RECEIVED
JAN 2 3 1997
OSTI

DOE/OR/02-1503/V2&D1

Remedial Investigation/Feasibility Study for the David Witherspoon, Inc., 901 Site Knoxville, Tennessee

Volume II: Appendixes



DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

DOE/OR/02-1503/V2&D1

Remedial Investigation/Feasibility Study for the David Witherspoon, Inc., 901 Site, Knoxville, Tennessee

Volume II: Appendixes

Date Issued—October 1996

Prepared by
Jacobs ER Team
125 Broadway Avenue
Oak Ridge, Tennessee
under contract DE-AC05-93OR22028

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

CONTENTS

FIGURES xv
TABLES xvii
ACRONYMS AND ABBREVIATIONS xxi

APPENDIX A: DAVID WITHERSPOON, INC., 901 SITE HISTORICAL DATA

APPENDIX B: FIELDWORK PLANS FOR THE DAVID WITHERSPOON, INC., 901 SITE

1. INTRODUCTION B-1
1.1 PURPOSE B-1
1.2 WORK PLAN OVERVIEW B-1
1.3 SITE DESCRIPTION B-2
1.4 DATA GAPS/DATA NEEDS B-2
1.4.1 Buried Debris B-2
1.4.2 Surface Radiological Data B-2
1.4.3 Surface Soil B-5
1.4.4 Surface Water B-5
1.4.5 Subsurface Soil B-5
1.4.6 Groundwater B-5
1.4.7 Surface Debris B-6
1.4.8 Aboveground Storage Tanks B-6
1.4.9 Creek Sediment B-6
1.4.10 Vegetation B-6
1.5 PROJECT SCHEDULE B-6

2. SAMPLING AND ANALYSIS PLAN B-9
2.1 SURFACE GEOPHYSICAL SURVEY B-9
2.1.1 Geophysical Survey Location B-9
2.1.2 Geophysical Survey Methodology B-9
2.2 TRENCH EXCAVATION B-10
2.2.1 Trench Excavation Location B-10
2.2.2 Trench Excavation Methodology B-10
2.3 SURFACE RADIOLOGICAL SURVEY B-12
2.3.1 Radiological Survey Locations B-12
2.3.2 Radiological Survey Methodology B-12
2.4 SURFACE SOIL SAMPLING B-14
2.4.1 Surface Soil Sampling Locations B-14
2.4.2 Surface Soil Sampling Methodology B-14
2.4.3 Surface Soil Analysis B-14

CONTENTS (continued)

2.5 SURFACE WATER SAMPLING B-16
2.5.1 Surface Water Sampling Locations B-16
2.5.2 Surface Water Sampling Methodologies B-16
2.5.3 Surface Water Analysis B-18
2.6 SUBSURFACE SOIL SAMPLING B-18
2.6.1 Subsurface Soil Sampling Locations B-18
2.6.2 Subsurface Soil Sampling Methodology B-20
2.6.3 Subsurface Soil Sample Analysis B-20
2.7 GROUNDWATER MONITORING B-20
2.7.1 Groundwater Sampling Locations B-21
2.7.2 Groundwater Sampling Methodologies B-21
2.7.3 Groundwater Sample Analysis B-23
2.8 SURFACE DEBRIS B-23
2.8.1 Debris Sampling Locations B-24
2.8.2 Debris Characterization Methodologies B-24
2.8.2.1 Debris pile volume estimates B-25
2.8.2.2 Debris inspection B-25
2.8.2.3 Radiological survey B-28
2.8.2.4 Debris sampling and analysis B-28
2.8.3 Debris Analysis B-29
2.9 DRUM SURVEY AND SAMPLE COLLECTION B-29
2.9.1 Drum Survey and Sample Collection Location B-30
2.9.2 Drum Survey Methodology B-30
2.9.2.1 Open to environment/empty B-30
2.9.2.2 Open to environment/liquids or solids B-32
2.9.2.3 Intact/empty B-32
2.9.2.4 Intact/liquids or solids B-32
2.10 BACKGROUND SAMPLING B-32
2.10.1 Background Sampling Locations B-33
2.10.2 Background Sampling Methodologies B-34
2.10.3 Background Sampling Analysis B-34
2.11 SURVEYING B-34
2.12 WETLANDS SURVEY B-34

3. QUALITY ASSURANCE PROJECT PLAN B-37
3.1 ORGANIZATION, QUALIFICATIONS, AND TRAINING B-37
3.1.1 Project Organization B-37
3.1.2 Key Field Positions and Responsibilities B-37
3.1.2.1 Field technical representative B-37
3.1.2.2 Site health and safety officer B-37
3.1.2.3 QA specialist B-37
3.1.2.4 Field specialist B-42
3.1.3 Qualifications and Training B-42

CONTENTS (continued)

3.2 SAMPLE MANAGEMENT B-42
3.2.1 Sample Identification B-43
3.2.1.1 Subsurface debris nomenclature B-43
3.2.1.2 Surface water storm flow, seeps, and groundwater sample nomenclature B-44
3.2.1.3 Subsurface soil sample nomenclature B-44
3.2.1.4 Surface debris sample nomenclature B-44
3.2.2 Sample Preparation and Shipment B-45
3.2.2.1 Containers B-45
3.2.2.2 Preservation B-45
3.2.2.3 Packaging and shipping B-45
3.2.2.4 Radiological survey B-46
3.2.2.5 Chain of custody B-46
3.2.3 Field Analysis B-47
3.2.3.1 Analysis B-47
3.2.3.2 Field QA/QC B-47
3.2.4 Laboratory Analysis B-48
3.2.4.1 Analysis B-48
3.2.4.2 Laboratory QA/QC B-59
3.2.5 Calibration Procedures and Frequency B-59
3.2.5.1 Field equipment B-59
3.2.5.2 Laboratory equipment B-60
3.2.6 Preventive Maintenance B-60
3.2.6.1 Field instrumentation equipment B-60
3.2.6.2 Laboratory equipment B-60
3.2.7 Data Reporting, Reduction, and Validation B-60
3.2.7.1 Data reporting B-60
3.2.7.2 Data reduction B-61
3.2.7.3 Precision, accuracy, representativeness, completeness, and compatibility parameters B-61
3.2.7.4 Validation of field data packages B-61
3.2.7.5 Validation of analytical data packages B-62
3.3 FIELD DOCUMENTATION B-63
3.3.1 Field Records B-63
3.3.2 Control and Submittal of Field Records B-63
3.4 DECONTAMINATION B-63
3.5 INTERNAL QC CHECKS B-63
3.5.1 Field Readiness Assessment B-63
3.5.2 Field Assessments B-64
3.5.3 Laboratory Evaluations B-64
3.6 NONCONFORMANCE AND CORRECTIVE ACTION B-65
3.6.1 Nonconformances B-65
3.6.2 Corrective Action B-65
3.7 QC SUMMARY REPORT B-66

CONTENTS (continued)

4. WASTE MANAGEMENT PLAN B-67
4.1 PURPOSE AND APPROACH B-67
4.2 ROLES AND RESPONSIBILITIES B-67
4.2.1 U.S. Department of Energy B-67
4.2.2 Jacobs ER Team B-67
4.2.3 Lockheed Martin Energy Systems B-68
4.3 WASTE STREAM IDENTIFICATION AND WASTE VOLUMES B-68
4.4 CONTAINERIZATION AND LABELING OF IDW B-69
4.5 IDW STAGING AREA B-69
4.6 SPILL PREVENTION CONTROL B-69
4.6.1 Management Practices/Preventive Measures B-70
4.6.2 Spill Response B-70
4.7 TRANSFERRING THE IDW TO ENERGY SYSTEMS B-70
4.7.1 Waste Acceptance Criteria B-70
4.7.2 Characterization of Waste B-71
4.7.3 Completion of Disposal Forms B-72
4.7.4 TRANSPORTING IDW B-73

5. HEALTH AND SAFETY PLAN B-75
5.1 INTRODUCTION B-75
5.1.1 Purpose B-75
5.1.2 Scope B-75
5.1.3 Overview B-75
5.2 KEY PERSONNEL B-77
5.2.1 Task-Specific Organization B-77
5.2.1.1 Task manager B-77
5.2.1.2 Field technical representative B-77
5.2.1.3 Program health and safety manager B-77
5.2.1.4 Site health and safety officer B-77
5.2.1.5 Field personnel B-84
5.2.1.6 Radiological control manager B-84
5.2.1.7 Radiological control technician B-84
5.2.1.8 Radiological support technicians B-85
5.2.1.9 Subcontractor responsibilities B-85
5.3 HAZARD CHARACTERIZATION AND ASSESSMENT B-85
5.3.1 Preliminary Evaluation B-85
5.3.2 Hazard Identification and Assessment B-86
5.3.2.1 Physical hazards B-86
5.3.2.2 Biological hazards B-92
5.3.2.3 Radiological hazards B-94
5.3.2.4 Chemical hazards B-95
5.3.2.5 Hazard communication B-96
5.3.2.6 Materials safety data sheets B-96
5.3.2.7 Controls B-96

CONTENTS (continued)

5.4 TRAINING REQUIREMENTS B-96
5.4.1 Hazardous Waste Operations Training B-96
5.4.2 Corporate Training Required B-97
5.4.3 HAZCOM Training B-97
5.4.4 Project-Specific Training B-97
5.5 PERSONAL PROTECTIVE EQUIPMENT B-98
5.5.1 Respiratory Protection B-99
5.5.2 Preliminary PPE Selection B-99
5.6 TEMPERATURE EXTREMES B-99
5.6.1 Hot Weather Conditions B-99
5.6.2 Cold Weather Conditions B-99
5.6.3 Adverse Weather Conditions B-100
5.7 MEDICAL SURVEILLANCE B-100
5.8 EXPOSURE MONITORING AND AIR SAMPLING B-100
5.8.1 Radiation Sampling Strategy B-100
5.8.2 Instrumentation and Equipment B-101
5.8.3 Chemical Monitoring B-101
5.8.4 Exposure Control for PCBs, Dioxins, and Furans B-102
5.9 SITE CONTROL B-102
5.10 DECONTAMINATION B-104
5.10.1 Personnel Decontamination B-104
5.10.2 Equipment Decontamination B-104
5.11 EMERGENCY RESPONSE/CONTINGENCY PLAN B-104
5.11.1 Emergency Contingency Plan B-104
5.12 EMERGENCY ACTION PLAN B-104
5.12.1 Communication B-104
5.12.2 Emergency Telephone Numbers B-106
5.12.3 Emergency Route to the Hospital B-106
5.12.4 Emergency Precautions B-106
5.12.5 Documentation B-106
5.13 WORK PRACTICES B-108
5.13.1 General Work Site Requirements B-108
5.13.1.1 Illumination B-108
5.13.1.2 Security B-108
5.13.1.3 Fire protection B-108
5.13.1.4 First aid B-108
5.13.1.5 Personal hygiene B-109
5.13.1.6 Eyewash station B-109
5.13.1.7 General field project safety B-109

APPENDIX C: RISK ASSESSMENT

1. DATA EVALUATION SUMMARIES C-3

CONTENTS (continued)

2. TOXICITY ASSESSMENT C-31
2.1 RADIATION TOXICITY C-31
2.2 RADIATION TOXICITY RELATED TO THE DWI 901 SITE C-32
2.3 METHODS OF EVALUATING RADIATION TOXICITY C-33
2.4 CHEMICAL TOXICITY C-34
2.4.1 Methods of Evaluating Chemical Toxicity C-35
2.4.2 Chemicals for Which EPA Toxicity Values Are Available C-35
2.4.3 Chemicals for Which No EPA Toxicity Values Are Available . . C-35

3. RISK CHARACTERIZATION C-39

4. UNCERTAINTY IN THE ASSESSMENT PROCESS C-41
4.1 UNCERTAINTY IN RADIOLOGICAL RISK ESTIMATES C-41
4.1.1 Data C-41
4.1.2 Chemicals of Potential Concern C-42
4.1.3 Exposure Assessment C-42
4.1.3.1 Exposure point concentrations C-42
4.1.3.2 Exposure assumptions C-43
4.1.4 Toxicity Assessment C-44
4.1.5 Risk Characterization C-44
4.2 UNCERTAINTY IN CHEMICAL RISK ESTIMATES C-45
4.2.1 Data C-45
4.2.2 Chemicals of Potential Concern C-45
4.2.3 Exposure Assessment C-46
4.2.3.1 Exposure point concentrations C-46
4.2.3.2 Exposure assumptions C-46
4.2.4 Toxicity Assessment C-47
4.2.5 Risk Characterization C-48

5. PARAMETERS AND ASSUMPTIONS C-49

6. USE OF THE LEAD MODEL VERSION 0.99D C-105

APPENDIX D: REMEDIATION TECHNOLOGY DISCUSSION

1. DISCUSSION OF RETAINED TECHNOLOGIES D-3
1.1 NO ACTION D-3
1.2 MONITORING D-3
1.2.1 Effectiveness D-4
1.2.2 Implementability D-4
1.2.3 Cost D-4
1.3 INSTITUTIONAL CONTROLS D-4
1.3.1 Effectiveness D-5
1.3.2 Implementability D-5

CONTENTS (continued)

1.3.3 Cost D-5
1.4 SOURCE CONTAINMENT D-5
1.4.1 Capping D-6
1.4.1.1 Effectiveness D-6
1.4.1.2 Implementability D-6
1.4.1.3 Cost D-6
1.4.2 Vertical Barriers D-7
1.4.2.1 Effectiveness D-7
1.4.2.2 Implementability D-8
1.4.2.3 Cost D-8
1.4.3 Subsurface Horizontal Barriers D-8
1.4.3.1 Effectiveness D-8
1.4.3.2 Implementability D-8
1.4.3.3 Cost D-9
1.4.4 Surface Water Controls D-9
1.4.4.1 Effectiveness D-9
1.4.4.2 Implementability D-9
1.4.4.3 Cost D-10
1.4.5 Dust Controls D-10
1.4.5.1 Effectiveness D-10
1.4.5.2 Implementability D-10
1.4.5.3 Cost D-11
1.5 SOURCE REMOVAL D-11
1.5.1 Excavation/Backfilling D-11
1.5.1.1 Effectiveness D-11
1.5.1.2 Implementability D-11
1.5.1.3 Cost D-12
1.5.2 Separation D-12
1.5.2.1 Effectiveness D-12
1.5.2.2 Implementability D-12
1.5.2.3 Cost D-12
1.5.3 Extraction D-13
1.5.3.1 Effectiveness D-13
1.5.3.2 Implementability D-13
1.5.3.3 Cost D-13
1.6 DISPOSAL D-14
1.6.1 Disposal of Decontaminated Material D-14
1.6.1.1 Effectiveness D-14
1.6.1.2 Implementability D-15
1.6.1.3 Cost D-15
1.6.2 Disposal of Contaminated Material D-15
1.6.2.1 Effectiveness D-16
1.6.2.2 Implementability D-16
1.6.2.3 Cost D-17

CONTENTS (continued)

1.7 EX SITU TREATMENT D-17
1.7.1 Physicochemical Treatment D-17
1.7.1.1 Effectiveness D-18
1.7.1.2 Implementability D-19
1.7.1.3 Cost D-19
1.7.2 Thermal Treatment D-19
1.7.2.1 Effectiveness D-20
1.7.2.2 Implementability D-20
1.7.2.3 Cost D-20
1.7.3 Biological Treatment D-20
1.7.3.1 Effectiveness D-21
1.7.3.2 Implementability D-21
1.7.3.3 Cost D-21
1.8 IN SITU TREATMENT D-22
1.8.1 Physicochemical Treatment D-22
1.8.1.1 Effectiveness D-22
1.8.1.2 Implementability D-23
1.8.1.3 Cost D-23
1.8.2 Thermal Treatment D-23
1.8.2.1 Effectiveness D-23
1.8.2.2 Implementability D-24
1.8.2.3 Cost D-24
1.8.3 Biological Treatment D-24
1.8.3.1 Effectiveness D-24
1.8.3.2 Implementability D-24
1.8.3.3 Cost D-24

APPENDIX E: ENGINEERING SUPPORT DOCUMENTATION

APPENDIX F: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS . . . F-3
1.1 CHEMICAL-SPECIFIC ARARS F-5
1.1.1 Groundwater F-5
1.1.2 Surface Water F-7
1.1.3 Soil F-8
1.1.4 Sediment F-9
1.2 LOCATION-SPECIFIC ARARS F-9
1.2.1 Aquatic Resources F-14
1.2.2 Floodplains F-15
1.2.3 Wetlands F-15
1.2.4 Cultural Resources F-15

CONTENTS (continued)

1.3 ACTION-SPECIFIC ARARS F-16
1.3.1 Alternative 1—No Action F-16
1.3.2 ARARs Common To All Action Alternatives F-16
1.3.2.1 Excavation and on-site consolidation F-24
1.3.2.2 Control of fugitive emissions F-24
1.3.2.3 Surface water control F-25
1.3.2.4 Construction of a decontamination facility and staging area F-25
1.3.2.5 Removal of surface debris F-25
1.3.2.6 Removal of standing vegetation F-26
1.3.2.7 Potential contaminated sediment and soil excavation and consolidation F-26
1.3.2.8 Dispositioning/transport of decontamination fluids/wastes F-27
1.3.3 Alternative 2—Multilayer Cap and Monitoring F-28
1.3.3.1 RCRA waste closure requirements F-28
1.3.3.2 Low-level waste closure requirements F-28
1.3.3.3 PCB waste closure requirements F-39
1.3.3.4 Institutional controls F-39
1.3.3.5 Monitoring F-39
1.3.4 Alternative 3—Minimal Treatment and Disposal at a Proposed EMWMF F-39
1.3.4.1 Clean closure F-40
1.3.4.2 Miscellaneous treatment unit F-40
1.3.4.3 Land disposal restrictions F-41
1.3.4.4 PCB requirements F-41
1.3.5 Alternative 4—Extensive Treatment and Disposal at Sanitary Facility F-42
1.3.5.1 RCRA requirements F-43
1.3.5.2 PCB requirements F-43
1.3.5.3 Clean closure F-43

2. REFERENCES F-43

APPENDIX G: COST ESTIMATE DOCUMENTATION

1. COST ESTIMATE—ALTERNATIVE 2 . . . . . G-3
1.1 INTRODUCTION G-3
1.1.1 Description of Alternative 2 . . . . . G-3
1.1.2 Summary Cost Data G-3
1.1.3 Project Summary WBS G-3
1.1.4 Project Schedule G-4
1.2 BASIS FOR COST ESTIMATE G-4
1.2.1 Engineering Estimate G-4

CONTENTS (continued)

1.2.2 Construction Estimate G-4
1.2.2.1 Material and labor pricing G-4
1.2.3 Wage Rates G-5
1.2.3.1 Indirect markups G-5
1.2.4 Energy Systems Site Overhead G-6
1.2.4.1 Energy Systems labor G-6
1.2.4.2 Energy Systems materials G-6
1.2.4.3 Energy Systems and DOE contractors G-7
1.2.5 Project Management/Liaison G-7
1.2.6 Escalation G-7
1.2.7 Contingency G-7
1.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS G-8
1.3.1 General Assumptions G-8
1.3.2 WBS-Specific Assumptions G-9
1.3.3 Direct Cost G-9
1.3.3.1 Temporary facilities/mobilization G-9
1.3.3.2 Site preparation G-9
1.3.3.3 Cap construction G-10
1.3.3.4 Decontamination/demobilization G-11
1.3.3.5 Secondary waste disposal G-11
1.3.3.6 Site maintenance G-11
1.4 COST SENSITIVITY ANALYSIS G-11
1.5 ESTIMATE DETAILS G-11
1.5.1 FY Reports G-11
1.5.2 Detailed Summary Report G-12
1.5.3 Estimate Reports G-12

2. COST ESTIMATE—ALTERNATIVE 3 . . . . . G-83
2.1 INTRODUCTION G-83
2.1.1 Description of Alternative 3 . . . . . G-83
2.1.2 Summary Cost Data G-83
2.1.3 Project Summary WBS G-83
2.1.4 Project Schedule G-84
2.2 BASIS FOR COST ESTIMATE G-84
2.2.1 Engineering Estimate G-84
2.2.2 Construction Estimate G-85
2.2.2.1 Material and labor pricing G-85
2.2.2.2 Wage rates G-85
2.2.2.3 Indirect markups G-86
2.2.3 Energy Systems Site Overhead G-86
2.2.3.1 Energy Systems labor G-86
2.2.3.2 Energy Systems materials G-87
2.2.3.3 Energy Systems and DOE contractors G-87
2.2.4 Project Management/Liaison G-87
2.2.5 Escalation G-87

CONTENTS (continued)

2.2.6 Contingency G-88
2.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS G-88
2.3.1 General Assumptions G-88
2.3.2 WBS-Specific Assumptions G-89
2.3.3 Direct Cost G-89
2.3.3.1 Temporary facilities/mobilization G-89
2.3.3.2 Site preparation G-89
2.3.3.3 Excavation/segregation G-90
2.3.3.4 Treatment G-91
2.3.3.5 Packaging/loading/transporting G-91
2.3.3.6 WAC-required actions G-91
2.3.3.7 Decontamination/demobilization G-91
2.3.3.8 Secondary waste disposal G-92
2.3.3.9 Site maintenance G-92
2.4 COST SENSITIVITY ANALYSIS G-92
2.5 ESTIMATE DETAILS G-92
2.5.1 FY Report G-92
2.5.2 Summary Reports G-93
2.5.3 Detailed Estimate Report G-93

3. COST ESTIMATE—ALTERNATIVE 4 . . . . . G-161
3.1 INTRODUCTION G-161
3.1.1 Description of Alternative 4 . . . . . G-161
3.1.2 Summary Cost Data G-161
3.1.3 Project Summary WBS G-161
3.1.4 Project Schedule G-162
3.2 BASIS FOR COST ESTIMATE G-162
3.2.1 Engineering Estimate G-162
3.2.2 Construction Estimate G-163
3.2.2.1 Material and labor pricing G-163
3.2.2.2 Wage rates G-163
3.2.2.3 Indirect markups G-164
3.2.3 Energy Systems Site Overhead G-164
3.2.3.1 Energy Systems labor G-164
3.2.3.2 Energy Systems materials G-165
3.2.3.3 Energy Systems and DOE contractors G-165
3.2.4 Project Management/Liaison G-165
3.2.5 Escalation G-165
3.2.6 Contingency G-166
3.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS G-166
3.3.1 General Assumptions G-166
3.3.2 WBS-Specific Assumptions G-167
3.3.3 Direct Cost G-167
3.3.3.1 Temporary facilities/mobilization G-167
3.3.3.2 Site preparation G-167

CONTENTS (continued)

3.3.3.3 Excavation/segregation G-168
3.3.3.4 Automated debris washing G-169
3.3.3.5 Vitrification G-170
3.3.3.6 Loading/transporting of pre/postvitrified material G-170
3.3.3.7 Loading/transporting of decontaminated debris G-170
3.3.3.8 WAC-required actions/disposal G-171
3.3.3.9 Decontamination/demobilization G-171
3.3.3.10 Secondary waste disposal G-171
3.3.3.11 Site maintenance G-171
3.4 COST SENSITIVITY ANALYSIS G-171
3.5 ESTIMATE DETAILS G-172
3.5.1 FY Reports G-172
3.5.2 Summary Reports G-172
3.5.3 Detailed Estimate Report G-172

FIGURES

Figure No.		Page
B.1.	Regional location map	B-3
B.2.	DWI 901 Site layout	B-4
B.3.	DWI 901 RI field schedule	B-7
B.4.	Proposed radiological surveying grids	B-13
B.5.	Proposed surface soil sampling locations	B-15
B.6.	Proposed surface water sampling locations	B-17
B.7.	Proposed soil boring locations	B-19
B.8.	Proposed groundwater monitoring well locations	B-22
B.9.	Debris pile locations	B-27
B.10.	Proposed drum characterization activities	B-31
B.11.	Background sampling locations	B-35
B.12.	DWI 901 Site organization chart	B-41
B.13.	Emergency situation action plan	B-105
B.14.	Route to the nearest hospital	B-107
G.1.	DWI 901 Site RI/FS, Alternative 2	G-15
G.2.	DWI 901 Site RI/FS, Alternative 3	G-97
G.3.	DWI 901 Site RI/FS, Alternative 4	G-175

TABLES

Table No.		Page
B.1.	Debris sample calculations, DWI 901 Site	B-25
B.2.	Debris volumes and number of samples, DWI 901 Site	B-26
B.3.	Sample matrix summary table, DWI 901 Site	B-38
B.4.	Field analysis summary table, DWI 901 Site	B-48
B.5.	Field quality control samples, DWI 901 Site	B-49
B.6.	Summary of analytical methods for the DWI 901 Site	B-50
B.7.	Waste volume estimates, DWI 901 Site,	B-68
B.8.	Radiation release limit guidance for solid wastes, DWI 901 Site	B-72
B.9.	Physical and chemical characteristics and safety information for preliminary contaminants of concern, DWI 901 Site	B-78
B.10.	Hazard identification and control, DWI 901 Site	B-87
C.1.	Human health COPC screening for the DWI 901 Site	C-4
C.2.	COPC mean and RME concentrations for the DWI 901 Site	C-27
C.3.	Toxicity values for carcinogenic COPCs at the DWI 901 Site	C-37
C.4.	Soil and sediment ingestion, DWI 901 Site	C-50
C.5.	Groundwater ingestion, DWI 901 Site	C-52
C.6.	Surface water ingestion, DWI 901 Site	C-54
C.7.	Dermal contact with chemicals in groundwater, DWI 901 Site	C-56
C.8.	Dermal contact with chemicals in soil and sediment, DWI 901 Site	C-57
C.9.	Inhalation of particulates, DWI 901 Site	C-59
C.10.	Risk from soil ingestion for a future adult resident at the DWI 901 Site	C-61
C.11.	Risk from inhalation of particulates in soil for a future adult resident at the DWI 901 Site	C-62
C.12.	Risk from dermal contact with chemicals in soil for a future adult resident at the DWI 901 Site	C-63
C.13.	Risk from groundwater ingestion for a future adult resident at the DWI 901 Site	C-64
C.14.	Risk from dermal contact with groundwater for a future adult resident at the DWI 901 Site	C-65
C.15.	Risk from sediment ingestion for a future adult resident while on the DWI 901 Site	C-66
C.16.	Risk from dermal contact with sediment for an adult wading in Goose Creek while on the DWI 901 Site	C-67
C.17.	Risk from soil ingestion for a child resident at the DWI 901 Site	C-68
C.18.	Risk from inhalation of particulates in soil for a child resident at the DWI 901 Site	C-69
C.19.	Risk from dermal contact with chemicals in soil for a child resident at the DWI 901 Site	C-70
C.20.	Risk from groundwater for a child resident at the DWI 901 Site	C-71
C.21.	Risk from dermal contact with groundwater for a child resident at the DWI 901 Site	C-72
C.22.	Risk from sediment ingestion for a child resident at the DWI 901 Site	C-73

TABLES (continued)

Table No.		Page
C.23.	Risk from dermal contact with chemicals in sediment for a child resident at the DWI 901 Site	C-74
C.24.	Risk from soil ingestion for an adolescent at the DWI 901 Site	C-75
C.25.	Risk from inhalation of particulates in soil for an adolescent at the DWI 901 Site	C-76
C.26.	Risk from dermal contact with chemicals in soil for an adolescent at the DWI 901 Site	C-77
C.27.	Risk from sediment ingestion for an adolescent wading in Goose Creek while on the DWI 901 Site	C-78
C.28.	Risk from dermal contact with sediment for an adolescent wading in Goose Creek while on the DWI 901 Site	C-79
C.29.	Risk from soil ingestion for a current employee at the DWI 901 Site	C-80
C.30.	Risk from inhalation of particulates in soil for a current employee at the DWI 901 Site	C-81
C.31.	Risk from dermal contact with chemicals in soil for a current employee at the DWI 901 Site	C-82
C.32.	Risk from soil ingestion for a future employee at the DWI 901 Site	C-83
C.33.	Risk from inhalation of particulates in soil for a future employee at the DWI 901 Site	C-84
C.34.	Risk from dermal contact with chemicals in soil for a future employee at the DWI 901 Site	C-85
C.35.	Risk from soil ingestion for a future adult resident at the Candora Road Area	C-86
C.36.	Risk from inhalation of particulates in soil for a future adult resident at the Candora Road Area	C-87
C.37.	Risk from dermal contact with chemicals in soil for an adult resident at the Candora Road Area	C-88
C.38.	Risk from soil ingestion for a child resident at the Candora Road Area	C-89
C.39.	Risk from inhalation of particulates in soil for a child resident at the Candora Road Area	C-90
C.40.	Risk from dermal contact with chemicals in soil for a child resident at the Candora Road Area	C-91
C.41.	Risk from soil ingestion for an adolescent at the Candora Road Area	C-92
C.42.	Risk from inhalation of particulates in soil for an adolescent at the Candora Road Area	C-93
C.43.	Risk from dermal contact with chemicals in soil for an adolescent at the Candora Road Area	C-94
C.44.	Risk from soil ingestion for a current employee at the Candora Road Area	C-95
C.45.	Risk from inhalation of particulates in soil for a current employee at the Candora Road Area	C-96
C.46.	Risk from dermal contact with chemicals in soil for a current employee at the Candora Road Area	C-97
C.47.	Risk from soil ingestion for a future employee at the Candora Road Area	C-98

TABLES (continued)

Table No.		Page
C.48.	Risk from inhalation of particulates in soil for a future employee at the Candora Road Area	C-99
C.49.	Risk from dermal contact with chemicals in soil for a future employee at the Candora Road Area	C-100
C.50.	Chemical exposure pathway summaries for the DWI 901 Site	C-101
C.51.	Chemical exposure pathway summaries for the Candora Road Area	C-102
C.52.	Radiological pathway summaries for the DWI 901 Site	C-103
C.53.	Radiological pathway summaries for the Candora Road Area	C-104
F.1.	Potential chemical-specific ARARs and TBC guidance for remedial actions at the DWI 901 Site	F-6
F.2.	Potential location-specific ARARs for remedial action at the DWI 901 Site	F-10
F.3.	Potential ARARs and TBC guidance common to all alternatives for the DWI 901 Site	F-17
F.4.	Potential additional action-specific ARARs and TBC guidance for Alternative 2–4 for the DWI 901 Site	F-29
G.1.	Alternative 2, summary report	G-17
G.2.	Alternative 2, fiscal year summary report by work breakdown structure	G-23
G.3.	Alternative 2, fiscal year summary report by participant	G-33
G.4.	Alternative 2, detailed summary report	G-43
G.5.	Alternative 3, summary report	G-99
G.6.	Alternative 3, fiscal year summary report	G-105
G.7.	Alternative 3, fiscal year summary report by participant	G-111
G.8.	Alternative 3, detail report	G-117
G.9.	Alternative 4, summary report	G-177
G.10.	Alternative 4, fiscal year summary report by work breakdown structure	G-185
G.11.	Alternative 4, fiscal year summary report by participant	G-191
G.12.	Alternative 4, detail report	G-197

ACRONYMS AND ABBREVIATIONS

AES	Automated Estimating System
ALARA	as low as reasonably achievable
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AWQC	ambient water quality criteria
BEIR	biological effects of ionizing radiation
BM	bill of material
Btu	British thermal unit
°C	degrees Celsius
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFC	certified for construction
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
cm	centimeter
COC	contaminant of concern
COE	U.S. Army Corps of Engineers
COPC	chemical of potential concern
cpm	counts per minute
CPR	cardiopulmonary resuscitation
CWA	Clean Water Act
dBA	decibel
dL	decaliter
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
DWI	David Witherspoon, Inc.
EDE	effective dose equivalent
EMWMF	Environmental Management Waste Management Facility
Energy Systems	Lockheed Martin Energy Systems
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
°F	degrees Fahrenheit
FFA	Federal Facility Agreement
FID	flame ionization detector
FPSC	fixed-price subcontractor
FR	*Federal Register*
FS	feasibility study
ft	foot
FTR	field technical representative

ACRONYMS AND ABBREVIATIONS (continued)

FWCA	Fish and Wildlife Coordination Act of 1958
FY	fiscal year
g	gram
gal	gallon
ha	hectare
HASP	health and safety plan
HAZCOM	hazard communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high-density polyethylene
HQ	hazard quotient
ICRP	International Commission on Radiological Protection
IDW	investigation-derived waste
in.	inch
kg	kilogram
km	kilometer
L	liter
lb	pound
LDR	land disposal restriction
LEL	lower exposure level
lin ft	linear foot
LLW	low-level waste
LTTD	low-temperature thermal desorption
m	meter
μCi	microcurie
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDA	minimum detectable activity
μg	microgram
mg	milligram
mil	1/100th of an inch
MK-Ferguson	MK-Ferguson of Oak Ridge Company
MOU	memorandum of understanding
μR	microrem
mrem	millirem
MSDS	Materials Safety Data Sheet
NAGRA	National Cooperative for the Storage of Radioactive Waste
NaI	sodium iodide
NCP	National Contingency Plan
NCR	nonconformance report
NEPA	National Environmental Policy Act of 1969
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
O&M	operation and maintenance
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation

ACRONYMS AND ABBREVIATIONS (continued)

OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and compatibility
PCB	polychlorinated biphenyl
pCi	picocurie
PHSM	program health and safety manager
PID	photoionization detector
POTW	publicly owned treatment work
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goal
Pu	plutonium
QA	quality assurance
QAPP	quality assurance program plan
QC	quality control
QCSR	quality control summary report
Ra	radium
RADCON	radiological control
RCRA	Resource Conservation and Recovery Act of 1976
RCT	radiological control technician
rem	roentgen equivalent man
RFD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
Rn	radon
RPD	relative percent difference
RST	radiological support technician
SDWA	Safe Drinking Water Act
SHSO	site health and safety officer
SMO	sample management organization
SOP	standard operating procedure
SOW	statement of work
SVOC	semivolatile organic compound
TAL	Target Analyte List
TBC	to be considered
TCA	*Tennessee Code Annotated*
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation
Th	thorium
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage, and disposal

ACRONYMS AND ABBREVIATIONS (continued)

U	uranium
UCL_{95}	95th percent upper confidence level of the mean
USC	*United States Code*
UST	underground storage tank
VOC	volatile organic compound
WAC	waste acceptance criteria
WBS	work breakdown structure
yd	yard

APPENDIX A

DAVID WITHERSPOON, INC., 901 SITE HISTORICAL DATA

A.1. David Witherspoon, Inc., 901 Site historical data
Tennessee Division of Superfund investigation

Sample number		GW-8
Date sampled		3-Apr-91
Depth		
Groundwater		
Parameter	Units	Results†
Metals		
Arsenic	ug/L	2 U
Barium	ug/L	160
Cadmium	ug/L	2 U
Chromium	ug/L	10 U
Copper	ug/L	5 U
Cyanide	mg/L	0.02 U
Lead	ug/L	10 U
Mercury	ug/L	0.2 U
Nickel	ug/L	20 U
Selenium	ug/L	2 U
Silver	ug/L	10 U
Zinc	ug/L	5 U
PCBs		
Aroclor-1254	ug/L	1 U
Volatile organic compounds		
Trichlorofluoromethane	ug/L	0.1 U
Semivolatile organic compounds		
Bis(2-ethylhexyl)phthalate	ug/L	27.8 D

18-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSW-1	SW-10	SW-6
Date sampled		3-Apr-91	3-Apr-91	3-Apr-91
Depth				
Surface Water				
Parameter	Units	Results†	Results†	Results†
Metals				
Arsenic	ug/L	2 U	2 U	2 U
Barium	ug/L	100	110	100 U
Cadmium	ug/L	2 U	2 U	2 U
Chromium	ug/L	10 U	10 U	10 U
Copper	ug/L	12	5	5 U
Cyanide	mg/L	0.02 U	0.02 U	0.02 U
Lead	ug/L	10 U	10 U	10 U
Mercury	ug/L	0.2 U	0.2 U	0.2 U
Nickel	ug/L	20 U	20 U	20 U
Selenium	ug/L	2 U	2 U	2 U
Silver	ug/L	10 U	10 U	10 U
Zinc	ug/L	5 U	8	5 U
PCBs				
Aroclor-1254	ug/L	1 U	1 U	1 U
Volatile organic compounds				
Trichlorofluoromethane	ug/L	0.1 U	0.1 U	4
Semivolatile organic compounds				
Bis(2-ethylhexyl)phthalate	ug/L	NA	19 D	120 D

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SS-1	SS-2	SS-3	SS-6
Date sampled		22-Aug-90	22-Aug-90	22-Aug-90	22-Aug-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Extraction procedure toxicity					
Barium	mg/kg	965	398	202	204
Cadmium	mg/kg	34.5	24.9	22	181
Chromium	mg/kg	166	216	182	184
Lead	mg/kg	3120	1510	683	7650
Nickel	mg/kg	291	266	367	90
Silver	mg/kg	2.26	3.44	2.25	11.4

