FINAL 165

FORSCOM

CORRECTIVE ACTION PLAN

3d Inf Div (Mech)

Part A Addendum

Underground Storage Tank 94A
Facility ID #9-089078
Fort Stewart, Georgia
Building 1320

Prepared for

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

Contract No. DACA21-95-D-0022
Delivery Order 0003

July 1998

SAIC®

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FINAL

ADDENDUM TO

CORRECTIVE ACTION PLAN - PART A REPORT
FOR
FACILITY ID #9-089078
UNDERGROUND STORAGE TANK 94A
AT
BUILDING 1320
FORT STEWART, GEORGIA

Prepared for:

U.S. Army Corps of Engineers - Savannah District
and
Fort Stewart Directorate of Public Works
Under Contract Number DACA21-95-D-0022
Delivery Order 0003

Prepared by:

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July 1998

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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APPENDICES (includes only additional data collected as part of this addendum)

LIST OF ACRONYMS

ACLs	alternate concentration limits
ARAR	applicable, relevant, and appropriate requirement
ASTM	American Society for Testing and Materials
BGS	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Corrective Action Plan
COC	chemicals of concern
CSF	cancer slope factor
DAF	dilution-attenuation factor
EPA	U.S. Environmental Protection Agency
GA EPD	Georgia Environmental Protection Division
GUST	Georgia Underground Storage Tank
HQ	hazard quotient
MCL	Maximum Contaminant Level
PAH	polynuclear aromatic hydrocarbon
QCSR	Quality Control Summary Report
SIP	site investigation plan
TOC	total organic carbon
TPH	total petroleum hydrocarbon
UST	underground storage tank

I. CORRECTIVE ACTION PLAN - PART A FORM & CERTIFICATION

This document represents the Addendum to the Corrective Action Plan (CAP)-Part A Report for underground storage tank (UST) 94A that was located at Building 1320 (Facility ID #9-089078), Fort Stewart, Georgia. The CAP-Part A site investigation for UST 94A was originally conducted in September 1996. Results of this investigation were documented in the original CAP-Part A Report *Corrective Action Plan - Part A Report for Facility ID #9-089089, Underground Storage Tank 94A at Building 1320, Fort Stewart, Georgia,* submitted to the Georgia Environmental Protection Division (GA EPD) in March 1997.

Comments received from GA EPD on March 19, 1998 (White 1998) approved fate and transport modeling at the site utilizing geological information obtained during the CAP-Part A and B investigations for Facility ID #9-089036. These results are summarized in this addendum to the original CAP-Part A Report. Based on the results of the fate and transport modeling, a no-further-action-required status is recommended for the site.

Part I of this addendum contains an updated, CAP-Part A form, including re-certification of the plan (with addendums). Supporting documentation related to information indicated on the CAP-Part A form is presented in Parts II through VI of this addendum and the original CAP-Part A Report submitted in March 1997.

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Georgia Department of Natural Resources

Environmental Protection Division

Underground Storage Tank Management Program
4244 International Parkway, Suite 104, Atlanta, Georgia 30354
Lonice C. Barrett, Commissioner
Harold Reheis, Director
(404)362-2687

CORRECTIVE ACTION PLAN
PART A

Facility Name: Building 1320 Area, UST 94A Site

Street Address: Wilson Avenue north of W. 15th Street

City: Fort Stewart County: Liberty Facility ID: 9-089078

Submitted by UST Owner/Operator:

Name: John H. Spears/Environmental Branch

Company: U.S. Army/HQ 3d Inf. Div. (Mech.)

Address: DPW ENRD ENV. Br. (Spears)
1557 Frank Cochran Drive

City: Fort Stewart State: Georgia

Zip Code: 31314-4928

Prepared by:

Name: Patricia Stoll

Company: SAIC

Address: P.O. Box 2502

City: Oak Ridge State: Tennessee

Zip Code: 37830

I. PLAN CERTIFICATION:

A. UST Owner/Operator

I hereby certify that the information contained in this plan and in all the attachments is true, accurate, and complete, and the plan satisfies all criteria and requirements of Rule 391-3-15-.09 of the Georgia Rules for Underground Storage Tank Management.

Name: John H. Spears

Signature: for Douglas H. Sivinski Date: 7/30/98

B. Professional Engineer or Professional Geologist

I hereby certify that I have directed the field work and preparation of this plan, in accordance with State Rules and Regulations. As a registered geologist and/or engineer, I certify that I am a qualified groundwater professional, as defined by the Georgia State Board of Professional Geologists. All of the information and laboratory data in this plan and in all of the attachments are true, accurate, complete, and in accordance with applicable State Rules and Regulations.

Name: Patricia Stoll

Signature: Patricia A Stoll

Date: 7/24/98

GEORGIA REGISTERED 22851 PROFESSIONAL ENGINEER P. A. STOLL

Georgia Stamp or Seal

Please complete the following form, check all of the boxes below that apply, and attached supporting documentation (such as narrative, figures, tables, maps, boring/well logs, etc.) where specified and applicable. Supporting documentation should be three-hole punched and prepared in conformity with the attached guidance document "Underground Storage Tank (UST) Release: Corrective Action Plan - Part A (CAP-A) Content", GUST-7A.

II. INITIAL RESPONSE REPORT:

A. Initial Abatement:

- [X] No Action Required
- [ ] Further Release or Migration of Contaminants Prevented
- [ ] Fire And Safety Hazards From Vapors And/Or Free Product Monitored and Mitigated
- [ ] Other (specify) _____

_____

B. Free Product Removal:

- [X] No Free Product Identified As Originating From Release
- [ ] Free Product (Non-Aqueous Phase Hydrocarbons) Removed by:
  - [ ] Manual Bailing
  - [ ] Passive Skimming
  - [ ] Automated Skimming
  - [ ] Automated Total Fluids Pumping, With Treatment System And Approved Wastewater Discharge
  - [ ] Other (specify) _____

_____

C. Tank History

- [X] Site Map Attached Identifying Former and/or Existing USTs (see Figure II-1, CAP-Part A)
- [ ] Not Applicable

D. Initial Site Characterization:

☒ Site Map: include the following items on an attached site map

- Tank Pit Area
- Piping Trenches
- Dispensers
- Sewer Lines (if present)
- Water Lines
- North Arrow
- Sample Locations (with sample numbers and depths)
- Tanks with ID#s, corresponding to Notification Form 7530-1
- Scale 1 in = 40 ft

1. Regulated Substance Released

☐ Gasoline ☐ Diesel ☐ Kerosene ☒ Waste oil

☐ Other _____

2. Source of Contamination

Number of USTs: in use 0 ; closed/removed 1

☐ Existing UST System(s): ☐ piping ☐ tank ☐ other

☒ Former UST System(s): ☒ piping ☒ tank ☐ other

3. Impacted Environmental Media

☒ Groundwater

☐ Free product

☒ Dissolved (BTEX and/or PAH) contamination exceeding:

☐ In-stream water quality standards

☒ Drinking water Maximum Contaminant Levels (MCLs)

☒ Soil Exceeding:

☐ Laboratory Detection Limits, but TPH is vertically delineated to Below Detection Limits (BDL) above the groundwater table or a groundwater sample from the worst-case location has BTEX and/or PAHs below applicable Drinking and/or In-stream water quality standards.

