for each area.

Preservation:
Areas classified Excellent, and managed for a natural evolving landscape character. Only very low impact recreational and scientific activities are allowed, and no facilities are permitted.

Retention:
Areas classified Good, and managed for a natural appearing landscape character. Permitted activity or minor development should repeat the natural form, line, color, and texture of the area and remain visually subordinate to the surrounding landscape. Changes in the size, intensity, direction and pattern of activity should be unobtrusive and not readily evident.

Modification:
Areas classified Good or Fair, and managed for pastoral or rural landscape character. Permitted activity and development may dominate the original character but should remain visually compatible with the remaining natural landscape. Vegetation and landform alterations should repeat the natural edges, forms, color, and texture of the surrounding area. The scale and

character of structures, roads, and other features should borrow naturally established forms, lines, lines, colors and patterns to provide the greatest possible visual harmony.

Maximum Modification:
Areas classified Fair or Poor, and managed for urban landscape character. Permitted activity and development generally dominates the original visual character. Vegetation and landform alterations should remain visually harmonious with the adjacent landscape. When seen In the foreground and middleground, they may not fully borrow the surrounding natural forms, lines, colors and textures. Likewise, development features seen from the same distances may be out of scale and have significant details that are discordant with the natural landscape character. Overall development should be directed toward achieving the greatest possible visual harmony.

Enhancement:
Any area classified less than Excellent, with a relatively short term management objective intended to restore and/or improve the desired scenic quality. Rehabilitation activities may include alteration, concealment, or removal of obtrusive and discordant elements. Enhancement activities may include addition or modification of natural elements and man-made features to increase the variety and attractiveness of spaces, edges, forms, colors, textures, and patterns.

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