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSOIL-3	DSS-4	DSS-5	Drum 103
Date sampled		3-Apr-91	3-Apr-91	3-Apr-91	1-Jan-87
Depth					
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Arsenic	mg/kg	8.2	NA	NA	29
Barium	mg/kg	162	NA	NA	200
Cadmium	mg/kg	0.2 U	NA	NA	80
Chromium	mg/kg	32	NA	NA	140
Copper	mg/kg	12.5	NA	NA	NA
Cyanide	mg/kg	0.16	13.5	0.805	NA
Lead	mg/kg	90	NA	NA	6000
Mercury	mg/kg	0.1 U	26	6.4	62.7
Nickel	mg/kg	13	NA	NA	NA
Selenium	mg/kg	0.2 U	NA	NA	1.2
Silver	mg/kg	1 U	NA	NA	110
Zinc	mg/kg	66.4	NA	NA	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 13	Drum 144	Drum 174	Drum 190
Date sampled		1-Jan-87	1-Jan-87	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Arsenic	mg/kg	22	NA	27	22
Barium	mg/kg	240	NA	230	270
Cadmium	mg/kg	130	NA	77	150
Chromium	mg/kg	49	NA	93	150
Lead	mg/kg	1200	NA	9600	6900
Mercury	mg/kg	12.4	NA	96.2	88.3
Selenium	mg/kg	5.6	NA	1.1	1.1
Silver	mg/kg	17	NA	11	19

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 216	Drum 27	Drum 4	Drum 55
Date sampled		1-Jan-87	1-Jan-87	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Arsenic	mg/kg	31	14	9	12
Barium	mg/kg	220	120	140	150
Cadmium	mg/kg	110	22	20	24
Chromium	mg/kg	100	44	37	33
Lead	mg/kg	5800	1000	400	770
Mercury	mg/kg	34.1	16.2	8.16	9.74
Selenium	mg/kg	7.5	0.5	1.8	0.7
Silver	mg/kg	25	4.6	0.74	1.5

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 88	SS-1	SS-2	SS-3
Date sampled		1-Jan-87	22-Aug-90	22-Aug-90	22-Aug-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	mg/kg	NA	31800	16700	60800
Arsenic	mg/kg	13	NA	NA	NA
Barium	mg/kg	220	965	398	202
Cadmium	mg/kg	27	34.5	24.9	22
Chromium	mg/kg	35	166	216	182
Copper	mg/kg	NA	2620	3640	2360
Iron	mg/kg	NA	131000	134000	112000
Lead	mg/kg	550	3120	1510	683
Magnesium	mg/kg	NA	8420	6100	7750
Manganese	mg/kg	NA	2090	1864	1390
Mercury	mg/kg	7.67	NA	NA	NA
Nickel	mg/kg	NA	291	266	367
Selenium	mg/kg	0.5	NA	NA	NA
Silver	mg/kg	1.7	2.26	3.44	2.25
Zinc	mg/kg	NA	8580	3750	2440

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SS-6	SS-9
Date sampled		22-Aug-90	3-Apr-91
Depth			
Soil			
Parameter	**Units**	**Results†**	**Results†**
Metals			
Aluminum	mg/kg	17200	NA
Arsenic	mg/kg	NA	7.3
Barium	mg/kg	204	108
Cadmium	mg/kg	181	0.2 U
Chromium	mg/kg	184	254
Copper	mg/kg	733	200
Cyanide	mg/kg	NA	0.02 U
Iron	mg/kg	63800	NA
Lead	mg/kg	7650	27
Magnesium	mg/kg	3310	NA
Manganese	mg/kg	5600	NA
Mercury	mg/kg	NA	0.1 U
Nickel	mg/kg	90	248
Selenium	mg/kg	NA	0.2 U
Silver	mg/kg	11.4	1 U
Zinc	mg/kg	26500	55.4

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		COMP TCLP
Date sampled		12-Mar-91
Depth		
Soil		
Parameter	Units	Results†
Toxicity characteristic leaching procedure		
Arsenic	mg/L	0.004
Barium	mg/L	1.16
Cadmium	mg/L	0.24
Chromium	mg/L	0.01 U
Copper	mg/L	2.8
Lead	mg/L	1.53
Mercury	mg/L	0.0003
Nickel	mg/L	0.54
Selenium	mg/L	0.004
Silver	mg/L	0.005
Zinc	mg/L	18.7

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSOIL-3	DSS-4	DSS-5	Drum 103
Date sampled		3-Apr-91	3-Apr-91	3-Apr-91	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1254	ug/kg	160 U	NA	NA	NA
Total PCBs	mg/kg	NA	NA	NA	136

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number Date sampled Depth Soil Parameter	Units	Drum 13 1-Jan-87 Results†	Drum 144 1-Jan-87 Results†	Drum 174 1-Jan-87 Results†	Drum 190 1-Jan-87 Results†
PCBs					
Total PCBs	mg/kg	89	NA	2400	7415

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 216	Drum 27	Drum 4	Drum 55
Date sampled		1-Jan-87	1-Jan-87	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Total PCBs	mg/kg	122	86	18	20

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 88	SS-1	SS-2	SS-3
Date sampled		1-Jan-87	22-Aug-90	22-Aug-90	22-Aug-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1248	ug/kg	NA	18500	7300	2510 U
Aroclor-1254	ug/kg	NA	21800	18500	29800
Aroclor-1260	ug/kg	NA	28710	13100	7490

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SS-6	SS-9
Date sampled		22-Aug-90	3-Apr-91
Depth			
Soil			
Parameter	**Units**	**Results†**	**Results†**
PCBs			
Aroclor-1254	ug/kg	2930	160 U
Aroclor-1260	ug/kg	11700	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSOIL-3	DSS-4	DSS-5	SS-1
Date sampled		3-Apr-91	3-Apr-91	3-Apr-91	22-Aug-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	NA	NA	NA	19
M&P xylene	ug/kg	NA	NA	NA	1 U
Toluene	ug/kg	NA	NA	NA	1000
Trichlorofluoromethane	ug/kg	0.1 U	NA	NA	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SS-2	SS-3	SS-9	Sample E
Date sampled		22-Aug-90	22-Aug-90	3-Apr-91	10-Aug-89
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	33	16	NA	NA
Benzene	ug/kg	NA	NA	NA	10 U
Ethylbenzene	ug/kg	NA	NA	NA	10 U
M&P xylene	ug/kg	6	NA	NA	NA
Methyl ethyl ketone	ug/kg	10 U	NA	NA	NA
Methylene Chloride	ug/kg	NA	0.8	NA	NA
O-xylene	ug/kg	4	NA	NA	NA
Tetrachloroethene	ug/kg	1	NA	NA	NA
Toluene	ug/kg	2	NA	NA	10 U
Trichlorofluoromethane	ug/kg	NA	NA	0.1 U	NA
Xylenes	ug/kg	NA	NA	NA	10 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Sample N	Sample S	Sample W
Date sampled		10-Aug-89	10-Aug-89	10-Aug-89
Depth				
Soil				
Parameter	Units	Results†	Results†	Results†
Volatile organic compounds				
Benzene	ug/kg	10	10	10
Ethylbenzene	ug/kg	10 U	10 U	10 U
Toluene	ug/kg	10 U	10 U	10 U
Xylenes	ug/kg	10 U	10 U	10 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSOIL-3	DSS-4	DSS-5	SS-1
Date sampled		3-Apr-91	3-Apr-91	3-Apr-91	22-Aug-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
2-chloronaphthalene	ug/kg	NA	NA	NA	1436
Anthracene	ug/kg	NA	NA	NA	2280
Benzo(a)anthracene	ug/kg	NA	NA	NA	3660
Benzo(a)pyrene	ug/kg	NA	NA	NA	3810
Benzo(b)fluoranthene	ug/kg	NA	NA	NA	3930
Benzo(g,h,i)perylene	ug/kg	NA	NA	NA	2520
Benzo(k)fluoranthene	ug/kg	NA	NA	NA	1950
Bis(2-ethylhexyl)phthalate	ug/kg	14900 D	NA	NA	NA
Chrysene	ug/kg	NA	NA	NA	4390
Fluoranthene	ug/kg	NA	NA	NA	10400
Indeno(1,2,3-cd)pyrene	ug/kg	NA	NA	NA	3010
Phenanthrene	ug/kg	NA	NA	NA	4290
Pyrene	ug/kg	NA	NA	NA	9710

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number Date sampled Depth Soil Parameter	Units	SS-2 22-Aug-90 Results†	SS-3 22-Aug-90 Results†	SS-6 22-Aug-90 Results†	SS-9 3-Apr-91 Results†
Semivolatile organic compounds					
4-chlorophenyl phenyl ether	ug/kg	1000 U	NA	NA	NA
Anthracene	ug/kg	797	8650	NA	NA
Benzo(a)anthracene	ug/kg	2300	26500	1720	NA
Benzo(a)pyrene	ug/kg	3100	31000	2200	NA
Benzo(b)fluoranthene	ug/kg	3320	31000	2310	NA
Benzo(g,h,i)perylene	ug/kg	1140	24200	1740	NA
Benzo(k)fluoranthene	ug/kg	1620	18800	979	NA
Bis(2-ethylhexyl)phthalate	ug/kg	NA	NA	NA	29300 D
Chrysene	ug/kg	2960	27100	1910	NA
Fluoranthene	ug/kg	6380	55500	3180	NA
Fluorene	ug/kg	NA	50900	NA	NA
Indeno(1,2,3-cd)pyrene	ug/kg	2000	26900	1820	NA
Phenanthrene	ug/kg	3090	30400	1060	NA
Pyrene	ug/kg	4980	50900	2710	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		001	002	003	004
Date sampled		12-Mar-91	12-Mar-91	12-Mar-91	12-Mar-91
Depth					
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Uranium-234	pCi/g	10.78	11.24	16.88	9.89
Uranium-235	pCi/g	0.54	0.52	0.73	0.4
Uranium-238	pCi/g	17.24	11.48	25.47	9.7

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		005	006	007	008
Date sampled		12-Mar-91	12-Mar-91	12-Mar-91	12-Mar-91
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Uranium-234	pCi/g	14.48	5.73	11.82	16.32
Uranium-235	pCi/g	0.58	0.26	0.5	0.68
Uranium-238	pCi/g	13.4	5.8	10.16	15.74

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		009	010	011	BHF-022
Date sampled		12-Mar-91	12-Mar-91	12-Mar-91	1-Mar-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Actinium-228	pCi/g	NA	NA	NA	4.5
Lead-212	pCi/g	NA	NA	NA	4.72
Lead-214	pCi/g	NA	NA	NA	2.04
Potassium-40	pCi/g	NA	NA	NA	6.22
Thorium-234	pCi/g	NA	NA	NA	204
Uranium-234	pCi/g	16.92	13.41	0.05	NA
Uranium-235	pCi/g	0.83	0.68	0.05 U	13.44
Uranium-238	pCi/g	16.61	13.78	0.05 U	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BHF-023	BHF-024	BHF-025	BHF-026
Date sampled		1-Mar-90	1-Mar-90	1-Mar-90	1-Mar-90
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Actinium-228	pCi/g	2.54	11.88	6.74	2.87
Lead-212	pCi/g	2.72	12.68	6.93	3.38
Lead-214	pCi/g	3.81	3.95	2.74	2.36
Potassium-40	pCi/g	7.22	4.64	5.26	7.9
Thorium-234	pCi/g	343	300	198.4	134
Uranium-235	pCi/g	8.35	13.32	11	8.36

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BHF-027	BHF-028	Drum 103	Drum 13
Date sampled		1-Mar-90	1-Mar-90	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Actinium-228	pCi/g	1.43	6.83	NA	NA
Gamma	pCi/g	NA	NA	200	300
Lead-212	pCi/g	1.53	4.17	NA	NA
Lead-214	pCi/g	1.56	12.98	NA	NA
Potassium-40	pCi/g	17.4	13.3	NA	NA
Thorium-234	pCi/g	122	476	NA	NA
Uranium	mg/kg	NA	NA	1488	283
Uranium-235	pCi/g	3.25	30.84	0.71	0.81

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 144	Drum 174	Drum 190	Drum 216
Date sampled		1-Jan-87	1-Jan-87	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Gamma	pCi/g	NA	70	200	200
Uranium	mg/kg	NA	961	861	1160
Uranium-235	wt%	NA	0.59	0.98	1.1

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Drum 27	Drum 4	Drum 55	Drum 88
Date sampled		1-Jan-87	1-Jan-87	1-Jan-87	1-Jan-87
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Gamma	pCi/g	100	400	1000	100
Uranium	mg/kg	602	737	108	182
Uranium-235	wt%	0.67	0.67	0.64	1.03

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number Date sampled Depth Soil Parameter	Units	WS-1A 1-Mar-87 0-6" Results†	WS-1B 1-Mar-87 8-12" Results†	WS-2 1-Mar-87 0-6" Results†	WS-3 1-Mar-87 0-6" Results†
Radionuclides					
Radium-226	pCi/g	2	1	3	21
Thorium-232	pCi/g	1	2	2	1
Uranium-234	pCi/g	11	2	2300	194
Uranium-235	pCi/g	1	1	250	8
Uranium-238	pCi/g	20	2	23000	198

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		WS-4
Date sampled		1-Mar-87
Depth		0-6"
Soil		
Parameter	**Units**	**Results†**
Radionuclides		
Radium-226	pCi/g	4
Thorium-232	pCi/g	21
Uranium-234	pCi/g	340
Uranium-235	pCi/g	29
Uranium-238	pCi/g	289

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		Sample E	Sample N	Sample S	Sample W
Date sampled		10-Aug-89	10-Aug-89	10-Aug-89	10-Aug-89
Depth					
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
OTHER					
Total Petroleum Hydrocarbons	ppm	10 U	10 U	10	10 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SD-4	SD-7
Date sampled		22-Aug-90	22-Aug-90
Depth			
Sediment			
Parameter	Units	Results†	Results†
Extraction procedure toxicity			
Barium	mg/kg	122	27.5
Cadmium	mg/kg	5.12	2 U
Chromium	mg/kg	63.7	11.5
Lead	mg/kg	311	60.2
Nickel	mg/kg	144	4.91

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSED-2	SD-4	SD-7	SED-11
Date sampled		3-Apr-91	22-Aug-90	22-Aug-90	3-Apr-91
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	NA	9180	5000	NA
Arsenic	mg/kg	NA	NA	NA	6.4
Barium	mg/kg	NA	122	27.5	67
Cadmium	mg/kg	NA	5.12	2 U	2.2
Chromium	mg/kg	NA	63.7	11.5	16
Copper	mg/kg	NA	528	14.4	18.2
Cyanide	mg/kg	0.02 U	NA	NA	0.02 U
Iron	mg/kg	NA	50700	14100	NA
Lead	mg/kg	NA	311	60.2	85
Magnesium	mg/kg	NA	6680	1250	NA
Manganese	mg/kg	NA	1450	469	NA
Mercury	mg/kg	0.1 U	NA	NA	0.23
Nickel	mg/kg	NA	144	4.91	9
Selenium	mg/kg	NA	NA	NA	0.2 U
Silver	mg/kg	NA	1 U	1 U	1 U
Zinc	mg/kg	NA	662	75	392

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SED-7
Date sampled		11-Aug-90
Depth		
Sediment		
Parameter	**Units**	**Results†**
Metals		
Cyanide	mg/kg	0.02 U
Mercury	mg/kg	22.1

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSED-2	F-1	F-2	SD-4
Date sampled		3-Apr-91	11-Aug-89	11-Aug-89	22-Aug-90
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1248	ug/kg	NA	NA	NA	1720
Aroclor-1254	ug/kg	NA	NA	NA	4460
Aroclor-1260	ug/kg	NA	NA	14000	6110

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SED-11	SED-7
Date sampled		3-Apr-91	11-Aug-90
Depth			
Sediment			
Parameter	Units	Results†	Results†
PCBs			
Aroclor-1254	ug/kg	439 D	NA
Aroclor-1260	ug/kg	168 D	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		F-1	F-2	SED-11
Date sampled		11-Aug-89	11-Aug-89	3-Apr-91
Depth				
Sediment				
Parameter	Units	Results†	Results†	Results†
Pesticides				
Chlordane	ug/kg	NA	NA	167 D
Delta-bhc	ug/kg	317	NA	NA
Dieldrin	ug/kg	NA	56.7	NA

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSED-2	F-1	F-2	SD-4
Date sampled		3-Apr-91	11-Aug-89	11-Aug-89	22-Aug-90
Depth					
Sediment					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	NA	NA	NA	16
Methylene Chloride	ug/kg	NA	1.9	1.6	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SD-7	SED-11	SED-7
Date sampled		22-Aug-90	3-Apr-91	11-Aug-90
Depth				
Sediment				
Parameter	**Units**	**Results†**	**Results†**	**Results†**
Volatile organic compounds				
Acetone	ug/kg	5	NA	NA
Trichlorofluoromethane	ug/kg	NA	0.1 U	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		BGSED-2	F-1	F-2	SD-4
Date sampled		3-Apr-91	11-Aug-89	11-Aug-89	22-Aug-90
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
2,4-dinitrotoluene	ug/kg	NA	NA	4 U	NA
Anthracene	ug/kg	NA	NA	NA	330 U
Benzo(a)anthracene	ug/kg	NA	NA	NA	330 U
Benzo(a)pyrene	ug/kg	NA	NA	NA	334
Benzo(b)fluoranthene	ug/kg	NA	NA	NA	330 U
Benzo(g,h,i)perylene	ug/kg	NA	NA	NA	336
Benzo(k)fluoranthene	ug/kg	NA	NA	NA	330 U
Chrysene	ug/kg	NA	NA	NA	330 U
Fluoranthene	ug/kg	NA	NA	NA	430
Indeno(1.2,3-cd)pyrene	ug/kg	NA	NA	NA	330 U
Phenanthrene	ug/kg	NA	NA	NA	330 U
Pyrene	ug/kg	NA	NA	NA	329

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		SD-7	SED-11	SED-7
Date sampled		22-Aug-90	3-Apr-91	11-Aug-90
Depth				
Sediment				
Parameter	Units	Results†	Results†	Results†
Semivolatile organic compounds				
Benzo(a)pyrene	ug/kg	732	NA	NA
Bis(2-ethylhexyl)phthalate	ug/kg	NA	19600 D	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.1. (continued)

Sample number		WP-5
Date sampled		22-Aug-90
Depth		
Composite Waste		
Parameter	Units	Results†
Extraction procedure toxicity		
Barium	mg/kg	215
Cadmium	mg/kg	12.1
Chromium	mg/kg	137
Lead	mg/kg	1310
Nickel	mg/kg	409
Metals		
Aluminum	mg/kg	25700
Barium	mg/kg	215
Cadmium	mg/kg	12.1
Chromium	mg/kg	137
Copper	mg/kg	4820
Iron	mg/kg	78800
Lead	mg/kg	1310
Magnesium	mg/kg	2170
Manganese	mg/kg	1340
Nickel	mg/kg	409
Silver	mg/kg	2.14
Zinc	mg/kg	3280
PCBs		
Aroclor-1248	ug/kg	14300
Aroclor-1254	ug/kg	20000
Aroclor-1260	ug/kg	13200
Semivolatile organic compounds		
Anthracene	ug/kg	354
Benzo(a)anthracene	ug/kg	1660
Benzo(a)pyrene	ug/kg	2950
Benzo(b)fluoranthene	ug/kg	3670
Benzo(g.h.i)perylene	ug/kg	3120
Benzo(k)fluoranthene	ug/kg	1630
Chrysene	ug/kg	1860
Fluoranthene	ug/kg	2970
Indeno(1.2.3-cd)pyrene	ug/kg	2670
Phenanthrene	ug/kg	1240
Pyrene	ug/kg	2860

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. David Witherspoon, Inc., 901 Site historical data
PRC Environmental Management, Inc., investigation

Sample number		MW-1	MW-2	MW-5	MW-5D
Date sampled		28-May-92	28-May-92	6-Nov-92	6-Nov-92
Depth					
Groundwater					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	ug/L	88800	4680	NA	1290 *
Antimony	ug/L	60.4	32 U	NA	NA
Arsenic	ug/L	9.8 U	6.8 U	3.1 B	NA
Barium	ug/L	694	249	NA	NA
Beryllium	ug/L	6.9	1 U	NA	NA
Cadmium	ug/L	6.3 U	2.3 U	NA	NA
Calcium	ug/L	167000	104000	118000	119000
Chromium	ug/L	124	20.4 U	NA	NA
Cobalt	ug/L	67.9	10 U	NA	NA
Copper	ug/L	572	69.6	6.5 B	4.5 B
Iron	ug/L	131000	4320	2770	2870
Lead	ug/L	597	111 J	3.3	NA
Magnesium	ug/L	18900	10100	4420 B	4480 B
Manganese	ug/L	9170	2780	152	165
Mercury	ug/L	61.9	35.4	NA	NA
Nickel	ug/L	152	20.3 B	NA	NA
Potassium	ug/L	6380	5050 U	NA	NA
Selenium	ug/L	10 U	10 U	NA	NA
Silver	ug/L	6 U	6 U	NA	NA
Sodium	ug/L	9160	20500	10400 E	10600 E
Thallium	ug/L	40 U	4 U	NA	NA
Vanadium	ug/L	130	9 B	NA	NA
Zinc	ug/L	1520	503	12.4 B	NA

22-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		MW-5	MW-5D
Date sampled		6-Nov-92	6-Nov-92
Depth			
Groundwater			
Parameter	Units	Results†	Results†
Pesticides			
Gamma-bhc	ug/L	NA	0.042 J
Toxaphene	ug/L	5 U	5 U
Volatile organic compounds			
Chloroform	ug/L	1 J	NA
Methane, trichlorofluoro	ug/L	38 JN	36 JN

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSA-01	SSA-02	SSA-03	SSA-04
Date sampled		19-May-92	20-May-92	20-May-92	21-May-92
Depth		2-5'	2-5'	2-5.5'	2-5'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	mg/kg	31700	24000	39600	26400
Antimony	mg/kg	8.2 UJ	16.2 UJ	8.5 UJ	15.8 UJ
Arsenic	mg/kg	2.5 U	3.4 U	0.53 U	19.8
Barium	mg/kg	67.7	218	154	116
Beryllium	mg/kg	1.8	2.4 B	3.2	1.3 B
Cadmium	mg/kg	0.51 U	1 U	0.53 U	0.99 U
Calcium	mg/kg	495 B	1810 B	7870	1360 B
Chromium	mg/kg	29.4 J	30.4 J	40.9 J	24.5 J
Cobalt	mg/kg	27.9 J	34.4 J	29.6 J	44 J
Copper	mg/kg	34.7	15	28.1	20.1
Cyanide	mg/kg	0.12 B	0.06 U	0.1 B	0.06 U
Iron	mg/kg	52700	38200	61200	39100
Lead	mg/kg	26.7 J	35.9 J	22.5 J	46.7 J
Magnesium	mg/kg	3830 J	1450 J	5540 J	1530 J
Manganese	mg/kg	1130 J	5060 J	1290 J	4450 J
Mercury	mg/kg	0.13 U	0.13 U	0.13 U	0.12 U
Nickel	mg/kg	33.2	18.3 B	53.5	21.7
Potassium	mg/kg	2210	919 U	2590	1020 U
Selenium	mg/kg	0.26 R	0.25 R	0.27 R	0.25 R
Silver	mg/kg	1.5 U	3 U	1.6 U	3 U
Sodium	mg/kg	79.7 B	55 U	166 U	143 U
Thallium	mg/kg	1 U	1 U	1.1 U	2.9 U
Vanadium	mg/kg	38.5	42.5	49	51.3
Zinc	mg/kg	94.3	63.1	132	75.3

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth		SSA-05 21-May-92 2-5'	SSA-06 26-May-92 2-6'	SSB-01 19-May-92 5-10'	SSB-02 20-May-92 5-9.5'
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	5060	11300	36200	22700
Antimony	mg/kg	7.7 UJ	15.2 UJ	8 UJ	15.9 UJ
Arsenic	mg/kg	1.7 U	8.2	2.8 U	7.8
Barium	mg/kg	40.6 B	308	119	161
Beryllium	mg/kg	0.41 B	1.4 B	2.9	1.9 B
Cadmium	mg/kg	0.48 U	0.95 U	0.5 U	0.99 U
Calcium	mg/kg	101000	1520 B	1730 B	7040
Chromium	mg/kg	21.4 J	18 J	34 J	30.8 J
Cobalt	mg/kg	7.9 J	24.3 J	28.3 J	25.1 J
Copper	mg/kg	8.2	10.2 B	35.9	46.6
Cyanide	mg/kg	0.06 U	0.06 U	0.67	0.06 U
Iron	mg/kg	15700	45400	50400	39800
Lead	mg/kg	15.1 J	23.6 J	23 J	44.8 J
Magnesium	mg/kg	2070 J	558 J	5950 J	1780 J
Manganese	mg/kg	461 J	3440 J	1080 J	3510 J
Mercury	mg/kg	0.12 U	0.12 U	0.13 U	0.43
Nickel	mg/kg	6.5 B	10.9 B	65.3	25.9
Potassium	mg/kg	343 U	681 U	2870	710 U
Selenium	mg/kg	0.24 R	0.24 R	0.25 R	0.25 R
Silver	mg/kg	1.4 U	2.9 U	1.5 U	3 U
Sodium	mg/kg	124 U	83.4 U	86 U	69.7 U
Thallium	mg/kg	0.96 U	0.95 U	1 U	0.99 U
Vanadium	mg/kg	14.5	31.1	39	36.2
Zinc	mg/kg	80.7	33.9	146	125

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-04	SSB-04D	SSB-05	SSB-05D
Date sampled		20-May-92	20-May-92	21-May-92	21-May-92
Depth		5-10'	5-10'	5-10'	5-10'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	22200	26700	6810	6000
Antimony	mg/kg	15.7 UJ	15.8 UJ	9.3 UJ	9 UJ
Arsenic	mg/kg	11.5	19.9 B	6.6	6
Barium	mg/kg	113	116	65	59.2
Beryllium	mg/kg	2.5	2.3 B	0.57 B	0.52 B
Cadmium	mg/kg	0.98 U	0.99 U	0.58 U	0.56 U
Calcium	mg/kg	1610 B	1120 B	147000	135000
Chromium	mg/kg	20.6 J	25.5 J	25.3 J	23.2 J
Cobalt	mg/kg	42.1 J	38.9 J	11 J	9.8 J
Copper	mg/kg	21.4	21.3	8.5	8.4
Cyanide	mg/kg	0.06 U	0.06 U	0.07 U	0.07 U
Iron	mg/kg	49000	48800	22900	21200
Lead	mg/kg	51.2 J	48.4 J	30.8 J	31 J
Magnesium	mg/kg	1140 J	1490 J	2030 J	1890 J
Manganese	mg/kg	4930 J	4620 J	666 J	620 J
Mercury	mg/kg	0.12 U	0.12 U	0.14 U	0.14 U
Nickel	mg/kg	20.7	24.2	7.3 B	7.3 B
Potassium	mg/kg	916 U	1360 U	414 U	402 U
Selenium	mg/kg	0.25 R	0.25 R	0.29 R	0.28 R
Silver	mg/kg	3 U	3 U	1.7 U	1.7 U
Sodium	mg/kg	114 U	110 U	135 U	98.1 U
Thallium	mg/kg	0.98 U	0.99 U	1.2 U	1.1 U
Vanadium	mg/kg	46.8	51	18.9	17
Zinc	mg/kg	71.4	83.2	59.3	54.9

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth		SSB-06 26-May-92 6-8.8'	SSC-01 19-May-92 10-12'	SSC-04 20-May-92 10-15'	SSC-05 21-May-92 10-15'
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	15100	38600	35200	18200
Antimony	mg/kg	8.3 UJ	8.5 UJ	16.6 UJ	8.4 UJ
Arsenic	mg/kg	10.8	53.5	2.8 U	7.1
Barium	mg/kg	73.4	181	154	81.2
Beryllium	mg/kg	1.3 B	3	4.1	0.67 B
Cadmium	mg/kg	0.52 U	0.53 U	1 U	0.53 U
Calcium	mg/kg	7060	7730	3150	49400
Chromium	mg/kg	36.2 J	35.5 J	28.4 J	26.2 J
Cobalt	mg/kg	16.1 J	22.4 J	41 J	16.8 J
Copper	mg/kg	20.8	35.5	27.1	13.1
Cyanide	mg/kg	0.06 U	0.07 U	0.06 U	0.07 U
Iron	mg/kg	52000	58300	63400	27700
Lead	mg/kg	25.9 J	31.8 J	38.7 J	36.9 J
Magnesium	mg/kg	1960 J	5060 J	1870 J	1600 J
Manganese	mg/kg	1300 J	1710 J	4560 J	715 J
Mercury	mg/kg	0.74	0.13 U	0.19	0.13 U
Nickel	mg/kg	31.7	49.6	33.2	12.8
Potassium	mg/kg	371 U	2580	1900 B	1010 U
Selenium	mg/kg	0.52 R	0.26 R	0.26 R	0.26 R
Silver	mg/kg	1.6 U	1.6 U	3.1 U	1.6 U
Sodium	mg/kg	71.3 U	108 U	72.9 U	107 U
Thallium	mg/kg	1 U	1.1 U	1 U	1.1 U
Vanadium	mg/kg	29.9	45.8	61.6	32.2
Zinc	mg/kg	63.3	123	109	56.4

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth Soil Parameter	Units	SSD-04 21-May-92 15-18.5' Results†	SSD-05 21-May-92 15-20' Results†	SSE-05 22-May-92 20-25' Results†
Metals				
Aluminum	mg/kg	33400	28900	24800
Antimony	mg/kg	18.2 UJ	42.4 UJ	8.6 UJ
Arsenic	mg/kg	14.5 B	26.5 B	25.8
Barium	mg/kg	196	266	76.5
Beryllium	mg/kg	4.7	2.6 B	1.8
Cadmium	mg/kg	1.1 U	2.7 U	0.54 U
Calcium	mg/kg	10600	3010 B	5920
Chromium	mg/kg	39.3 J	32.3 J	28.8 J
Cobalt	mg/kg	32.1 J	33.9 J	19.8 J
Copper	mg/kg	50.3	31.7 B	29.5
Cyanide	mg/kg	0.41 B	0.07 U	0.07 U
Iron	mg/kg	79100	70100	46200
Lead	mg/kg	167	38.9 J	29.3 J
Magnesium	mg/kg	3700 J	2280 J	5650 J
Manganese	mg/kg	5040 J	11900 J	1500 J
Mercury	mg/kg	0.17	0.13 U	0.13 U
Nickel	mg/kg	65.7	37.4 B	37.7
Potassium	mg/kg	2170 B	1910 B	1770
Selenium	mg/kg	0.28 R	0.27 R	0.27 R
Silver	mg/kg	3.4 U	8 U	1.6 U
Sodium	mg/kg	93.7 U	126 U	77.9 U
Thallium	mg/kg	1.1 U	1.1 U	1.1 U
Vanadium	mg/kg	56.3	41.5 B	31.3
Zinc	mg/kg	153	98.4	91.5

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth Soil Parameter	Units	SSA-01 19-May-92 2-5' Results†	SSA-02 20-May-92 2-5' Results†	SSA-03 20-May-92 2-5.5' Results†	SSA-04 21-May-92 2-5' Results†
PCBs					
Aroclor-1248	ug/kg	47	33 U	33 U	33 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSA-05	SSA-06	SSB-01	SSB-02
Date sampled		21-May-92	26-May-92	19-May-92	20-May-92
Depth		2-5'	2-6'	5-10'	5-9.5'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1248	ug/kg	33 U	33 U	79	33 U
Aroclor-1260	ug/kg	NA	NA	33 U	340

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-04	SSB-04D	SSB-05	SSB-05D
Date sampled		20-May-92	20-May-92	21-May-92	21-May-92
Depth		5-10'	5-10'	5-10'	5-10'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1248	ug/kg	33 U	33 R	33 R	33 U
Aroclor-1260	ug/kg	33 U	364 J	33 R	33 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-06
Date sampled		26-May-92
Depth		6-8.8'
Soil		
Parameter	**Units**	**Results†**
PCBs		
Aroclor-1248	ug/kg	33 U
Aroclor-1260	ug/kg	33 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth		SSA-01 19-May-92 2-5'	SSA-02 20-May-92 2-5'	SSA-03 20-May-92 2-5.5'	SSA-04 21-May-92 2-5'
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
Delta-bhc	ug/kg	2.9	1.7 U	1.7 U	1.7 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSA-05	SSA-06	SSB-01	SSB-02
Date sampled		21-May-92	26-May-92	19-May-92	20-May-92
Depth		2-5'	2-6'	5-10'	5-9.5'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Pesticides					
4,4'-dde	ug/kg	NA	NA	3.6 J	14.8
Delta-bhc	ug/kg	1.7 U	1.7 U	2.3	1.7 U
Gamma-chlordane	ug/kg	NA	NA	1.7 U	1.7 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-04	SSB-04D	SSB-05	SSB-05D
Date sampled		20-May-92	20-May-92	21-May-92	21-May-92
Depth		5-10'	5-10'	5-10'	5-10'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
4,4'-dde	ug/kg	3.3 U	3.3 UJ	3.3 UJ	3.3 U
Delta-bhc	ug/kg	1.7 U	1.7 UJ	3 J	1.7 U
Gamma-chlordane	ug/kg	1.7 U	1.7 UJ	1.7 UJ	2.857 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-06
Date sampled		26-May-92
Depth		6-8.8'
Soil		
Parameter	**Units**	**Results†**
Pesticides		
4,4'-dde	ug/kg	3.3 U
Delta-bhc	ug/kg	1.7 U
Gamma-chlordane	ug/kg	1.7 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSA-01	SSA-02	SSA-02R	SSA-03
Date sampled		19-May-92	20-May-92	20-May-92	20-May-92
Depth		2-5'	2-5'	2-5'	2-5.5'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Volatile organic compounds					
Methyl ethyl ketone	ug/kg	13 U	78	73	54
Toluene	ug/kg	150 J	310 E	300 J	960 E
Xylenes	ug/kg	13 U	4 J	4 J	4 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSA-03R	SSA-04	SSA-05	SSA-06
Date sampled		20-May-92	21-May-92	21-May-92	26-May-92
Depth		2-5.5'	2-5'	2-5'	2-6'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Methyl ethyl ketone	ug/kg	62 U	12 U	21 J	62 U
Toluene	ug/kg	800 J	33 J	8 J	62 U
Xylenes	ug/kg	62 U	12 U	12 U	62 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-01	SSB-01R	SSB-02	SSB-02R
Date sampled		19-May-92	19-May-92	20-May-92	20-May-92
Depth		5-10'	5-10'	5-9.5'	5-9.5'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	150 U	130 U	870 BE	440 U
Methyl ethyl ketone	ug/kg	NA	NA	67	62 U
Toluene	ug/kg	510 E	500 J	530 E	670 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-04	SSB-04D	SSB-05	SSB-05D
Date sampled		20-May-92	20-May-92	21-May-92	21-May-92
Depth		5-10'	5-10'	5-10'	5-10'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	31 U	93 U	120 U	200 U
Toluene	ug/kg	4 J	27 J	2 J	14 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSB-06	SSC-01	SSC-04	SSC-04R
Date sampled		26-May-92	19-May-92	20-May-92	20-May-92
Depth		6-8.8'	10-12'	10-15'	10-15'
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Acetone	ug/kg	950	NA	NA	NA
Methyl ethyl ketone	ug/kg	NA	10 J	13 U	65 U
Tetrachloroethene	ug/kg	NA	NA	5 J	65 U
Toluene	ug/kg	9 J	240 J	390 E	180 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SSC-05	SSD-04	SSD-05	SSE-05
Date sampled		21-May-92	21-May-92	21-May-92	22-May-92
Depth		10-15'	15-18.5'	15-20'	20-25'
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Volatile organic compounds					
Methyl ethyl ketone	ug/kg	13 U	14 U	13 U	74
Toluene	ug/kg	13 U	2 J	1 J	9 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number Date sampled Depth		SSC-01 19-May-92 10-12'	SSC-04 20-May-92 10-15'	SSC-05 21-May-92 10-15'
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds				
Butylbenzylphthalate	ug/kg	140 J	430 U	430 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-01	SD-02	SD-02D	SD-03
Date sampled		26-May-92	26-May-92	26-May-92	26-May-92
Depth		0-.5'	0-.5'	0-.5'	0-.5'
Sediment					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	mg/kg	6490	7290	6260	4730
Antimony	mg/kg	44.9 UJ	16.1 UJ	8.1 UJ	8 UJ
Arsenic	mg/kg	4.5 U	5.8	4.6 U	12.5
Barium	mg/kg	225 B	66 B	50.9	30 B
Beryllium	mg/kg	1.4 U	1 B	0.71 B	0.74 B
Cadmium	mg/kg	2.8 U	1 U	0.51 U	2.1 U
Calcium	mg/kg	217000	2660	8820	43400
Chromium	mg/kg	55.7 J	16.9 J	12 J	26.3 J
Cobalt	mg/kg	14.4 J	18.2 J	12.4 J	10.8 J
Copper	mg/kg	27.7 B	8 B	6.4	9.8
Cyanide	mg/kg	0.06 U	0.56 B	0.07 B	0.23 B
Iron	mg/kg	19200	21700	16100	23800
Lead	mg/kg	37.1 J	21.1 J	18.2 J	79.8
Magnesium	mg/kg	15500 J	554 J	1420 J	4910 J
Manganese	mg/kg	12200 J	3480 J	1610 J	686 J
Mercury	mg/kg	0.96	0.13 U	0.13 U	0.13 U
Nickel	mg/kg	20.4 B	7 U	6.1 B	9.6 B
Potassium	mg/kg	2000 U	718 U	362 U	359 U
Selenium	mg/kg	0.23 R	0.27 R	0.28 R	0.27 R
Silver	mg/kg	8.4 U	3 U	1.5 U	1.5 U
Sodium	mg/kg	243 U	64.2 U	65.5 B	62.9 U
Thallium	mg/kg	0.93 U	1 U	1 U	1 U
Vanadium	mg/kg	25.5 B	20 B	15.4	15.4
Zinc	mg/kg	125	41	39.4	361