☒ Thresholds listed in Table A, Rule 391-3-15-.09

☐ Thresholds listed in Table B, Rule 391-3-15-.09

☐ Alternate Threshold Levels (ATLs) (Reference Appendix I)

D. **Initial Site Characterization** (continued):

☐ Drinking Water Supply Impacted

☐ Surface Water Impacted

☒ Attach Laboratory Analytical Data: the following items must be included (see Appendix C)

- Laboratory Method
- Date of Sampling
- Date of Analysis
- Detection Limits
- Signed Chain of Custody
- Quality Control Data

4. Local Water Resources

☒ Drinking Water Supplies Located In:

High or average groundwater pollution susceptibility area:*

☒ Public water systems within 2.0 miles

☐ Non-public water systems within 0.5 mile

Low groundwater pollution susceptibility area:*

☐ Public water systems within 1.0 mile

☐ Non-public water systems within 0.25 mile

* As defined by the Groundwater Pollution Susceptibility Map of Georgia.

☒ Surface Water Bodies: Distance (nearest) 500 (drainage ditch) 2120 Mill Creek) feet (regardless of hydraulic gradient)

☒ Attach Documentation of Water Supply Survey and Field Reconnaissance

5. Other Hydrogeologic Data (specify values)

☒ Depth To Groundwater (shallowest) 3.40 feet BGS

☒ Groundwater Flow Direction Northeast to Southwest

☒ Hydraulic Gradient 0.043 feet/feet

6. Corrective Action Completed Or In-Progress

☒ USTs/Source Removed (after confirmed release)

☐ Excavation And Treatment/Disposal Of Contaminated Backfill Materials & Native Soils
☐ Attach manifest of proper soil disposal

☐ Other (specify) _____

_____

D. Initial Site Characterization (continued):

7. Conclusions And Recommendations

☒ No Further Action Required, including the preparation or implementation of a Site Investigation Plan. NOTE: Based on additional sampling required by GA EPD and the results of site-specific fate and transport modeling, no further action is required; however, a Site Investigation Plan has been prepared which provides justification for the NFAR status.

☐ OR

Prepare Corrective Action Plan - Part B, with a schedule for SIP implementation and submittal of CAP-Part B

8. Site Ranking

Environmental Sensitivity Score: 2250
(see Appendix II)

III. SITE INVESTIGATION PLAN:

A. Horizontal And Vertical Extent Of Contaminants In:

☐ Soil

☐ Groundwater

☐ Free product

☐ Dissolved phase

☐ Surface Water

☒ Not applicable since horizontal and vertical extent have been determined.

B. Vadose Zone and Aquifer Characteristics:

☐ Vertical Soil Permeability (Optional)

☐ Infiltration Rate (Optional)

☐ Saturated Horizontal Hydraulic Conductivity

☐ Total Organic Carbon (Optional)

☐ Dissolved Iron (Optional)

☐ Effective Porosity

☐ Seepage Velocity

☐ Grain-size Distribution (Optional)

☐ Total Petroleum Hydrocarbons (Optional)

☐ Pilot Test(s) (Optional)

☒ Other (specify) No Further Investigation Required

IV. PUBLIC NOTICE:

☐ Certified Letters to Adjacent and Potentially Affected Property Owners and Local Officials

☒ Legal Notice in Newspaper, as pre-approved by EPD

☐ Other EPD Approved Method (specify):

_____

V. CLAIM FOR REIMBURSEMENT: (For GUST Trust Fund sites only)

☐ GUST Trust Fund Application (GUST-36), must be attached if applicable

☐ Cost Proposal

- ☐ Non-Reimbursable Costs

  OR

- ☐ Reimbursable Costs
  - ☐ Invoices and Proofs-of-Payment, per GUST-91
  - ☐ Total Projected Costs to implement the Site Investigation Report (SIR) and prepare data for the Site Investigation Review Meeting, per GUST-91

☐ Payment Schedule for Reimbursement

☒ Not Applicable

II. INITIAL RESPONSE REPORT

II.A Initial Abatement

No change from the original CAP-Part A Report submitted in March 1997, no action was required.

II.B Free Product Removal

Temporary piezometers were installed in the boreholes and screened across the water table to monitor for free product. No free product was detected during the 1996 investigation.

II.C Tank History

No change from the original CAP-Part A Report submitted in March 1997.

II.D Initial Site Characterization

No change from the original CAP-Part A Report submitted in March 1997.

II.D.1 Regulated Substance Released

No change from the original CAP-Part A Report submitted in March 1997.

II.D.2 Source of Contamination

No change from the original CAP-Part A Report submitted in March 1997.

II.D.3 Impacted Environmental Media

II.D.3.a Soils

A summary of the analytical results for the soil samples collected during the September 1996 CAP-Part A site investigation activities at the site is presented in Table II-3 of the original CAP-Part A Report submitted in March 1997. Laboratory data sheets for the September 1996 samples and the project Quality Control Summary Report (QCSR) were presented in Appendices C-1 and C-3 of the original CAP-Part A report submitted in March 1997.

II.D.3.a.1 Initial Site Characterization

During the initial site characterization by Anderson Columbia, soil samples collected from the tank pit after the tank removal indicated concentrations of benzene above the applicable soil threshold level (Table A, Column 2) in the tank pit.

II.D.3.a.2 CAP-Part A Investigation (September 1996)

Trace concentrations of toluene were detected in sample 3702A1. The concentrations of toluene were well below the corresponding soil threshold levels. Total petroleum hydrocarbon (TPH) concentrations from the site investigation samples ranged from 66.5 mg/kg to 75.1 mg/kg, in samples 3704B1 and 3702A1, respectively.

The extent of contamination appeared to be limited to the immediate vicinity of the tank pit area

II.D.3.a.3 Soil Investigation Conclusions

The nature and extent of the soil contamination at the UST 94A site was evaluated using analytical data from the CAP-Part A site investigation and the initial site characterization (i.e., tank removal). Although benzene was detected in the tankpit during closure activities at concentrations exceeding its respective threshold level, soil samples collected during the CAP-Part A investigation did not indicate the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX) and polynuclear aromatic hydrocarbon (PAH) compounds above applicable soil threshold levels in the boreholes.

Therefore, it is concluded that the soil contamination observed during the tank removal is limited to the immediate area of the tank pit and that the extent of contamination has been delineated.

II.D.3.b Groundwater

A summary of the analytical results for the groundwater samples collected during the September 1996 CAP-Part A site investigation activities at the site is presented in Table II-4 of the original CAP-Part A Report submitted in March 1997. Laboratory data sheets for the September 1996 samples and the project QCSR are presented in Appendices C-2 and C-3 of the CAP-Part A report submitted in March 1997.

II.D.3.b.1 Initial Site Characterization

Groundwater samples were not collected during tank removal activities.

II.D.3.b.2 CAP-Part A Investigation (September 1996)

For the groundwater samples collected during the 1996 site investigation activites, one sample (3701W2) had detectable concentrations of BTEX; however, only the benzene concentration was above its respective maximum contaminant level (MCL). For sample 3701W2, the benzene concentration was 260 µg/L.

Since benzene was the only constituent identified above its MCL and was identified in one sample, the Installation requested that fate and transport modeling be conducted at the site to determine whether groundwater contamination will affect nearby drinking water supply wells and/or surface water bodies. GA EPD approved the use of fate and transport modeling at this site in correspondence dated March 19, 1998. Thus, following the completion of field investigation activites in September 1996 and receipt of GA EPD comments on March 19, 1998, the potential receptor survey, fate and transport modeling, and a risk

screening were performed to assess contaminant migration and impacts. Site-specific geotechnical parameters were estimated for the site based on the geotechnical information from similar UST sites at Fort Stewart. Since benzene was the only constituent identified above its MCL and was identified in one sample, the Installation requested that fate and transport modeling be conducted at the site to determine whether or not groundwater contamination will affect nearby drinking water supply wells and/or surface water bodies. GA EPD approved the use of fate and transport modeling at this site in correspondence dated March 19, 1998. Thus, the results of the potential receptor survey, risk screening, and fate and transport modeling are presented in Appendix G.

II.D.3.b.3 Groundwater Investigation Conclusions

The extent of groundwater contamination was determined to be limited to the area immediately surrounding the tank pit. The results of the potential recap for survey, risk screening, and fate and transport modeling indicate a no-further-action-required status is warranted for this site.

II.D.3.c Surface Water Impacted

No change from the original CAP-Part A Report submitted in March 1997.

II.D.3.d Drinking Water Impacted

No change from the original CAP-Part A Report submitted in March 1997.

II.D.4 Local Water Resources

II.D.4.a Drinking Water Supplies

No change from the original CAP-Part A Report submitted in March 1997.

II.D.4.b Surface Water Bodies

No change from the original CAP-Part A Report submitted in March 1997.

II.D.5 Other Hydrogeologic Data

II.D.5.a Depth to Groundwater

No change from the original CAP-Part A Report submitted in March 1997.

II.D.5.b Groundwater Flow Direction

No change from original CAP-Part A Report submitted in March 1997.

II.D.5.c Hydraulic Gradient

No change from the original CAP-Part A Report submitted in March 1997.

II.D.5.d Total Organic Carbon (Optional)

No changes from the original CAP-Part A Report submitted in March 1997.

II.D.5.e Grain Size Distribution

No changes from the original CAP-Part A Report submitted in March 1997.

II.D.5.f Total Petroleum Hydrocarbons (Optional)

No changes from the original CAP-Part A Report submitted in March 1997.

II.D.6 Corrective Action Completed or In Progress

II.D.6.a USTs Removed

No change from the original CAP-Part A Report submitted in March 1997.

II.D.6.b Excavation and Treatment/Disposal of Backfill and Native Soils

No change from the original CAP-Part A Report submitted in March 1997.

II.D.7 Conclusions and Recommendations

II.D.7.a Summary of Conclusions

The UST 94A site, Facility ID #9-089078, is located within an average or higher groundwater pollution susceptibility area. Public groundwater supply wells are located within a 2-mile radius of the site; however, the distance between the site and the nearest supply well is greater than 500 feet. Surface water bodies are located within a 1-mile radius of the site; however, the distance between the site and the nearest surface water body is greater than 500 feet. Based on this information, the applicable soil threshold levels for the site are those listed in Table A (GDNR Rules for Underground Storage Tank Management, Chapter 391-3-15) for the Average or Higher Groundwater Pollution Susceptibility Area (Column 2) greater than 500 feet to a withdrawal point category. Regulatory limits (i.e., MCLs) for groundwater contamination at the site are in accordance with the Safe Drinking Water Act.

The site was characterized through soil sampling conducted during the removal of UST 94A, and a CAP-Part A site investigation that involved both soil and groundwater sampling. Two soil samples were collected from the tank pit excavation during removal activities. In 1996, four soil boreholes were drilled,

one located within the former tank pit and three others around the perimeter of the pit. Two soil samples and one groundwater sample were collected from each of the four boreholes.

Soil analytical data from the tank removal sampling indicated that the soil from the tank pit was contaminated with benzene exceeding its applicable soil threshold level. The CAP-Part A investigation indicated only a trace amount of toluene in one sample, 3702A1. No soil contamination above threshold levels was found during the CAP-Part A investigation in the soil borings in and around the tank pit.

Groundwater analytical data from the site characterization of the CAP-Part A investigation indicate that benzene contamination in groundwater exceeded its MCL. However, this contamination was delineated and is limited to an area in the immediate vicinity of the tank pit. Waste oil analytes were not detected above detection limits or MCLs in groundwater samples collected from piezometers installed around the perimeter of the former tank pit (i.e., 37-02 through 37-04).

As a result of the risk screening, no COCs were selected for soils and benzene and lead were selected as COCs for groundwater. However, the lead concentrations in groundwater were attributed to the suspended particles in the samples. The benzene concentration in groundwater was below the ACL of 990 μg/L.

Results of the fate and transport modeling indicate that benzene will not reach a drainage ditch located 500 feet west of the site or Mill Creek located 2120 feet west of the site. Vertical migration of the contaminant plume to the Principal Artesian aquifer is improbable due to the thick and impermeable confining unit that separates the surficial aquifer from the Principal Artesian aquifer.

II.D.7.b Recommendations

Analytical results for soil and groundwater samples collected during the site investigation at the site are sufficient to define the nature and extent of petroleum-related contamination at the site. Based on these findings, further investigation of the UST 94A site, Facility ID #9-089078, is not required, and a no-further-action-required status is recommended for the site. The rationale for this recommendation is presented in Section III, Site Investigation Plan (SIP).

II.D.8 Site Ranking

No change from the original CAP-Part A Report submitted in March 1997.

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III. SITE INVESTIGATION PLAN

This SIP presents the technical approach used to delineate the full extent of soil and/or groundwater contamination as a result of releases from UST 94A, Facility ID #9-089078.

III.A Horizontal and Vertical Extent of Contamination

III.A.1 Soils

Soil contamination was delineated by analyzing soil collected during initial site characterization (i.e., tank removal) and CAP-Part A site investigation. The CAP-Part A investigation consisted of one borehole in the tank pit, and three boreholes around the perimeter of the tank pit. Soil samples that were collected from the tank pit after the tank removal indicated concentrations of benzene above its soil threshold level. The depth at which the tank removal samples were collected is not known; however, given the fact that the groundwater table is located at a depth of approximately 5 to 6 feet BGS, it is unlikely that these samples were taken from a point at or below the groundwater table. Soil samples collected from boreholes 37-01 through 37-04 that were located in and around the perimeter of the tank pit did not indicate the presence of BTEX or PAH compounds.

The horizontal and vertical extent of the soil contamination was determined during the CAP-Part A site investigations. Therefore, no additional soil borings are recommended as part of the SIP.

III.A.2 Groundwater

Groundwater contamination was delineated by analyzing groundwater from four temporary piezometers installed in and around the contamination source during the CAP-Part A site investigation. Groundwater samples collected from three piezometers that were located around the perimeter of the tank pit did not indicate the presence of BTEX or PAH compounds. The groundwater samples collected from boring 37-01 (the borehole in the tank pit) indicated that the concentration of benzene exceeded its MCL.

The extent of the groundwater contamination was determined during the CAP-Part A site investigation. The groundwater contamination is limited laterally to the immediate tank pit area so that extensive vertical migration is unlikely. Therefore, no monitoring wells are recommended as part of the SIP.

III.A.3 Surface Water

No changes from the original CAP-Part A Report submitted in March 1997.

III.B Vadose Zone and Aquifer Characteristics

No changes from the original CAP-Part A Report submitted in March 1997.

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IV. PUBLIC NOTICE

No change from the original CAP-Part A Report submitted in March 1997.

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V. CLAIM FOR REIMBURSEMENT: GUST TRUST FUND

No change from the original CAP-Part A Report submitted in March 1997.

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VI. REFERENCES

White, Kenneth F. 1998. Letter to John Spears (Fort Stewart DPW ENRD Environmental Branch), March 19, 1998.