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-04
Date sampled		26-May-92
Depth		2-2.5'
Sediment		
Parameter	**Units**	**Results†**
Metals		
Aluminum	mg/kg	12500
Antimony	mg/kg	8.7 UJ
Arsenic	mg/kg	3.9 U
Barium	mg/kg	97.8
Beryllium	mg/kg	1.1 B
Cadmium	mg/kg	0.55 U
Calcium	mg/kg	2680
Chromium	mg/kg	14.9 J
Cobalt	mg/kg	16.4 J
Copper	mg/kg	11
Cyanide	mg/kg	0.07 U
Iron	mg/kg	22700
Lead	mg/kg	27.9 J
Magnesium	mg/kg	783 J
Manganese	mg/kg	1710 J
Mercury	mg/kg	0.14 U
Nickel	mg/kg	9.3 B
Potassium	mg/kg	391 U
Selenium	mg/kg	0.27 R
Silver	mg/kg	1.6 U
Sodium	mg/kg	75.6 B
Thallium	mg/kg	1.1 U
Vanadium	mg/kg	25.8
Zinc	mg/kg	30.5

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-01	SD-02	SD-02D	SD-03
Date sampled		26-May-92	26-May-92	26-May-92	26-May-92
Depth		0-.5'	0-.5'	0-.5'	0-.5'
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Volatile organic compounds					
Acetone	ug/kg	30000	1200	18000	49000 E
Ethylbenzene	ug/kg	470 J	62 U	1500 U	1500 U
Xylenes	ug/kg	1200 J	62 U	1500 U	1500 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-03R	SD-04
Date sampled		26-May-92	26-May-92
Depth		0-.5'	2-2.5'
Sediment			
Parameter	Units	Results†	Results†
Volatile organic compounds			
Acetone	ug/kg	33000	31000
Ethylbenzene	ug/kg	3000 U	1600 U
Xylenes	ug/kg	3000 U	1600 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-01	SD-02	SD-02D	SD-03
Date sampled		26-May-92	26-May-92	26-May-92	26-May-92
Depth		0-.5'	0-.5'	0-.5'	0-.5'
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Benzo(a)pyrene	ug/kg	380 U	320 J	420 U	410 U
Di-n-butylphthalate	ug/kg	380 U	52 J	420 U	410 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.2. (continued)

Sample number		SD-04
Date sampled		26-May-92
Depth		2-2.5'
Sediment		
Parameter	**Units**	**Results†**
Semivolatile organic compounds		
Benzo(a)pyrene	ug/kg	280 J
Di-n-butylphthalate	ug/kg	450 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. David Witherspoon, Inc., 901 Site historical data
Halliburton investigation

Sample number		DW-GW-01	DW-MW-02	DW-MW-03	DW-TW-01
Date sampled		27-Jan-94	27-Jan-94	26-Jan-94	25-Jan-94
Depth					
Groundwater					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	ug/L	460 UJ	570 UJ	620 UJ	32000 J
Antimony	ug/L	50 U	50 U	50 U	50 U
Arsenic	ug/L	4 U	4 U	4 U	10 U
Barium	ug/L	32	140	48	530
Beryllium	ug/L	4 U	4 U	4 U	4 U
Cadmium	ug/L	5 U	5 U	5 U	5 U
Calcium	ug/L	86000	110000	88000	190000
Chromium	ug/L	7 U	7 U	7 U	25
Cobalt	ug/L	20 U	20 U	20 U	29
Copper	ug/L	20 U	20 U	20 U	20 U
Cyanide	ug/L	10 U	10 U	10 U	10 U
Iron	ug/L	250 U	580 U	460 U	61000
Lead	ug/L	2 U	7	2 U	36
Magnesium	ug/L	5200	7400	8600	18000
Manganese	ug/L	20 U	3200	880	4400
Mercury	ug/L	0.2 U	0.29	0.2 U	0.2 U
Nickel	ug/L	40 U	40 U	40 U	51 J
Potassium	ug/L	1900 U	1900 U	9800	5100
Selenium	ug/L	4 U	4 U	4 U	36 U
Silver	ug/L	8 U	8 U	8 U	8 U
Sodium	ug/L	7300	15000	18000	17000
Thallium	ug/L	3 UJ	3 UJ	3 UJ	3 UJ
Vanadium	ug/L	10 U	10 U	10 U	48
Zinc	ug/L	4 U	370	11	93
PCBs					
Aroclor-1016	ug/L	1 U	1 U	1 U	1 U
Aroclor-1221	ug/L	2 U	2 U	2 U	2 U
Aroclor-1232	ug/L	1 U	1 U	1 U	1 U
Aroclor-1242	ug/L	1 U	1 U	1 U	1 U
Aroclor-1248	ug/L	1 U	1 U	1 U	1 U
Aroclor-1254	ug/L	1 U	1 U	1 U	1 U
Aroclor-1260	ug/L	1 U	1 U	1 U	1 U
Pesticides					
4,4'-ddd (p,p'-ddd)	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-dde (p,p'-dde)	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-ddt (p,p'-ddt)	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Aldrin	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Alpha-bhc	ug/L	0.05 U	0.05 U	0.05 U	0.05 U

18-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-GW-01	DW-MW-02	DW-MW-03	DW-TW-01
Date sampled		27-Jan-94	27-Jan-94	26-Jan-94	25-Jan-94
Depth					
Groundwater					
Parameter	Units	Results†	Results†	Results†	Results†
Pesticides					
Alpha-chlordane /2	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Beta-bhc	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Delta-bhc	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan I	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan II	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Endrin ketone	ug/L	0.1 U	0.1 U	0.1 U	0.1 U
Gamma-bhc	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Gamma-chlordane /2	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor expoxide	ug/L	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	ug/L	0.5 U	0.5 U	0.5 U	0.5 U
Toxaphene	ug/L	5 U	5 U	5 U	5 U
Volatile organic compounds					
1,1,1-trichloroethane	ug/L	10 U	10 U	10 U	10 U
1,1,2,2-tetrachloroethane	ug/L	10 U	10 U	10 U	10 U
1,1,2-trichloroethane	ug/L	10 U	10 U	10 U	10 U
1,1-dichloroethane	ug/L	10 U	10 U	10 U	10 U
1,1-dichloroethene (1,1-dichloroethylene	ug/L	10 U	10 U	10 U	10 U
1,2 -dichloroethane	ug/L	10 U	10 U	10 U	10 U
1,2-dichloroethene (total)	ug/L	10 U	10 U	10 U	10 U
1,2-dichloropropane	ug/L	10 U	10 U	10 U	10 U
Acetone	ug/L	10 U	10 U	10 U	10 U
Benzene	ug/L	10 U	10 U	10 U	10 U
Bromodichloromethane	ug/L	10 U	10 U	10 U	10 U
Bromoform	ug/L	10 U	10 U	10 U	10 U
Bromomethane	ug/L	10 U	10 U	10 U	10 U
Carbon disulfide	ug/L	10 U	10 U	10 U	10 U
Carbon tetrachloride	ug/L	10 U	10 U	10 U	10 U
Chlorobenzene	ug/L	10 U	10 U	10 U	10 U
Chloroethane	ug/L	10 U	10 U	10 U	10 U
Chloroform	ug/L	10 U	10 U	10 U	10 U
Chloromethane	ug/L	10 U	10 U	10 U	10 U
Cis-1,3-dichloropropene	ug/L	10 U	10 U	10 U	10 U
Dibromochloromethane	ug/L	10 U	10 U	10 U	10 U
Ethylbenzene	ug/L	10 U	10 U	10 U	10 U

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-GW-01	DW-MW-02	DW-MW-03	DW-TW-01
Date sampled		27-Jan-94	27-Jan-94	26-Jan-94	25-Jan-94
Depth					
Groundwater					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
Methyl butyl ketone	ug/L	10 U	10 U	10 U	10 U
Methyl ethyl ketone	ug/L	10 U	10 U	10 U	10 U
Methyl isobutyl ketone	ug/L	10 U	10 U	10 U	10 U
Methylene Chloride	ug/L	10 U	10 U	10 U	10 U
Styrene	ug/L	10 U	10 U	10 U	10 U
Tetrachloroethene	ug/L	10 U	10 U	10 U	10 U
Toluene	ug/L	10 U	10 U	10 U	10 U
Trans-1,3-dichloropropene	ug/L	10 U	10 U	10 U	10 U
Trichloroethene (trichloroethylene)	ug/L	10 U	10 U	10 U	10 U
Vinyl Chloride	ug/L	10 U	10 U	10 U	10 U
Xylenes	ug/L	10 U	10 U	10 U	10 U
Semivolatile organic compounds					
(3-and/or 4-) methylphenol	ug/L	10 U	10 U	10 U	10 U
1,2,4-trichlorobenzene	ug/L	10 U	10 U	10 U	10 U
1,2-dichlorobenzene	ug/L	10 U	10 U	10 U	10 U
1,3-dichlorobenzene	ug/L	10 U	10 U	10 U	10 U
1,4-dichlorobenzene	ug/L	10 U	10 U	10 U	10 U
2,2'-chloroisopropylether	ug/L	10 U	10 U	10 U	10 U
2,4,5-trichlorophenol	ug/L	25 U	25 U	25 U	25 U
2,4,6-trichlorophenol	ug/L	10 U	10 U	10 U	10 U
2,4-dichlorophenol	ug/L	10 U	10 U	10 U	10 U
2,4-dimethylphenol	ug/L	10 U	10 U	10 U	10 U
2,4-dinitrophenol	ug/L	25 U	25 U	25 U	25 U
2,4-dinitrotoluene	ug/L	10 U	10 U	10 U	10 U
2,6-dinitrotoluene	ug/L	10 U	10 U	10 U	10 U
2-chloronaphthalene	ug/L	10 U	10 U	10 U	10 U
2-chlorophenol	ug/L	10 U	10 U	10 U	10 U
2-methyl-4,6-dinitrophenol	ug/L	25 U	25 U	25 U	25 U
2-methylnaphthalene	ug/L	10 U	10 U	10 U	10 U
2-methylphenol	ug/L	10 U	10 U	10 U	10 U
2-nitroaniline	ug/L	25 U	25 U	25 U	25 U
2-nitrophenol	ug/L	10 U	10 U	10 U	10 U
3,3'-dichlorobenzidine	ug/L	10 U	10 U	10 U	10 U
3-nitroaniline	ug/L	25 U	25 U	25 U	25 U
4-bromophenyl phenyl ether	ug/L	10 U	10 U	10 U	10 U
4-chloro-3-methylphenol	ug/L	10 U	10 U	10 U	10 U
4-chloroaniline	ug/L	10 U	10 U	10 U	10 U
4-chlorophenyl phenyl ether	ug/L	10 U	10 U	10 U	10 U
4-nitroaniline	ug/L	25 U	25 U	25 U	25 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-GW-01	DW-MW-02	DW-MW-03	DW-TW-01
Date sampled		27-Jan-94	27-Jan-94	26-Jan-94	25-Jan-94
Depth					
Groundwater					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
4-nitrophenol	ug/L	25 U	25 U	25 U	25 U
Acenaphthene	ug/L	10 U	10 U	10 U	10 U
Acenaphthylene	ug/L	10 U	10 U	10 U	10 U
Anthracene	ug/L	10 U	10 U	10 U	10 U
Benzo(a)anthracene	ug/L	10 U	10 U	10 U	10 U
Benzo(a)pyrene	ug/L	10 U	10 U	10 U	10 U
Benzo(B and/or K)fluoranthene	ug/L	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	ug/L	10 U	10 U	10 U	10 U
Benzyl butyl phthalate	ug/L	10 U	10 U	10 U	10 U
Bis(2-chloroethoxy)methane	ug/L	10 U	10 U	10 U	10 U
Bis(2-chloroethyl) ether	ug/L	10 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	ug/L	10 U	10 U	10 U	10 U
Carbazole	ug/L	10 U	10 U	10 U	10 U
Chrysene	ug/L	10 U	10 U	10 U	10 U
Di-n-butylphthalate	ug/L	10 U	10 U	10 U	10 U
Di-n-octylphthalate	ug/L	10 U	10 U	10 U	10 U
Dibenzo(a,h)anthracene	ug/L	10 U	10 U	10 U	10 U
Dibenzofuran	ug/L	10 U	10 U	10 U	10 U
Diethyl phthalate	ug/L	10 U	10 U	10 U	10 U
Dimethyl phthalate	ug/L	10 U	10 U	10 U	10 U
Fluoranthene	ug/L	10 U	10 U	10 U	10 U
Fluorene	ug/L	10 U	10 U	10 U	10 U
Hexachlorobenzene	ug/L	10 U	10 U	10 U	10 U
Hexachlorobutadiene	ug/L	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	ug/L	10 U	10 U	10 U	10 U
Hexachloroethane	ug/L	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	ug/L	10 U	10 U	10 U	10 U
Isophorone	ug/L	10 U	10 U	10 U	10 U
N-nitroso-di-n-propylamine	ug/L	10 U	10 U	10 U	10 U
N-nitrosodiphenylamine	ug/L	10 U	10 U	10 U	10 U
Naphthalene	ug/L	10 U	10 U	10 U	10 U
Nitrobenzene	ug/L	10 U	10 U	10 U	10 U
Pentachlorophenol	ug/L	25 U	25 U	25 U	25 U
Phenanthrene	ug/L	10 U	10 U	10 U	10 U
Phenol	ug/L	10 U	10 U	10 U	10 U
Pyrene	ug/L	10 U	10 U	10 U	10 U
Radionuclides					
Gross Alpha	pCi/L	0.9 J	3.4	3.3	24
Gross Beta	pCi/L	2	4.5	9.5	18

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-GW-01	DW-MW-02	DW-MW-03	DW-TW-01
Date sampled		27-Jan-94	27-Jan-94	26-Jan-94	25-Jan-94
Depth					
Groundwater					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Thorium-232	pCi/L	0.1 U	0.1 U	0.1 UJ	0.17
Thorium-234	pCi/L	20 U	20 U	20 U	22 U
Uranium-234	pCi/L	0.15 J	1.4	1.2 J	1.6 J
Uranium-235	pCi/L	0.1 UJ	0.1 U	0.1 UJ	0.1 UJ
Uranium-238	pCi/L	0.1 UJ	1.1	1.1 J	1.4 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	11000	12000	16000	17000
Antimony	mg/kg	20 UJ	20 UJ	12 J	20 UJ
Arsenic	mg/kg	8.8 J	14 J	9.4 J	14 J
Barium	mg/kg	92	89	170	180
Beryllium	mg/kg	2 U	1.6	0.98 U	1.1 U
Cadmium	mg/kg	1.2 U	2.1	5.5	3.4 J
Calcium	mg/kg	2800	62000	90000	14000
Chromium	mg/kg	14	20	120	37
Cobalt	mg/kg	15	14	14	15
Copper	mg/kg	7.7	60	570	240
Cyanide	mg/kg	0.68 U	0.68 U	0.68 U	0.75 U
Iron	mg/kg	24000	37000	47000	50000
Lead	mg/kg	22	190	320	220
Magnesium	mg/kg	670	7500	8600	4200
Manganese	mg/kg	1800	1200	1900	1100
Mercury	mg/kg	0.14 U	0.44	2.4	1.6
Nickel	mg/kg	14 J	26 J	120	54
Potassium	mg/kg	500 U	1200 J	1400 J	1400 J
Selenium	mg/kg	0.98 UR	0.98 UR	0.98 UR	1.1 UR
Silver	mg/kg	2.1 U	2.1 U	2.1 U	2.3 U
Sodium	mg/kg	140 U	150 U	1300	250 U
Thallium	mg/kg	0.73 UJ	0.74 UJ	0.74 UJ	0.81 UJ
Vanadium	mg/kg	23	30	29	33
Zinc	mg/kg	27	310	920	540

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	4000	15000	8200	3700
Antimony	mg/kg	11 J	25 J	24 J	9.1 UJ
Arsenic	mg/kg	2.7 J	9.4 J	22 J	17 J
Barium	mg/kg	80	310	330	40
Beryllium	mg/kg	0.87 U	1 U	2 U	0.78 U
Cadmium	mg/kg	1.3 J	41	12	1.4
Calcium	mg/kg	170000	45000	66000	290000
Chromium	mg/kg	41	220	110	9.8
Cobalt	mg/kg	3.2	20	13	3.2 J
Copper	mg/kg	43	4400	790	77
Cyanide	mg/kg	0.6 U	0.71 U	0.79 U	0.54 U
Iron	mg/kg	16000	82000	54000	9600
Lead	mg/kg	63	2000	930	53
Magnesium	mg/kg	55000	7900	6400	11000
Manganese	mg/kg	2400	1600	790	260
Mercury	mg/kg	0.31	9.1	130	0.46
Nickel	mg/kg	20 J	260	130	20
Potassium	mg/kg	610 J	830 J	530 J	1000 J
Selenium	mg/kg	0.87 UR	1 UR	0.87 UR	7.8 UR
Silver	mg/kg	1.9 U	2.2 U	1.9 U	1.7 U
Sodium	mg/kg	220	350 U	320 U	180 U
Thallium	mg/kg	0.65 UJ	0.77 UJ	0.65 UJ	0.59 UJ
Vanadium	mg/kg	16	25	16	6.7
Zinc	mg/kg	240	5300	3400	130

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number Date sampled Depth		DW-SS-08 27-Jan-94 0-6"	DW-SS-09 27-Jan-94 0-6"	DW-SS-10 27-Jan-94 0-6"	DW-SS-11 26-Jan-94 0-6"
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	11000	9000	15000	NA
Antimony	mg/kg	24 J	27 J	20 UJ	NA
Arsenic	mg/kg	24 J	30 J	25	NA
Barium	mg/kg	550	290	830	NA
Beryllium	mg/kg	1 U	0.99 U	1 U	NA
Cadmium	mg/kg	17	13	45 JN	NA
Calcium	mg/kg	120000	54000	40000	NA
Chromium	mg/kg	180	230	160 J	NA
Cobalt	mg/kg	19	25	59 J	NA
Copper	mg/kg	7500	1300	1800	NA
Cyanide	mg/kg	1.6	0.82	2	0.95
Iron	mg/kg	96000	120000	190000 J	NA
Lead	mg/kg	1600	830	2400	NA
Magnesium	mg/kg	12000	4100	5200	NA
Manganese	mg/kg	1800	1500	2800 J	NA
Mercury	mg/kg	8.1	16	430 J	NA
Nickel	mg/kg	400	150	410 J	NA
Potassium	mg/kg	630	510 U	1100	NA
Selenium	mg/kg	1 UR	2 UJ	1.1 UJ	NA
Silver	mg/kg	2.2 U	2.1 U	3.8 JN	NA
Sodium	mg/kg	960	650 U	490 U	NA
Thallium	mg/kg	0.78 UJ	0.74 UJ	0.85 UJ	NA
Vanadium	mg/kg	25	32	12	NA
Zinc	mg/kg	16000	3400	8400	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	**Units**	**Results†**	**Results†**
Metals			
Aluminum	mg/kg	16000	7200
Antimony	mg/kg	20 UJ	17 J
Arsenic	mg/kg	16 J	7.6 J
Barium	mg/kg	200	310
Beryllium	mg/kg	1.4	0.84 U
Cadmium	mg/kg	2.1	8.6
Calcium	mg/kg	9200	150000
Chromium	mg/kg	21	50
Cobalt	mg/kg	16	8.9
Copper	mg/kg	67	4700
Cyanide	mg/kg	0.68 U	0.59 U
Iron	mg/kg	34000	31000
Lead	mg/kg	220	1900
Magnesium	mg/kg	1700	16000
Manganese	mg/kg	1800	2200
Mercury	mg/kg	1.1	3
Nickel	mg/kg	27	66
Potassium	mg/kg	1700	700
Selenium	mg/kg	0.98 UR	0.84 UR
Silver	mg/kg	2.1 U	1.8 U
Sodium	mg/kg	150 U	240 U
Thallium	mg/kg	0.73 UJ	0.63 UJ
Vanadium	mg/kg	34	16
Zinc	mg/kg	570	14000

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number Date sampled Depth		DW-SB-01 25-Jan-94 SUBSURFACE	DW-SS-01 25-Jan-94 0-6"	DW-SS-02 26-Jan-94 0-6"	DW-SS-03 26-Jan-94 0-6"
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1016	ug/kg	43 U	230 U	38 U	46 U
Aroclor-1221	ug/kg	88 U	470 U	77 U	94 U
Aroclor-1232	ug/kg	43 U	230 U	38 U	46 U
Aroclor-1242	ug/kg	43 U	230 U	38 U	46 U
Aroclor-1248	ug/kg	43 U	230 U	38 U	46 U
Aroclor-1254	ug/kg	43 U	230 U	1200 C	1500 C
Aroclor-1260	ug/kg	43 U	230 U	440 C	540 N

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1016	ug/kg	38 U	190 U	8000 U	180 U
Aroclor-1221	ug/kg	78 U	390 U	16000 U	370 U
Aroclor-1232	ug/kg	38 U	190 U	8000 U	180 U
Aroclor-1242	ug/kg	38 U	190 U	8000 U	180 U
Aroclor-1248	ug/kg	38 U	3800 CN	8000 U	180 U
Aroclor-1254	ug/kg	140 N	7100 C	28000 C	2900 C
Aroclor-1260	ug/kg	340	3700 C	8000 U	180 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number Date sampled Depth		DW-SS-08 27-Jan-94 0-6"	DW-SS-09 27-Jan-94 0-6"	DW-SS-10 27-Jan-94 0-6"	DW-SS-11 26-Jan-94 0-6"
Soil Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	9600 U	2400 U	2600 U	99 U
Aroclor-1221	ug/kg	19000 U	4900 U	5200 U	200 U
Aroclor-1232	ug/kg	9600 U	2400 U	2600 U	99 U
Aroclor-1242	ug/kg	200000 C	2400 U	2600 U	99 U
Aroclor-1248	ug/kg	100000 C	2400 U	2600 U	99 U
Aroclor-1254	ug/kg	9600 U	45000 C	52000 C	99 U
Aroclor-1260	ug/kg	9600 U	12000 C	5400 C	99 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	Units	Results†	Results†
PCBs			
Aroclor-1016	ug/kg	44 U	41 U
Aroclor-1221	ug/kg	89 U	84 U
Aroclor-1232	ug/kg	44 U	41 U
Aroclor-1242	ug/kg	44 U	41 U
Aroclor-1248	ug/kg	44 U	41 U
Aroclor-1254	ug/kg	44 U	6500 C
Aroclor-1260	ug/kg	44 U	41 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
4,4'-ddd (p,p'-ddd)	ug/kg	4.3 U	23 U	3.8 U	4.6 U
4,4'-dde (p,p'-dde)	ug/kg	4.3 U	23 U	3.8 U	4.6 U
4,4'-ddt (p,p'-ddt)	ug/kg	4.3 U	21 J	3.8 U	4.6 U
Aldrin	ug/kg	2.2 U	12 U	2 U	2.4 U
Alpha-bhc	ug/kg	2.2 U	12 U	2 U	2.4 U
Alpha-chlordane /2	ug/kg	2.2 U	71	2 U	2.4 U
Beta-bhc	ug/kg	2.2 U	12 U	2 U	2.4 U
Delta-bhc	ug/kg	2.2 U	12 U	2 U	2.4 U
Dieldrin	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Endosulfan I	ug/kg	2.2 U	12 U	2 U	2.4 U
Endosulfan II	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Endosulfan sulfate	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Endrin	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Endrin aldehyde	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Endrin ketone	ug/kg	4.3 U	23 U	3.8 U	4.6 U
Gamma-bhc	ug/kg	2.2 U	12 U	2 U	2.4 U
Gamma-chlordane /2	ug/kg	2.2 U	73	2 U	2.4 U
Heptachlor	ug/kg	2.2 U	12 U	2 U	2.4 U
Heptachlor expoxide	ug/kg	2.2 U	12 U	2 U	2.4 U
Methoxychlor	ug/kg	22 U	120 U	20 U	24 U
Toxaphene	ug/kg	220 U	1200 U	200 U	240 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
4,4'-ddd (p,p'-ddd)	ug/kg	3.8 U	19 U	800 U	18 U
4,4'-dde (p,p'-dde)	ug/kg	3.8 U	19 U	800 U	18 U
4,4'-ddt (p,p'-ddt)	ug/kg	3.8 U	19 U	800 U	18 U
Aldrin	ug/kg	2 U	10 U	410 U	9.3 U
Alpha-bhc	ug/kg	2 U	10 U	410 U	9.3 U
Alpha-chlordane /2	ug/kg	2 U	10 U	410 U	9.3 U
Beta-bhc	ug/kg	2 U	10 U	410 U	9.3 U
Delta-bhc	ug/kg	2 U	10 U	410 U	9.3 U
Dieldrin	ug/kg	3.8 U	19 U	800 U	18 U
Endosulfan I	ug/kg	2 U	10 U	410 U	9.3 U
Endosulfan II	ug/kg	3.8 U	19 U	800 U	18 U
Endosulfan sulfate	ug/kg	3.8 U	19 U	800 U	18 U
Endrin	ug/kg	3.8 U	19 U	800 U	18 U
Endrin aldehyde	ug/kg	3.8 U	19 U	800 U	18 U
Endrin ketone	ug/kg	3.8 U	19 U	800 U	18 U
Gamma-bhc	ug/kg	2 U	10 U	410 U	9.3 U
Gamma-chlordane /2	ug/kg	2 U	10 U	410 U	9.3 U
Heptachlor	ug/kg	2 U	10 U	410 U	9.3 U
Heptachlor expoxide	ug/kg	2 U	10 U	410 U	9.3 U
Methoxychlor	ug/kg	20 U	100 U	4100 U	93 U
Toxaphene	ug/kg	200 U	1000 U	41000 U	930 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-08	DW-SS-09	DW-SS-10	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
4,4'-ddd (p,p'-ddd)	ug/kg	960 U	240 U	260 U	20 U
4,4'-dde (p,p'-dde)	ug/kg	960 U	240 U	260 U	840 C
4,4'-ddt (p,p'-ddt)	ug/kg	960 U	240 U	260 U	2400 C
Aldrin	ug/kg	490 U	120 U	130 U	5.1 U
Alpha-bhc	ug/kg	490 U	120 U	130 U	5.1 U
Alpha-chlordane /2	ug/kg	490 U	120 U	130 U	220 U
Beta-bhc	ug/kg	490 U	120 U	130 U	5.1 U
Delta-bhc	ug/kg	490 U	120 U	130 U	5.1 U
Dieldrin	ug/kg	960 U	240 U	260 U	9.9 U
Endosulfan I	ug/kg	490 U	120 U	130 U	5.1 U
Endosulfan II	ug/kg	960 U	240 U	260 U	9.9 U
Endosulfan sulfate	ug/kg	960 U	240 U	260 U	30 U
Endrin	ug/kg	960 U	240 U	260 U	9.9 U
Endrin aldehyde	ug/kg	960 U	240 U	260 U	20 U
Endrin ketone	ug/kg	960 U	240 U	260 U	20 U
Gamma-bhc	ug/kg	490 U	120 U	130 U	5.1 U
Gamma-chlordane /2	ug/kg	490 U	120 U	130 U	270 U
Heptachlor	ug/kg	490 U	120 U	130 U	7.7
Heptachlor expoxide	ug/kg	490 U	120 U	130 U	15
Methoxychlor	ug/kg	4900 U	1200 U	1300 U	51 U
Toxaphene	ug/kg	49000 U	12000 U	13000 U	510 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	**Units**	**Results†**	**Results†**
Pesticides			
4,4'-ddd (p,p'-ddd)	ug/kg	4.4 U	4.1 U
4,4'-dde (p,p'-dde)	ug/kg	20 U	4.1 U
4,4'-ddt (p,p'-ddt)	ug/kg	170	4.1 U
Aldrin	ug/kg	2.3 U	2.1 U
Alpha-bhc	ug/kg	2.3 U	2.1 U
Alpha-chlordane /2	ug/kg	16	2.1 U
Beta-bhc	ug/kg	2.3 U	2.1 U
Delta-bhc	ug/kg	2.3 U	2.1 U
Dieldrin	ug/kg	75	4.1 U
Endosulfan I	ug/kg	2.3 U	2.1 U
Endosulfan II	ug/kg	4.8 U	4.1 U
Endosulfan sulfate	ug/kg	4.4 U	4.1 U
Endrin	ug/kg	20 U	4.1 U
Endrin aldehyde	ug/kg	5.3	4.1 U
Endrin ketone	ug/kg	4.4 U	4.1 U
Gamma-bhc	ug/kg	3 U	2.1 U
Gamma-chlordane /2	ug/kg	18	2.1 U
Heptachlor	ug/kg	4 U	2.1 U
Heptachlor expoxide	ug/kg	2.3 U	2.1 U
Methoxychlor	ug/kg	58	21 U
Toxaphene	ug/kg	230 U	210 U

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-01	DW-SS-03	DW-SS-04	DW-SS-05
Date sampled		25-Jan-94	26-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
1,2,3,4,6,7,8 Heptachlorodibenzodioxin	ng/kg	740 J	1400	35	320
1,2,3,4,6,7,8 Heptachlorodibenzofuran	ng/kg	130 J	440	10 U	250
1,2,3,4,7,8 Hexachlorodibenzodioxin	ng/kg	20 U	20 U	10 U	10 U
1,2,3,4,7,8 Hexachlorodibenzofuran	ng/kg	10	46	5.4 J	35
1,2,3,4,7,8,9 Heptachlorodibenzofuran	ng/kg	10	26	2.2 J	32
1,2,3,6,7,8 Hexachlorodibenzodioxin	ng/kg	24	31	10 U	18
1,2,3,6,7,8 Hexachlorodibenzofuran	ng/kg	8.4 J	22	2.3 J	32
1,2,3,7,8 Pentachlorodibenzodioxin	ng/kg	10 U	20 U	10 U	10 U
1,2,3,7,8 Pentachlorodibenzofuran	ng/kg	10 U	20 U	10 U	17
1,2,3,7,8,9 Hexachlorodibenzodioxin	ng/kg	25	20 U	10 U	18
1,2,3,7,8,9 Hexachlorodibenzofuran	ng/kg	10 U	20 U	10 U	10 U
2,3,4,6,7,8 Hexachlorodibenzofuran	ng/kg	10 U	25	10 U	36
2,3,4,7,8 Pentachlorodibenzofuran	ng/kg	4 J	18 J	2.2 J	32
2,3,7,8-TCDD	ng/kg	2 U	4 U	2 U	1.3 J
2,3,7,8-TCDF	ng/kg	3.9	71 J	3.4	55
Hpcdd (total)	ng/kg	1400 J	2400 J	68 J	630 J
Hpcdf (total)	ng/kg	310 J	1500 J	17 J	480 J
Hxcdd (total)	ng/kg	180 J	230 J	18 J	210 J
Hxcdf (total)	ng/kg	160 J	530 J	23 J	450 J
Ocdd (total)	ng/kg	5200 J	9400 J	210	1800
Ocdf (total)	ng/kg	210 J	1100	110	410
Pecdd (total)	ng/kg	23 J	43 J	3.2 J	66 J
Pecdf (total)	ng/kg	100 J	310 J	24 J	450 J
Tcdd (total)	ng/kg	11 J	62 J	2 UJ	76 J
Tcdf (total)	ng/kg	56 J	230 J	24 J	430 J
Teq (toxic. Equiv. Value. From I-tef/89)	ng/kg	23 J	68 J	2.9 J	46

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-07	DW-SS-08	DW-SS-09	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
1,2,3,4,6,7,8 Heptachlorodibenzodioxin	ng/kg	36	500	2600 J	220
1,2,3,4,6,7,8 Heptachlorodibenzofuran	ng/kg	18	120	420	78
1,2,3,4,7,8 Hexachlorodibenzodioxin	ng/kg	10 U	10 U	30 U	10 U
1,2,3,4,7,8 Hexachlorodibenzofuran	ng/kg	7.5 J	22	88	18
1,2,3,4,7,8,9 Heptachlorodibenzofuran	ng/kg	2.3 J	21	57	10 U
1,2,3,6,7,8 Hexachlorodibenzodioxin	ng/kg	10 U	17	91	10 U
1,2,3,6,7,8 Hexachlorodibenzofuran	ng/kg	2.7 J	33	35	9.1 J
1,2,3,7,8 Pentachlorodibenzodioxin	ng/kg	10 U	10 U	10 U	10 U
1,2,3,7,8 Pentachlorodibenzofuran	ng/kg	10 U	13	20	10 U
1,2,3,7,8,9 Hexachlorodibenzodioxin	ng/kg	10 U	20 U	34	10 U
1,2,3,7,8,9 Hexachlorodibenzofuran	ng/kg	10 U	10 U	10 U	10 U
2,3,4,6,7,8 Hexachlorodibenzofuran	ng/kg	10 U	8.9 J	26	8.6 J
2,3,4,7,8 Pentachlorodibenzofuran	ng/kg	4 J	38	41	5.8 J
2,3,7,8-TCDD	ng/kg	0.2 J	2.2 J	4.6 J	1 J
2,3,7,8-TCDF	ng/kg	8.9	35	66	10
Hpcdd (total)	ng/kg	74 J	940 J	6100 J	440 J
Hpcdf (total)	ng/kg	42 J	280 J	1400 J	190 J
Hxcdd (total)	ng/kg	26 J	180 J	570 J	73 J
Hxcdf (total)	ng/kg	34 J	230 J	720 J	140 J
Ocdd (total)	ng/kg	200	2900	16000 J	2000
Ocdf (total)	ng/kg	25	220	1600	190
Pecdd (total)	ng/kg	5.5 J	53 J	94 J	20 J
Pecdf (total)	ng/kg	30 J	300 J	410 J	160 J
Tcdd (total)	ng/kg	6 J	58 J	150 J	22 J
Tcdf (total)	ng/kg	39 J	700 J	460 J	130 J
Teq (toxic. Equiv. Value. From I-tef/89)	ng/kg	4.9 J	43	110 J	14 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
1,1,1-trichloroethane	ug/kg	13 U	14 U	11 U	14 U
1,1,2,2-tetrachloroethane	ug/kg	13 U	14 U	11 U	14 U
1,1,2-trichloroethane	ug/kg	13 U	14 U	11 U	14 U
1,1-dichloroethane	ug/kg	13 U	14 U	11 U	14 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	13 U	14 U	11 U	14 U
1,2 -dichloroethane	ug/kg	13 U	14 U	11 U	14 U
1,2-dichloroethene (total)	ug/kg	13 U	14 U	11 U	14 U
1,2-dichloropropane	ug/kg	13 U	14 U	11 U	14 U
Acetone	ug/kg	70 U	40 U	20 U	20 U
Benzene	ug/kg	13 U	14 U	11 U	14 U
Bromodichloromethane	ug/kg	13 U	14 U	11 U	14 U
Bromoform	ug/kg	13 U	14 U	11 U	14 U
Bromomethane	ug/kg	13 U	14 U	11 U	14 U
Carbon disulfide	ug/kg	13 U	14 U	11 U	14 U
Carbon tetrachloride	ug/kg	13 U	14 U	11 U	14 U
Chlorobenzene	ug/kg	13 U	14 U	11 U	14 U
Chloroethane	ug/kg	13 U	14 U	11 U	14 U
Chloroform	ug/kg	13 U	14 U	11 U	14 U
Chloromethane	ug/kg	13 U	14 U	11 U	14 U
Cis-1,3-dichloropropene	ug/kg	13 U	14 U	11 U	14 U
Dibromochloromethane	ug/kg	13 U	14 U	11 U	14 U
Ethylbenzene	ug/kg	13 U	14 U	11 U	14 U
Methyl butyl ketone	ug/kg	13 U	14 U	11 U	14 U
Methyl ethyl ketone	ug/kg	13 U	14 U	11 U	14 U
Methyl isobutyl ketone	ug/kg	13 U	14 U	11 U	14 U
Methylene Chloride	ug/kg	40 U	30 U	20 U	30 U
Styrene	ug/kg	13 U	14 U	11 U	14 U
Tetrachloroethene	ug/kg	13 U	14 U	11 U	14 U
Toluene	ug/kg	13 U	14 U	11 U	14 U
Trans-1,3-dichloropropene	ug/kg	13 U	14 U	11 U	14 U
Trichloroethene (trichloroethylene)	ug/kg	13 U	14 U	11 U	14 U
Vinyl Chloride	ug/kg	13 U	14 U	11 U	14 U
Xylenes	ug/kg	13 U	14 U	11 U	14 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Volatile organic compounds					
1,1,1-trichloroethane	ug/kg	12 U	12 U	12 U	11 U
1,1,2,2-tetrachloroethane	ug/kg	12 U	12 U	12 U	11 U
1,1,2-trichloroethane	ug/kg	12 U	12 U	12 U	11 U
1,1-dichloroethane	ug/kg	12 U	12 U	12 U	11 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	12 U	12 U	12 U	11 U
1,2 -dichloroethane	ug/kg	12 U	12 U	12 U	11 U
1,2-dichloroethene (total)	ug/kg	12 U	12 U	12 U	11 U
1,2-dichloropropane	ug/kg	12 U	12 U	12 U	11 U
Acetone	ug/kg	12 U	20 U	12 U	11 U
Benzene	ug/kg	12 U	12 U	12 U	11 U
Bromodichloromethane	ug/kg	12 U	12 U	12 U	11 U
Bromoform	ug/kg	12 U	12 U	12 U	11 U
Bromomethane	ug/kg	12 U	12 U	12 U	11 U
Carbon disulfide	ug/kg	12 U	12 U	12 U	11 U
Carbon tetrachloride	ug/kg	12 U	12 U	12 U	11 U
Chlorobenzene	ug/kg	12 U	12 U	12 U	11 U
Chloroethane	ug/kg	12 U	12 U	12 U	11 U
Chloroform	ug/kg	12 U	12 U	12 U	11 U
Chloromethane	ug/kg	12 U	12 U	12 U	11 U
Cis-1,3-dichloropropene	ug/kg	12 U	12 U	12 U	11 U
Dibromochloromethane	ug/kg	12 U	12 U	12 U	11 U
Ethylbenzene	ug/kg	12 U	12 U	12 U	11 U
Methyl butyl ketone	ug/kg	12 U	12 U	12 U	11 U
Methyl ethyl ketone	ug/kg	12 U	12 U	12 U	11 U
Methyl isobutyl ketone	ug/kg	12 U	12 U	12 U	11 U
Methylene Chloride	ug/kg	80 U	30 U	20 U	30 U
Styrene	ug/kg	12 U	12 U	12 U	11 U
Tetrachloroethene	ug/kg	12 U	12 U	12 U	11 U
Toluene	ug/kg	12 U	12 U	3 J	11 U
Trans-1,3-dichloropropene	ug/kg	12 U	12 U	12 U	11 U
Trichloroethene (trichloroethylene)	ug/kg	12 U	12 U	12 U	11 U
Vinyl Chloride	ug/kg	12 U	12 U	12 U	11 U
Xylenes	ug/kg	12 U	12 U	12 U	11 U