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APPENDIX A

SOIL BORING LOGS

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APPENDIX B

TECHNICAL APPROACH FOR FACILITY ID #9-089078

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APPENDIX C

ANALYTICAL DATA SHEETS

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APPENDIX D

DOCUMENTATION OF WATER SUPPLY SURVEY FOR THE FORT STEWART GARRISON AREA

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APPENDIX E

SITE RANKING FORM FOR FACILITY ID #9-089079

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No changes from the original CAP-Part A submitted to GA EPD in March 1997.

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APPENDIX F

PUBLIC NOTIFICATION NEWSPAPER ANNOUNCEMENT FOR FACILITY ID #9-089079

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No changes from the original CAP-Part A submitted to GA EPD in March 1997.

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APPENDIX G

RISK-BASED CORRECTIVE ACTION

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G. PROVIDE RISK-BASED CORRECTIVE ACTION

G.1 Approach

A risk-based approach was utilized to determine the need for further action at the UST 94A site. Due to the nature of the contamination (petroleum hydrocarbon contamination of groundwater), the risk-based approach was limited to human health concerns. Ecological risk concerns are negligible as a result of the lack of habitat available for ecological receptors due to 10 inches of concrete overlying the entire site.

The methods for assessing human health concerns for the site were derived primarily from recent Georgia Environmental Protection Division (GA EPD) guidance (GA EPD 1996) and the *Supplemental Guidance to RAGS: Region IV Bulletin Human Health Risk Assessment* (EPA 1994); these were supplemented by additional guidance documents on risk assessment methods referenced in this section. Risk-based remediation threshold levels were identified in two steps: (1) screening against risk-based and applicable, relevant, and appropriate requirement (ARAR)-based screening levels for chemicals of concern (COCs), and (2) development of site-specific alternate concentration limits (ACLs) for the COCs identified during the screening. The following sections present the conceptual model of the exposure setting and potential receptors and the general methodology employed to perform the screening for COCs and the development of ACLs.

G.2 Potential Receptor Survey

G.2.1 Exposure Assessment

The exposure assessment identifies any potentially complete pathways between the contaminant source and potential receptors. This involves identifying potential current and future receptors, release mechanisms through which contamination may come into contact with the receptors, and the routes of exposure through which the receptors may be exposed.

The site is located within an active military installation. The UST 94A site is located within an access-controlled fence of a secured motorpool. The land use at the site is currently military industrial. An Installation housing area is located approximately 2000 feet to the northeast. Mill Creek is located approximately 2120 feet west of the site.

No current on-site receptors have been identified for the site. Potential current off-site receptors include military residents and children. Potential future on-site receptors may include industrial workers and residential receptors.

No connection between site contamination and current off-site receptors has been identified. It is unlikely that Installations residents will come in contact with contaminated groundwater due to the depth at which drinking water is pumped from the Floridan aquifer and the thick confining layer located between this aquifer and the surficial aquifer. No basements have been identified in the area that could potentially be affected by vapor intrusion from chemicals in the groundwater. None of the Installation's water supply wells are

located downgradient of the UST 94A site. The water supply wells are separated from the surficial aquifer by the Hawthorn Group, a thick and highly effective confining unit.

Potential future on-site industrial receptors may come in direct contact with site soil contamination during construction or excavation activities. Potential future residential receptors may come in direct contact with groundwater contamination during household water use.

Exposure from *direct contact pathways* represents exposure via direct contact with the source media. For direct contact pathways the exposure point concentration is the concentration source term (EPA 1994) and is represented by data collected at the site. Screening for the direct contact pathways utilize the results of the data collected at the UST 94A site to perform the screens.

Exposure pathways that incorporate chemical migration to a secondary media (groundwater, surface water, sediments, air, and biota) or to an off-site receptor are referred to as *indirect contact pathways*. The exposure point concentrations for the secondary media will be determined using mathematical models that take into consideration chemical-specific and media-specific properties to estimate the chemical concentration in the secondary exposure media.

G.2.2 Screening for Chemicals of Concern

The purpose of a risk evaluation screen is to identify the COCs and areas of concern at a site, and possibly identify sites for which no further action is needed. The first step in the risk process uses screening levels that are readily obtainable and, due to their conservative nature, can be used with a high degree of confidence to indicate sites for which no further action is required.

An ASTM (ASTM 1995) Tier 1-type risk evaluation process will be applied to the data collected for the UST 94A site to identify any COCs and media for which no further action is needed. The risk evaluation screen involves the following steps:

- Identify potential migration and exposure pathways associated with the site and identify potential exposure scenarios that should be used to select screening levels.
- Identify risk-based and ARAR-based screening levels for each contaminant.
- Compare site-related concentrations to screening levels to determine if any chemicals of potential concern exist at the site.
- Compare detection limits to screening levels to identify potential false negative screening results.

The screening levels for the UST 94A site data have been taken from the following sources based on GA EPD guidance (GA EPD 1996):

- Federal MCLs (EPA 1989);
- GUST Soil Threshold Levels (Table A, Column 2);

- Soil screening levels developed by U.S. Environmental Protection Agency (EPA 1996); and
- Soil and groundwater risk-based concentrations developed by U.S. Environmental Protection Agency (EPA) Region 3 (EPA 1996).

These values reflect screening levels based on a combination of ARARs (i.e., MCLs and GUST Soil Threshold Levels), and calculated risk-based values (i.e., EPA Region 3 risk-based concentrations). Soil and groundwater screening levels reflect a combination of both ARAR-based and risk-based values.

Screening levels inherently incorporate assumptions about land use. In identifying COCs, it is generally accepted that screening levels will reflect any potential future land uses and, thus, reflect a conservative residential use scenario (EPA 1991; EPA 1996; ASTM 1995). Based on GA EPD guidance, risk-based screening levels reflect residential land use for groundwater and industrial land use for deep soils (GA EPD 1996).

Default residential exposure scenarios for groundwater assume that use of the land could someday be residential, and that the following exposures could occur:

- Ingestion of groundwater, and
- Inhalation of volatiles during showering.

The default industrial exposure assumptions for deep soils assume that the following exposures could occur:

- Incidental ingestion of soil, and
- Inhalation of volatiles and dust.

The EPA Soil Screening Guidance (EPA 1996) provides two options for selecting soil values that address protection of groundwater. One value assumes no contaminant dilution or attenuation would occur between the soil and groundwater; a second value assumes a 20-fold dilution-attenuation factor (DAF). A DAF of 20 was used to develop soil screening values protective of groundwater at the UST 94A site.

If ARAR- or risk-based values are not available, it generally reflects (1) that the chemical is not considered to be toxic except perhaps at extremely high concentrations (e.g., aluminum, sodium, etc.); (2) no dose-response data indicate a toxic effect; or (3) EPA is currently reviewing toxicity information and no reference dose or cancer slope factor currently is available.

G.2.3 Results

The risk screening process is a systematic screening of sample results to determine site-related COCs. Chemical concentrations below risk- or ARAR-based screening levels are not considered COCs and are not evaluated further. Addendum Tables G.1 and G.2 present the results of the risk-based screening for the Part A SI soil data and groundwater data, respectively.