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-08	DW-SS-09	DW-SS-10	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Volatile organic compounds					
1,1,1-trichloroethane	ug/kg	14 U	15 U	16 U	15 U
1,1,2,2-tetrachloroethane	ug/kg	14 U	15 U	16 U	15 U
1,1,2-trichloroethane	ug/kg	14 U	15 U	16 U	15 U
1,1-dichloroethane	ug/kg	14 U	15 U	16 U	15 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	14 U	15 U	16 U	15 U
1,2 -dichloroethane	ug/kg	14 U	15 U	16 U	15 U
1,2-dichloroethene (total)	ug/kg	14 U	15 U	16 U	15 U
1,2-dichloropropane	ug/kg	14 U	15 U	16 U	15 U
Acetone	ug/kg	14 U	15 U	30 U	15 U
Benzene	ug/kg	14 U	15 U	16 U	15 U
Bromodichloromethane	ug/kg	14 U	15 U	16 U	15 U
Bromoform	ug/kg	14 U	15 U	16 U	15 U
Bromomethane	ug/kg	14 U	15 U	16 U	15 U
Carbon disulfide	ug/kg	14 U	15 U	16 U	15 U
Carbon tetrachloride	ug/kg	14 U	15 U	16 U	15 U
Chlorobenzene	ug/kg	14 U	15 U	16 U	15 U
Chloroethane	ug/kg	14 U	15 U	16 U	15 U
Chloroform	ug/kg	14 U	15 U	16 U	15 U
Chloromethane	ug/kg	14 U	15 U	16 U	15 U
Cis-1,3-dichloropropene	ug/kg	14 U	15 U	16 U	15 U
Dibromochloromethane	ug/kg	14 U	15 U	16 U	15 U
Ethylbenzene	ug/kg	14 U	15 U	16 U	15 U
Methyl butyl ketone	ug/kg	14 U	15 U	16 U	15 U
Methyl ethyl ketone	ug/kg	14 U	15 U	16 U	15 U
Methyl isobutyl ketone	ug/kg	14 U	15 U	16 U	15 U
Methylene Chloride	ug/kg	40 U	30 U	50 U	30 U
Styrene	ug/kg	14 U	15 U	16 U	15 U
Tetrachloroethene	ug/kg	14 U	15 U	16 U	15 U
Toluene	ug/kg	14 U	15 U	16 U	15 U
Trans-1,3-dichloropropene	ug/kg	14 U	15 U	16 U	15 U
Trichloroethene (trichloroethylene)	ug/kg	14 U	15 U	16 U	15 U
Vinyl Chloride	ug/kg	14 U	15 U	16 U	15 U
Xylenes	ug/kg	14 U	15 U	16 U	15 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	Units	Results†	Results†
Volatile organic compounds			
1,1,1-trichloroethane	ug/kg	13 U	12 U
1,1,2,2-tetrachloroethane	ug/kg	13 U	12 U
1,1,2-trichloroethane	ug/kg	13 U	12 U
1,1-dichloroethane	ug/kg	13 U	12 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	13 U	12 U
1,2 -dichloroethane	ug/kg	13 U	12 U
1,2-dichloroethene (total)	ug/kg	13 U	12 U
1,2-dichloropropane	ug/kg	13 U	12 U
Acetone	ug/kg	13 U	30 U
Benzene	ug/kg	13 U	12 U
Bromodichloromethane	ug/kg	13 U	12 U
Bromoform	ug/kg	13 U	12 U
Bromomethane	ug/kg	13 U	12 U
Carbon disulfide	ug/kg	13 U	12 U
Carbon tetrachloride	ug/kg	13 U	12 U
Chlorobenzene	ug/kg	13 U	12 U
Chloroethane	ug/kg	13 U	12 U
Chloroform	ug/kg	13 U	12 U
Chloromethane	ug/kg	13 U	12 U
Cis-1,3-dichloropropene	ug/kg	13 U	12 U
Dibromochloromethane	ug/kg	13 U	12 U
Ethylbenzene	ug/kg	13 U	12 U
Methyl butyl ketone	ug/kg	13 U	12 U
Methyl ethyl ketone	ug/kg	13 U	12 U
Methyl isobutyl ketone	ug/kg	13 U	12 U
Methylene Chloride	ug/kg	30 U	30 U
Styrene	ug/kg	13 U	12 U
Tetrachloroethene	ug/kg	13 U	12 U
Toluene	ug/kg	13 U	12 U
Trans-1,3-dichloropropene	ug/kg	13 U	12 U
Trichloroethene (trichloroethylene)	ug/kg	13 U	12 U
Vinyl Chloride	ug/kg	13 U	12 U
Xylenes	ug/kg	13 U	12 U

† = data qualifier
NA = data not available
ND = not detected

18-Jul-96

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
(3-and/or 4-) methylphenol	ug/kg	430 U	460 U	760 U	460 U
1,2,4-trichlorobenzene	ug/kg	430 U	460 U	760 U	460 U
1,2-dichlorobenzene	ug/kg	430 U	460 U	760 U	460 U
1,3-dichlorobenzene	ug/kg	430 U	460 U	760 U	460 U
1,4-dichlorobenzene	ug/kg	430 U	460 U	760 U	460 U
2,2'-chloroisopropylether	ug/kg	430 U	460 U	760 U	460 U
2,4,5-trichlorophenol	ug/kg	1000 U	1100 U	1800 U	1100 U
2,4,6-trichlorophenol	ug/kg	430 U	460 U	760 U	460 U
2,4-dichlorophenol	ug/kg	430 U	460 U	760 U	460 U
2,4-dimethylphenol	ug/kg	430 U	460 U	760 U	460 U
2,4-dinitrophenol	ug/kg	1000 U	1100 U	1800 U	1100 U
2,4-dinitrotoluene	ug/kg	430 U	460 U	760 U	460 U
2,6-dinitrotoluene	ug/kg	430 U	460 U	760 U	460 U
2-chloronaphthalene	ug/kg	430 U	460 U	760 U	460 U
2-chlorophenol	ug/kg	430 U	460 U	760 U	460 U
2-methyl-4,6-dinitrophenol	ug/kg	1000 U	1100 U	1800 U	1100 U
2-methylnaphthalene	ug/kg	430 U	64 J	760 U	460 U
2-methylphenol	ug/kg	430 U	460 U	760 U	460 U
2-nitroaniline	ug/kg	1000 U	1100 U	1800 U	1100 U
2-nitrophenol	ug/kg	430 U	460 U	760 U	460 U
3,3'-dichlorobenzidine	ug/kg	430 U	460 U	760 U	460 U
3-nitroaniline	ug/kg	1000 U	1100 U	1800 U	1100 U
4-bromophenyl phenyl ether	ug/kg	430 U	460 U	760 U	460 U
4-chloro-3-methylphenol	ug/kg	430 U	460 U	760 U	460 U
4-chloroaniline	ug/kg	430 U	460 U	760 U	460 U
4-chlorophenyl phenyl ether	ug/kg	430 U	460 U	760 U	460 U
4-nitroaniline	ug/kg	1000 U	1100 U	1800 U	1100 U
4-nitrophenol	ug/kg	1000 U	1100 U	1800 U	1100 U
Acenaphthene	ug/kg	430 U	460 U	300 J	460 U
Acenaphthylene	ug/kg	430 U	460 U	760 U	460 U
Anthracene	ug/kg	430 U	460 U	390 J	460 U
Benzo(a)anthracene	ug/kg	430 U	460 U	1900 U	460 U
Benzo(a)pyrene	ug/kg	430 U	460 U	1600	460 U
Benzo(B and/or K)fluoranthene	ug/kg	430 U	460 U	3400	930
Benzo(g,h,i)perylene	ug/kg	430 U	460 U	760 U	460 U
Benzyl butyl phthalate	ug/kg	430 U	460 U	760 U	460 U
Bis(2-chloroethoxy)methane	ug/kg	430 U	460 U	760 U	460 U
Bis(2-chloroethyl) ether	ug/kg	430 U	460 U	760 U	460 U
Bis(2-ethylhexyl)phthalate	ug/kg	430 U	990 U	1500 U	460 U
Carbazole	ug/kg	430 U	460 U	760 U	460 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Chrysene	ug/kg	430 U	230 J	1700	480
Di-n-butylphthalate	ug/kg	430 U	460 U	760 U	460 U
Di-n-octylphthalate	ug/kg	430 U	460 U	760 U	460 U
Dibenzo(a,h)anthracene	ug/kg	430 U	460 U	760 U	460 U
Dibenzofuran	ug/kg	430 U	460 U	760 U	460 U
Diethyl phthalate	ug/kg	430 U	460 U	760 U	460 U
Dimethyl phthalate	ug/kg	430 U	460 U	760 U	460 U
Fluoranthene	ug/kg	430 U	210 J	2400	500
Fluorene	ug/kg	430 U	460 U	160 J	460 U
Hexachlorobenzene	ug/kg	430 U	460 U	760 U	460 U
Hexachlorobutadiene	ug/kg	430 U	460 U	760 U	460 U
Hexachlorocyclopentadiene	ug/kg	430 U	460 U	760 U	460 U
Hexachloroethane	ug/kg	430 U	460 U	760 U	460 U
Indeno(1,2,3-cd)pyrene	ug/kg	430 U	460 U	760 U	460 U
Isophorone	ug/kg	430 U	460 U	760 U	460 U
N-nitroso-di-n-propylamine	ug/kg	430 U	460 U	760 U	460 U
N-nitrosodiphenylamine	ug/kg	430 U	460 U	760 U	460 U
Naphthalene	ug/kg	430 U	460 U	78 J	460 U
Nitrobenzene	ug/kg	430 U	460 U	760 U	460 U
Pentachlorophenol	ug/kg	1000 U	1100 U	1800 U	1100 U
Phenanthrene	ug/kg	430 U	140 J	1500	150 J
Phenol	ug/kg	430 U	460 U	760 U	460 U
Pyrene	ug/kg	430 U	200 J	1600	410 J

† = data qualifier
NA = data not available
ND = not detected

18-Jul-96

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
(3-and/or 4-) methylphenol	ug/kg	380 U	78 J	390 U	360 U
1,2,4-trichlorobenzene	ug/kg	380 U	390 U	390 U	360 U
1,2-dichlorobenzene	ug/kg	380 U	390 U	390 U	360 U
1,3-dichlorobenzene	ug/kg	380 U	390 U	390 U	360 U
1,4-dichlorobenzene	ug/kg	380 U	390 U	390 U	360 U
2,2'-chloroisopropylether	ug/kg	380 U	390 U	390 U	360 U
2,4,5-trichlorophenol	ug/kg	930 U	950 U	950 U	880 U
2,4,6-trichlorophenol	ug/kg	380 U	390 U	390 U	360 U
2,4-dichlorophenol	ug/kg	380 U	390 U	390 U	360 U
2,4-dimethylphenol	ug/kg	380 U	390 U	390 U	360 U
2,4-dinitrophenol	ug/kg	930 U	950 U	950 U	880 U
2,4-dinitrotoluene	ug/kg	380 U	390 U	390 U	360 U
2,6-dinitrotoluene	ug/kg	380 U	390 U	390 U	360 U
2-chloronaphthalene	ug/kg	380 U	390 U	390 U	360 U
2-chlorophenol	ug/kg	380 U	390 U	390 U	360 U
2-methyl-4,6-dinitrophenol	ug/kg	930 U	950 U	950 U	880 U
2-methylnaphthalene	ug/kg	380 U	94 J	150 J	38 J
2-methylphenol	ug/kg	380 U	390 U	390 U	360 U
2-nitroaniline	ug/kg	930 U	950 U	950 U	880 U
2-nitrophenol	ug/kg	380 U	390 U	390 U	360 U
3,3'-dichlorobenzidine	ug/kg	380 U	390 U	390 U	360 U
3-nitroaniline	ug/kg	930 U	950 U	950 U	880 U
4-bromophenyl phenyl ether	ug/kg	380 U	390 U	390 U	360 U
4-chloro-3-methylphenol	ug/kg	380 U	390 U	390 U	360 U
4-chloroaniline	ug/kg	380 U	390 U	390 U	360 U
4-chlorophenyl phenyl ether	ug/kg	380 U	390 U	390 U	360 U
4-nitroaniline	ug/kg	930 U	950 U	950 U	880 U
4-nitrophenol	ug/kg	930 U	950 U	950 U	880 U
Acenaphthene	ug/kg	380 U	60 J	210 J	250 J
Acenaphthylene	ug/kg	380 U	390 U	390 U	360 U
Anthracene	ug/kg	380 U	390 U	560	680
Benzo(a)anthracene	ug/kg	380 U	550 U	1800 U	2100 U
Benzo(a)pyrene	ug/kg	380 U	390 U	1400	1400
Benzo(B and/or K)fluoranthene	ug/kg	230 J	1800	2800	2600
Benzo(g.h.i)perylene	ug/kg	380 U	470 U	420 U	380 U
Benzyl butyl phthalate	ug/kg	380 U	390 U	1100 U	360 U
Bis(2-chloroethoxy)methane	ug/kg	380 U	390 U	390 U	360 U
Bis(2-chloroethyl) ether	ug/kg	380 U	390 U	390 U	360 U
Bis(2-ethylhexyl)phthalate	ug/kg	380 U	910 U	790 U	360 U
Carbazole	ug/kg	380 U	390 U	360 J	540

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Chrysene	ug/kg	160 J	690 U	1800	2000
Di-n-butylphthalate	ug/kg	380 U	390 U	390 U	360 U
Di-n-octylphthalate	ug/kg	380 U	390 U	390 U	360 U
Dibenzo(a,h)anthracene	ug/kg	380 U	390 U	390 U	360 U
Dibenzofuran	ug/kg	380 U	45 J	150 J	140 J
Diethyl phthalate	ug/kg	380 U	390 U	390 U	360 U
Dimethyl phthalate	ug/kg	380 U	390 U	390 U	360 U
Fluoranthene	ug/kg	260 J	930	2000	2500
Fluorene	ug/kg	380 U	390 U	390 U	240 J
Hexachlorobenzene	ug/kg	380 U	390 U	390 U	360 U
Hexachlorobutadiene	ug/kg	380 U	390 U	390 U	360 U
Hexachlorocyclopentadiene	ug/kg	380 U	390 U	390 U	360 U
Hexachloroethane	ug/kg	380 U	390 U	390 U	360 U
Indeno(1,2,3-cd)pyrene	ug/kg	380 U	510	650	590 U
Isophorone	ug/kg	380 U	390 U	390 U	360 U
N-nitroso-di-n-propylamine	ug/kg	380 U	390 U	390 U	360 U
N-nitrosodiphenylamine	ug/kg	380 U	390 U	390 U	360 U
Naphthalene	ug/kg	380 U	120 J	140 J	91 J
Nitrobenzene	ug/kg	380 U	390 U	390 U	360 U
Pentachlorophenol	ug/kg	930 U	950 U	950 U	880 U
Phenanthrene	ug/kg	160 J	560	1800	2400
Phenol	ug/kg	380 U	390 U	390 U	360 U
Pyrene	ug/kg	200 J	800 U	2200	2500

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-08	DW-SS-09	DW-SS-10	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
(3-and/or 4-) methylphenol	ug/kg	4800 U	480 U	510 U	500 U
1,2,4-trichlorobenzene	ug/kg	4800 U	480 U	510 U	500 U
1,2-dichlorobenzene	ug/kg	4800 U	480 U	510 U	500 U
1,3-dichlorobenzene	ug/kg	4800 U	480 U	510 U	500 U
1,4-dichlorobenzene	ug/kg	4800 U	480 U	510 U	500 U
2,2'-chloroisopropylether	ug/kg	4800 U	480 U	510 U	500 U
2,4,5-trichlorophenol	ug/kg	12000 U	1200 U	1200 U	1200 U
2,4,6-trichlorophenol	ug/kg	4800 U	480 U	510 U	500 U
2,4-dichlorophenol	ug/kg	4800 U	480 U	510 U	500 U
2,4-dimethylphenol	ug/kg	4800 U	480 U	510 U	500 U
2,4-dinitrophenol	ug/kg	12000 U	1200 U	1200 U	1200 U
2,4-dinitrotoluene	ug/kg	4800 U	480 U	510 U	500 U
2,6-dinitrotoluene	ug/kg	4800 U	480 U	510 U	500 U
2-chloronaphthalene	ug/kg	4800 U	480 U	510 U	500 U
2-chlorophenol	ug/kg	4800 U	480 U	510 U	500 U
2-methyl-4,6-dinitrophenol	ug/kg	12000 U	1200 U	1200 U	1200 U
2-methylnaphthalene	ug/kg	750 J	56 J	330 J	68 J
2-methylphenol	ug/kg	4800 U	480 U	510 U	500 U
2-nitroaniline	ug/kg	12000 U	1200 U	1200 U	1200 U
2-nitrophenol	ug/kg	4800 U	480 U	510 U	500 U
3,3'-dichlorobenzidine	ug/kg	4800 U	480 U	510 U	500 U
3-nitroaniline	ug/kg	12000 U	1200 U	1200 U	1200 U
4-bromophenyl phenyl ether	ug/kg	4800 U	480 U	510 U	500 U
4-chloro-3-methylphenol	ug/kg	4800 U	480 U	510 U	500 U
4-chloroaniline	ug/kg	4800 U	480 U	510 U	500 U
4-chlorophenyl phenyl ether	ug/kg	4800 U	480 U	510 U	500 U
4-nitroaniline	ug/kg	12000 U	1200 U	1200 U	1200 U
4-nitrophenol	ug/kg	12000 U	1200 U	1200 U	1200 U
Acenaphthene	ug/kg	4800 U	480 U	510 U	500 U
Acenaphthylene	ug/kg	4800 U	480 U	510 U	500 U
Anthracene	ug/kg	4800 U	120 J	510 U	500 U
Benzo(a)anthracene	ug/kg	4800 U	480 U	610 U	500 U
Benzo(a)pyrene	ug/kg	660 J	480 U	670 U	310 J
Benzo(B and/or K)fluoranthene	ug/kg	970 J	890	1300	880
Benzo(g,h,i)perylene	ug/kg	870 J	480 U	520 U	500 U
Benzyl butyl phthalate	ug/kg	4800 U	820 U	1800	500 U
Bis(2-chloroethoxy)methane	ug/kg	4800 U	480 U	510 U	500 U
Bis(2-chloroethyl) ether	ug/kg	4800 U	480 U	510 U	500 U
Bis(2-ethylhexyl)phthalate	ug/kg	7200 U	55000	21000	500 U
Carbazole	ug/kg	4800 U	90 J	510 U	61 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-08	DW-SS-09	DW-SS-10	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Chrysene	ug/kg	560 J	520	800	400 J
Di-n-butylphthalate	ug/kg	4800 U	480 U	9500	500 U
Di-n-octylphthalate	ug/kg	4800 U	480 U	1200	500 U
Dibenzo(a,h)anthracene	ug/kg	4800 U	480 U	510 U	500 U
Dibenzofuran	ug/kg	4800 U	480 U	83 J	500 U
Diethyl phthalate	ug/kg	4800 U	480 U	510 U	500 U
Dimethyl phthalate	ug/kg	4800 U	480 U	510 U	500 U
Fluoranthene	ug/kg	800 J	580	600	600
Fluorene	ug/kg	4800 U	480 U	510 U	500 U
Hexachlorobenzene	ug/kg	4800 U	480 U	510 U	500 U
Hexachlorobutadiene	ug/kg	4800 U	480 U	510 U	500 U
Hexachlorocyclopentadiene	ug/kg	4800 U	480 U	510 U	500 U
Hexachloroethane	ug/kg	4800 U	480 U	510 U	500 U
Indeno(1,2,3-cd)pyrene	ug/kg	4800 U	480 U	590 U	500 U
Isophorone	ug/kg	4800 U	480 U	510 U	500 U
N-nitroso-di-n-propylamine	ug/kg	4800 U	480 U	510 U	500 U
N-nitrosodiphenylamine	ug/kg	4800 U	480 U	510 U	500 U
Naphthalene	ug/kg	4800 U	56 J	190 J	51 J
Nitrobenzene	ug/kg	4800 U	480 U	510 U	500 U
Pentachlorophenol	ug/kg	12000 U	1200 U	1200 U	1200 U
Phenanthrene	ug/kg	570 J	460 J	640	270 J
Phenol	ug/kg	4800 U	480 U	510 U	500 U
Pyrene	ug/kg	4800 U	600	790	430 J

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	Units	Results†	Results†
Semivolatile organic compounds			
(3-and/or 4-) methylphenol	ug/kg	440 U	410 U
1,2,4-trichlorobenzene	ug/kg	440 U	410 U
1,2-dichlorobenzene	ug/kg	440 U	410 U
1,3-dichlorobenzene	ug/kg	440 U	410 U
1,4-dichlorobenzene	ug/kg	440 U	410 U
2,2'-chloroisopropylether	ug/kg	440 U	410 U
2,4,5-trichlorophenol	ug/kg	1100 U	990 U
2,4,6-trichlorophenol	ug/kg	440 U	410 U
2,4-dichlorophenol	ug/kg	440 U	410 U
2,4-dimethylphenol	ug/kg	440 U	410 U
2,4-dinitrophenol	ug/kg	1100 U	990 U
2,4-dinitrotoluene	ug/kg	440 U	410 U
2,6-dinitrotoluene	ug/kg	440 U	410 U
2-chloronaphthalene	ug/kg	440 U	410 U
2-chlorophenol	ug/kg	440 U	410 U
2-methyl-4,6-dinitrophenol	ug/kg	1100 U	990 U
2-methylnaphthalene	ug/kg	260 J	83 J
2-methylphenol	ug/kg	440 U	410 U
2-nitroaniline	ug/kg	1100 U	990 U
2-nitrophenol	ug/kg	440 U	410 U
3,3'-dichlorobenzidine	ug/kg	440 U	410 U
3-nitroaniline	ug/kg	1100 U	990 U
4-bromophenyl phenyl ether	ug/kg	440 U	410 U
4-chloro-3-methylphenol	ug/kg	440 U	410 U
4-chloroaniline	ug/kg	440 U	410 U
4-chlorophenyl phenyl ether	ug/kg	440 U	410 U
4-nitroaniline	ug/kg	1100 U	990 U
4-nitrophenol	ug/kg	1100 U	990 U
Acenaphthene	ug/kg	440 U	180 J
Acenaphthylene	ug/kg	440 U	410 U
Anthracene	ug/kg	440 U	300 J
Benzo(a)anthracene	ug/kg	440 U	630 U
Benzo(a)pyrene	ug/kg	440 U	470 U
Benzo(B and/or K)fluoranthene	ug/kg	690	970
Benzo(g,h,i)perylene	ug/kg	440 U	410 U
Benzyl butyl phthalate	ug/kg	440 U	410 U
Bis(2-chloroethoxy)methane	ug/kg	440 U	410 U
Bis(2-chloroethyl) ether	ug/kg	440 U	410 U
Bis(2-ethylhexyl)phthalate	ug/kg	790 U	410 U
Carbazole	ug/kg	70 J	220 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	Units	Results†	Results†
Semivolatile organic compounds			
Chrysene	ug/kg	310 J	670
Di-n-butylphthalate	ug/kg	440 U	410 U
Di-n-octylphthalate	ug/kg	440 U	410 U
Dibenzo(a,h)anthracene	ug/kg	440 U	410 U
Dibenzofuran	ug/kg	81 J	97 J
Diethyl phthalate	ug/kg	440 U	410 U
Dimethyl phthalate	ug/kg	440 U	410 U
Fluoranthene	ug/kg	560	1000
Fluorene	ug/kg	440 U	190 J
Hexachlorobenzene	ug/kg	440 U	410 U
Hexachlorobutadiene	ug/kg	440 U	410 U
Hexachlorocyclopentadiene	ug/kg	440 U	410 U
Hexachloroethane	ug/kg	440 U	410 U
Indeno(1,2,3-cd)pyrene	ug/kg	440 U	410 U
Isophorone	ug/kg	440 U	410 U
N-nitroso-di-n-propylamine	ug/kg	440 U	410 U
N-nitrosodiphenylamine	ug/kg	440 U	410 U
Naphthalene	ug/kg	220 J	170 J
Nitrobenzene	ug/kg	440 U	410 U
Pentachlorophenol	ug/kg	1100 U	990 U
Phenanthrene	ug/kg	450	1100
Phenol	ug/kg	440 U	410 U
Pyrene	ug/kg	440 U	890

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SB-01	DW-SS-01	DW-SS-02	DW-SS-03
Date sampled		25-Jan-94	25-Jan-94	26-Jan-94	26-Jan-94
Depth		SUBSURFACE	0-6"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Barium-140	pCi/g	ND	ND	ND	ND
Bismuth-212	pCi/g	0.808	0.759	0.262	1.19
Bismuth-214	pCi/g	0.961	0.853	0.423	1.04
Cesium-137	pCi/g	0.0224	0.405	0.038	0.113
Gross Alpha	pCi/g	16	22	11	24
Gross Beta	pCi/g	14	28	13	37
Iodine-131	pCi/g	ND	ND	ND	ND
Lead-212	pCi/g	1.34	1.24	0.412	1.89
Lead-214	pCi/g	1.12	0.999	0.49	1.21
Potassium-40	pCi/g	7.14	13.7	3.54	22.3
Protactinium-234m	pCi/g	NR	2.89	7.43	4.4
Radium-226	pCi/g	2.44	2.65	1.73	5.68
Radium-228	pCi/g	1.31	1.28	0.47	1.84
Thallium-208	pCi/g	0.412	0.36	0.139	0.583
Thorium-232	pCi/g	1 J	0.93 J	0.42	0.62
Thorium-234	pCi/g	1.59	0.272	4.42	3.27
Uranium-234	pCi/g	1	1.3	5	3.8
Uranium-235	pCi/g	0.141	0.157	0.19	0.32
Uranium-238	pCi/g	1.3	1.13	5.1	3.5

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-04	DW-SS-05	DW-SS-06	DW-SS-07
Date sampled		27-Jan-94	26-Jan-94	27-Jan-94	27-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Barium-140	pCi/g	ND	ND	ND	ND
Bismuth-212	pCi/g	0.206	0.406	16.2	0.289
Bismuth-214	pCi/g	0.481	0.693	2.45	0.444
Cesium-137	pCi/g	ND	0.113	0.316	0.0176
Gross Alpha	pCi/g	7.9	44	220	8.1
Gross Beta	pCi/g	12	41	180	11
Iodine-131	pCi/g	ND	ND	ND	ND
Lead-212	pCi/g	0.43	0.727	27.1	0.536
Lead-214	pCi/g	0.535	0.759	3.18	0.484
Potassium-40	pCi/g	8	6.65	6.81	7.67
Protactinium-234m	pCi/g	2.37	28.2	122	7.16
Radium-226	pCi/g	ND	1.37	74.4	0.84
Radium-228	pCi/g	0.438	0.847	31.9	0.543
Thallium-208	pCi/g	0.123	0.239	8.81	0.16
Thorium-232	pCi/g	0.27 J	0.53	25	0.42
Thorium-234	pCi/g	1.33	15	64.5	5.31
Uranium-234	pCi/g	1 U	19 J	78 J	2 U
Uranium-235	pCi/g	0.143	1.08	4.45	0.158
Uranium-238	pCi/g	1 U	18 J	66 J	2 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-08	DW-SS-09	DW-SS-10	DW-SS-11
Date sampled		27-Jan-94	27-Jan-94	27-Jan-94	26-Jan-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Barium-140	pCi/g	ND	ND	ND	ND
Bismuth-212	pCi/g	NR	NR	79.3	0.663
Bismuth-214	pCi/g	1.09	33	13.6	0.761
Cesium-137	pCi/g	0.175	0.196	1.72	0.553
Gross Alpha	pCi/g	17	280	3000	16
Gross Beta	pCi/g	22	200	2700	23
Iodine-131	pCi/g	ND	ND	ND	ND
Lead-212	pCi/g	0.719	1	149	0.989
Lead-214	pCi/g	1.02	35.5	15.6	0.852
Potassium-40	pCi/g	5.31	4.37	ND	8.87
Protactinium-234m	pCi/g	19.3	94.4	2720	4.38
Radium-226	pCi/g	ND	104	1710	3.16
Radium-228	pCi/g	0.846	1.3	154	1.08
Thallium-208	pCi/g	0.169	0.289	47.6	0.322
Thorium-232	pCi/g	0.6	0.87	73 J	0.92 J
Thorium-234	pCi/g	8.46	52.4	1690	2.93
Uranium-234	pCi/g	13	58 J	1300 J	2.8
Uranium-235	pCi/g	0.653	6.08	103	0.187
Uranium-238	pCi/g	12 J	59 J	1300 J	2.6

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SS-12	DW-SS-13
Date sampled		26-Jan-94	27-Jan-94
Depth		0-6"	0-6"
Soil			
Parameter	**Units**	**Results†**	**Results†**
Radionuclides			
Barium-140	pCi/g	ND	ND
Bismuth-212	pCi/g	0.69	0.339
Bismuth-214	pCi/g	1.1	0.549
Cesium-137	pCi/g	0.998	0.112
Gross Alpha	pCi/g	23	10
Gross Beta	pCi/g	25	18
Iodine-131	pCi/g	ND	ND
Lead-212	pCi/g	1.31	0.6009
Lead-214	pCi/g	1.24	0.669
Potassium-40	pCi/g	9.98	8.61
Protactinium-234m	pCi/g	2.94	4.67
Radium-226	pCi/g	3.2	5.21
Radium-228	pCi/g	1.41	0.612
Thallium-208	pCi/g	0.428	0.181
Thorium-232	pCi/g	1.1	0.5
Thorium-234	pCi/g	1.63	4.66
Uranium-234	pCi/g	2 J	4.5
Uranium-235	pCi/g	0.192	0.318
Uranium-238	pCi/g	1.8 J	4

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	mg/kg	6500	13000	5800	10000
Antimony	mg/kg	20 UJ	14 J	20 UJ	20 UJ
Arsenic	mg/kg	14 J	8.1 J	5.9 J	10 J
Barium	mg/kg	44	210	59	85
Beryllium	mg/kg	0.99 U	1.1 U	1.2 U	2 U
Cadmium	mg/kg	1.2 U	6.2	1.9	3.2
Calcium	mg/kg	65000	59000	19000	46000
Chromium	mg/kg	20	86	17	28
Cobalt	mg/kg	13	13	8.1	11
Copper	mg/kg	15	830	100	140
Cyanide	mg/kg	0.69 U	NA	0.83 U	0.89 U
Iron	mg/kg	25000	43000	17000	27000
Lead	mg/kg	67	440	85	190
Magnesium	mg/kg	5900	7200	2300	5200
Manganese	mg/kg	730	1900	570	1000
Mercury	mg/kg	0.33	7	2.1	4.9
Nickel	mg/kg	15	83	23	28 J
Potassium	mg/kg	510 U	690 J	610 U	1100 J
Selenium	mg/kg	0.99 UR	1.1 UR	1.2 UR	1.3 UR
Silver	mg/kg	2.1 U	2.3 U	2.6 U	2.7 U
Sodium	mg/kg	90 U	350 U	110 U	100 U
Thallium	mg/kg	0.74 UJ	0.8 UJ	0.9 UJ	0.96 UJ
Vanadium	mg/kg	18	25	14	22
Zinc	mg/kg	130	1900	250	520

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	Units	Results†	Results†
Metals			
Aluminum	mg/kg	5300	5500
Antimony	mg/kg	20 UJ	20 UJ
Arsenic	mg/kg	6.8 J	7.2 J
Barium	mg/kg	47	59
Beryllium	mg/kg	1.3 U	1.1 U
Cadmium	mg/kg	4.1 J	2.8 J
Calcium	mg/kg	31000	27000
Chromium	mg/kg	15	15
Cobalt	mg/kg	6.7	8
Copper	mg/kg	59	46
Cyanide	mg/kg	0.93 U	0.78 U
Iron	mg/kg	17000	17000
Lead	mg/kg	80	83
Magnesium	mg/kg	3300	3600
Manganese	mg/kg	750	970
Mercury	mg/kg	1.3	0.87
Nickel	mg/kg	18	17
Potassium	mg/kg	690 U	780 J
Selenium	mg/kg	1.3 UR	1.1 UR
Silver	mg/kg	2.9 U	2.4 U
Sodium	mg/kg	190 U	130 U
Thallium	mg/kg	1 UJ	0.84 UJ
Vanadium	mg/kg	13	14
Zinc	mg/kg	500	360

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	43 U	46 U	51 U	51 U
Aroclor-1221	ug/kg	87 U	94 U	100 U	100 U
Aroclor-1232	ug/kg	43 U	46 U	51 U	51 U
Aroclor-1242	ug/kg	43 U	46 U	51 U	51 U
Aroclor-1248	ug/kg	43 U	46 U	51 U	51 U
Aroclor-1254	ug/kg	43 U	4000 C	410	910 C
Aroclor-1260	ug/kg	43 U	2700 C	250	780 C

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	**Units**	**Results†**	**Results†**
PCBs			
Aroclor-1016	ug/kg	50 U	49 U
Aroclor-1221	ug/kg	100 U	100 U
Aroclor-1232	ug/kg	50 U	49 U
Aroclor-1242	ug/kg	50 U	49 U
Aroclor-1248	ug/kg	50 U	49 U
Aroclor-1254	ug/kg	300	49 U
Aroclor-1260	ug/kg	500	49 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Pesticides					
4.4'-ddd (p,p'-ddd)	ug/kg	4.3 U	4.6 U	6 U	5.1 U
4.4'-dde (p,p'-dde)	ug/kg	1.6 J	4.6 U	5.1 U	5.1 U
4,4'-ddt (p,p'-ddt)	ug/kg	4.3 U	4.6 U	5.1 U	5.1 U
Aldrin	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Alpha-bhc	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Alpha-chlordane /2	ug/kg	6.1	2.4 U	2.6 U	2.6 U
Beta-bhc	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Delta-bhc	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Dieldrin	ug/kg	5.9	4.6 U	10 U	30 U
Endosulfan I	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Endosulfan II	ug/kg	4.3 U	4.6 U	5.1 U	8 U
Endosulfan sulfate	ug/kg	4.3 U	4.6 U	5.1 U	5.1 U
Endrin	ug/kg	4.3 U	4.6 U	5.1 U	5.1 U
Endrin aldehyde	ug/kg	4.3 U	4.6 U	5.1 U	5.1 U
Endrin ketone	ug/kg	4.3 U	4.6 U	5.1 U	5.1 U
Gamma-bhc	ug/kg	2.2 U	2.4 U	4 U	2.6 U
Gamma-chlordane /2	ug/kg	11	2.4 U	7 U	8 U
Heptachlor	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Heptachlor expoxide	ug/kg	2.2 U	2.4 U	2.6 U	2.6 U
Methoxychlor	ug/kg	22 U	24 U	26 U	26 U
Toxaphene	ug/kg	220 U	240 U	260 U	260 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	Units	Results†	Results†
Pesticides			
4,4'-ddd (p,p'-ddd)	ug/kg	5 U	4.9 U
4,4'-dde (p,p'-dde)	ug/kg	5 U	4.9 U
4,4'-ddt (p,p'-ddt)	ug/kg	5 U	4.9 U
Aldrin	ug/kg	2.6 U	2.5 U
Alpha-bhc	ug/kg	2.6 U	2.5 U
Alpha-chlordane /2	ug/kg	2.6 U	3 U
Beta-bhc	ug/kg	2.6 U	2.5 U
Delta-bhc	ug/kg	2.6 U	2.5 U
Dieldrin	ug/kg	8 U	20 U
Endosulfan I	ug/kg	2.6 U	2.5 U
Endosulfan II	ug/kg	5 U	4.9 U
Endosulfan sulfate	ug/kg	5 U	4.9 U
Endrin	ug/kg	5 U	14
Endrin aldehyde	ug/kg	5 U	4.9 U
Endrin ketone	ug/kg	5 U	4.9 U
Gamma-bhc	ug/kg	2.6 U	2.5 U
Gamma-chlordane /2	ug/kg	7 U	6 N
Heptachlor	ug/kg	2.6 U	2.5 U
Heptachlor expoxide	ug/kg	2.6 U	2.5 U
Methoxychlor	ug/kg	26 U	25 U
Toxaphene	ug/kg	260 U	250 U

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-02	DW-SD-03
Date sampled		26-Jan-94	26-Jan-94
Depth			
Sediment			
Parameter	**Units**	**Results†**	**Results†**
Dioxins			
1,2,3,4,6,7,8 Heptachlorodibenzodioxin	ng/kg	260	160
1,2,3,4,6,7,8 Heptachlorodibenzofuran	ng/kg	65	30
1,2,3,4,7,8 Hexachlorodibenzodioxin	ng/kg	10 U	10 U
1,2,3,4,7,8 Hexachlorodibenzofuran	ng/kg	17	6.3 J
1,2,3,4,7,8,9 Heptachlorodibenzofuran	ng/kg	8.5 J	3.9 J
1,2,3,6,7,8 Hexachlorodibenzodioxin	ng/kg	10 U	10 U
1,2,3,6,7,8 Hexachlorodibenzofuran	ng/kg	8.2 J	3.4 J
1,2,3,7,8 Pentachlorodibenzodioxin	ng/kg	10 U	10 U
1,2,3,7,8 Pentachlorodibenzofuran	ng/kg	10 U	10 U
1,2,3,7,8,9 Hexachlorodibenzodioxin	ng/kg	10 U	10 U
1,2,3,7,8,9 Hexachlorodibenzofuran	ng/kg	10 U	10 U
2,3,4,6,7,8 Hexachlorodibenzofuran	ng/kg	7.1 J	10 U
2,3,4,7,8 Pentachlorodibenzofuran	ng/kg	7.8 J	2.7 J
2,3,7,8-TCDD	ng/kg	2 U	2 U
2,3,7,8-TCDF	ng/kg	11	4.2
Hpcdd (total)	ng/kg	510 J	310 J
Hpcdf (total)	ng/kg	200 J	80 J
Hxcdd (total)	ng/kg	74 J	43 J
Hxcdf (total)	ng/kg	110 J	52 J
Ocdd (total)	ng/kg	2800	1100
Ocdf (total)	ng/kg	220	66
Pecdd (total)	ng/kg	13 J	10 UJ
Pecdf (total)	ng/kg	94 J	38 J
Tcdd (total)	ng/kg	13 J	6.1 J
Tcdf (total)	ng/kg	86 J	40 J
Teq (toxic. Equiv. Value. From I-tef/89)	ng/kg	15	5.8 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Volatile organic compounds					
1,1,1-trichloroethane	ug/kg	13 U	14 U	15 U	16 U
1,1,2,2-tetrachloroethane	ug/kg	13 U	14 U	15 U	16 U
1,1,2-trichloroethane	ug/kg	13 U	14 U	15 U	16 U
1,1-dichloroethane	ug/kg	13 U	14 U	15 U	16 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	13 U	14 U	15 U	16 U
1,2 -dichloroethane	ug/kg	13 U	14 U	15 U	16 U
1,2-dichloroethene (total)	ug/kg	13 U	14 U	15 U	16 U
1,2-dichloropropane	ug/kg	13 U	14 U	15 U	16 U
Acetone	ug/kg	30 U	30 U	40 U	16 U
Benzene	ug/kg	13 U	14 U	15 U	16 U
Bromodichloromethane	ug/kg	13 U	14 U	15 U	16 U
Bromoform	ug/kg	13 U	14 U	15 U	16 U
Bromomethane	ug/kg	13 U	14 U	15 U	16 U
Carbon disulfide	ug/kg	13 U	14 U	15 U	16 U
Carbon tetrachloride	ug/kg	13 U	14 U	15 U	16 U
Chlorobenzene	ug/kg	13 U	14 U	15 U	16 U
Chloroethane	ug/kg	13 U	14 U	15 U	16 U
Chloroform	ug/kg	13 U	14 U	15 U	16 U
Chloromethane	ug/kg	13 U	14 U	15 U	16 U
Cis-1,3-dichloropropene	ug/kg	13 U	14 U	15 U	16 U
Dibromochloromethane	ug/kg	13 U	14 U	15 U	16 U
Ethylbenzene	ug/kg	13 U	14 U	15 U	16 U
Methyl butyl ketone	ug/kg	13 U	14 U	15 U	16 U
Methyl ethyl ketone	ug/kg	13 U	14 U	15 U	16 U
Methyl isobutyl ketone	ug/kg	13 U	14 U	15 U	16 U
Methylene Chloride	ug/kg	30 U	40 U	40 U	30 U
Styrene	ug/kg	13 U	14 U	15 U	16 U
Tetrachloroethene	ug/kg	13 U	14 U	15 U	16 U
Toluene	ug/kg	13 U	14 U	15 U	16 U
Trans-1,3-dichloropropene	ug/kg	13 U	14 U	15 U	16 U
Trichloroethene (trichloroethylene)	ug/kg	13 U	14 U	15 U	16 U
Vinyl Chloride	ug/kg	13 U	14 U	15 U	16 U
Xylenes	ug/kg	13 U	14 U	15 U	16 U

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	**Units**	**Results†**	**Results†**
Volatile organic compounds			
1,1,1-trichloroethane	ug/kg	15 U	15 U
1,1,2,2-tetrachloroethane	ug/kg	15 U	15 U
1,1,2-trichloroethane	ug/kg	15 U	15 U
1,1-dichloroethane	ug/kg	15 U	15 U
1,1-dichloroethene (1,1-dichloroethylene	ug/kg	15 U	15 U
1,2 -dichloroethane	ug/kg	15 U	15 U
1,2-dichloroethene (total)	ug/kg	15 U	15 U
1,2-dichloropropane	ug/kg	15 U	15 U
Acetone	ug/kg	15 U	50 U
Benzene	ug/kg	15 U	15 U
Bromodichloromethane	ug/kg	15 U	15 U
Bromoform	ug/kg	15 U	15 U
Bromomethane	ug/kg	15 U	15 U
Carbon disulfide	ug/kg	15 U	15 U
Carbon tetrachloride	ug/kg	15 U	15 U
Chlorobenzene	ug/kg	15 U	15 U
Chloroethane	ug/kg	15 U	15 U
Chloroform	ug/kg	15 U	15 U
Chloromethane	ug/kg	15 U	15 U
Cis-1,3-dichloropropene	ug/kg	15 U	15 U
Dibromochloromethane	ug/kg	15 U	15 U
Ethylbenzene	ug/kg	15 U	15 U
Methyl butyl ketone	ug/kg	15 U	15 U
Methyl ethyl ketone	ug/kg	15 U	15 U
Methyl isobutyl ketone	ug/kg	15 U	15 U
Methylene Chloride	ug/kg	130 U	40 U
Styrene	ug/kg	15 U	15 U
Tetrachloroethene	ug/kg	15 U	15 U
Toluene	ug/kg	15 U	15 U
Trans-1,3-dichloropropene	ug/kg	15 U	15 U
Trichloroethene (trichloroethylene)	ug/kg	15 U	15 U
Vinyl Chloride	ug/kg	15 U	15 U
Xylenes	ug/kg	15 U	15 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
(3-and/or 4-) methylphenol	ug/kg	430 U	1400 U	1700	510 U
1,2,4-trichlorobenzene	ug/kg	430 U	1400 U	510 U	510 U
1,2-dichlorobenzene	ug/kg	430 U	1400 U	510 U	510 U
1,3-dichlorobenzene	ug/kg	430 U	1400 U	510 U	510 U
1,4-dichlorobenzene	ug/kg	430 U	1400 U	510 U	510 U
2,2'-chloroisopropylether	ug/kg	430 U	1400 U	510 U	510 U
2,4,5-trichlorophenol	ug/kg	1000 U	3400 U	1200 U	1200 U
2,4,6-trichlorophenol	ug/kg	430 U	1400 U	510 U	510 U
2,4-dichlorophenol	ug/kg	430 U	1400 U	510 U	510 U
2,4-dimethylphenol	ug/kg	430 U	1400 U	510 U	510 U
2,4-dinitrophenol	ug/kg	1000 U	3400 U	1200 U	1200 U
2,4-dinitrotoluene	ug/kg	430 U	1400 U	510 U	510 U
2,6-dinitrotoluene	ug/kg	430 U	1400 U	510 U	510 U
2-chloronaphthalene	ug/kg	430 U	1400 U	510 U	510 U
2-chlorophenol	ug/kg	430 U	1400 U	510 U	510 U
2-methyl-4,6-dinitrophenol	ug/kg	1000 U	3400 U	1200 U	1200 U
2-methylnaphthalene	ug/kg	430 U	1400 U	62 J	59 J
2-methylphenol	ug/kg	430 U	1400 U	510 U	510 U
2-nitroaniline	ug/kg	1000 U	3400 U	1200 U	1200 U
2-nitrophenol	ug/kg	430 U	1400 U	510 U	510 U
3,3'-dichlorobenzidine	ug/kg	430 U	1400 U	510 U	510 U
3-nitroaniline	ug/kg	1000 U	3400 U	1200 U	1200 U
4-bromophenyl phenyl ether	ug/kg	430 U	1400 U	510 U	510 U
4-chloro-3-methylphenol	ug/kg	430 U	1400 U	510 U	510 U
4-chloroaniline	ug/kg	430 U	1400 U	510 U	510 U
4-chlorophenyl phenyl ether	ug/kg	430 U	1400 U	510 U	510 U
4-nitroaniline	ug/kg	1000 U	3400 U	1200 U	1200 U
4-nitrophenol	ug/kg	1000 U	3400 U	1200 U	1200 U
Acenaphthene	ug/kg	81 J	1400 U	510 U	510 U
Acenaphthylene	ug/kg	430 U	1400 U	510 U	510 U
Anthracene	ug/kg	180 J	1400 U	510 U	510 U
Benzo(a)anthracene	ug/kg	430 U	1400 U	570 U	630
Benzo(a)pyrene	ug/kg	620	1400 U	510 U	570
Benzo(B and/or K)fluoranthene	ug/kg	1400	1800	1200	1500
Benzo(g,h,i)perylene	ug/kg	430 U	1400 U	510 U	510 U
Benzyl butyl phthalate	ug/kg	430 U	1400 U	510 U	510 U
Bis(2-chloroethoxy)methane	ug/kg	430 U	1400 U	510 U	510 U
Bis(2-chloroethyl) ether	ug/kg	430 U	1400 U	510 U	510 U
Bis(2-ethylhexyl)phthalate	ug/kg	430 U	6700	1400 U	1200 U
Carbazole	ug/kg	430 U	1400 U	510 U	510 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Chrysene	ug/kg	690	880 J	590 U	680
Di-n-butylphthalate	ug/kg	430 U	1400 U	510 U	510 U
Di-n-octylphthalate	ug/kg	430 U	1400 U	510 U	510 U
Dibenzo(a,h)anthracene	ug/kg	430 U	1400 U	510 U	510 U
Dibenzofuran	ug/kg	430 U	1400 U	510 U	510 U
Diethyl phthalate	ug/kg	430 U	1400 U	510 U	510 U
Dimethyl phthalate	ug/kg	430 U	1400 U	510 U	510 U
Fluoranthene	ug/kg	1000	1300 J	1100 U	1000
Fluorene	ug/kg	90 J	1400 U	510 U	510 U
Hexachlorobenzene	ug/kg	430 U	1400 U	510 U	510 U
Hexachlorobutadiene	ug/kg	430 U	1400 U	510 U	510 U
Hexachlorocyclopentadiene	ug/kg	430 U	1400 U	510 U	510 U
Hexachloroethane	ug/kg	430 U	1400 U	510 U	510 U
Indeno(1,2,3-cd)pyrene	ug/kg	430 U	1400 U	510 U	510 U
Isophorone	ug/kg	430 U	1400 U	510 U	510 U
N-nitroso-di-n-propylamine	ug/kg	430 U	1400 U	510 U	510 U
N-nitrosodiphenylamine	ug/kg	430 U	1400 U	510 U	510 U
Naphthalene	ug/kg	430 U	170 J	510 U	510 U
Nitrobenzene	ug/kg	430 U	1400 U	510 U	510 U
Pentachlorophenol	ug/kg	1000 U	3400 U	1200 U	1200 U
Phenanthrene	ug/kg	700	700 J	660	450 J
Phenol	ug/kg	430 U	1400 U	510 U	510 U
Pyrene	ug/kg	710	980 J	790	730

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	Units	Results†	Results†
Semivolatile organic compounds			
(3-and/or 4-) methylphenol	ug/kg	500 U	980 U
1,2,4-trichlorobenzene	ug/kg	500 U	980 U
1,2-dichlorobenzene	ug/kg	500 U	980 U
1,3-dichlorobenzene	ug/kg	500 U	980 U
1,4-dichlorobenzene	ug/kg	500 U	980 U
2,2'-chloroisopropylether	ug/kg	500 U	980 U
2,4,5-trichlorophenol	ug/kg	1200 U	2400 U
2,4,6-trichlorophenol	ug/kg	500 U	980 U
2,4-dichlorophenol	ug/kg	500 U	980 U
2,4-dimethylphenol	ug/kg	500 U	980 U
2,4-dinitrophenol	ug/kg	1200 U	2400 U
2,4-dinitrotoluene	ug/kg	500 U	980 U
2,6-dinitrotoluene	ug/kg	500 U	980 U
2-chloronaphthalene	ug/kg	500 U	980 U
2-chlorophenol	ug/kg	500 U	980 U
2-methyl-4,6-dinitrophenol	ug/kg	1200 U	2400 U
2-methylnaphthalene	ug/kg	84 J	980 U
2-methylphenol	ug/kg	500 U	980 U
2-nitroaniline	ug/kg	1200 U	2400 U
2-nitrophenol	ug/kg	500 U	980 U
3,3'-dichlorobenzidine	ug/kg	500 U	980 U
3-nitroaniline	ug/kg	1200 U	2400 U
4-bromophenyl phenyl ether	ug/kg	500 U	980 U
4-chloro-3-methylphenol	ug/kg	500 U	980 U
4-chloroaniline	ug/kg	500 U	980 U
4-chlorophenyl phenyl ether	ug/kg	500 U	980 U
4-nitroaniline	ug/kg	1200 U	2400 U
4-nitrophenol	ug/kg	1200 U	2400 U
Acenaphthene	ug/kg	500 U	980 U
Acenaphthylene	ug/kg	500 U	980 U
Anthracene	ug/kg	500 U	980 U
Benzo(a)anthracene	ug/kg	1000	1600
Benzo(a)pyrene	ug/kg	940	1700
Benzo(B and/or K)fluoranthene	ug/kg	2400	4600
Benzo(g,h,i)perylene	ug/kg	500 U	980 U
Benzyl butyl phthalate	ug/kg	500 U	980 U
Bis(2-chloroethoxy)methane	ug/kg	500 U	980 U
Bis(2-chloroethyl) ether	ug/kg	500 U	980 U
Bis(2-ethylhexyl)phthalate	ug/kg	770 U	1100 U
Carbazole	ug/kg	500 U	420 J

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	**Units**	**Results†**	**Results†**
Semivolatile organic compounds			
Chrysene	ug/kg	1200	2200
Di-n-butylphthalate	ug/kg	500 U	980 U
Di-n-octylphthalate	ug/kg	500 U	980 U
Dibenzo(a,h)anthracene	ug/kg	500 U	980 U
Dibenzofuran	ug/kg	500 U	980 U
Diethyl phthalate	ug/kg	500 U	980 U
Dimethyl phthalate	ug/kg	500 U	980 U
Fluoranthene	ug/kg	1900	4200
Fluorene	ug/kg	500 U	120 J
Hexachlorobenzene	ug/kg	500 U	980 U
Hexachlorobutadiene	ug/kg	500 U	980 U
Hexachlorocyclopentadiene	ug/kg	500 U	980 U
Hexachloroethane	ug/kg	500 U	980 U
Indeno(1,2,3-cd)pyrene	ug/kg	500 U	980 U
Isophorone	ug/kg	500 U	980 U
N-nitroso-di-n-propylamine	ug/kg	500 U	980 U
N-nitrosodiphenylamine	ug/kg	500 U	980 U
Naphthalene	ug/kg	70 J	980 U
Nitrobenzene	ug/kg	500 U	980 U
Pentachlorophenol	ug/kg	1200 U	2400 U
Phenanthrene	ug/kg	610	1800
Phenol	ug/kg	350 J	980 U
Pyrene	ug/kg	1300	2700

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-01	DW-SD-02	DW-SD-03	DW-SD-04
Date sampled		26-Jan-94	26-Jan-94	26-Jan-94	25-Jan-94
Depth					
Sediment					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Barium-140	pCi/g	ND	ND	ND	ND
Bismuth-212	pCi/g	0.528	0.459	0.28	0.605
Bismuth-214	pCi/g	0.539	0.635	0.423	0.764
Cesium-137	pCi/g	0.0523	0.0769	0.0517	0.245
Gross Alpha	pCi/g	11	30	19	22
Gross Beta	pCi/g	12	32	10	18
Iodine-131	pCi/g	ND	ND	ND	ND
Lead-212	pCi/g	0.796	0.677	0.504	1.02
Lead-214	pCi/g	0.601	0.706	0.456	0.849
Potassium-40	pCi/g	8.62	5.37	3.9	8.56
Protactinium-234m	pCi/g	NR*	17.6	3.35	4.03
Radium-226	pCi/g	ND*	1.26	0.296	0.878
Radium-228	pCi/g	0.905	0.767	0.546	1.06
Thallium-208	pCi/g	0.265	0.232	0.161	0.321
Thorium-232	pCi/g	0.68	0.45	0.47	0.84 J
Thorium-234	pCi/g	NR*	12.3	0.776	2.84
Uranium-234	pCi/g	0.6	9.8	1.7	2.8
Uranium-235	pCi/g	0.0694 *	0.65	0.0978	0.171
Uranium-238	pCi/g	0.65	9.2	1.8	2.6

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.3. (continued)

Sample number		DW-SD-05	DW-SD-06
Date sampled		25-Jan-94	25-Jan-94
Depth			
Sediment			
Parameter	**Units**	**Results†**	**Results†**
Radionuclides			
Barium-140	pCi/g	ND	ND
Bismuth-212	pCi/g	0.577	0.498
Bismuth-214	pCi/g	0.616	0.634
Cesium-137	pCi/g	0.0731	0.0735
Gross Alpha	pCi/g	20	15
Gross Beta	pCi/g	13	15
Iodine-131	pCi/g	ND	ND
Lead-212	pCi/g	0.953	0.837
Lead-214	pCi/g	0.722	0.738
Potassium-40	pCi/g	4.97	5.75
Protactinium-234m	pCi/g	3.74	1.79
Radium-226	pCi/g	2.35	1.99
Radium-228	pCi/g	0.998	0.817
Thallium-208	pCi/g	0.289	0.251
Thorium-232	pCi/g	0.75	0.86 J
Thorium-234	pCi/g	1.77	1.15
Uranium-234	pCi/g	1.4	0.9
Uranium-235	pCi/g	0.14	NR
Uranium-238	pCi/g	1.4	0.93

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. David Witherspoon, Inc., 901 Site historical data
Roy F. Weston, Inc. investigation

Sample number		WR-1A-01-01	WR-1B-01-01	WR-1C-01-01	WR-1D-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-6"	0-24"	0-3"	0-12"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	9250	13400	17600	4580
Antimony	mg/kg	38.8 U	48.1	32 U	6.6 U
Arsenic	mg/kg	4.5	7.5	8.7	4.1
Barium	mg/kg	93.9	251	140	193
Beryllium	mg/kg	1.1	1.1	0.53 U	0.55 U
Cadmium	mg/kg	32.5	28.8	34.2	2.9
Calcium	mg/kg	19200	20400	184000	133000
Chromium	mg/kg	85	526	162	72.9
Cobalt	mg/kg	22.3	31.9	13.6	5.5 U
Copper	mg/kg	8370	22800	3260	96.4
Cyanide	mg/kg	1.3 U	1.4 U	1.1 U	1.1 U
Iron	mg/kg	71400	124000	58500	17400
Lead	mg/kg	791	305	931	175
Magnesium	mg/kg	1420	2010	12100	51800
Manganese	mg/kg	1370	2590	1650	5980
Mercury	mg/kg	17.3	2.3	6.6	10.9
Nickel	mg/kg	185	433	2040	19.6
Potassium	mg/kg	653	690 U	532 U	549 U
Selenium	mg/kg	0.65 U	0.69 U	0.53 U	0.55 U
Silver	mg/kg	6.5 U	6.9 U	5.3 U	1.1 U
Sodium	mg/kg	647 U	690 U	686	549 U
Thallium	mg/kg	1.3 U	1.4 U	1.1 U	1.1 U
Vanadium	mg/kg	19.2	30	7.9	15.5
Zinc	mg/kg	3770	4640	3530	844

18-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth		WR-1E-01-01 3-Mar-94 0-14"	WR-1F-01-01 3-Mar-94 0-24"	WR-2A-01-01 28-Feb-94 0-24"	WR-2B-01-01 28-Feb-94 0-10"
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	13000	40300	13400	16500
Antimony	mg/kg	73.5 U	71.4 U	7.9 U	8.2 U
Arsenic	mg/kg	14.8	10	2.3	2.8
Barium	mg/kg	1170	336	53.1	28
Beryllium	mg/kg	0.61 U	0.8	1.5	1.5
Cadmium	mg/kg	53.7	27.1	4.5	0.68 U
Calcium	mg/kg	70400	47500	2780	879
Chromium	mg/kg	77.3	206	16.4	18.1
Cobalt	mg/kg	318	17.1	20.8	17.9
Copper	mg/kg	1870	2180	62.4	33.3
Cyanide	mg/kg	1.2 U	1.6	1.3 U	1.4 U
Iron	mg/kg	75100	97400	39900	44500
Lead	mg/kg	2510	1020	96.8	46.2
Magnesium	mg/kg	6490	10300	1240	2300
Manganese	mg/kg	1360	8140	930	488
Mercury	mg/kg	63.5	6.2	0.54	0.14 U
Nickel	mg/kg	4840	338	25.4	27.5
Potassium	mg/kg	612 U	595 U	776	741
Selenium	mg/kg	0.62 U	0.6 U	0.66 U	0.68 U
Silver	mg/kg	12.3 U	11.9 U	2.6 U	2.7 U
Sodium	mg/kg	612 U	3750	656	681 U
Thallium	mg/kg	1.2 U	1.2 U	1.3 U	1.4 U
Vanadium	mg/kg	11.3	34.7	19.3	21.4
Zinc	mg/kg	14200	3060	312	95.5

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth Soil Parameter	Units	WR-2C-01-01 28-Feb-94 0-12" Results†	WR-2D-01-01 28-Feb-94 0-24" Results†	WR-2E-01-01 28-Feb-94 0-2" Results†	WR-2F-01-01 28-Feb-94 0-8" Results†
Metals					
Aluminum	mg/kg	8200	10900	34900	14200
Antimony	mg/kg	7.2 U	87.4	67	12.8
Arsenic	mg/kg	7.3	13.1	12	4.8
Barium	mg/kg	202	725	686	452
Beryllium	mg/kg	0.9	0.58	0.66 U	0.54 U
Cadmium	mg/kg	4.9	32.8	30.7	3.6
Calcium	mg/kg	73200	43100	54500	83500
Chromium	mg/kg	53.2	73.2	93	111
Cobalt	mg/kg	17.7	18.3	15	6.3
Copper	mg/kg	1640	1590	3210	325
Cyanide	mg/kg	1.2 U	1.2 U	1.3 U	1.1 U
Iron	mg/kg	34100	98900	76300	36200
Lead	mg/kg	280	3750	1720	263
Magnesium	mg/kg	13400	5550	7200	19300
Manganese	mg/kg	2990	1430	1720	14600
Mercury	mg/kg	8.2	25.8	23.4	16.2
Nickel	mg/kg	107	196	288	37
Potassium	mg/kg	714	597	657 U	544 U
Selenium	mg/kg	0.6 U	0.58 U	0.66 U	0.54 U
Silver	mg/kg	1.2 U	11.6 U	6.6 U	1.3
Sodium	mg/kg	602 U	581 U	657 U	544 U
Thallium	mg/kg	1.2 U	1.2 U	1.3 U	1.1 U
Vanadium	mg/kg	20.7	10.6	12.4	25.3
Zinc	mg/kg	1260	59200	10800	1470

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3A-01-01	WR-3B-01-01	WR-3C-01-01	WR-3C-01-R1
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-24"	0-24"	0-4"	RINSATE
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	16500	10100	10200	200 U
Antimony	mg/kg	8.3 U	7.2 U	74.5 U	60 U
Arsenic	mg/kg	3.1	7.1	14.1	10 U
Barium	mg/kg	31.8	134	738	200 U
Beryllium	mg/kg	0.73	1.2	0.65	5 U
Cadmium	mg/kg	0.69 U	2.3	19.1	5 U
Calcium	mg/kg	1550	4580	40200	5000 U
Chromium	mg/kg	21.6	34.1	63	10 U
Cobalt	mg/kg	6.9 U	28.6	18.4	50 U
Copper	mg/kg	20	85.2	1650	25 U
Cyanide	mg/kg	1.4 U	1.2 U	1.2 U	5 U
Iron	mg/kg	36700	38200	86200	100 U
Lead	mg/kg	38.7	252	1530	3 U
Magnesium	mg/kg	1430	969	3660	5000 U
Manganese	mg/kg	88.8	3750	1410	15 U
Mercury	mg/kg	0.14 U	0.47	31.4	0.2 U
Nickel	mg/kg	10.9	29.8	112	40 U
Potassium	mg/kg	964	843	713	5000 U
Selenium	mg/kg	0.69 U	0.59 U	0.62 U	5 U
Silver	mg/kg	1.4 U	1.2 U	12.4 U	10 U
Sodium	mg/kg	688 U	598 U	620 U	5000 U
Thallium	mg/kg	1.4 U	1.2 U	1.2 U	10 U
Vanadium	mg/kg	25.6	27	13.9	50 U
Zinc	mg/kg	45.1	249	4670	20 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3D-01-01	WR-3E-01-01	WR-3E-01-D1	WR-3F-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-3"	0-24"	0-24"	0-12"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	9460	13100	16000	8770
Antimony	mg/kg	15.6	79.3 U	79.7 U	69.4 U
Arsenic	mg/kg	12.4	4.6	3.2	11.4
Barium	mg/kg	138	402	55.8	562
Beryllium	mg/kg	0.54 U	0.89	1.8	0.88
Cadmium	mg/kg	6.6	11.4	6.6 U	15
Calcium	mg/kg	149000	16800	1040	46400
Chromium	mg/kg	205	48.5	19.5	36.7
Cobalt	mg/kg	10.1	17.3	21	19.1
Copper	mg/kg	2030	907	31.5	1170
Cyanide	mg/kg	1.1 U	1.3 U	1.3 U	1.2 U
Iron	mg/kg	38800	58800	53200	57900
Lead	mg/kg	559	1010	29.7	1070
Magnesium	mg/kg	16100	2640	1420	4890
Manganese	mg/kg	1550	1050	1210	2030
Mercury	mg/kg	12.1	1.8	0.35	0.63
Nickel	mg/kg	175	87.2	16.1	99.8
Potassium	mg/kg	580	843	833	881
Selenium	mg/kg	0.54 U	0.65 U	0.67 U	0.58 U
Silver	mg/kg	1.1 U	13.2 U	13.3 U	11.6 U
Sodium	mg/kg	538 U	660 U	664 U	578 U
Thallium	mg/kg	1.1 U	1.3 U	1.3 U	1.2 U
Vanadium	mg/kg	9.7	24	28.1	17
Zinc	mg/kg	2170	3710	180	4800

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4A-01-01	WR-4B-01-01	WR-4C-01-01	WR-4D-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-4"	0-4"	0-5"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Metals					
Aluminum	mg/kg	7800	11100	9890	9760
Antimony	mg/kg	68.6 U	102	73.8 U	72.4 U
Arsenic	mg/kg	6.5	8.5	17	12.8
Barium	mg/kg	166	123	986	857
Beryllium	mg/kg	0.57	0.99	0.62 U	0.72
Cadmium	mg/kg	39.4	21.7	39.4	35.7
Calcium	mg/kg	82900	65000	35000	52600
Chromium	mg/kg	47.8	3480	115	110
Cobalt	mg/kg	15.6	44	22.8	31.3
Copper	mg/kg	661	408	2200	2140
Cyanide	mg/kg	1.1 U	1.2 U	1.2 U	1.2 U
Iron	mg/kg	55400	65000	112000	89100
Lead	mg/kg	584	341	2130	6270
Magnesium	mg/kg	3730	7330	5720	6980
Manganese	mg/kg	1030	1260	5380	6550
Mercury	mg/kg	10.4	10.2	396	1660
Nickel	mg/kg	187	3160	406	342
Potassium	mg/kg	572 U	626	744	924
Selenium	mg/kg	0.57 U	0.62 U	0.77	0.6 U
Silver	mg/kg	11.4 U	12.2 U	12.3 U	12.1 U
Sodium	mg/kg	572 U	609 U	615 U	603 U
Thallium	mg/kg	1.1 U	1.2 U	1.2 U	1.2 U
Vanadium	mg/kg	12.2	6.1 U	14.8	6 U
Zinc	mg/kg	1890	1160	10900	5290

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4E-01-01	WR-4F-01-01	WR-5A-01-01	WR-5B-01-01
Date sampled		25-Feb-94	25-Feb-94	24-Feb-94	24-Feb-94
Depth		0-8"	0-10"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	5400	3910	4810	5340
Antimony	mg/kg	10.3	6.9 U	10.8	15.4
Arsenic	mg/kg	11.7	8.6	5.1	6.3
Barium	mg/kg	149	89	242	193
Beryllium	mg/kg	0.62 U	0.58 U	0.54 U	0.56 U
Cadmium	mg/kg	7	3.6	6.2	7.7
Calcium	mg/kg	151000	227000	85100	67000
Chromium	mg/kg	36.2	28.9	40.8	88.2
Cobalt	mg/kg	8.7	5.8 U	9.3	8.2
Copper	mg/kg	434	341	279	486
Cyanide	mg/kg	1.2 U	1.2 U	1.1 U	1.1 U
Iron	mg/kg	38500	16100	26800	29300
Lead	mg/kg	649	213	365	548
Magnesium	mg/kg	16500	11500	23100	6450
Manganese	mg/kg	736	957	2080	1050
Mercury	mg/kg	10.4	7.1	32.6	11.7
Nickel	mg/kg	171	22.3	90.7	72.6
Potassium	mg/kg	622 U	579 U	542 U	590
Selenium	mg/kg	1	0.58 U	0.56 U	0.57 U
Silver	mg/kg	2	1.2 U	108 U	112 U
Sodium	mg/kg	622 U	579 U	542 U	559 U
Thallium	mg/kg	1.2 U	1.2 U	1.1 U	1.1 U
Vanadium	mg/kg	10.6	8.2	10.1	6.9
Zinc	mg/kg	1420	907	2210	1590

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5B-01-R1	WR-5C-01-01	WR-5D-01-01	WR-5E-01-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	24-Feb-94
Depth		RINSATE	0-3"	0-4"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	ug/L	200 U	7090	7280	7650
Antimony	ug/L	60 U	10	16.5	23.6
Arsenic	ug/L	10 U	13.7	6.4	4.1
Barium	ug/L	200 U	73	223	140
Beryllium	ug/L	5 U	0.55 U	0.56 U	0.57 U
Cadmium	ug/L	5 U	3.6	15.1	5.5
Calcium	ug/L	5000 U	160000	233000	161000
Chromium	ug/L	11.7	51.8	228	845
Cobalt	ug/L	50 U	10.4	9.5	18.9
Copper	ug/L	25 U	393	1770	570
Cyanide	ug/L	5 U	1.1 U	1.1 U	1.1 U
Iron	ug/L	126	30500	41400	49300
Lead	ug/L	3 U	260	395	501
Magnesium	ug/L	5000 U	17100	16200	27300
Manganese	ug/L	15 U	1040	3710	2410
Mercury	ug/L	0.2 U	2.7	4.2	5.2
Nickel	ug/L	40 U	141	225	641
Potassium	ug/L	5000 U	552	560 U	566 U
Selenium	ug/L	5 U	0.55 U	0.56 U	0.57 U
Silver	ug/L	10 U	110 U	112 U	113 U
Sodium	ug/L	5000 U	549 U	560 U	566 U
Thallium	ug/L	10 U	1.1 U	1.1 U	1.1 U
Vanadium	ug/L	50 U	5.7	21.6	6.4
Zinc	ug/L	20 U	770	1310	1050

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5F-01-01	WR-AA-01-01	WR-BB-01-01	WR-CC-01-01
Date sampled		24-Feb-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-8"	0-8"	0-4"	0-2"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	20600	11300	40200	17500
Antimony	mg/kg	7.9	74.3 U	74.6 U	60.8 U
Arsenic	mg/kg	2.6	4.8	13.4	17.2
Barium	mg/kg	114	80.8	176	342
Beryllium	mg/kg	0.55 U	0.76	0.93	0.59
Cadmium	mg/kg	0.54 U	77.5	27.9	28.5
Calcium	mg/kg	162000	35100	55000	28900
Chromium	mg/kg	40.1	370	819	233
Cobalt	mg/kg	5.5 U	34.7	25.2	22.7
Copper	mg/kg	130	36200	4680	1480
Cyanide	mg/kg	1.1 U	1.2 U	1.2 U	1 U
Iron	mg/kg	22000	146000	125000	154000
Lead	mg/kg	75.2	2070	1070	1590
Magnesium	mg/kg	15300	2230	6490	6850
Manganese	mg/kg	1300	1490	1860	2000
Mercury	mg/kg	0.54	1.2	6.3	13.9
Nickel	mg/kg	23	1570	408	1210
Potassium	mg/kg	549 U	619 U	774	646
Selenium	mg/kg	0.51 U	0.62 U	0.62 U	0.5 U
Silver	mg/kg	110 U	12.4 U	12.4 U	10.1 U
Sodium	mg/kg	549 U	619 U	1370	3340
Thallium	mg/kg	1 U	1.2 U	1.2 U	1 U
Vanadium	mg/kg	8.3	15.1	49.8	16.4
Zinc	mg/kg	195	12500	3710	2990