Addendum Table G.1. Risk-based Screening of Soil Data at the UST 94A Site, Facility ID #9-089078

Station:	Screening Levels			37-01	37-02	37-02	37-03	37-03	37-04
Sample ID:				3701B1	3702A1	3702B1	3703B1	3703C1	3704B1
Sample Interval:				2.5' - 5.0'	1.0' - 2.5'	2.5' - 5.0'	2.5' - 5.0'	5.0' - 7.5'	2.5' - 5.0'
Media:				Soil	Soil	Soil	Soil	Soil	Soil
Sample Type:				Grab	Grab	Grab	Grab	Grab	Grab
Collection Date:				20-Sep-96	20-Sep-96	20-Sep-96	20-Sep-96	20-Sep-96	20-Sep-96
Units:	Georgia UST Corrective Action Levels for Soil[a] (ug/kg)	Risk-based Screening Level[b] (ug/kg)	Leaching to Groundwater (ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
2-Chloronaphthalene[d]	N/A[e]	82000000	84000	369 U	355 U	358 U	357 U	398 U	367 U
Acenaphthene	N/A[e]	120000000	570000	369 U	355 U	358 U	357 U	398 U	367 U
Acenaphthylene	N/A[e]	61000000	4200000	369 U	355 U	358 U	357 U	398 U	367 U
Anthracene	N/A[e]	610000000	12000000	369 U	355 U	358 U	357 U	398 U	367 U
Benzene	8	200000	30	5.7 U	5.5 U	5.4 U	5.4 U	6.1 U	5.6 U
Benzo(a)anthracene	N/A[e]	7800	2000	369 U	355 U	358 U	357 U	398 U	367 U
Benzo(a)pyrene	N/A[e]	780	8000	369 U	355 U	358 U	357 U	398 U	367 U
Benzo(b)fluoranthene	N/A[e]	7800	5000	369 U	355 U	358 U	357 U	398 U	367 U
Benzo(g,h,i)perylene	N/A[e]			369 U	355 U	358 U	357 U	398 U	367 U
Benzo(k)fluoranthene	N/A[e]	78000	49000	369 U	355 U	358 U	357 U	398 U	367 U
Chrysene	N/A[e]	780000	160000	369 U	355 U	358 U	357 U	398 U	367 U
Dibenzo(a,h)anthracene	N/A[e]	780	2000	369 U	355 U	358 U	357 U	398 U	367 U
Ethylbenzene	10000	200000000	13000	5.7 U	5.5 U	5.4 U	5.4 U	6.1 U	5.6 U
Fluoranthene	N/A[e]	82000000	4300000	369 U	355 U	358 U	357 U	398 U	367 U
Fluorene	N/A[e]	82000000	560000	369 U	355 U	358 U	357 U	398 U	367 U
Indeno(1,2,3-cd)pyrene	N/A[e]	7800	14000	369 U	355 U	358 U	357 U	398 U	367 U
Lead	--	5000000	--	1100 U	6900 =		2300 =		6100 =
Naphthalene	N/A[e]	82000000	84000	369 U	355 U	358 U	357 U	398 U	367 U
Phenanthrene[f]	N/A[e]	61000000	4200000	369 U	355 U	358 U	357 U	398 U	367 U
Pyrene	N/A[e]	61000000	4200000	369 U	355 U	358 U	357 U	398 U	367 U
Toluene	6000	410000000	12000	5.7 U	9.6 =	6.1 J	5.4 U	6.1 U	5.6 U
Total Petroleum Hydrocarbons	--	--	--	11400 U	75100 =	10800 U	10900 U	29900 U	66500 =
Xylenes, Total	700000	1000000000	190000	5.7 U	5.5 U	5.4 U	5.4 U	6.1 U	5.6 U

[a] Average or higher groundwater pollution susceptibility area (where public water supply is within 2.0 mi.).
[b] Protective of soil exposure during Industrial Land Use.
[c] Protective of groundwater ingestion. Used a dilution attenuation factor of 20.
[d] Values based on naphthalene as a surrogate chemical.
[e] Not applicable. The screening level exceeds the expected soil concentration under free product condition.
[f] Values based on pyrene as a surrogate chemical.
10 Bold values indicate results exceeding Georgia UST action levels.
10 Italicized values indicate results exceeding risk-based screening levels.
<u>10</u> Underlined values indicate results exceeding leaching to groundwater screening levels.
U Indicates that the compound was not detected above the reported sample quantitation limit
J Indicates that the value for the compound was an estimated value
UJ Indicates that the sample was not detected above an approximate sample quantitation limit
R Indicates that the sample results are unusable and the presence or absence of the compound could not be verified
= Indicates that the compound was detected at the concentration reported

Addendum Table G.2. Risk-based Screening of Groundwater Data at the UST 94A Site, Facility ID #9-089078

Station:	Screening Levels		37-01	37-02	37-03	37-04
Sample ID:			3701W2	3702W2	3703W2	3704W2
Media:		Risk-based	Groundwater	Groundwater	Groundwater	Groundwater
Sample Type:	Federal	Screening	Grab	Grab	Grab	Grab
Collection Date:	SDWA MCLs	Level[a]	20-Sep-96	20-Sep-96	20-Sep-96	20-Sep-96
Units:	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
2-Chloronaphthalene[b]		1500	10 U	10 U	10 U	11.1 U
Acenaphthene		2200	10 U	10 U	10 U	11.1 U
Acenaphthylene		1100	10 U	10 U	10 U	11.1 U
Anthracene		11000	10 U	10 U	10 U	11.1 U
Benzene	5	0.36	**260** =	0.99 J	5 U	5 U
Benzo(a)anthracene		0.092	10 U	10 U	10 U	11.1 U
Benzo(a)pyrene	0.2	0.0092	**10** U	**10** U	**10** U	**11.1** U
Benzo(b)fluoranthene		0.092	10 U	10 U	10 U	11.1 U
Benzo(g,h,i)perylene			10 U	10 U	10 U	11.1 U
Benzo(k)fluoranthene		0.92	10 U	10 U	10 U	11.1 U
Chrysene		9.2	10 U	10 U	10 U	11.1 U
Dibenzo(a,h)anthracene		0.0092	10 U	10 U	10 U	11.1 U
Ethylbenzene	700	1300	87.3 =	5 U	5 U	5 U
Fluoranthene		1500	10 U	10 U	10 U	11.1 U
Fluorene		1500	10 U	10 U	10 U	11.1 U
Indeno(1,2,3-cd)pyrene		0.092	10 U	10 U	10 U	11.1 U
Lead	15[d]		**86.4** =	**22.6** =	**54.6** =	**65.5** =
Naphthalene		1500	54 =	10 U	10 U	11.1 U
Phenanthrene[c]		1100	10 U	10 U	10 U	11.1 U
Pyrene		1100	10 U	10 U	10 U	11.1 U
Toluene	1000	750	25.4 =	5 U	5 U	5 U
Xylenes, Total	10000	12000	167 =	5 U	5 U	5 U

[a] Protective of tap water ingestion by a resident.

[b] Values based on naphthalene as a surrogate chemical.

[c] Values based on pyrene as a surrogate chemical.

[d] Technology Action Level (Federal Register Vol. 56. No. 110, June 7, 1991)

10 Bold values indicate results exceeding Federal Safe Drinking Water Act Maximum Contaminant Levels.

10 Underlined values indicate results exceeding risk-based screening levels.

U Indicates that the compound was not detected above the reported sample quantitation limit

J Indicates that the value for the compound was an estimated value

UJ Indicates that the sample was not detected above an approximate sample quantitation limit

R Indicates that the sample results are unusable and the presence or absence of the compound could not be verified

= Indicates that the compound was detected at the concentration reported

Lead, toluene, and TPH were detected in site soils. No detections exceeded screening levels. No COCs were selected for site soils. Detection limits for soil samples were below screening values. No COCs for soils were selected based on a detection limit screening.

In groundwater, benzene was detected above the risk-based screening value in two samples. One of these detections for benzene also exceeded the MCL of 5 µg/L by two orders of magnitude. Lead was analyzed for and detected in four samples; all four detections exceeded the technology action level of lead (15 µg/L). Ethylbenzene, naphthalene, toluene, and xylenes were also detected in one sample below screening levels. Benzene and lead were selected as COCs for UST 94A area groundwater.