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-DD-01-01	WR-EE-01-01	WR-FF-01-01	WR-GG-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-2"	0-3"	0-12"	0-5"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	17200	16700	17500	4590
Antimony	mg/kg	69.2 U	63.5 U	82.6 U	162
Arsenic	mg/kg	44.1	15.5	11.6	17.4
Barium	mg/kg	418	737	281	442
Beryllium	mg/kg	0.58 U	0.55	0.69 U	0.59 U
Cadmium	mg/kg	14.7	24	16.9	25.7
Calcium	mg/kg	56700	45900	72900	34200
Chromium	mg/kg	794	464	107	106
Cobalt	mg/kg	17.3	20.1	11.3	24.7
Copper	mg/kg	3270	4530	3650	14100
Cyanide	mg/kg	1.2 U	1.1 U	1.4 U	1.2 U
Iron	mg/kg	102000	120000	64900	124000
Lead	mg/kg	1020	1760	1100	8320
Magnesium	mg/kg	7460	7400	4900	5350
Manganese	mg/kg	1500	2750	1240	1630
Mercury	mg/kg	21.2	20.5	70.9	81.7
Nickel	mg/kg	375	466	111	337
Potassium	mg/kg	1030	628	688 U	592 U
Selenium	mg/kg	0.58 U	0.63	12.4	0.59 U
Silver	mg/kg	11.5 U	10.6 U	13.8 U	11.8 U
Sodium	mg/kg	4680	1650	688 U	592 U
Thallium	mg/kg	1.2 U	1 U	1.4 U	1.2 U
Vanadium	mg/kg	9.6	14.1	10.7	7
Zinc	mg/kg	12100	10600	5030	6110

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-GG-01-D1	WR-GG-01-R1	WR-HH-01-01	WR-II-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-5"	RINSATE	0-7"	0-3"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Metals					
Aluminum	mg/kg	5660	200 U	4250	3810
Antimony	mg/kg	72.6 U	60 U	6.6 U	33.1 U
Arsenic	mg/kg	18.1	10 U	6.2	9.9
Barium	mg/kg	385	200 U	52.2	114
Beryllium	mg/kg	0.6 U	5 U	0.55 U	0.55 U
Cadmium	mg/kg	28.6	5 U	2.3	11.9
Calcium	mg/kg	41400	5000 U	201000	190000
Chromium	mg/kg	193	10 U	38.1	41.6
Cobalt	mg/kg	23.4	50 U	7.4	11.8
Copper	mg/kg	4180	25 U	283	978
Cyanide	mg/kg	1.2 U	5 U	1.1 U	1.1 U
Iron	mg/kg	124000	100 U	26300	52600
Lead	mg/kg	2250	3 U	98.2	386
Magnesium	mg/kg	3730	5000 U	10200	7420
Manganese	mg/kg	1430	15 U	531	942
Mercury	mg/kg	130	0.2 U	18.5	42
Nickel	mg/kg	336	40 U	154	231
Potassium	mg/kg	605 U	5000 U	548 U	552 U
Selenium	mg/kg	0.6 U	5 U	0.54 U	0.55 U
Silver	mg/kg	12.1 U	10 U	10.9 U	5.5 U
Sodium	mg/kg	605 U	5000 U	548 U	552 U
Thallium	mg/kg	1.2 U	10 U	1.1 U	1.1 U
Vanadium	mg/kg	6 U	50 U	5.5	5.5 U
Zinc	mg/kg	5120	20 U	448	1860

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-XX-01-01	WR-YY-01-01
Date sampled		24-Feb-94	24-Feb-94
Depth		0-4"	0-4"
Soil			
Parameter	**Units**	**Results†**	**Results†**
Metals			
Aluminum	mg/kg	4810	7480
Antimony	mg/kg	6.6	8
Arsenic	mg/kg	3.2	6.5
Barium	mg/kg	67.4	60.4
Beryllium	mg/kg	0.53 U	0.58 U
Cadmium	mg/kg	3.3	1.9
Calcium	mg/kg	204000	234000
Chromium	mg/kg	32.4	31.3
Cobalt	mg/kg	9.4	5.8 U
Copper	mg/kg	732	214
Cyanide	mg/kg	1.1 U	1.2 U
Iron	mg/kg	50800	20700
Lead	mg/kg	208	102
Magnesium	mg/kg	10900	9920
Manganese	mg/kg	759	875
Mercury	mg/kg	1.6	2.5
Nickel	mg/kg	42.7	21.3
Potassium	mg/kg	534 U	580 U
Selenium	mg/kg	0.53 U	0.58 U
Silver	mg/kg	107 U	116 U
Sodium	mg/kg	534 U	580 U
Thallium	mg/kg	1.1 U	1.2 U
Vanadium	mg/kg	53.4 U	10.9
Zinc	mg/kg	421	407

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth		WR-1A-01-01 28-Feb-94 0-6"	WR-1B-01-01 28-Feb-94 0-24"	WR-1C-01-01 28-Feb-94 0-3"	WR-1D-01-01 28-Feb-94 0-12"
Soil **Parameter**	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1016	ug/kg	260 U	2800 U	2100 U	220 U
Aroclor-1221	ug/kg	260 U	2800 U	2100 U	220 U
Aroclor-1232	ug/kg	260 U	2800 U	2100 U	220 U
Aroclor-1242	ug/kg	260 U	2800 U	2100 U	220 U
Aroclor-1248	ug/kg	260 U	2800 U	2100 U	220 U
Aroclor-1254	ug/kg	570	5600	5400	330
Aroclor-1260	ug/kg	650	11000	3000	420

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1E-01-01	WR-1F-01-01	WR-2A-01-01	WR-2B-01-01
Date sampled		3-Mar-94	3-Mar-94	28-Feb-94	28-Feb-94
Depth		0-14"	0-24"	0-24"	0-10"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	5000 U	4800 U	100 U	110 U
Aroclor-1221	ug/kg	5000 U	4800 U	100 U	110 U
Aroclor-1232	ug/kg	5000 U	4800 U	100 U	110 U
Aroclor-1242	ug/kg	5000 U	4800 U	100 U	110 U
Aroclor-1248	ug/kg	5000 U	4800 U	100 U	110 U
Aroclor-1254	ug/kg	38000	27000	90	94
Aroclor-1260	ug/kg	11000	7900	170	120

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-2C-01-01	WR-2D-01-01	WR-2E-01-01	WR-2F-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-12"	0-24"	0-2"	0-8"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1016	ug/kg	2400 U	2300 U	1100 U	220 U
Aroclor-1221	ug/kg	2400 U	2300 U	1100 U	220 U
Aroclor-1232	ug/kg	2400 U	2300 U	1100 U	220 U
Aroclor-1242	ug/kg	2400 U	2300 U	1100 U	220 U
Aroclor-1248	ug/kg	2400 U	2300 U	1100 U	220 U
Aroclor-1254	ug/kg	4000	5500	6600	1200
Aroclor-1260	ug/kg	1300	6500	4300	990

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3A-01-01	WR-3B-01-01	WR-3C-01-01	WR-3C-01-R1
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-24"	0-24"	0-4"	RINSATE
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	57 U	240 U	2500 U	0.58 U
Aroclor-1221	ug/kg	57 U	240 U	2500 U	0.58 U
Aroclor-1232	ug/kg	57 U	240 U	2500 U	0.58 U
Aroclor-1242	ug/kg	57 U	240 U	2500 U	0.58 U
Aroclor-1248	ug/kg	57 U	240 U	2500 U	0.58 U
Aroclor-1254	ug/kg	110 U	280	10000	1.2 U
Aroclor-1260	ug/kg	110 U	570	10000	1.2 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3D-01-01	WR-3E-01-01	WR-3E-01-D1	WR-3F-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-3"	0-24"	0-24"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	800 U	270 U	55 U	230 U
Aroclor-1221	ug/kg	800 U	270 U	55 U	230 U
Aroclor-1232	ug/kg	800 U	270 U	55 U	230 U
Aroclor-1242	ug/kg	800 U	270 U	55 U	230 U
Aroclor-1248	ug/kg	800 U	270 U	55 U	230 U
Aroclor-1254	ug/kg	3300	120	19	1100
Aroclor-1260	ug/kg	3200	310	89	1700

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4A-01-01	WR-4B-01-01	WR-4C-01-01	WR-4D-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-4"	0-4"	0-5"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	2300 U	2500 U	2500 U	49000 U
Aroclor-1221	ug/kg	2300 U	2500 U	2500 U	49000 U
Aroclor-1232	ug/kg	2300 U	2500 U	2500 U	49000 U
Aroclor-1242	ug/kg	2300 U	2500 U	2500 U	49000 U
Aroclor-1248	ug/kg	2300 U	2500 U	2500 U	49000 U
Aroclor-1254	ug/kg	2000	2100	13000	160000
Aroclor-1260	ug/kg	4900	5500	4300	43000

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth		WR-4E-01-01 25-Feb-94 0-8"	WR-4F-01-01 25-Feb-94 0-10"	WR-5A-01-01 24-Feb-94 0-6"	WR-5B-01-01 24-Feb-94 0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	990 U	230 U	230 U	460 U
Aroclor-1221	ug/kg	990 U	230 U	230 U	460 U
Aroclor-1232	ug/kg	990 U	230 U	230 U	460 U
Aroclor-1242	ug/kg	990 U	230 U	230 U	460 U
Aroclor-1248	ug/kg	990 U	230 U	230 U	460 U
Aroclor-1254	ug/kg	1300	800	150	880
Aroclor-1260	ug/kg	3100	1100	580	2300

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5B-01-R1	WR-5C-01-01	WR-5D-01-01	WR-5E-01-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	24-Feb-94
Depth		RINSATE	0-3"	0-4"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/L	0.55 U	2200 U	2200 U	450 U
Aroclor-1221	ug/L	0.55 U	2200 U	2200 U	450 U
Aroclor-1232	ug/L	0.55 U	2200 U	2200 U	450 U
Aroclor-1242	ug/L	0.55 U	2200 U	2200 U	450 U
Aroclor-1248	ug/L	0.55 U	2200 U	2200 U	450 U
Aroclor-1254	ug/L	1.1 U	3300	11000	1200
Aroclor-1260	ug/L	1.1 U	1700	15000	1300

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5F-01-01	WR-AA-01-01	WR-BB-01-01	WR-CC-01-01
Date sampled		24-Feb-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-8"	0-8"	0-4"	0-2"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
PCBs					
Aroclor-1016	ug/kg	220 U	2500 U	5000 U	4100 U
Aroclor-1221	ug/kg	220 U	2500 U	5000 U	4100 U
Aroclor-1232	ug/kg	220 U	2500 U	5000 U	4100 U
Aroclor-1242	ug/kg	220 U	2500 U	5000 U	4100 U
Aroclor-1248	ug/kg	220 U	2500 U	5000 U	4100 U
Aroclor-1254	ug/kg	230	4000	35000	22000
Aroclor-1260	ug/kg	370	740	6900	6800

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-DD-01-01	WR-EE-01-01	WR-FF-01-01	WR-GG-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-2"	0-3"	0-12"	0-5"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	23000 U	42000 U	11000 U	9500 U
Aroclor-1221	ug/kg	23000 U	42000 U	11000 U	9500 U
Aroclor-1232	ug/kg	23000 U	42000 U	11000 U	9500 U
Aroclor-1242	ug/kg	23000 U	42000 U	11000 U	9500 U
Aroclor-1248	ug/kg	63000	140000	11000 U	9500 U
Aroclor-1254	ug/kg	47000 U	85000 U	49000	31000
Aroclor-1260	ug/kg	47000 U	85000 U	28000	15000

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-GG-01-D1	WR-GG-01-R1	WR-HH-01-01	WR-II-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-5"	RINSATE	0-7"	0-3"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
PCBs					
Aroclor-1016	ug/kg	9800 U	0.59 U	880 U	2200 U
Aroclor-1221	ug/kg	9800 U	0.59 U	880 U	2200 U
Aroclor-1232	ug/kg	9800 U	0.59 U	880 U	2200 U
Aroclor-1242	ug/kg	9800 U	0.59 U	880 U	2200 U
Aroclor-1248	ug/kg	9800 U	0.59 U	880 U	2200 U
Aroclor-1254	ug/kg	34000	1.2 U	1100	6700
Aroclor-1260	ug/kg	16000	1.2 U	1900	6200

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-XX-01-01	WR-YY-01-01
Date sampled		24-Feb-94	24-Feb-94
Depth		0-4"	0-4"
Soil			
Parameter	Units	Results†	Results†
PCBs			
Aroclor-1016	ug/kg	210 U	230 U
Aroclor-1221	ug/kg	210 U	230 U
Aroclor-1232	ug/kg	210 U	230 U
Aroclor-1242	ug/kg	210 U	230 U
Aroclor-1248	ug/kg	210 U	230 U
Aroclor-1254	ug/kg	720	290
Aroclor-1260	ug/kg	910	520

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1B-02-01	WR-1F-01-02	WR-2C-01-02	WR-2E-01-02
Date sampled		19-May-94	18-May-94	18-May-94	18-May-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
2,3,7,8-TCDD	ng/kg	0.0001 U	0.0001 U	0.0002 U	0.0002 U
2,3,7,8-TCDF	ng/kg	0.0028	0.0001 U	0.0002 U	0.0001 U
Hpcdd (total)	ng/kg	0.012	0.0013 S	0.0073	0.0019
Hpcdf (total)	ng/kg	0.028 D	0.0007 JS	0.0044	0.0009 S
Hxcdd (total)	ng/kg	0.0076	0.0002 U	0.0006 S	0.0003 U
Hxcdf (total)	ng/kg	0.025	0.0002 J	0.0014 S	0.0004 JS
Ocdd (total)	ng/kg	0.016	0.0041 S	0.023 D	0.0046
Ocdf (total)	ng/kg	0.015	0.0005 JS	0.0031	0.037 D
Pecdd (total)	ng/kg	0.0039 J	0.0002 U	0.0002 U	0.0002 U
Pecdf (total)	ng/kg	0.018	0.0002 U	0.0003 U	0.0003 U
Tcdd (total)	ng/kg	0.0019 J	0.0001 U	0.0002 U	0.0002 U
Tcdf (total)	ng/kg	0.013	0.0001 U	0.0002 U	0.0001 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth Soil Parameter	Units	WR-2F-01-02 18-May-94 0-6" Results†	WR-3C-01-02 18-May-94 0-6" Results†	WR-3D-01-02 18-May-94 0-6" Results†	WR-4C-01-02 18-May-94 0-6" Results†
Dioxins					
2,3,7,8-TCDD	ng/kg	0.0002 U	0.0002 U	0.0002 U	0.0002 U
2,3,7,8-TCDF	ng/kg	0.0002 U	0.0004 J	0.0002 U	0.0003 U
Hpcdd (total)	ng/kg	0.0004 U	0.0061	0.0004 U	0.0025
Hpcdf (total)	ng/kg	0.0003 U	0.0028	0.0003 U	0.0013 S
Hxcdd (total)	ng/kg	0.0004 U	0.0006 JS	0.0003 U	0.0005 S
Hxcdf (total)	ng/kg	0.0003 U	0.0023	0.0003 U	0.0017 S
Ocdd (total)	ng/kg	0.0021 S	0.022 D	0.0012 HS	0.0065
Ocdf (total)	ng/kg	0.0004 U	0.011	0.0005 U	0.003
Pecdd (total)	ng/kg	0.0003 U	0.0002 U	0.0004 U	0.0003 U
Pecdf (total)	ng/kg	0.0002 U	0.0014	0.0003 U	0.0022 S
Tcdd (total)	ng/kg	0.0002 U	0.0002 U	0.0003 U	0.0002 U
Tcdf (total)	ng/kg	0.0002 U	0.0004 J	0.0002 U	0.0003 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4D-01-02	WR-4F-02-01	WR-5D-01-02	WR-BB-01-02
Date sampled		18-May-94	19-May-94	18-May-94	18-May-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
2,3,7,8-TCDD	ng/kg	0.0001 U	0.0004 JS	0.0004 U	0.0001 U
2,3,7,8-TCDF	ng/kg	0.0003 U	0.14 E	0.0004 U	0.0003 J
Hpcdd (total)	ng/kg	0.017 D	0.0005 JS	0.0006 U	0.0022
Hpcdf (total)	ng/kg	0.0048	0.0017 JS	0.0005 U	0.0007 JS
Hxcdd (total)	ng/kg	0.0012 JS	0.0004 U	0.0007 U	0.0039
Hxcdf (total)	ng/kg	0.0017 S	0.022	0.0004 U	0.0007 J
Ocdd (total)	ng/kg	0.064 D	0.0031 J	0.003 S	0.0042
Ocdf (total)	ng/kg	0.0053	0.0007 JS	0.0006 JS	0.0006 J
Pecdd (total)	ng/kg	0.0002 U	0.0005 U	0.0007 U	0.0014 J
Pecdf (total)	ng/kg	0.0011 S	0.19 E	0.0005 U	0.0007 JS
Tcdd (total)	ng/kg	0.0001 U	0.0016 JS	0.0004 U	0.0011 J
Tcdf (total)	ng/kg	0.0007 JS	0.76 E	0.0004 U	0.0006 J

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-BB-01-02	WR-DD-01-02	WR-EE-01-02	WR-EE-01-D2
Date sampled		18-May-94	18-May-94	18-May-94	18-May-94
Depth		0-6"	0-6"	0-6"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
2,3,7,8-TCDD	ng/kg	0.0001 U	0.0001 U	0.0003 U	0.0003 U
2,3,7,8-TCDF	ng/kg	0.0002 J	0.0002 U	0.0005 U	0.0003 U
Hpcdd (total)	ng/kg	0.0017	0.0018	0.0027 S	0.002 S
Hpcdf (total)	ng/kg	0.0006 JS	0.0011 S	0.0011 S	0.0006 S
Hxcdd (total)	ng/kg	0.003 B	0.0007 JS	0.0005 U	0.0008 U
Hxcdf (total)	ng/kg	0.0007 J	0.001 JS	0.0005 H	0.0006 U
Ocdd (total)	ng/kg	0.0038	0.0031	0.01	0.0074 U
Ocdf (total)	ng/kg	0.0007 J	0.0007 JS	0.001 S	0.0007 JS
Pecdd (total)	ng/kg	0.0011 J	0.0002 U	0.0004 U	0.0005 U
Pecdf (total)	ng/kg	0.0004 JS	0.0002 U	0.0005 U	0.0005 U
Tcdd (total)	ng/kg	0.0008 J	0.0001 U	0.0003 U	0.0004 U
Tcdf (total)	ng/kg	0.0006 J	0.0002 U	0.0005 U	0.0003 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth		WR-FF-01-02 19-May-94 0-6"	WR-FF-02-01 19-May-94 0-6"	WR-GG-01-02 18-May-94 0-6"	WR-HH-01-02 18-May-94 0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Dioxins					
2,3,7,8-TCDD	ng/kg	0.0001 U	0.0001 U	0.0001 U	0.0004 U
2,3,7,8-TCDF	ng/kg	0.0002 J	0.0001 U	0.0004 J	0.0004 U
Hpcdd (total)	ng/kg	0.0031	0.0002 JS	0.0053	0.0011 U
Hpcdf (total)	ng/kg	0.0013 S	0.0002 JS	0.0031	0.0009 U
Hxcdd (total)	ng/kg	0.0006 JS	0.0001 U	0.0004 U	0.0008 U
Hxcdf (total)	ng/kg	0.0008 JS	0.0001 J	0.0016 J	0.0007 U
Ocdd (total)	ng/kg	0.013	0.001 S	0.025 D	0.0041 S
Ocdf (total)	ng/kg	0.0016	0.0001 JS	0.0044	0.0011 U
Pecdd (total)	ng/kg	0.0002 U	0.0001 U	0.0002 U	0.0006 U
Pecdf (total)	ng/kg	0.0004 JS	0.0001 JS	0.0009 S	0.0004 U
Tcdd (total)	ng/kg	0.0001 U	0.0001 U	0.0001 U	0.0004 U
Tcdf (total)	ng/kg	0.0002 J	0.0001 J	0.0009 J	0.0004 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-II-01-02
Date sampled		18-May-94
Depth		0-6"
Soil		
Parameter	**Units**	**Results†**
Dioxins		
2,3,7,8-TCDD	ng/kg	0.0002 U
2,3,7,8-TCDF	ng/kg	0.0003 U
Hpcdd (total)	ng/kg	0.0035
Hpcdf (total)	ng/kg	0.0012 S
Hxcdd (total)	ng/kg	0.0004 U
Hxcdf (total)	ng/kg	0.0003 U
Ocdd (total)	ng/kg	0.02
Ocdf (total)	ng/kg	0.0011 S
Pecdd (total)	ng/kg	0.0005 U
Pecdf (total)	ng/kg	0.0004 U
Tcdd (total)	ng/kg	0.0002 U
Tcdf (total)	ng/kg	0.0003 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1A-01-01	WR-1B-01-01	WR-1C-01-01	WR-1D-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-6"	0-24"	0-3"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	420 U	2200 U	340 U	350 U
1,2-dichlorobenzene	ug/kg	420 U	2200 U	340 U	350 U
1,3-dichlorobenzene	ug/kg	420 U	2200 U	340 U	350 U
1,4-dichlorobenzene	ug/kg	420 U	2200 U	340 U	350 U
2,4,5-trichlorophenol	ug/kg	2100 U	11000 U	1700 U	1800 U
2,4,6-trichlorophenol	ug/kg	420 U	2200 U	340 U	350 U
2,4-dichlorophenol	ug/kg	420 U	2200 U	340 U	350 U
2,4-dimethylphenol	ug/kg	420 U	390 J	340 U	350 U
2,4-dinitrophenol	ug/kg	2100 U	11000 U	1700 U	1800 U
2,4-dinitrotoluene	ug/kg	420 U	2200 U	340 U	350 U
2,6-dinitrotoluene	ug/kg	420 U	2200 U	340 U	350 U
2-chloronaphthalene	ug/kg	420 U	2200 U	340 U	350 U
2-chlorophenol	ug/kg	420 U	2200 U	340 U	350 U
2-methylnaphthalene	ug/kg	420 U	2200 U	39 J	350 U
2-methylphenol	ug/kg	420 U	2200 U	340 U	350 U
2-nitroaniline	ug/kg	2100 U	11000 U	1700 U	1800 U
2-nitrophenol	ug/kg	420 U	2200 U	340 U	350 U
3,3'-dichlorobenzidine	ug/kg	840 U	4500 U	690 U	710 U
3-nitroaniline	ug/kg	2100 U	11000 U	1700 U	1800 U
4,6-dinitro-2-methylphenol	ug/kg	2100 U	11000 U	1700 U	1800 U
4-bromophenyl phenyl ether	ug/kg	420 U	2200 U	340 U	350 U
4-chloro-3-methylphenol	ug/kg	420 U	2200 U	340 U	350 U
4-chloroaniline	ug/kg	420 U	2200 U	340 U	350 U
4-chlorophenyl phenyl ether	ug/kg	420 U	2200 U	340 U	350 U
4-methylphenol	ug/kg	420 U	300 J	340 U	350 U
4-nitroaniline	ug/kg	2100 U	11000 U	1700 U	1800 U
4-nitrophenol	ug/kg	2100 U	11000 U	1700 U	1800 U
Acenaphthene	ug/kg	420 U	290 J	340 U	350 U
Acenaphthylene	ug/kg	420 U	2200 U	340 U	350 U
Anthracene	ug/kg	420 U	910 J	68 J	350 U
Benzo(a)anthracene	ug/kg	120 J	2300	420	74 J
Benzo(a)pyrene	ug/kg	91 J	1600 J	570	42 J
Benzo(b)fluoranthene	ug/kg	120 J	1600 J	690	67 J
Benzo(g,h,i)perylene	ug/kg	190 J	3100	500	350 U
Benzo(k)fluoranthene	ug/kg	98 J	1500 J	770	70 J
Benzoic acid	ug/kg	2100 U	11000 U	1700 U	1800 U
Benzyl alcohol	ug/kg	420 U	2200 U	340 U	350 U
Bis(2-chloroethoxy)methane	ug/kg	420 U	2200 U	340 U	350 U
Bis(2-chloroethyl) ether	ug/kg	420 U	2200 U	340 U	350 U
Bis(2-chloroisopropyl) ether	ug/kg	420 U	2200 U	340 U	350 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1A-01-01	WR-1B-01-01	WR-1C-01-01	WR-1D-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-6"	0-24"	0-3"	0-12"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	54 JB	2900 B	300 JB	350 U
Butylbenzylphthalate	ug/kg	420 U	2200 U	340 U	350 U
Chrysene	ug/kg	140 J	2400	580	130 J
Di-n-butylphthalate	ug/kg	1300 B	920 JB	170 JB	300 JB
Di-n-octylphthalate	ug/kg	420 U	2200 U	340 U	350 U
Dibenzo(a,h)anthracene	ug/kg	61 J	1200 J	240 J	350 U
Dibenzofuran	ug/kg	420 U	2200 U	340 U	350 U
Diethyl phthalate	ug/kg	420 U	2200 U	340 U	350 U
Dimethyl phthalate	ug/kg	420 U	2200 U	340 U	350 U
Fluoranthene	ug/kg	190 J	4600	710	210 J
Fluorene	ug/kg	420 U	390 J	340 U	350 U
Hexachlorobenzene	ug/kg	420 U	430 J	340 U	350 U
Hexachlorobutadiene	ug/kg	420 U	2200 U	340 U	350 U
Hexachlorocyclopentadiene	ug/kg	420 U	2200 U	340 U	350 U
Hexachloroethane	ug/kg	420 U	2200 U	340 U	350 U
Indeno(1,2,3-cd)pyrene	ug/kg	170 J	2800	510	350 U
Isophorone	ug/kg	420 U	2200 U	340 U	350 U
N-nitroso-di-n-propylamine	ug/kg	420 U	2200 U	340 U	350 U
N-nitrosodiphenylamine	ug/kg	420 U	2200 U	340 U	44 J
Naphthalene	ug/kg	420 U	2200 U	340 U	350 U
Nitrobenzene	ug/kg	420 U	2200 U	340 U	350 U
Pentachlorophenol	ug/kg	2100 U	11000 U	1700 U	1800 U
Phenanthrene	ug/kg	110 J	3100	250 J	120 J
Phenol	ug/kg	420 U	2200 U	340 U	350 U
Pyrene	ug/kg	220 J	4000	270 J	160 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1E-01-01	WR-1F-01-01	WR-2A-01-01	WR-2B-01-01
Date sampled		3-Mar-94	3-Mar-94	28-Feb-94	28-Feb-94
Depth		0-14"	0-24"	0-24"	0-10"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	830 U	400 U	430 U	440 U
1,2-dichlorobenzene	ug/kg	830 U	400 U	430 U	440 U
1,3-dichlorobenzene	ug/kg	830 U	400 U	430 U	440 U
1,4-dichlorobenzene	ug/kg	830 U	400 U	430 U	440 U
2,4,5-trichlorophenol	ug/kg	4100 U	2000 U	2200 U	2200 U
2,4,6-trichlorophenol	ug/kg	830 U	400 U	430 U	440 U
2,4-dichlorophenol	ug/kg	830 U	400 U	430 U	440 U
2,4-dimethylphenol	ug/kg	830 U	400 U	430 U	440 U
2,4-dinitrophenol	ug/kg	4100 U	2000 U	2200 U	2200 U
2,4-dinitrotoluene	ug/kg	830 U	400 U	430 U	440 U
2,6-dinitrotoluene	ug/kg	830 U	400 U	430 U	440 U
2-chloronaphthalene	ug/kg	830 U	400 U	430 U	440 U
2-chlorophenol	ug/kg	830 U	400 U	430 U	440 U
2-methylnaphthalene	ug/kg	830 U	66 J	430 U	440 U
2-methylphenol	ug/kg	830 U	400 U	430 U	440 U
2-nitroaniline	ug/kg	4100 U	2000 U	2200 U	2200 U
2-nitrophenol	ug/kg	830 U	400 U	430 U	440 U
3,3'-dichlorobenzidine	ug/kg	1700 U	790 U	860 U	880 U
3-nitroaniline	ug/kg	4100 U	2000 U	2200 U	2200 U
4,6-dinitro-2-methylphenol	ug/kg	4100 U	2000 U	2200 U	2200 U
4-bromophenyl phenyl ether	ug/kg	830 U	400 U	430 U	440 U
4-chloro-3-methylphenol	ug/kg	830 U	400 U	430 U	440 U
4-chloroaniline	ug/kg	830 U	400 U	430 U	440 U
4-chlorophenyl phenyl ether	ug/kg	830 U	400 U	430 U	440 U
4-methylphenol	ug/kg	830 U	400 U	430 U	440 U
4-nitroaniline	ug/kg	4100 U	2000 U	2200 U	2200 U
4-nitrophenol	ug/kg	4100 U	2000 U	2200 U	2200 U
Acenaphthene	ug/kg	830 U	240 J	430 U	440 U
Acenaphthylene	ug/kg	830 U	41 J	430 U	440 U
Anthracene	ug/kg	160 J	670	430 U	440 U
Benzo(a)anthracene	ug/kg	510 J	2300	89 J	440 U
Benzo(a)pyrene	ug/kg	600 J	2000	96 J	440 U
Benzo(b)fluoranthene	ug/kg	570 J	1700	93 J	440 U
Benzo(g,h,i)perylene	ug/kg	500 J	1600	130 J	440 U
Benzo(k)fluoranthene	ug/kg	540 J	1600	86 J	440 U
Benzoic acid	ug/kg	4100 U	2000 U	2200 U	2200 U
Benzyl alcohol	ug/kg	830 U	400 U	430 U	440 U
Bis(2-chloroethoxy)methane	ug/kg	830 U	400 U	430 U	440 U
Bis(2-chloroethyl) ether	ug/kg	830 U	400 U	430 U	440 U
Bis(2-chloroisopropyl) ether	ug/kg	830 U	400 U	430 U	440 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1E-01-01	WR-1F-01-01	WR-2A-01-01	WR-2B-01-01
Date sampled		3-Mar-94	3-Mar-94	28-Feb-94	28-Feb-94
Depth		0-14"	0-24"	0-24"	0-10"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	7900	830	110 JB	63 JB
Butylbenzylphthalate	ug/kg	830 U	400 U	430 U	440 U
Chrysene	ug/kg	590 J	2600	110 J	440 U
Di-n-butylphthalate	ug/kg	420 J	88 J	390 JB	330 JB
Di-n-octylphthalate	ug/kg	830 U	400 U	430 U	440 U
Dibenzo(a,h)anthracene	ug/kg	210 J	500	430 U	440 U
Dibenzofuran	ug/kg	830 U	150 J	430 U	440 U
Diethyl phthalate	ug/kg	830 U	400 U	430 U	440 U
Dimethyl phthalate	ug/kg	830 U	400 U	430 U	440 U
Fluoranthene	ug/kg	860	4500	130 J	440 U
Fluorene	ug/kg	830 U	260 J	430 U	440 U
Hexachlorobenzene	ug/kg	830 U	400 U	430 U	440 U
Hexachlorobutadiene	ug/kg	830 U	400 U	430 U	440 U
Hexachlorocyclopentadiene	ug/kg	830 U	400 U	430 U	440 U
Hexachloroethane	ug/kg	830 U	400 U	430 U	440 U
Indeno(1,2,3-cd)pyrene	ug/kg	410 J	1200	95 J	440 U
Isophorone	ug/kg	830 U	400 U	430 U	440 U
N-nitroso-di-n-propylamine	ug/kg	830 U	400 U	430 U	440 U
N-nitrosodiphenylamine	ug/kg	830 U	400 U	430 U	440 U
Naphthalene	ug/kg	830 U	92 J	430 U	440 U
Nitrobenzene	ug/kg	830 U	400 U	430 U	440 U
Pentachlorophenol	ug/kg	4100 U	2000 U	2200 U	2200 U
Phenanthrene	ug/kg	580 J	2700	72 J	440 U
Phenol	ug/kg	830 U	400 U	430 U	440 U
Pyrene	ug/kg	850	4300	78 J	440 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-2C-01-01	WR-2D-01-01	WR-2E-01-01	WR-2F-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-12"	0-24"	0-2"	0-8"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	15000 U	780 U	410 U	340 U
1,2-dichlorobenzene	ug/kg	15000 U	780 U	410 U	340 U
1,3-dichlorobenzene	ug/kg	15000 U	780 U	410 U	340 U
1,4-dichlorobenzene	ug/kg	15000 U	780 U	410 U	340 U
2,4,5-trichlorophenol	ug/kg	77000 U	3900 U	2100 U	1700 U
2,4,6-trichlorophenol	ug/kg	15000 U	780 U	410 U	340 U
2,4-dichlorophenol	ug/kg	15000 U	780 U	410 U	340 U
2,4-dimethylphenol	ug/kg	15000 U	780 U	410 U	340 U
2,4-dinitrophenol	ug/kg	77000 U	3900 U	2100 U	1700 U
2,4-dinitrotoluene	ug/kg	15000 U	780 U	410 U	340 U
2,6-dinitrotoluene	ug/kg	15000 U	780 U	410 U	340 U
2-chloronaphthalene	ug/kg	15000 U	780 U	410 U	340 U
2-chlorophenol	ug/kg	15000 U	780 U	410 U	340 U
2-methylnaphthalene	ug/kg	3100 J	780 U	72 J	340 U
2-methylphenol	ug/kg	15000 U	780 U	410 U	340 U
2-nitroaniline	ug/kg	77000 U	3900 U	2100 U	1700 U
2-nitrophenol	ug/kg	15000 U	780 U	410 U	340 U
3,3'-dichlorobenzidine	ug/kg	31000 U	1600 U	820 U	690 U
3-nitroaniline	ug/kg	77000 U	3900 U	2100 U	1700 U
4,6-dinitro-2-methylphenol	ug/kg	77000 U	3900 U	2100 U	1700 U
4-bromophenyl phenyl ether	ug/kg	15000 U	780 U	410 U	340 U
4-chloro-3-methylphenol	ug/kg	15000 U	780 U	410 U	340 U
4-chloroaniline	ug/kg	15000 U	780 U	410 U	340 U
4-chlorophenyl phenyl ether	ug/kg	15000 U	780 U	410 U	340 U
4-methylphenol	ug/kg	15000 U	780 U	410 U	340 U
4-nitroaniline	ug/kg	77000 U	3900 U	2100 U	1700 U
4-nitrophenol	ug/kg	77000 U	3900 U	2100 U	1700 U
Acenaphthene	ug/kg	9800 J	780 U	190 J	67 J
Acenaphthylene	ug/kg	15000 U	780 U	410 U	340 U
Anthracene	ug/kg	19000	210 J	440	160 J
Benzo(a)anthracene	ug/kg	44000	640 J	2000	760
Benzo(a)pyrene	ug/kg	43000	450 J	1900	830
Benzo(b)fluoranthene	ug/kg	42000	570 J	1400	810
Benzo(g,h,i)perylene	ug/kg	31000	470 J	1100	700
Benzo(k)fluoranthene	ug/kg	41000	610 J	1300	840
Benzoic acid	ug/kg	77000 U	3900 U	2100 U	1700 U
Benzyl alcohol	ug/kg	15000 U	780 U	410 U	340 U
Bis(2-chloroethoxy)methane	ug/kg	15000 U	780 U	410 U	340 U
Bis(2-chloroethyl) ether	ug/kg	15000 U	780 U	410 U	340 U
Bis(2-chloroisopropyl) ether	ug/kg	15000 U	780 U	410 U	340 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-2C-01-01	WR-2D-01-01	WR-2E-01-01	WR-2F-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-12"	0-24"	0-2"	0-8"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	15000 U	12000 B	2200 B	230 JB
Butylbenzylphthalate	ug/kg	15000 U	730 J	1100	340 U
Chrysene	ug/kg	53000	730 J	2200	860
Di-n-butylphthalate	ug/kg	15000 U	1300 B	790 B	2000 B
Di-n-octylphthalate	ug/kg	15000 U	780 U	410 U	390
Dibenzo(a,h)anthracene	ug/kg	15000 U	310 J	570	340 J
Dibenzofuran	ug/kg	8100 J	780 U	110 J	38 J
Diethyl phthalate	ug/kg	15000 U	780 U	410 U	340 U
Dimethyl phthalate	ug/kg	15000 U	780 U	410 U	94 J
Fluoranthene	ug/kg	130000	1200	2600	1200
Fluorene	ug/kg	14000 J	780 U	150 J	63 J
Hexachlorobenzene	ug/kg	15000 U	780 U	410 U	340 U
Hexachlorobutadiene	ug/kg	15000 U	780 U	410 U	340 U
Hexachlorocyclopentadiene	ug/kg	15000 U	780 U	410 U	340 U
Hexachloroethane	ug/kg	15000 U	780 U	410 U	340 U
Indeno(1,2,3-cd)pyrene	ug/kg	28000	670 J	1600	720
Isophorone	ug/kg	15000 U	780 U	410 U	340 U
N-nitroso-di-n-propylamine	ug/kg	15000 U	780 U	410 U	340 U
N-nitrosodiphenylamine	ug/kg	15000 U	780 U	410 U	340 U
Naphthalene	ug/kg	10000 J	780 U	82 J	38 J
Nitrobenzene	ug/kg	15000 U	780 U	410 U	340 U
Pentachlorophenol	ug/kg	77000 U	3900 U	2100 U	1700 U
Phenanthrene	ug/kg	120000	520 J	1900	620
Phenol	ug/kg	15000 U	780 U	410 U	340 U
Pyrene	ug/kg	99000	1300	2400	1100

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3A-01-01	WR-3B-01-01	WR-3C-01-01	WR-3C-01-R1
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-24"	0-24"	0-4"	RINSATE
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
2,4,5-trichlorophenol	ug/kg	2300 U	2000 U	2000 U	55 U
2,4,6-trichlorophenol	ug/kg	450 U	400 U	410 U	11 U
2,4-dinitrophenol	ug/kg	2300 U	2000 U	2000 U	55 U
2,4-dinitrotoluene	ug/kg	450 U	400 U	410 U	11 U
2,6-dinitrotoluene	ug/kg	450 U	400 U	410 U	11 U
2-chloronaphthalene	ug/kg	450 U	400 U	410 U	11 U
2-nitroaniline	ug/kg	2300 U	2000 U	2000 U	55 U
3,3'-dichlorobenzidine	ug/kg	900 U	790 U	810 U	22 U
3-nitroaniline	ug/kg	2300 U	2000 U	2000 U	55 U
4,6-dinitro-2-methylphenol	ug/kg	2300 U	2000 U	2000 U	55 U
4-bromophenyl phenyl ether	ug/kg	450 U	400 U	410 U	11 U
4-chlorophenyl phenyl ether	ug/kg	450 U	400 U	410 U	11 U
4-nitroaniline	ug/kg	2300 U	2000 U	2000 U	55 U
4-nitrophenol	ug/kg	2300 U	2000 U	2000 U	55 U
Acenaphthene	ug/kg	450 U	400 U	52 J	11 U
Acenaphthylene	ug/kg	450 U	400 U	280 J	11 U
Anthracene	ug/kg	450 U	62 J	270 J	11 U
Benzo(a)anthracene	ug/kg	450 U	760	1500	11 U
Benzo(a)pyrene	ug/kg	450 U	700	1400	11 U
Benzo(b)fluoranthene	ug/kg	450 U	820	1800	11 U
Benzo(g,h,i)perylene	ug/kg	450 U	610	750	11 U
Benzo(k)fluoranthene	ug/kg	450 U	790	2000	11 U
Bis(2-ethylhexyl)phthalate	ug/kg	450 U	400 U	520 B	2 JB
Butylbenzylphthalate	ug/kg	450 U	400 U	410 U	11 U
Chrysene	ug/kg	450 U	830	1900	11 U
Di-n-butylphthalate	ug/kg	390 JB	500 B	550 B	1 JB
Di-n-octylphthalate	ug/kg	450 U	400 U	410 U	11 U
Dibenzo(a,h)anthracene	ug/kg	450 U	240 J	340 J	11 U
Dibenzofuran	ug/kg	450 U	400 U	44 J	11 U
Diethyl phthalate	ug/kg	450 U	400 U	410 U	11 U
Dimethyl phthalate	ug/kg	450 U	400 U	410 U	11 U
Fluoranthene	ug/kg	450 U	1000	2600	11 U
Fluorene	ug/kg	450 U	400 U	74 J	11 U
Hexachlorobenzene	ug/kg	450 U	400 U	99 J	11 U
Indeno(1,2,3-cd)pyrene	ug/kg	450 U	560	770	11 U
N-nitrosodiphenylamine	ug/kg	450 U	400 U	410 U	11 U
Pentachlorophenol	ug/kg	2300 U	2000 U	2000 U	55 U
Phenanthrene	ug/kg	450 U	260 J	670	11 U
Pyrene	ug/kg	450 U	1400	1400	11 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3D-01-01	WR-3E-01-01	WR-3E-01-D1	WR-3F-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-3"	0-24"	0-24"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	NA	440 U	440 U	360 U
1,2-dichlorobenzene	ug/kg	NA	440 U	440 U	360 U
1,3-dichlorobenzene	ug/kg	NA	440 U	440 U	360 U
1,4-dichlorobenzene	ug/kg	NA	440 U	440 U	360 U
2,4,5-trichlorophenol	ug/kg	1800 U	2200 U	2200 U	1800 U
2,4,6-trichlorophenol	ug/kg	360 U	440 U	440 U	360 U
2,4-dichlorophenol	ug/kg	NA	440 U	440 U	360 U
2,4-dimethylphenol	ug/kg	NA	440 U	440 U	360 U
2,4-dinitrophenol	ug/kg	1800 U	2200 U	2200 U	1800 U
2,4-dinitrotoluene	ug/kg	360 U	440 U	440 U	360 U
2,6-dinitrotoluene	ug/kg	360 U	440 U	440 U	360 U
2-chloronaphthalene	ug/kg	360 U	440 U	440 U	360 U
2-chlorophenol	ug/kg	NA	440 U	440 U	360 U
2-methylnaphthalene	ug/kg	NA	440 U	440 U	58 J
2-methylphenol	ug/kg	NA	440 U	440 U	360 U
2-nitroaniline	ug/kg	1800 U	2200 U	2200 U	1800 U
2-nitrophenol	ug/kg	NA	440 U	440 U	360 U
3,3'-dichlorobenzidine	ug/kg	710 U	870 U	880 U	730 U
3-nitroaniline	ug/kg	1800 U	2200 U	2200 U	1800 U
4,6-dinitro-2-methylphenol	ug/kg	1800 U	2200 U	2200 U	1800 U
4-bromophenyl phenyl ether	ug/kg	360 U	440 U	440 U	360 U
4-chloro-3-methylphenol	ug/kg	NA	440 U	440 U	360 U
4-chloroaniline	ug/kg	NA	440 U	440 U	360 U
4-chlorophenyl phenyl ether	ug/kg	360 U	440 U	440 U	360 U
4-methylphenol	ug/kg	NA	440 U	440 U	360 U
4-nitroaniline	ug/kg	1800 U	2200 U	2200 U	1800 U
4-nitrophenol	ug/kg	1800 U	2200 U	2200 U	1800 U
Acenaphthene	ug/kg	42 J	440 U	440 U	360 U
Acenaphthylene	ug/kg	140 J	440 U	440 U	150 J
Anthracene	ug/kg	150 J	440 U	440 U	120 J
Benzo(a)anthracene	ug/kg	750	440 U	440 U	350 J
Benzo(a)pyrene	ug/kg	920	440 U	440 U	530
Benzo(b)fluoranthene	ug/kg	1100	440 U	440 U	780
Benzo(g,h,i)perylene	ug/kg	320 J	440 U	440 U	360 U
Benzo(k)fluoranthene	ug/kg	1200	440 U	440 U	1200
Benzoic acid	ug/kg	NA	2200 U	2200 U	1800 U
Benzyl alcohol	ug/kg	NA	440 U	440 U	360 U
Bis(2-chloroethoxy)methane	ug/kg	NA	440 U	440 U	360 U
Bis(2-chloroethyl) ether	ug/kg	NA	440 U	440 U	360 U
Bis(2-chloroisopropyl) ether	ug/kg	NA	440 U	440 U	360 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3D-01-01	WR-3E-01-01	WR-3E-01-D1	WR-3F-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-3"	0-24"	0-24"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	650 B	100 JB	56 JB	1100 B
Butylbenzylphthalate	ug/kg	360 U	440 U	440 U	360 U
Chrysene	ug/kg	930	440 U	440 U	540
Di-n-butylphthalate	ug/kg	360 U	170 JB	240 JB	650 B
Di-n-octylphthalate	ug/kg	360 U	440 U	440 U	360 U
Dibenzo(a,h)anthracene	ug/kg	130 J	440 U	440 U	360 U
Dibenzofuran	ug/kg	36 J	440 U	440 U	360 U
Diethyl phthalate	ug/kg	360 U	440 U	440 U	360 U
Dimethyl phthalate	ug/kg	360 U	440 U	440 U	360 U
Fluoranthene	ug/kg	1300	440 U	440 U	690
Fluorene	ug/kg	65 J	440 U	440 U	360 U
Hexachlorobenzene	ug/kg	360 U	440 U	440 U	360 U
Hexachlorobutadiene	ug/kg	NA	440 U	440 U	360 U
Hexachlorocyclopentadiene	ug/kg	NA	440 U	440 U	360 U
Hexachloroethane	ug/kg	NA	440 U	440 U	360 U
Indeno(1,2,3-cd)pyrene	ug/kg	330 J	440 U	440 U	360 U
Isophorone	ug/kg	NA	440 U	440 U	360 U
N-nitroso-di-n-propylamine	ug/kg	NA	440 U	440 U	360 U
N-nitrosodiphenylamine	ug/kg	360 U	440 U	440 U	360 U
Naphthalene	ug/kg	NA	440 U	440 U	360 U
Nitrobenzene	ug/kg	NA	440 U	440 U	360 U
Pentachlorophenol	ug/kg	1800 U	2200 U	2200 U	1800 U
Phenanthrene	ug/kg	520	440 U	440 U	170 J
Phenol	ug/kg	NA	440 U	440 U	360 U
Pyrene	ug/kg	480	440 U	440 U	340

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4A-01-01	WR-4B-01-01	WR-4C-01-D1	WR-4D-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-4"	0-4"	0-5"	0-12"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
2-methylnaphthalene	ug/kg	NA	NA	84 J	NA
3,3'-dichlorobenzidine	ug/kg	NA	NA	NA	540 J
Acenaphthene	ug/kg	NA	180 J	NA	NA
Anthracene	ug/kg	170 J	350 J	210 J	220 J
Benzo(a)anthracene	ug/kg	430 J	1300	950	1200 J
Benzo(a)pyrene	ug/kg	460 J	1000	930	430 J
Benzo(b)fluoranthene	ug/kg	390 J	1200	920	1400 J
Benzo(g,h,i)perylene	ug/kg	440 J	1000	900	1700 J
Benzo(k)fluoranthene	ug/kg	530 J	1100	760 J	880 J
Bis(2-ethylhexyl)phthalate	ug/kg	180 JB	350 JB	970 B	19000 B
Chrysene	ug/kg	510 J	1500	1000	1400 J
Dibenzo(a,h)anthracene	ug/kg	150 J	480 J	350 J	460 J
Fluoranthene	ug/kg	740 J	2100	1700	1700 J
Fluorene	ug/kg	NA	180 J	NA	NA
Indeno(1,2,3-cd)pyrene	ug/kg	390 J	940	830	1500 J
Phenanthrene	ug/kg	440 J	1400	800	860 J
Pyrene	ug/kg	720 J	NA	1500	1900 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4E-01-01	WR-4F-01-01	WR-5A-01-01	WR-5B-01-01
Date sampled		25-Feb-94	25-Feb-94	24-Feb-94	24-Feb-94
Depth		0-8"	0-10"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	NA	NA	330 U	720 U
1,2-dichlorobenzene	ug/kg	NA	NA	330 U	720 U
1,3-dichlorobenzene	ug/kg	NA	NA	330 U	720 U
1,4-dichlorobenzene	ug/kg	NA	NA	330 U	720 U
2,4,5-trichlorophenol	ug/kg	NA	NA	1600 U	3600 U
2,4,6-trichlorophenol	ug/kg	NA	NA	330 U	720 U
2,4-dichlorophenol	ug/kg	NA	NA	330 U	720 U
2,4-dimethylphenol	ug/kg	NA	NA	330 U	720 U
2,4-dinitrophenol	ug/kg	NA	NA	1600 U	3600 U
2,4-dinitrotoluene	ug/kg	NA	NA	330 U	720 U
2,6-dinitrotoluene	ug/kg	NA	NA	330 U	720 U
2-chloronaphthalene	ug/kg	NA	NA	330 U	720 U
2-chlorophenol	ug/kg	NA	NA	330 U	720 U
2-methylnaphthalene	ug/kg	NA	NA	42 J	170 J
2-methylphenol	ug/kg	NA	NA	330 U	720 U
2-nitroaniline	ug/kg	NA	NA	1600 U	3600 U
2-nitrophenol	ug/kg	NA	NA	330 U	720 U
3,3'-dichlorobenzidine	ug/kg	NA	NA	660 U	1400 U
3-nitroaniline	ug/kg	NA	NA	1600 U	3600 U
4,6-dinitro-2-methylphenol	ug/kg	NA	NA	1600 U	3600 U
4-bromophenyl phenyl ether	ug/kg	NA	NA	330 U	720 U
4-chloro-3-methylphenol	ug/kg	NA	NA	330 U	720 U
4-chloroaniline	ug/kg	NA	NA	330 U	720 U
4-chlorophenyl phenyl ether	ug/kg	NA	NA	330 U	720 U
4-methylphenol	ug/kg	NA	NA	330 U	720 U
4-nitroaniline	ug/kg	NA	NA	1600 U	3600 U
4-nitrophenol	ug/kg	NA	NA	1600 U	3600 U
Acenaphthene	ug/kg	NA	NA	330 U	720 U
Acenaphthylene	ug/kg	NA	NA	49 J	120 J
Anthracene	ug/kg	84 J	NA	83 J	97 J
Benzo(a)anthracene	ug/kg	620 J	540 J	380	610 J
Benzo(a)pyrene	ug/kg	510 J	410 J	450	810
Benzo(b)fluoranthene	ug/kg	510 J	440 J	540	1000
Benzo(g,h,i)perylene	ug/kg	NA	NA	380	1500
Benzo(k)fluoranthene	ug/kg	630 J	400 J	400	720
Benzoic acid	ug/kg	NA	NA	1600 U	3600 U
Benzyl alcohol	ug/kg	NA	NA	330 U	720 U
Bis(2-chloroethoxy)methane	ug/kg	NA	NA	330 U	720 U
Bis(2-chloroethyl) ether	ug/kg	NA	NA	330 U	720 U
Bis(2-chloroisopropyl) ether	ug/kg	NA	NA	330 U	720 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4E-01-01	WR-4F-01-01	WR-5A-01-01	WR-5B-01-01
Date sampled		25-Feb-94	25-Feb-94	24-Feb-94	24-Feb-94
Depth		0-8"	0-10"	0-6"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	190 JB	NA	210 JB	700 JB
Butylbenzylphthalate	ug/kg	NA	NA	330 U	720 U
Chrysene	ug/kg	650 J	430 J	410	700 J
Di-n-butylphthalate	ug/kg	NA	NA	300 JB	370 JB
Di-n-octylphthalate	ug/kg	NA	NA	330 U	110 J
Dibenzo(a,h)anthracene	ug/kg	NA	NA	240 J	580 J
Dibenzofuran	ug/kg	NA	NA	330 U	720 U
Diethyl phthalate	ug/kg	NA	NA	330 U	720 U
Dimethyl phthalate	ug/kg	NA	NA	330 U	4800
Fluoranthene	ug/kg	970	1100 J	720	610 J
Fluorene	ug/kg	NA	NA	330 U	720 U
Hexachlorobenzene	ug/kg	NA	NA	330 U	720 U
Hexachlorobutadiene	ug/kg	NA	NA	330 U	720 U
Hexachlorocyclopentadiene	ug/kg	NA	NA	330 U	720 U
Hexachloroethane	ug/kg	NA	NA	330 U	720 U
Indeno(1.2,3-cd)pyrene	ug/kg	NA	NA	360	1100
Isophorone	ug/kg	NA	NA	330 U	720 U
N-nitroso-di-n-propylamine	ug/kg	NA	NA	330 U	720 U
N-nitrosodiphenylamine	ug/kg	NA	NA	330 U	720 U
Naphthalene	ug/kg	NA	NA	330 U	720 U
Nitrobenzene	ug/kg	NA	NA	330 U	720 U
Pentachlorophenol	ug/kg	NA	NA	1600 U	3600 U
Phenanthrene	ug/kg	400 J	790 J	320 J	300 J
Phenol	ug/kg	NA	NA	330 U	720 U
Pyrene	ug/kg	870	880 J	590	690 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5B-01-R1	WR-5C-01-01	WR-5D-01-01	WR-5E-01-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	24-Feb-94
Depth		RINSATE	0-3"	0-4"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/L	10 U	360 U	1800 U	1800 U
1,2-dichlorobenzene	ug/L	10 U	360 U	1800 U	1800 U
1,3-dichlorobenzene	ug/L	10 U	360 U	1800 U	1800 U
1,4-dichlorobenzene	ug/L	10 U	360 U	1800 U	1800 U
2,4,5-trichlorophenol	ug/L	50 U	1800 U	9000 U	8800 U
2,4,6-trichlorophenol	ug/L	10 U	360 U	1800 U	1800 U
2,4-dichlorophenol	ug/L	10 U	360 U	1800 U	1800 U
2,4-dimethylphenol	ug/L	10 U	360 U	1800 U	1800 U
2,4-dinitrophenol	ug/L	50 U	1800 U	9000 U	8800 U
2,4-dinitrotoluene	ug/L	10 U	360 U	1800 U	1800 U
2,6-dinitrotoluene	ug/L	10 U	360 U	1800 U	1800 U
2-chloronaphthalene	ug/L	10 U	360 U	1800 U	1800 U
2-chlorophenol	ug/L	10 U	360 U	1800 U	1800 U
2-methylnaphthalene	ug/L	10 U	360 U	1800 U	1800 U
2-methylphenol	ug/L	10 U	360 U	1800 U	1800 U
2-nitroaniline	ug/L	50 U	1800 U	9000 U	8800 U
2-nitrophenol	ug/L	10 U	360 U	1800 U	1800 U
3,3'-dichlorobenzidine	ug/L	20 U	720 U	3600 U	3500 U
3-nitroaniline	ug/L	50 U	1800 U	9000 U	8800 U
4,6-dinitro-2-methylphenol	ug/L	50 U	1800 U	9000 U	8800 U
4-bromophenyl phenyl ether	ug/L	10 U	360 U	1800 U	1800 U
4-chloro-3-methylphenol	ug/L	10 U	360 U	1800 U	1800 U
4-chloroaniline	ug/L	10 U	360 U	1800 U	1800 U
4-chlorophenyl phenyl ether	ug/L	10 U	360 U	1800 U	1800 U
4-methylphenol	ug/L	10 U	360 U	1800 U	1800 U
4-nitroaniline	ug/L	50 U	1800 U	9000 U	8800 U
4-nitrophenol	ug/L	50 U	1800 U	9000 U	8800 U
Acenaphthene	ug/L	10 U	360 U	1800 U	1800 U
Acenaphthylene	ug/L	10 U	360 U	1800 U	1800 U
Anthracene	ug/L	10 U	46 J	1800 U	1800 U
Benzo(a)anthracene	ug/L	10 U	170 J	590 J	450 J
Benzo(a)pyrene	ug/L	10 U	210 J	480 J	500 J
Benzo(b)fluoranthene	ug/L	10 U	310 J	770 J	760 J
Benzo(g,h,i)perylene	ug/L	10 U	220 J	800 J	1800 U
Benzo(k)fluoranthene	ug/L	10 U	240 J	570 J	510 J
Benzoic acid	ug/L	50 U	1800 U	9000 U	8800 U
Benzyl alcohol	ug/L	10 U	360 U	1800 U	1800 U
Bis(2-chloroethoxy)methane	ug/L	10 U	360 U	1800 U	1800 U
Bis(2-chloroethyl) ether	ug/L	10 U	360 U	1800 U	1800 U
Bis(2-chloroisopropyl) ether	ug/L	10 U	360 U	1800 U	1800 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5B-01-R1	WR-5C-01-01	WR-5D-01-01	WR-5E-01-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	24-Feb-94
Depth		RINSATE	0-3"	0-4"	0-6"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/L	10 U	340 JB	1800 B	310 JB
Butylbenzylphthalate	ug/L	10 U	360 U	1800 U	1800 U
Chrysene	ug/L	10 U	220 J	760 J	630 J
Di-n-butylphthalate	ug/L	10 U	270 JB	440 JB	420 JB
Di-n-octylphthalate	ug/L	10 U	360 U	1800 U	1800 U
Dibenzo(a,h)anthracene	ug/L	10 U	100 J	240 J	1800 U
Dibenzofuran	ug/L	10 U	360 U	1800 U	1800 U
Diethyl phthalate	ug/L	10 U	360 U	1800 U	1800 U
Dimethyl phthalate	ug/L	10 U	360 U	1800 U	1800 U
Fluoranthene	ug/L	10 U	270 J	770 J	610 J
Fluorene	ug/L	10 U	360 U	1800 U	1800 U
Hexachlorobenzene	ug/L	10 U	360 U	1800 U	1800 U
Hexachlorobutadiene	ug/L	10 U	360 U	1800 U	1800 U
Hexachlorocyclopentadiene	ug/L	10 U	360 U	1800 U	1800 U
Hexachloroethane	ug/L	10 U	360 U	1800 U	1800 U
Indeno(1,2,3-cd)pyrene	ug/L	10 U	210 J	590 J	1800 U
Isophorone	ug/L	10 U	360 U	1800 U	1800 U
N-nitroso-di-n-propylamine	ug/L	10 U	360 U	1800 U	1800 U
N-nitrosodiphenylamine	ug/L	10 U	360 U	1800 U	1800 U
Naphthalene	ug/L	10 U	360 U	1800 U	1800 U
Nitrobenzene	ug/L	10 U	360 U	1800 U	1800 U
Pentachlorophenol	ug/L	50 U	1800 U	9000 U	8800 U
Phenanthrene	ug/L	10 U	110 J	430 J	260 J
Phenol	ug/L	10 U	360 U	1800 U	1800 U
Pyrene	ug/L	10 U	220 J	910 J	570 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5F-01-01	WR-AA-01-01	WR-BB-01-01	WR-CC-01-01
Date sampled		24-Feb-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-8"	0-8"	0-4"	0-2"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	350 U	410 U	420 U	1700 U
1,2-dichlorobenzene	ug/kg	350 U	410 U	420 U	1700 U
1,3-dichlorobenzene	ug/kg	350 U	410 U	420 U	1700 U
1,4-dichlorobenzene	ug/kg	350 U	410 U	420 U	1700 U
2,4,5-trichlorophenol	ug/kg	1800 U	2100 U	2100 U	8400 U
2,4,6-trichlorophenol	ug/kg	350 U	410 U	420 U	1700 U
2,4-dichlorophenol	ug/kg	350 U	410 U	420 U	1700 U
2,4-dimethylphenol	ug/kg	350 U	410 U	420 U	1700 U
2,4-dinitrophenol	ug/kg	1800 U	2100 U	2100 U	8400 U
2,4-dinitrotoluene	ug/kg	350 U	410 U	420 U	1700 U
2,6-dinitrotoluene	ug/kg	350 U	410 U	420 U	1700 U
2-chloronaphthalene	ug/kg	350 U	410 U	420 U	1700 U
2-chlorophenol	ug/kg	350 U	410 U	420 U	1700 U
2-methylnaphthalene	ug/kg	350 U	410 U	420 U	1700 U
2-methylphenol	ug/kg	350 U	410 U	420 U	1700 U
2-nitroaniline	ug/kg	1800 U	2100 U	2100 U	8400 U
2-nitrophenol	ug/kg	350 U	410 U	420 U	1700 U
3,3'-dichlorobenzidine	ug/kg	700 U	830 U	830 U	3400 U
3-nitroaniline	ug/kg	1800 U	2100 U	2100 U	8400 U
4,6-dinitro-2-methylphenol	ug/kg	1800 U	2100 U	2100 U	8400 U
4-bromophenyl phenyl ether	ug/kg	350 U	410 U	420 U	1700 U
4-chloro-3-methylphenol	ug/kg	350 U	410 U	420 U	1700 U
4-chloroaniline	ug/kg	350 U	410 U	420 U	1700 U
4-chlorophenyl phenyl ether	ug/kg	350 U	410 U	420 U	1700 U
4-methylphenol	ug/kg	350 U	410 U	420 U	1700 U
4-nitroaniline	ug/kg	1800 U	2100 U	2100 U	8400 U
4-nitrophenol	ug/kg	1800 U	2100 U	2100 U	8400 U
Acenaphthene	ug/kg	350 U	410 U	200 J	1700 U
Acenaphthylene	ug/kg	350 U	410 U	420 U	1700 U
Anthracene	ug/kg	72 J	59 J	590	370 J
Benzo(a)anthracene	ug/kg	310 J	180 J	1600	2100
Benzo(a)pyrene	ug/kg	360	190 J	1800	1400 J
Benzo(b)fluoranthene	ug/kg	410	190 J	1700	1500 J
Benzo(g,h,i)perylene	ug/kg	350	150 J	1500	1600 J
Benzo(k)fluoranthene	ug/kg	370	160 J	1500	1500 J
Benzoic acid	ug/kg	1800 U	2100 U	2100 U	8400 U
Benzyl alcohol	ug/kg	350 U	410 U	420 U	1700 U
Bis(2-chloroethoxy)methane	ug/kg	350 U	410 U	420 U	1700 U
Bis(2-chloroethyl) ether	ug/kg	350 U	410 U	420 U	1700 U
Bis(2-chloroisopropyl) ether	ug/kg	350 U	410 U	420 U	1700 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5F-01-01	WR-AA-01-01	WR-BB-01-01	WR-CC-01-01
Date sampled		24-Feb-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-8"	0-8"	0-4"	0-2"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	140 JB	1600	1200	7500
Butylbenzylphthalate	ug/kg	350 U	410 U	420 U	1700 U
Chrysene	ug/kg	390	210 J	1800	1600 J
Di-n-butylphthalate	ug/kg	420 B	160 J	81 J	420 J
Di-n-octylphthalate	ug/kg	350 U	410 U	420 U	1700 U
Dibenzo(a,h)anthracene	ug/kg	170 J	53 J	510	520 J
Dibenzofuran	ug/kg	350 U	410 U	98 J	1700 U
Diethyl phthalate	ug/kg	350 U	410 U	420 U	1700 U
Dimethyl phthalate	ug/kg	350 U	410 U	420 U	1700 U
Fluoranthene	ug/kg	430	380 J	3500	6600
Fluorene	ug/kg	350 U	410 U	170 J	1700 U
Hexachlorobenzene	ug/kg	350 U	410 U	420 U	1700 U
Hexachlorobutadiene	ug/kg	350 U	410 U	420 U	1700 U
Hexachlorocyclopentadiene	ug/kg	350 U	410 U	420 U	1700 U
Hexachloroethane	ug/kg	350 U	410 U	420 U	1700 U
Indeno(1,2,3-cd)pyrene	ug/kg	310 J	130 J	1300	1400 J
Isophorone	ug/kg	350 U	410 U	420 U	1700 U
N-nitroso-di-n-propylamine	ug/kg	350 U	410 U	420 U	1700 U
N-nitrosodiphenylamine	ug/kg	350 U	410 U	420 U	1700 U
Naphthalene	ug/kg	350 U	410 U	59 J	1700 U
Nitrobenzene	ug/kg	350 U	410 U	420 U	1700 U
Pentachlorophenol	ug/kg	1800 U	2100 U	2100 U	8400 U
Phenanthrene	ug/kg	150 J	250 J	2100	3500
Phenol	ug/kg	350 U	410 U	420 U	1700 U
Pyrene	ug/kg	390	350 J	3100	5000

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-DD-01-01	WR-EE-01-01	WR-FF-01-01	WR-GG-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-2"	0-3"	0-12"	0-5"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	390 U	3500 U	460 U	400 U
1,2-dichlorobenzene	ug/kg	390 U	3500 U	460 U	400 U
1,3-dichlorobenzene	ug/kg	390 U	3500 U	460 U	400 U
1,4-dichlorobenzene	ug/kg	390 U	3500 U	460 U	400 U
2,4,5-trichlorophenol	ug/kg	1900 U	18000 U	2300 U	2000 U
2,4,6-trichlorophenol	ug/kg	390 U	3500 U	460 U	400 U
2,4-dichlorophenol	ug/kg	390 U	3500 U	460 U	400 U
2,4-dimethylphenol	ug/kg	390 U	3500 U	460 U	400 U
2,4-dinitrophenol	ug/kg	1900 U	18000 U	2300 U	2000 U
2,4-dinitrotoluene	ug/kg	390 U	3500 U	460 U	400 U
2,6-dinitrotoluene	ug/kg	390 U	3500 U	460 U	400 U
2-chloronaphthalene	ug/kg	390 U	3500 U	460 U	400 U
2-chlorophenol	ug/kg	390 U	3500 U	460 U	400 U
2-methylnaphthalene	ug/kg	150 J	3500 U	460 U	420
2-methylphenol	ug/kg	390 U	3500 U	460 U	400 U
2-nitroaniline	ug/kg	1900 U	18000 U	2300 U	2000 U
2-nitrophenol	ug/kg	390 U	3500 U	460 U	400 U
3,3'-dichlorobenzidine	ug/kg	780 U	7100 U	920 U	790 U
3-nitroaniline	ug/kg	1900 U	18000 U	2300 U	2000 U
4,6-dinitro-2-methylphenol	ug/kg	1900 U	18000 U	2300 U	2000 U
4-bromophenyl phenyl ether	ug/kg	390 U	3500 U	460 U	400 U
4-chloro-3-methylphenol	ug/kg	390 U	3500 U	460 U	400 U
4-chloroaniline	ug/kg	390 U	3500 U	460 U	400 U
4-chlorophenyl phenyl ether	ug/kg	390 U	3500 U	460 U	400 U
4-methylphenol	ug/kg	390 U	3500 U	460 U	400 U
4-nitroaniline	ug/kg	1900 U	18000 U	2300 U	2000 U
4-nitrophenol	ug/kg	1900 U	18000 U	2300 U	2000 U
Acenaphthene	ug/kg	390 U	3500 U	460 U	400 U
Acenaphthylene	ug/kg	390 U	3500 U	460 U	400 U
Anthracene	ug/kg	56 J	3500 U	130 J	100 J
Benzo(a)anthracene	ug/kg	470	1100 J	460	290 J
Benzo(a)pyrene	ug/kg	790	860 J	480	310 J
Benzo(b)fluoranthene	ug/kg	640	3500 U	550	370 J
Benzo(g,h,i)perylene	ug/kg	660	3500 U	570	320 J
Benzo(k)fluoranthene	ug/kg	500	1500 J	460	310 J
Benzoic acid	ug/kg	1900 U	18000 U	2300 U	2000 U
Benzyl alcohol	ug/kg	390 U	3500 U	460 U	400 U
Bis(2-chloroethoxy)methane	ug/kg	390 U	3500 U	460 U	400 U
Bis(2-chloroethyl) ether	ug/kg	390 U	3500 U	460 U	400 U
Bis(2-chloroisopropyl) ether	ug/kg	390 U	3500 U	460 U	400 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-DD-01-01	WR-EE-01-01	WR-FF-01-01	WR-GG-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-2"	0-3"	0-12"	0-5"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	3700	11000	890	1200
Butylbenzylphthalate	ug/kg	390 U	3500 U	670	400 U
Chrysene	ug/kg	380 J	970 J	550	380 J
Di-n-butylphthalate	ug/kg	330 J	580 J	360 J	2600
Di-n-octylphthalate	ug/kg	390 U	3500 U	460 U	400 U
Dibenzo(a,h)anthracene	ug/kg	140 J	880 J	150 J	98 J
Dibenzofuran	ug/kg	390 U	3500 U	460 U	82 J
Diethyl phthalate	ug/kg	390 U	3500 U	460 U	400 U
Dimethyl phthalate	ug/kg	390 U	610 J	460 U	400 U
Fluoranthene	ug/kg	650	870 J	930	550
Fluorene	ug/kg	390 U	3500 U	460 U	400 U
Hexachlorobenzene	ug/kg	390 U	3500 U	460 U	400 U
Hexachlorobutadiene	ug/kg	390 U	3500 U	460 U	400 U
Hexachlorocyclopentadiene	ug/kg	390 U	3500 U	460 U	400 U
Hexachloroethane	ug/kg	390 U	3500 U	460 U	400 U
Indeno(1,2,3-cd)pyrene	ug/kg	500	1500 J	480	280 J
Isophorone	ug/kg	390 U	3500 U	460 U	400 U
N-nitroso-di-n-propylamine	ug/kg	390 U	3500 U	460 U	400 U
N-nitrosodiphenylamine	ug/kg	390 U	3500 U	460 U	400 U
Naphthalene	ug/kg	41 J	3500 U	460 U	210 J
Nitrobenzene	ug/kg	390 U	3500 U	460 U	400 U
Pentachlorophenol	ug/kg	1900 U	18000 U	2300 U	2000 U
Phenanthrene	ug/kg	170 J	680 J	410 J	430
Phenol	ug/kg	390 U	3500 U	460 U	400 U
Pyrene	ug/kg	1300	1700 J	920	520

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-GG-01-D1	WR-GG-01-R1	WR-HH-01-01	WR-II-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-5"	RINSATE	0-7"	0-3"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
1,2,4-trichlorobenzene	ug/kg	410 U	12 U	1800 U	350 U
1,2-dichlorobenzene	ug/kg	410 U	12 U	1800 U	350 U
1,3-dichlorobenzene	ug/kg	410 U	12 U	1800 U	350 U
1,4-dichlorobenzene	ug/kg	410 U	12 U	1800 U	350 U
2,4,5-trichlorophenol	ug/kg	2000 U	60 U	9100 U	1800 U
2,4,6-trichlorophenol	ug/kg	410 U	12 U	1800 U	350 U
2,4-dichlorophenol	ug/kg	410 U	12 U	1800 U	350 U
2,4-dimethylphenol	ug/kg	410 U	12 U	1800 U	350 U
2,4-dinitrophenol	ug/kg	2000 U	60 U	9100 U	1800 U
2,4-dinitrotoluene	ug/kg	410 U	12 U	1800 U	350 U
2,6-dinitrotoluene	ug/kg	410 U	12 U	1800 U	350 U
2-chloronaphthalene	ug/kg	410 U	12 U	1800 U	350 U
2-chlorophenol	ug/kg	410 U	12 U	1800 U	350 U
2-methylnaphthalene	ug/kg	500	12 U	400 J	54 J
2-methylphenol	ug/kg	410 U	12 U	1800 U	350 U
2-nitroaniline	ug/kg	2000 U	60 U	9100 U	1800 U
2-nitrophenol	ug/kg	410 U	12 U	1800 U	350 U
3,3'-dichlorobenzidine	ug/kg	820 U	24 U	3600 U	700 U
3-nitroaniline	ug/kg	2000 U	60 U	9100 U	1800 U
4,6-dinitro-2-methylphenol	ug/kg	2000 U	60 U	9100 U	1800 U
4-bromophenyl phenyl ether	ug/kg	410 U	12 U	1800 U	350 U
4-chloro-3-methylphenol	ug/kg	410 U	12 U	1800 U	350 U
4-chloroaniline	ug/kg	410 U	12 U	1800 U	350 U
4-chlorophenyl phenyl ether	ug/kg	410 U	12 U	1800 U	350 U
4-methylphenol	ug/kg	410 U	12 U	1800 U	350 U
4-nitroaniline	ug/kg	2000 U	60 U	9100 U	1800 U
4-nitrophenol	ug/kg	2000 U	60 U	9100 U	1800 U
Acenaphthene	ug/kg	79 J	12 U	2400	180 J
Acenaphthylene	ug/kg	410 U	12 U	1800 U	36 J
Anthracene	ug/kg	99 J	12 U	3300	280 J
Benzo(a)anthracene	ug/kg	440	12 U	13000	1200
Benzo(a)pyrene	ug/kg	360 J	12 U	10000	930
Benzo(b)fluoranthene	ug/kg	430	12 U	11000	1100
Benzo(g,h,i)perylene	ug/kg	370 J	12 U	7100	530
Benzo(k)fluoranthene	ug/kg	340 J	12 U	9200	970
Benzoic acid	ug/kg	2000 U	60 U	9100 U	1800 U
Benzyl alcohol	ug/kg	410 U	12 U	1800 U	350 U
Bis(2-chloroethoxy)methane	ug/kg	410 U	12 U	1800 U	350 U
Bis(2-chloroethyl) ether	ug/kg	410 U	12 U	1800 U	350 U
Bis(2-chloroisopropyl) ether	ug/kg	410 U	12 U	1800 U	350 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-GG-01-D1	WR-GG-01-R1	WR-HH-01-01	WR-II-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-5"	RINSATE	0-7"	0-3"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Semivolatile organic compounds					
Bis(2-ethylhexyl)phthalate	ug/kg	750	5 JB	1800 U	230 J
Butylbenzylphthalate	ug/kg	410 U	12 U	1800 U	160 J
Chrysene	ug/kg	460	12 U	14000	1400
Di-n-butylphthalate	ug/kg	1500	3 JB	1800 U	260 J
Di-n-octylphthalate	ug/kg	410 U	12 U	1800 U	350 U
Dibenzo(a,h)anthracene	ug/kg	240 J	12 U	2900	230 J
Dibenzofuran	ug/kg	110 J	12 U	900 J	67 J
Diethyl phthalate	ug/kg	410 U	12 U	1800 U	350 U
Dimethyl phthalate	ug/kg	410 U	12 U	1800 U	350 U
Fluoranthene	ug/kg	580	12 U	24000	2100
Fluorene	ug/kg	73 J	12 U	1500 J	100 J
Hexachlorobenzene	ug/kg	410 U	12 U	1800 U	350 U
Hexachlorobutadiene	ug/kg	410 U	12 U	1800 U	350 U
Hexachlorocyclopentadiene	ug/kg	410 U	12 U	1800 U	350 U
Hexachloroethane	ug/kg	410 U	12 U	1800 U	350 U
Indeno(1.2,3-cd)pyrene	ug/kg	360 J	12 U	7100	530
Isophorone	ug/kg	410 U	12 U	1800 U	350 U
N-nitroso-di-n-propylamine	ug/kg	410 U	12 U	1800 U	350 U
N-nitrosodiphenylamine	ug/kg	410 U	12 U	1800 U	350 U
Naphthalene	ug/kg	230 J	12 U	2200	140 J
Nitrobenzene	ug/kg	410 U	12 U	1800 U	350 U
Pentachlorophenol	ug/kg	2000 U	60 U	9100 U	1800 U
Phenanthrene	ug/kg	610	12 U	13000	1100
Phenol	ug/kg	330 J	12 U	1800 U	350 U
Pyrene	ug/kg	410 U	12 U	20000	1900