Detection limits for several PAHs exceeded risk-based screening levels. For these chemicals, risk-based values represent values below analytically achievable levels. No additional COCs for groundwater were selected based on the detection limit screening.

G.2.4 Uncertainties

Groundwater samples collected during the CAP-Part A investigations were collected from hydropunch sampling devices or temporary piezometers and contained a high amount of suspended solids and were very turbid. The lead concentrations in these samples above the technology action level is attributed to the suspended particles and not the contaminated groundwater.

G.2.5 Alternate Concentration Limits

Detections exceeding the conservative generic screening levels are considered COCs. ACLs are developed for the COCs using site-specific information. GA EPD recommends developing risk-based remediation levels using a risk goal at least 1×10^{-6} and not to exceed 1×10^{-4} for all carcinogens, and a hazard quotient (HQ) of 3 for noncarcinogens (GA EPD 1996).

Data were screened against risk- and ARAR-based screening levels. No COCs were identified for UST 94A soils. Benzene and lead were selected as COCs for groundwater. No risk-based methodology can be employed to develop site-specific cleanup levels for lead in the groundwater at the site. The default screening level of 15 µg/L for lead based on the technology action level will be used as the ACL for the site. The ACL for benzene was developed using a target risk of 1×10^{-4}. No current receptor for groundwater contamination exists at the site. The most likely potential future exposure would be ingestion of groundwater by an industrial worker. An ACL for an industrial drinking water receptor was calculated using a target risk of 1×10^{-4} and EPA methodology (EPA 1994). The groundwater ACL calculated for benzene is 990 µg/L. ACL calculations are in Section G.5.

G.3 Fate and Transport Model

The AT123D model was used to determine the impact of dissolved hydrocarbons on potential receptors. Modeling of the leaching of soil contamination to the groundwater was not performed because there was no soil contamination above the water table. Site-specific geotechnical data was estimated based on geotechnical information from similar UST sites at Fort Stewart. A drainage ditch is located approximately

500 feet from the site. In addition to the drainage ditch, Mill Creek is located approximately 2120 feet from the site. Both Mill Creek and the drainage ditch were evaluated as potential receptors. Vertical migration of the contaminant plume through the confining unit to the Principal Artesian aquifer is improbable. The confining unit has a vertical hydraulic conductivity on the order of 10^{-8} cm/sec and ranges from 15- to 90-feet thick. The surficial aquifer where the contaminant plume is located is not used as a source of drinking water.

The modeling results are provided in Section G.6 of this appendix. Two potential downgradient locations where a receptor may encounter migrating groundwater contamination were modeled. A drainage ditch approximately 500 feet away from the site and Mill Creek approximately 2120 feet west of the site are the nearest possible locations where a receptor may encounter migrating groundwater contamination due to a possible hydraulic connection between the groundwater and the surface water in the ditch and the creek. Contaminant migration modeling for 100 years of groundwater migrating to surface water in the ditch and in the creek, when accounting for biodegradation, indicates that benzene will not reach either location in detectable levels. If biodegradation and natural attenuation is ignored, benzene will still not reach Mill Creek in detectable levels, but modeled benzene concentrations exceeded the MCL in the drainage ditch after 25 years. No hydraulic connection between the ditch and the groundwater is known to exist, and ignoring biodegradation and natural attenuation will result in an overly conservative modeling estimate. If the drainage ditch is receiving influx from the groundwater due to a hydraulic connection, any detected benzene levels in the surface water would not be at concentrations above MCLs based on the current site conditions at Facility ID #9-089078, due to biodegradation and natural attenuation.

G.4 Conclusions and Recommendations

The following conclusions are based on a review of the CAP-Part A site investigation results using a risk-based approach:

- Risk-based screening results show that benzene exceed initial risk-based screening levels. Using a site-specific scenario of an industrial worker exposure, this chemical does not exceed its ACLs.
- The receptor survey indicates present hydrocarbon contamination does not impact drinking water supplies.
- Fate and transport modeling indicates that contamination from current site conditions at Facility ID #9-089078 will never exceed MCLs at a conservatively defined downgradient receptor.

Considering the site characteristics, natural attenuation will provide the best corrective action. Therefore, based on the results of the fate and transport modeling, a no-further-action-required status is recommended for the site. A monitoring program is not recommended to confirm the modeling predictions, since all additional requirements of GA EPD as stated in correspondence dated March 19, 1998, have been completed. In addition, permanent monitoring wells do not exist at the site, as they were not required by GA EPD.

G.5 Alternate Concentration Limits Calculations

ACL Calculation for Benzene

CSF	Benzene oral Cancer Slope Factor	= 0.029 $(mg/kg\text{-}day)^{-1}$
IR	Ingestion rate	= 1 L/day
EF	Exposure frequency	= 250 days/year
ED	Exposure duration	= 25 years
BW	Body weight	= 70 kg
AT	Averaging time = 70 years × 365 days/year	= 25550 days
TR	Target Risk	= 1×10^{-4}

$$ACL = \frac{TR \times BW \times AT}{IR \times EF \times ED \times CSF} = \frac{10^{-4} \times 70 \times 25550}{1 \times 250 \times 25 \times 0.029}$$

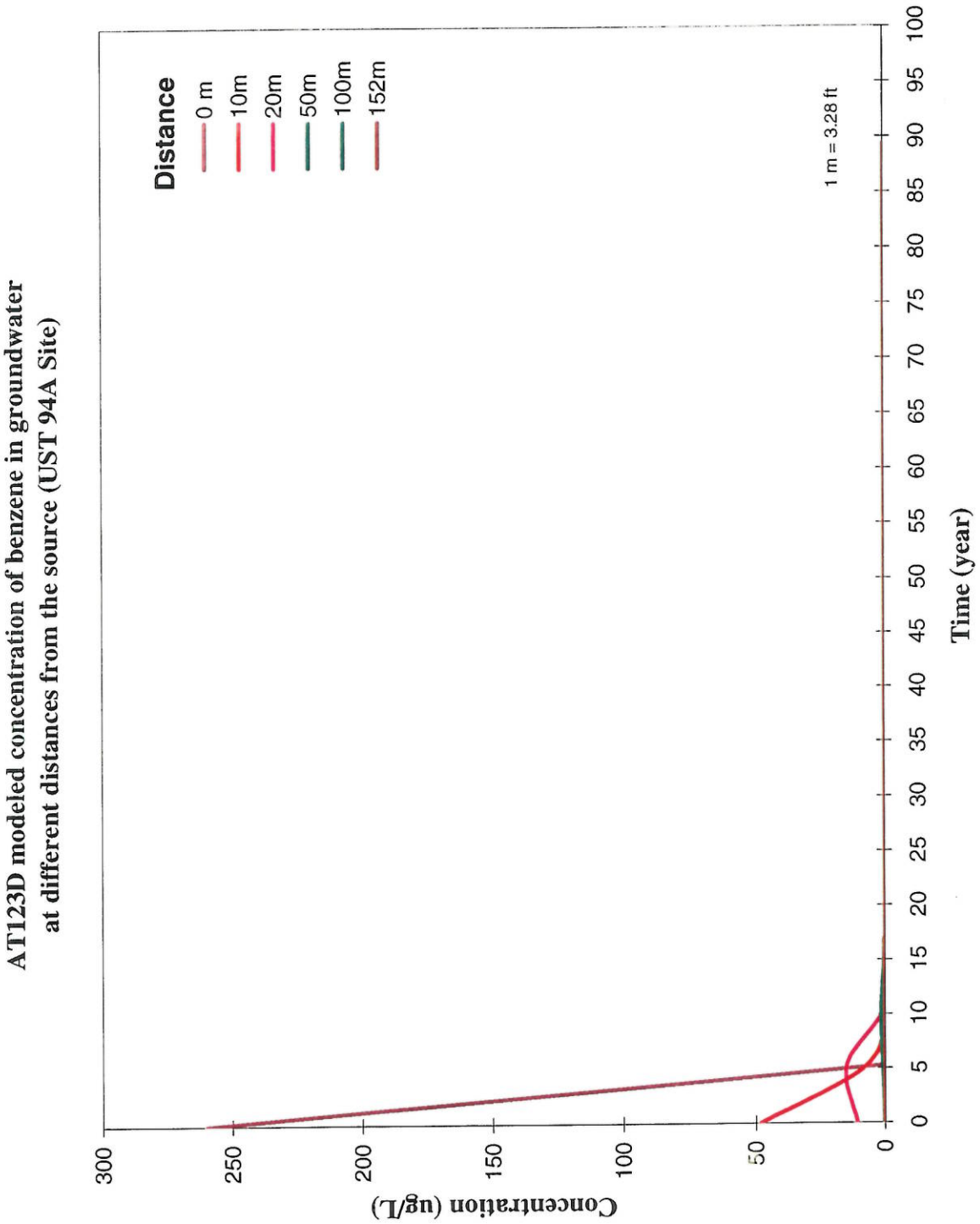
$$= 0.987 \text{ mg/L}$$

$$\sim 0.990 \text{ mg/L}$$

$$\sim 990 \text{ µg/L}$$

G.6 Fate and Transport Modeling Results

Following are the data for fate and transport modeling.


AT123D modeled concentration of benzene in groundwater
at different distances from the source (UST 94A Site)
Distance
0 m
10m
20m
50m
100m
152m
1 m = 3.28 ft
Concentration (ug/L)
300
250
200
150
100
50
0
Time (year)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

Ft Stewart, UST 94A Site, Benzene (calibrated plume)

NO. OF POINTS IN X-DIRECTION	10
NO. OF POINTS IN Y-DIRECTION	5
NO. OF POINTS IN Z-DIRECTION	1
NO. OF ROOTS: NO. OF SERIES TERMS	400
NO. OF BEGINNING TIME STEP	122
NO. OF ENDING TIME STEP	1220
NO. OF TIME INTERVALS FOR PRINTED OUT SOLUTION	64
INSTANTANEOUS SOURCE CONTROL = 0 FOR INSTANT SOURCE	1
SOURCE CONDITION CONTROL = 0 FOR STEADY SOURCE	0
INTERMITTENT OUTPUT CONTROL = 0 NO SUCH OUTPUT	1
CASE CONTROL =1 THERMAL, = 2 FOR CHEMICAL, = 3 RAD	2

AQUIFER DEPTH, = 0.0 FOR INFINITE DEEP (METERS) ...	0.1097E+02
AQUIFER WIDTH, = 0.0 FOR INFINITE WIDE (METERS) ...	0.0000E+00
BEGIN POINT OF X-SOURCE LOCATION (METERS)	-0.2285E+01
END POINT OF X-SOURCE LOCATION (METERS)	0.2285E+01
BEGIN POINT OF Y-SOURCE LOCATION (METERS)	-0.1525E+01
END POINT OF Y-SOURCE LOCATION (METERS)	0.1525E+01
BEGIN POINT OF Z-SOURCE LOCATION (METERS)	0.0000E+00
END POINT OF Z-SOURCE LOCATION (METERS)	0.2000E+01

POROSITY	0.2000E+00
HYDRAULIC CONDUCTIVITY (METER/HOUR)	0.7200E-02
HYDRAULIC GRADIENT	0.4300E-01
LONGITUDINAL DISPERSIVITY (METER)	0.2000E+01
LATERAL DISPERSIVITY (METER)	0.1000E+01
VERTICAL DISPERSIVITY (METER)	0.1000E+01
DISTRIBUTION COEFFICIENT, KD (M**3/KG)	0.3410E-03
HEAT EXCHANGE COEFFICIENT (KCAL/HR-M**2-DEGREE C)..	0.0000E+00

MOLECULAR DIFFUSION MULTIPLY BY POROSITY (M**2/HR)	0.3530E-05
DECAY CONSTANT (PER HOUR)	0.4012E-04
BULK DENSITY OF THE SOIL (KG/M**3)	0.1596E+04
ACCURACY TOLERANCE FOR REACHING STEADY STATE	0.1000E-02
DENSITY OF WATER (KG/M**3)	0.1000E+04
TIME INTERVAL SIZE FOR THE DESIRED SOLUTION (HR) ..	0.7200E+03
DISCHARGE TIME (HR)	0.8760E+05
WASTE RELEASE RATE (KCAL/HR), (KG/HR), OR (CI/HR) .	0.2340E-05

RETARDATION FACTOR	0.3721E+01
RETARDED DARCY VELOCITY (M/HR)	0.4160E-03
RETARDED LONGITUDINAL DISPERSION COEF. (M**2/HR) ..	0.8367E-03
RETARDED LATERAL DISPERSION COEFFICIENT (M**2/HR) .	0.4207E-03
RETARDED VERTICAL DISPERSION COEFFICIENT (M**2/HR).	0.4207E-03

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.0000E+00 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.8712E+05 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.173E-01	0.238E-01	0.266E-01	0.196E-01	0.695E-02	0.157E-03	0.273E-10	0.000E+00	0.000E+00	0.000E+00
4.	0.338E-01	0.442E-01	0.431E-01	0.265E-01	0.814E-02	0.169E-03	0.291E-10	0.000E+00	0.000E+00	0.000E+00
3.	0.685E-01	0.833E-01	0.672E-01	0.341E-01	0.923E-02	0.179E-03	0.305E-10	0.000E+00	0.000E+00	0.000E+00
2.	0.137E+00	0.153E+00	0.974E-01	0.412E-01	0.101E-01	0.187E-03	0.316E-10	0.000E+00	0.000E+00	0.000E+00
0.	0.260E+00	0.269E+00	0.136E+00	0.483E-01	0.109E-01	0.193E-03	0.325E-10	0.000E+00	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.1332E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.112E-03	0.180E-03	0.337E-03	0.787E-03	0.210E-02	0.513E-03	0.202E-06	0.000E+00	0.000E+00	0.000E+00
4.	0.201E-03	0.320E-03	0.598E-03	0.137E-02	0.344E-02	0.607E-03	0.216E-06	0.000E+00	0.000E+00	0.000E+00
3.	0.365E-03	0.581E-03	0.108E-02	0.244E-02	0.570E-02	0.701E-03	0.228E-06	0.000E+00	0.000E+00	0.000E+00
2.	0.651E-03	0.104E-02	0.191E-02	0.426E-02	0.934E-02	0.788E-03	0.237E-06	0.000E+00	0.000E+00	0.000E+00
0.	0.113E-02	0.180E-02	0.331E-02	0.728E-02	0.152E-01	0.877E-03	0.244E-06	0.000E+00	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.1793E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.123E-05	0.199E-05	0.393E-05	0.109E-04	0.553E-04	0.299E-03	0.314E-05	0.772E-10	0.000E+00	0.000E+00
4.	0.218E-05	0.352E-05	0.694E-05	0.192E-04	0.953E-04	0.444E-03	0.345E-05	0.825E-10	0.000E+00	0.000E+00
3.	0.392E-05	0.633E-05	0.125E-04	0.342E-04	0.167E-03	0.666E-03	0.371E-05	0.868E-10	0.000E+00	0.000E+00
2.	0.693E-05	0.112E-04	0.220E-04	0.602E-04	0.288E-03	0.992E-03	0.392E-05	0.901E-10	0.000E+00	0.000E+00
0.	0.120E-04	0.193E-04	0.379E-04	0.103E-03	0.487E-03	0.149E-02	0.410E-05	0.928E-10	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.2254E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.149E-07	0.243E-07	0.489E-07	0.145E-06	0.955E-06	0.272E-04	0.735E-05	0.620E-08	0.000E+00	0.000E+00
4.	0.263E-07	0.428E-07	0.861E-07	0.255E-06	0.166E-05	0.441E-04	0.913E-05	0.669E-08	0.000E+00	0.000E+00
3.	0.472E-07	0.768E-07	0.154E-06	0.456E-06	0.294E-05	0.725E-04	0.112E-04	0.710E-08	0.000E+00	0.000E+00
2.	0.834E-07	0.135E-06	0.272E-06	0.802E-06	0.513E-05	0.118E-03	0.137E-04	0.741E-08	0.000E+00	0.000E+00
0.	0.144E-06	0.233E-06	0.468E-06	0.138E-05	0.874E-05	0.191E-03	0.169E-04	0.767E-08	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.2714E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.190E-09	0.310E-09	0.631E-09	0.194E-08	0.147E-07	0.107E-05	0.442E-05	0.443E-07	0.000E+00	0.000E+00
4.	0.335E-09	0.546E-09	0.111E-08	0.341E-08	0.257E-07	0.179E-05	0.628E-05	0.499E-07	0.000E+00	0.000E+00
3.	0.600E-09	0.977E-09	0.199E-08	0.610E-08	0.456E-07	0.304E-05	0.901E-05	0.552E-07	0.000E+00	0.000E+00
2.	0.106E-08	0.172E-08	0.350E-08	0.107E-07	0.797E-07	0.512E-05	0.129E-04	0.601E-07	0.000E+00	0.000E+00
0.	0.182E-08	0.296E-08	0.601E-08	0.184E-07	0.136E-06	0.851E-05	0.187E-04	0.651E-07	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.3175E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.248E-11	0.408E-11	0.835E-11	0.263E-10	0.216E-09	0.284E-07	0.823E-06	0.872E-07	0.000E+00	0.000E+00
4.	0.438E-11	0.718E-11	0.147E-10	0.461E-10	0.378E-09	0.483E-07	0.126E-05	0.109E-06	0.000E+00	0.000E+00
3.	0.788E-11	0.128E-10	0.262E-10	0.823E-10	0.673E-09	0.836E-07	0.196E-05	0.136E-06	0.000E+00	0.000E+00
2.	0.139E-10	0.226E-10	0.462E-10	0.144E-09	0.118E-08	0.143E-06	0.303E-05	0.169E-06	0.000E+00	0.000E+00
0.	0.240E-10	0.388E-10	0.793E-10	0.248E-09	0.202E-08	0.240E-06	0.471E-05	0.213E-06	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.3636E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.231E-13	0.516E-13	0.109E-12	0.355E-12	0.313E-11	0.615E-09	0.717E-07	0.597E-07	0.000E+00	0.000E+00
4.	0.464E-13	0.931E-13	0.193E-12	0.623E-12	0.547E-11	0.106E-08	0.115E-06	0.825E-07	0.000E+00	0.000E+00
3.	0.934E-13	0.167E-12	0.346E-12	0.111E-11	0.974E-11	0.185E-08	0.186E-06	0.115E-06	0.000E+00	0.000E+00
2.	0.180E-12	0.294E-12	0.612E-12	0.195E-11	0.171E-10	0.318E-08	0.299E-06	0.160E-06	0.000E+00	0.000E+00
0.	0.327E-12	0.505E-12	0.106E-11	0.334E-11	0.292E-10	0.538E-08	0.480E-06	0.226E-06	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.4097E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.337E-14	0.443E-13	0.118E-10	0.386E-08	0.169E-07	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.672E-14	0.778E-13	0.204E-10	0.632E-08	0.249E-07	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.136E-13	0.139E-12	0.359E-10	0.105E-07	0.373E-07	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.263E-13	0.244E-12	0.621E-10	0.174E-07	0.556E-07	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.486E-13	0.418E-12	0.105E-09	0.284E-07	0.837E-07	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.4558E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.401E-15	0.211E-12	0.152E-09	0.248E-08	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.800E-15	0.366E-12	0.252E-09	0.381E-08	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.155E-14	0.645E-12	0.427E-09	0.596E-08	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.292E-14	0.112E-11	0.715E-09	0.927E-08	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.529E-14	0.191E-11	0.118E-08	0.145E-07	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.5018E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.359E-14	0.480E-11	0.226E-09	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.623E-14	0.807E-11	0.357E-09	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.110E-13	0.138E-10	0.575E-09	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.191E-13	0.233E-10	0.920E-09	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.326E-13	0.389E-10	0.147E-08	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.5479E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.574E-16	0.130E-12	0.145E-10	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.100E-15	0.221E-12	0.234E-10	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.176E-15	0.380E-12	0.385E-10	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.304E-15	0.647E-12	0.627E-10	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.515E-15	0.108E-11	0.101E-09	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.5940E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X = 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.315E-14	0.718E-12	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.537E-14	0.118E-11	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.931E-14	0.196E-11	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.159E-13	0.324E-11	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.268E-13	0.530E-11	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.6401E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X = 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.700E-16	0.291E-13	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.120E-15	0.483E-13	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.209E-15	0.813E-13	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.358E-15	0.136E-12	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.605E-15	0.224E-12	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.6862E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X = 0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.146E-17	0.101E-14	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.250E-17	0.169E-14	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.438E-17	0.287E-14	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.754E-17	0.482E-14	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.128E-16	0.800E-14	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.7322E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.282E-19	0.311E-16	0.000E+00	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.491E-19	0.522E-16	0.000E+00	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.864E-19	0.893E-16	0.000E+00	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.147E-18	0.151E-15	0.000E+00	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.246E-18	0.252E-15	0.000E+00	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.7783E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.864E-18	0.625E-21	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.146E-17	0.676E-21	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.251E-17	0.718E-21	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.426E-17	0.750E-21	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.713E-17	0.776E-21	0.000E+00

DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.8244E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

	X									
Y	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.222E-19	0.360E-20	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.376E-19	0.417E-20	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.650E-19	0.479E-20	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.111E-18	0.541E-20	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.186E-18	0.610E-20	0.000E+00

STEADY STATE SOLUTION HAS NOT BEEN REACHED BEFORE FINAL SIMULATING TIME

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DISTRIBUTION OF DISSOLVED CHEMICALS IN PPM AT 0.8705E+06 HRS
(ADSORBED CHEMICAL CONC. = 0.3410E+00 * DISSOLVED CHEMICAL CONC.)
Z = 0.00

Y	X									
	0.	2.	5.	10.	20.	50.	100.	152.	500.	645.
5.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.529E-21	0.949E-20	0.000E+00
4.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.902E-21	0.113E-19	0.000E+00
3.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.156E-20	0.135E-19	0.000E+00
2.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.267E-20	0.160E-19	0.000E+00
0.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.449E-20	0.192E-19	0.000E+00

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