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-XX-01-01	WR-YY-01-01
Date sampled		24-Feb-94	24-Feb-94
Depth		0-4"	0-4"
Soil			
Parameter	Units	Results†	Results†
Semivolatile organic compounds			
1,2,4-trichlorobenzene	ug/kg	1800 U	1900 U
1,2-dichlorobenzene	ug/kg	1800 U	1900 U
1,3-dichlorobenzene	ug/kg	1800 U	1900 U
1,4-dichlorobenzene	ug/kg	1800 U	1900 U
2,4,5-trichlorophenol	ug/kg	8800 U	9600 U
2,4,6-trichlorophenol	ug/kg	1800 U	1900 U
2,4-dichlorophenol	ug/kg	1800 U	1900 U
2,4-dimethylphenol	ug/kg	1800 U	1900 U
2,4-dinitrophenol	ug/kg	8800 U	9600 U
2,4-dinitrotoluene	ug/kg	1800 U	1900 U
2,6-dinitrotoluene	ug/kg	1800 U	1900 U
2-chloronaphthalene	ug/kg	1800 U	1900 U
2-chlorophenol	ug/kg	1800 U	1900 U
2-methylnaphthalene	ug/kg	1800 U	1900 U
2-methylphenol	ug/kg	1800 U	1900 U
2-nitroaniline	ug/kg	8800 U	9600 U
2-nitrophenol	ug/kg	1800 U	1900 U
3,3'-dichlorobenzidine	ug/kg	3500 U	3900 U
3-nitroaniline	ug/kg	8800 U	9600 U
4,6-dinitro-2-methylphenol	ug/kg	8800 U	9600 U
4-bromophenyl phenyl ether	ug/kg	1800 U	1900 U
4-chloro-3-methylphenol	ug/kg	1800 U	1900 U
4-chloroaniline	ug/kg	1800 U	1900 U
4-chlorophenyl phenyl ether	ug/kg	1800 U	1900 U
4-methylphenol	ug/kg	1800 U	1900 U
4-nitroaniline	ug/kg	8800 U	9600 U
4-nitrophenol	ug/kg	8800 U	9600 U
Acenaphthene	ug/kg	1800 U	1900 U
Acenaphthylene	ug/kg	1800 U	1900 U
Anthracene	ug/kg	1800 U	1900 U
Benzo(a)anthracene	ug/kg	1800 U	640 J
Benzo(a)pyrene	ug/kg	260 J	630 J
Benzo(b)fluoranthene	ug/kg	340 J	550 J
Benzo(g,h,i)perylene	ug/kg	690 J	680 J
Benzo(k)fluoranthene	ug/kg	240 J	720 J
Benzoic acid	ug/kg	8800 U	9600 U
Benzyl alcohol	ug/kg	1800 U	1900 U
Bis(2-chloroethoxy)methane	ug/kg	1800 U	1900 U
Bis(2-chloroethyl) ether	ug/kg	1800 U	1900 U
Bis(2-chloroisopropyl) ether	ug/kg	1800 U	1900 U

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-XX-01-01	WR-YY-01-01
Date sampled		24-Feb-94	24-Feb-94
Depth		0-4"	0-4"
Soil			
Parameter	**Units**	**Results†**	**Results†**
Semivolatile organic compounds			
Bis(2-ethylhexyl)phthalate	ug/kg	1200 JB	960 JB
Butylbenzylphthalate	ug/kg	1800 U	290 J
Chrysene	ug/kg	300 J	760 J
Di-n-butylphthalate	ug/kg	470 JB	400 JB
Di-n-octylphthalate	ug/kg	1800 U	1900 U
Dibenzo(a,h)anthracene	ug/kg	1800 U	1900 U
Dibenzofuran	ug/kg	1800 U	1900 U
Diethyl phthalate	ug/kg	1800 U	1900 U
Dimethyl phthalate	ug/kg	1800 U	1100 J
Fluoranthene	ug/kg	300 J	1100 J
Fluorene	ug/kg	1800 U	1900 U
Hexachlorobenzene	ug/kg	1800 U	1900 U
Hexachlorobutadiene	ug/kg	1800 U	1900 U
Hexachlorocyclopentadiene	ug/kg	1800 U	1900 U
Hexachloroethane	ug/kg	1800 U	1900 U
Indeno(1,2,3-cd)pyrene	ug/kg	1800 U	600 J
Isophorone	ug/kg	1800 U	1900 U
N-nitroso-di-n-propylamine	ug/kg	1800 U	1900 U
N-nitrosodiphenylamine	ug/kg	1800 U	1900 U
Naphthalene	ug/kg	1800 U	1900 U
Nitrobenzene	ug/kg	1800 U	1900 U
Pentachlorophenol	ug/kg	8800 U	9600 U
Phenanthrene	ug/kg	1800 U	560 J
Phenol	ug/kg	240 J	1900 U
Pyrene	ug/kg	360 J	1100 J

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1A-01-01	WR-1B-01-01	WR-1C-01-01	WR-1D-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-6"	0-24"	0-3"	0-12"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	21.9	9.2	13.5	13.1
Gross Beta	pCi/g	43.5	29.6	18.8	17.2

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-1E-01-01	WR-1E-02-01	WR-1E-02-R1	WR-1F-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-14"	0-3"	RINSATE	0-24"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Cesium-137	pCi/g	NA	2.2	10.2 U	NA
Gross Alpha	pCi/g	316.6	NA	NA	53.1
Gross Beta	pCi/g	404.7	NA	NA	61.4
Plutonium-238	pCi/g	NA	0.19 U	0.89 U	NA
Plutonium-239	pCi/g	NA	0.2	0.63 U	NA
Strontium-89	pCi/g	NA	NA	2.4 U	NA
Strontium-90	pCi/g	NA	NA	3.65	NA
Thorium-228	pCi/g	NA	NA	1.2 U	NA
Thorium-232	pCi/g	NA	NA	0.45 U	NA
Thorium-234	pCi/g	NA	96.5	NA	NA
Uranium-234	pCi/g	NA	93.69	0.66 U	NA
Uranium-235	pCi/g	NA	5.72 U	1.13 U	NA
Uranium-238	pCi/g	NA	94.41	1.13 U	NA

22-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-2A-01-01	WR-2B-01-01	WR-2C-01-01	WR-2D-01-01
Date sampled		28-Feb-94	28-Feb-94	28-Feb-94	28-Feb-94
Depth		0-24"	0-10"	0-12"	0-24"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	4.1	4.6	3	28.8
Gross Beta	pCi/g	10.7	9	4	39.8

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-2E-01-01	WR-2F-01-01	WR-3A-01-01	WR-3B-01-01
Date sampled		28-Feb-94	28-Feb-94	25-Feb-94	25-Feb-94
Depth		0-2"	0-8"	0-24"	0-24"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	67	12.9	9.1	13.8
Gross Beta	pCi/g	103.8	26	16.9	28.1

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3C-01-01	WR-3C-01-R1	WR-3D-01-01	WR-3E-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-4"	RINSATE	0-3"	0-24"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	42.4	1.5	10.7	15.2
Gross Beta	pCi/g	73.3	0.72 U	22.1	22.2

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-3E-01-D1	WR-3F-01-01	WR-4A-01-01	WR-4B-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-24"	0-12"	0-4"	0-4"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	21.7	12.4	27.5	18.9
Gross Beta	pCi/g	29.6	22.4	38.8	23.9

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4C-01-01	WR-4C-02-01	WR-4D-01-01	WR-4D-02-02
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	25-Feb-94
Depth		0-5"	0-4"	0-12"	0-2"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Cesium-137	pCi/g	NA	4.1	NA	10.1
Gross Alpha	pCi/g	122.4	NA	562.9	NA
Gross Beta	pCi/g	197	NA	991.8	NA
Plutonium-238	pCi/g	NA	NA	NA	0.18 U
Plutonium-239	pCi/g	NA	NA	NA	7.54
Protactinium-234	pCi/g	NA	4.9	NA	34.5
Thorium-234	pCi/g	NA	962.2	NA	723.7
Uranium-234	pCi/g	NA	410.4	NA	445.1
Uranium-235	pCi/g	NA	15.35	NA	46.84 U
Uranium-238	pCi/g	NA	687.3	NA	683.4

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-4E-01-01	WR-4E-02-01	WR-4F-01-01	WR-5A-01-01
Date sampled		25-Feb-94	25-Feb-94	25-Feb-94	24-Feb-94
Depth		0-8"	0-2"	0-10"	0-6"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Cesium-137	pCi/g	NA	1.9	NA	NA
Gross Alpha	pCi/g	20.1	NA	12.6	20.9
Gross Beta	pCi/g	20.9	NA	20.9	23.2
Strontium-89	pCi/g	NA	0.71 U	NA	NA
Strontium-90	pCi/g	NA	0.45	NA	NA
Thorium-234	pCi/g	NA	61.5	NA	NA
Uranium-234	pCi/g	NA	54.25	NA	NA
Uranium-235	pCi/g	NA	6.46 U	NA	NA
Uranium-238	pCi/g	NA	90.29	NA	NA

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5B-01-01	WR-5B-01-R1	WR-5C-01-01	WR-5C-02-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	24-Feb-94
Depth		0-6"	RINSATE	0-3"	0-3"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Cesium-137	pCi/g	NA	NA	NA	19.9
Gross Alpha	pCi/g	16.7	0.13 U	6.6	NA
Gross Beta	pCi/g	20.7	0.17 U	13.6	NA
Protactinium-234	pCi/g	NA	NA	NA	2
Strontium-89	pCi/g	NA	NA	NA	0.72 U
Strontium-90	pCi/g	NA	NA	NA	2.5
Thorium-234	pCi/g	NA	NA	NA	585.9
Uranium-234	pCi/g	NA	NA	NA	318.9
Uranium-235	pCi/g	NA	NA	NA	11.79
Uranium-238	pCi/g	NA	NA	NA	362

22-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-5D-01-01	WR-5E-01-01	WR-5F-01-01	WR-AA-01-01
Date sampled		24-Feb-94	24-Feb-94	24-Feb-94	3-Mar-94
Depth		0-4"	0-6"	0-8"	0-8"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Gross Alpha	pCi/g	22.7	9.6	4.2	21.7
Gross Beta	pCi/g	26.8	14.7	5.7	46.6

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-BB-01-01	WR-CC-01-01	WR-CC-02-01	WR-DD-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-4"	0-2"	0-4"	0-2"
Soil					
Parameter	Units	Results†	Results†	Results†	Results†
Radionuclides					
Cesium-137	pCi/g	NA	NA	62.3	NA
Gross Alpha	pCi/g	46.6	27.3	NA	22.8
Gross Beta	pCi/g	76.5	46.2	NA	40.3
Plutonium-238	pCi/g	NA	NA	0.24 U	NA
Plutonium-239	pCi/g	NA	NA	0.21 U	NA
Thorium-228	pCi/g	NA	NA	0.55	NA
Thorium-230	pCi/g	NA	NA	12.9	NA
Thorium-232	pCi/g	NA	NA	0.54	NA
Thorium-234	pCi/g	NA	NA	99.5	NA
Uranium-234	pCi/g	NA	NA	189.9	NA
Uranium-235	pCi/g	NA	NA	10.49 U	NA
Uranium-238	pCi/g	NA	NA	196.3	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-EE-01-01	WR-EE-02-01	WR-FF-01-01	WR-GG-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-3"	0-2"	0-12"	0-5"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Cesium-137	pCi/g	NA	1.6	NA	NA
Gross Alpha	pCi/g	67.2	NA	146.1	531.8
Gross Beta	pCi/g	88	NA	174.9	623.5
Plutonium-238	pCi/g	NA	0.25 U	NA	NA
Plutonium-239	pCi/g	NA	0.23 U	NA	NA
Thorium-234	pCi/g	NA	9.3	NA	NA
Uranium-234	pCi/g	NA	52.99	NA	NA
Uranium-235	pCi/g	NA	4.53 U	NA	NA
Uranium-238	pCi/g	NA	54.94	NA	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number Date sampled Depth Soil Parameter	Units	WR-GG-01-D1 3-Mar-94 0-5" Results†	WR-GG-01-R1 3-Mar-94 RINSATE Results†	WR-GG-02-01 3-Mar-94 0-2" Results†	WR-HH-01-01 3-Mar-94 0-7" Results†
Radionuclides					
Actinium-228	pCi/g	NA	NA	30.3	NA
Cesium-137	pCi/g	NA	NA	0.75	NA
Gross Alpha	pCi/g	520.3	0.38 U	NA	70.5
Gross Beta	pCi/g	619.3	0.5	NA	104.3
Plutonium-238	pCi/g	NA	NA	0.24 U	NA
Plutonium-239	pCi/g	NA	NA	0.42	NA
Protactinium-234	pCi/g	NA	NA	1618	NA
Thallium-208	pCi/g	NA	NA	14.7	NA
Thorium-234	pCi/g	NA	NA	16780	NA
Uranium-234	pCi/g	NA	NA	34770	NA
Uranium-235	pCi/g	NA	NA	1511	NA
Uranium-238	pCi/g	NA	NA	39490	NA

18-Jul-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-HH-02-01	WR-HH-02-01-R	WR-HH-02-D1	WR-II-01-01
Date sampled		3-Mar-94	3-Mar-94	3-Mar-94	3-Mar-94
Depth		0-2"	0-2"	0-2"	0-3"
Soil					
Parameter	**Units**	**Results†**	**Results†**	**Results†**	**Results†**
Radionuclides					
Cesium-137	pCi/g	6.3 U	6.3 U	4.3 U	NA
Gross Alpha	pCi/g	NA	NA	NA	995.6
Gross Beta	pCi/g	NA	NA	NA	1234.8
Plutonium-238	pCi/g	0.2 U	0.2 U	0.28 U	NA
Plutonium-239	pCi/g	0.11 U	0.24	0.15 U	NA
Protactinium-234	pCi/g	12380	12310	7767	NA
Strontium-89	pCi/g	0.69 U	0.68 U	0.64 U	NA
Strontium-90	pCi/g	65.6	40.7	260	NA
Thallium-208	pCi/g	NA	NA	3.4	NA
Thorium-228	pCi/g	11.8	6.8	5.4	NA
Thorium-230	pCi/g	41.9	52.8	24.5	NA
Thorium-232	pCi/g	11.6	6.7	5.36	NA
Thorium-234	pCi/g	55210	55240	32390	NA
Uranium-234	pCi/g	79810	92530	50590	NA
Uranium-235	pCi/g	3036	3727	2274	NA
Uranium-238	pCi/g	79750	98530	53680	NA

22-Oct-96

† = data qualifier
NA = data not available
ND = not detected

A.4. (continued)

Sample number		WR-XX-01-01	WR-YG-01-01	WR-YY-01-01
Date sampled		24-Feb-94		24-Feb-94
Depth		0-4"		0-4"
Soil				
Parameter	**Units**	**Results†**	**Results†**	**Results†**
Radionuclides				
Cesium-137	pCi/g	NA	3.5 U	NA
Gross Alpha	pCi/g	2.7	NA	11.3
Gross Beta	pCi/g	8.1	NA	14.7
Protactinium-234	pCi/g	NA	2036	NA
Thorium-234	pCi/g	NA	31690	NA
Uranium-234	pCi/g	NA	17490	NA
Uranium-235	pCi/g	NA	47560 U	NA
Uranium-238	pCi/g	NA	129700	NA

† = data qualifier
NA = data not available
ND = not detected

18-Jul-96

APPENDIX B

FIELDWORK PLANS FOR THE DAVID WITHERSPOON, INC., 901 SITE

CONTENTS

FIGURES . . . . . B-ix
TABLES . . . . . B-ix
ACRONYMS AND ABBREVIATIONS . . . . . B-xi

1. INTRODUCTION B-1
   1.1 PURPOSE B-1
   1.2 WORK PLAN OVERVIEW B-1
   1.3 SITE DESCRIPTION B-2
   1.4 DATA GAPS/DATA NEEDS B-2
      1.4.1 Buried Debris B-2
      1.4.2 Surface Radiological Data B-2
      1.4.3 Surface Soil B-5
      1.4.4 Surface Water B-5
      1.4.5 Subsurface Soil B-5
      1.4.6 Groundwater B-5
      1.4.7 Surface Debris B-6
      1.4.8 Aboveground Storage Tanks B-6
      1.4.9 Creek Sediment B-6
      1.4.10 Vegetation B-6
   1.5 PROJECT SCHEDULE B-6

2. SAMPLING AND ANALYSIS PLAN B-9
   2.1 SURFACE GEOPHYSICAL SURVEY B-9
      2.1.1 Geophysical Survey Location B-9
      2.1.2 Geophysical Survey Methodology B-9
   2.2 TRENCH EXCAVATION B-10
      2.2.1 Trench Excavation Location B-10
      2.2.2 Trench Excavation Methodology B-10
   2.3 SURFACE RADIOLOGICAL SURVEY B-12
      2.3.1 Radiological Survey Locations B-12
      2.3.2 Radiological Survey Methodology B-12
   2.4 SURFACE SOIL SAMPLING B-14
      2.4.1 Surface Soil Sampling Locations B-14
      2.4.2 Surface Soil Sampling Methodology B-14
      2.4.3 Surface Soil Analysis B-14
   2.5 SURFACE WATER SAMPLING B-16
      2.5.1 Surface Water Sampling Locations B-16
      2.5.2 Surface Water Sampling Methodologies B-16
      2.5.3 Surface Water Analysis B-18
   2.6 SUBSURFACE SOIL SAMPLING B-18
      2.6.1 Subsurface Soil Sampling Locations B-18
      2.6.2 Subsurface Soil Sampling Methodology B-20
      2.6.3 Subsurface Soil Sample Analysis B-20

CONTENTS (continued)

2.7 GROUNDWATER MONITORING B-20
2.7.1 Groundwater Sampling Locations B-21
2.7.2 Groundwater Sampling Methodologies B-21
2.7.3 Groundwater Sample Analysis B-23
2.8 SURFACE DEBRIS B-23
2.8.1 Debris Sampling Locations B-24
2.8.2 Debris Characterization Methodologies B-24
2.8.2.1 Debris pile volume estimates B-25
2.8.2.2 Debris inspection B-25
2.8.2.3 Radiological survey B-28
2.8.2.4 Debris sampling and analysis B-28
2.8.3 Debris Analysis B-29
2.9 DRUM SURVEY AND SAMPLE COLLECTION B-29
2.9.1 Drum Survey and Sample Collection Location B-30
2.9.2 Drum Survey Methodology B-30
2.9.2.1 Open to environment/empty B-30
2.9.2.2 Open to environment/liquids or solids B-32
2.9.2.3 Intact/empty B-32
2.9.2.4 Intact/liquids or solids B-32
2.10 BACKGROUND SAMPLING B-32
2.10.1 Background Sampling Locations B-33
2.10.2 Background Sampling Methodologies B-34
2.10.3 Background Sampling Analysis B-34
2.11 SURVEYING B-34
2.12 WETLANDS SURVEY B-34

3. QUALITY ASSURANCE PROJECT PLAN B-37
3.1 ORGANIZATION, QUALIFICATIONS, AND TRAINING B-37
3.1.1 Project Organization B-37
3.1.2 Key Field Positions and Responsibilities B-37
3.1.2.1 Field technical representative B-37
3.1.2.2 Site health and safety officer B-37
3.1.2.3 QA specialist B-37
3.1.2.4 Field specialist B-42
3.1.3 Qualifications and Training B-42
3.2 SAMPLE MANAGEMENT B-42
3.2.1 Sample Identification B-43
3.2.1.1 Subsurface debris nomenclature B-43
3.2.1.2 Surface water storm flow, seeps, and groundwater sample nomenclature B-44
3.2.1.3 Subsurface soil sample nomenclature B-44
3.2.1.4 Surface debris sample nomenclature B-44
3.2.2 Sample Preparation and Shipment B-45
3.2.2.1 Containers B-45
3.2.2.2 Preservation B-45

CONTENTS (continued)

3.2.2.3 Packaging and shipping B-45
3.2.2.4 Radiological survey B-46
3.2.2.5 Chain of custody B-46
3.2.3 Field Analysis B-47
3.2.3.1 Analysis B-47
3.2.3.2 Field QA/QC B-47
3.2.4 Laboratory Analysis B-48
3.2.4.1 Analysis B-48
3.2.4.2 Laboratory QA/QC B-59
3.2.5 Calibration Procedures and Frequency B-59
3.2.5.1 Field equipment B-59
3.2.5.2 Laboratory equipment B-60
3.2.6 Preventive Maintenance B-60
3.2.6.1 Field instrumentation equipment B-60
3.2.6.2 Laboratory equipment B-60
3.2.7 Data Reporting, Reduction, and Validation B-60
3.2.7.1 Data reporting B-60
3.2.7.2 Data reduction B-61
3.2.7.3 Precision, accuracy, representativeness, completeness, and compatibility parameters B-61
3.2.7.4 Validation of field data packages B-61
3.2.7.5 Validation of analytical data packages B-62
3.3 FIELD DOCUMENTATION B-63
3.3.1 Field Records B-63
3.3.2 Control and Submittal of Field Records B-63
3.4 DECONTAMINATION B-63
3.5 INTERNAL QC CHECKS B-63
3.5.1 Field Readiness Assessment B-63
3.5.2 Field Assessments B-64
3.5.3 Laboratory Evaluations B-64
3.6 NONCONFORMANCE AND CORRECTIVE ACTION B-65
3.6.1 Nonconformances B-65
3.6.2 Corrective Action B-65
3.7 QC SUMMARY REPORT B-66

4. WASTE MANAGEMENT PLAN B-67
4.1 PURPOSE AND APPROACH B-67
4.2 ROLES AND RESPONSIBILITIES B-67
4.2.1 U.S. Department of Energy B-67
4.2.2 Jacobs ER Team B-67
4.2.3 Lockheed Martin Energy Systems B-68
4.3 WASTE STREAM IDENTIFICATION AND WASTE VOLUMES B-68
4.4 CONTAINERIZATION AND LABELING OF IDW B-69
4.5 IDW STAGING AREA B-69

CONTENTS (continued)

4.6 SPILL PREVENTION CONTROL B-69
4.6.1 Management Practices/Preventive Measures B-70
4.6.2 Spill Response B-70
4.7 TRANSFERRING THE IDW TO ENERGY SYSTEMS B-70
4.7.1 Waste Acceptance Criteria B-70
4.7.2 Characterization of Waste B-71
4.7.3 Completion of Disposal Forms B-72
4.7.4 TRANSPORTING IDW B-73

5. HEALTH AND SAFETY PLAN B-75
5.1 INTRODUCTION B-75
5.1.1 Purpose B-75
5.1.2 Scope B-75
5.1.3 Overview B-75
5.2 KEY PERSONNEL B-77
5.2.1 Task-Specific Organization B-77
5.2.1.1 Task manager B-77
5.2.1.2 Field technical representative B-77
5.2.1.3 Program health and safety manager B-77
5.2.1.4 Site health and safety officer B-77
5.2.1.5 Field personnel B-84
5.2.1.6 Radiological control manager B-84
5.2.1.7 Radiological control technician B-84
5.2.1.8 Radiological support technicians B-85
5.2.1.9 Subcontractor responsibilities B-85
5.3 HAZARD CHARACTERIZATION AND ASSESSMENT B-85
5.3.1 Preliminary Evaluation B-85
5.3.2 Hazard Identification and Assessment B-86
5.3.2.1 Physical hazards B-86
5.3.2.2 Biological hazards B-92
5.3.2.3 Radiological hazards B-94
5.3.2.4 Chemical hazards B-95
5.3.2.5 Hazard communication B-96
5.3.2.6 Materials safety data sheets B-96
5.3.2.7 Controls B-96
5.4 TRAINING REQUIREMENTS B-96
5.4.1 Hazardous Waste Operations Training B-96
5.4.2 Corporate Training Required B-97
5.4.3 HAZCOM Training B-97
5.4.4 Project-Specific Training B-97
5.5 PERSONAL PROTECTIVE EQUIPMENT B-98
5.5.1 Respiratory Protection B-99
5.5.2 Preliminary PPE Selection B-99
5.6 TEMPERATURE EXTREMES B-99
5.6.1 Hot Weather Conditions B-99

CONTENTS (continued)

5.6.2 Cold Weather Conditions B-99
5.6.3 Adverse Weather Conditions B-100
5.7 MEDICAL SURVEILLANCE B-100
5.8 EXPOSURE MONITORING AND AIR SAMPLING B-100
5.8.1 Radiation Sampling Strategy B-100
5.8.2 Instrumentation and Equipment B-101
5.8.3 Chemical Monitoring B-101
5.8.4 Exposure Control for PCBs, Dioxins, and Furans B-102
5.9 SITE CONTROL B-102
5.10 DECONTAMINATION B-104
5.10.1 Personnel Decontamination B-104
5.10.2 Equipment Decontamination B-104
5.11 EMERGENCY RESPONSE/CONTINGENCY PLAN B-104
5.11.1 Emergency Contingency Plan B-104
5.12 EMERGENCY ACTION PLAN B-104
5.12.1 Communication B-104
5.12.2 Emergency Telephone Numbers B-106
5.12.3 Emergency Route to the Hospital B-106
5.12.4 Emergency Precautions B-106
5.12.5 Documentation B-106
5.13 WORK PRACTICES B-108
5.13.1 General Work Site Requirements B-108
5.13.1.1 Illumination B-108
5.13.1.2 Security B-108
5.13.1.3 Fire protection B-108
5.13.1.4 First aid B-108
5.13.1.5 Personal hygiene B-109
5.13.1.6 Eyewash station B-109
5.13.1.7 General field project safety B-109

FIGURES

Figure No.		Page
B.1.	Regional location map	B-3
B.2.	DWI 901 Site layout	B-4
B.3.	DWI 901 RI field schedule	B-7
B.4.	Proposed radiological surveying grids	B-13
B.5.	Proposed surface soil sampling locations	B-15
B.6.	Proposed surface water sampling locations	B-17
B.7.	Proposed soil boring locations	B-19
B.8.	Proposed groundwater monitoring well locations	B-22
B.9.	Debris pile locations	B-27
B.10.	Proposed drum characterization activities	B-31
B.11.	Background sampling locations	B-35
B.12.	DWI 901 Site organization chart	B-41
B.13.	Emergency situation action plan	B-105
B.14.	Route to the nearest hospital	B-107

TABLES

Table No.		Page
B.1.	Debris sample calculations, DWI 901 Site	B-25
B.2.	Debris volumes and number of samples, DWI 901 Site	B-26
B.3.	Sample matrix summary table, DWI 901 Site	B-38
B.4.	Field analysis summary table, DWI 901 Site	B-48
B.5.	Field quality control samples, DWI 901 Site	B-49
B.6.	Summary of analytical methods for the DWI 901 Site	B-50
B.7.	Waste volume estimates, DWI 901 Site,	B-68
B.8.	Radiation release limit guidance for solid wastes, DWI 901 Site	B-72
B.9.	Physical and chemical characteristics and safety information for preliminary contaminants of concern, DWI 901 Site	B-78
B.10.	Hazard identification and control, DWI 901 Site	B-87

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
ASTM	American Society for Testing and Materials
°C	degrees Celsius
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
cm	centimeter
COC	contaminant of concern
CPR	cardiopulmonary resuscitation
dBA	decibel
DOE	U.S. Department of Energy
DWI	David Witherspoon, Inc.
Energy Systems	Lockheed Martin Energy Systems
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
°F	degrees Fahrenheit
FS	feasibility study
ft	foot
FTR	field technical representative
g	gram
gal	gallon
ha	hectare
HASP	health and safety plan
HAZCOM	hazard communication
in.	inch
IDW	investigation-derived waste
km	kilometer
L	liter
lb	pound
LEL	lower exposure level
m	meter
MDA	minimum detectable activity
mg	milligram
μR	microrem
MSDS	Materials Safety Data Sheet
NaI	sodium iodide
NCR	nonconformance report
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness, and compatibility
PCB	polychlorinated biphenyl
pCi	picocurie
PHSM	program health and safety manager
PID	photoionization detector

ACRONYMS AND ABBREVIATIONS (continued)

PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goal
Pu	plutonium
QA	quality assurance
QAPP	quality assurance program plan
QC	quality control
QCSR	quality control summary report
Ra	radium
RADCON	radiological control
RCRA	Resource Conservation and Recovery Act of 1976
RCT	radiological control technician
RI	remedial investigation
RPD	relative percent difference
RST	radiological support technician
SHSO	site health and safety officer
SMO	sample management organization
SOP	standard operating procedure
SOW	statement of work
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation
Th	thorium
TSCA	Toxic Substances Control Act of 1976
TSD	treatment, storage, and disposal
U	uranium
VOC	volatile organic compound
WAC	waste acceptance criteria
yd	yard

1. INTRODUCTION

1.1 PURPOSE

This work plan establishes the methods and requirements for conducting remedial investigation (RI) activities at the David Witherspoon, Inc. (DWI) 901 Site. The plan is in accordance with the rules of the Hazardous Substance Remedial Action Program under the direction of the Tennessee Department of Environment and Conservation (TDEC), Division of Superfund [TN Rules 1200-1-3] and its implementing regulations. Additional rules of the state of Tennessee; Comprehensive Environmental Response, Compensation, and Liability Act of 1980; and the U.S. Environmental Protection Agency (EPA) guidance were also consulted during development of this work plan. Data generated from these activities will support the development of the final RI/feasibility study (FS) report.

During the development of the preliminary RI/FS, the data from all previous investigations at the site were used to the fullest extent practical. However, because of the focused objectives of the previous investigations, the data are not of sufficient quantity and/or quality to complete the final RI/FS. It is the objective of this supplemental fieldwork to strategically fill data gaps identified in the preliminary RI/FS.

1.2 WORK PLAN OVERVIEW

Proposed RI activities designed to fill data gaps include a surface geophysical survey, exploratory trench excavation, surface radiological survey, surface soil sampling, surface water sampling, subsurface soil sampling, monitoring well construction, monitoring well sampling, aquifer testing, debris pile characterization, drum sampling, background characterization, and surveying.

This work plan provides a brief site history, discusses existing data gaps/data needs, presents the proposed field schedule, and provides a detailed description of RI activities. Specific quality assurance (QA)/quality control (QC) requirements are discussed in Chapter 3. Specific procedures for managing investigation-derived waste (IDW) are discussed in Chapter 4, and specific health and safety requirements are included in Chapter 5.

1.3 SITE DESCRIPTION

The DWI 901 Site, located at 901 Maryville Pike, consists of 3.8 ha (9.5 acres). The site is approximately 0.8 km (0.5 mile) south of the Tennessee River in Knoxville, Tennessee (Fig. B.1). The site is situated in a mixed residential and light industrial use area known as the Vestal Community (Fig. B.2). Industrial facilities directly adjacent to the DWI 901 Site include the Tennessee Asphalt Co., Alpha Industries, and CSX Railroad. A detailed discussion of site geology, hydrology, and surrounding land use is included in the preliminary RI/FS.

1.4 DATA GAPS/DATA NEEDS

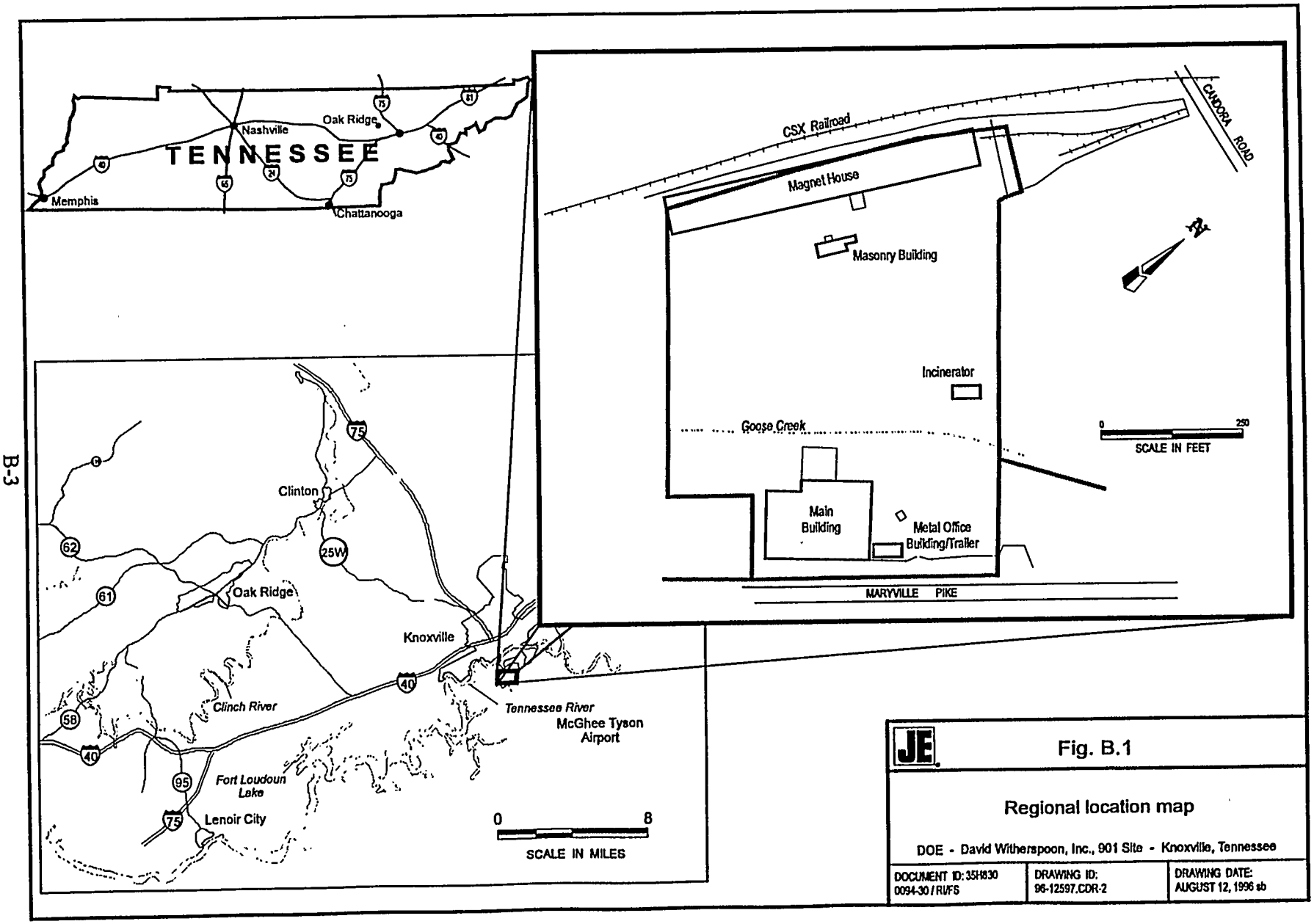
The following summary provides a brief assessment of the quantity and quality of existing data used in the preliminary RI/FS report, and describes investigative activities designed to supplement each existing data set for completion of the final RI/FS.

1.4.1 Buried Debris

During previous investigations at the DWI 901 Site, buried debris was encountered while attempting to install groundwater monitoring wells (Haliburton 1995). In addition, a detailed review of aerial photographs suggests the presence of buried material. To date, no efforts have been made to confirm the presence of buried debris, define vertical or horizontal boundaries of subsurface debris, or provide characterization as to the nature of subsurface debris. Two investigative techniques will be used to characterize buried debris. First, an EM-61 Magnetic Survey will be conducted to provide approximate locations of subsurface debris. Upon receiving results of the EM-61 survey, exploratory trenches will be completed to define the lateral and vertical location and nature of subsurface debris. Specific locations, procedures, and objectives of the EM-61 survey are discussed in the sampling and analysis plan, Section 2.1. Specific locations, procedures, and objectives of the exploratory trenching program are discussed in the sampling and analysis plan, Section 2.2.

1.4.2 Surface Radiological Data

Surface radiological surveys at the DWI 901 Site have not been documented outside of the site boundary. Elevated levels of radioactivity have been documented at or near the Tennessee Asphalt Co., and the Candora Road Area property boundary. To assess off-site migration, a surface radiological survey will be conducted in accordance with the sampling and analysis plan, Section 2.3. Survey readings will be used to determine the extent of contaminant distribution.



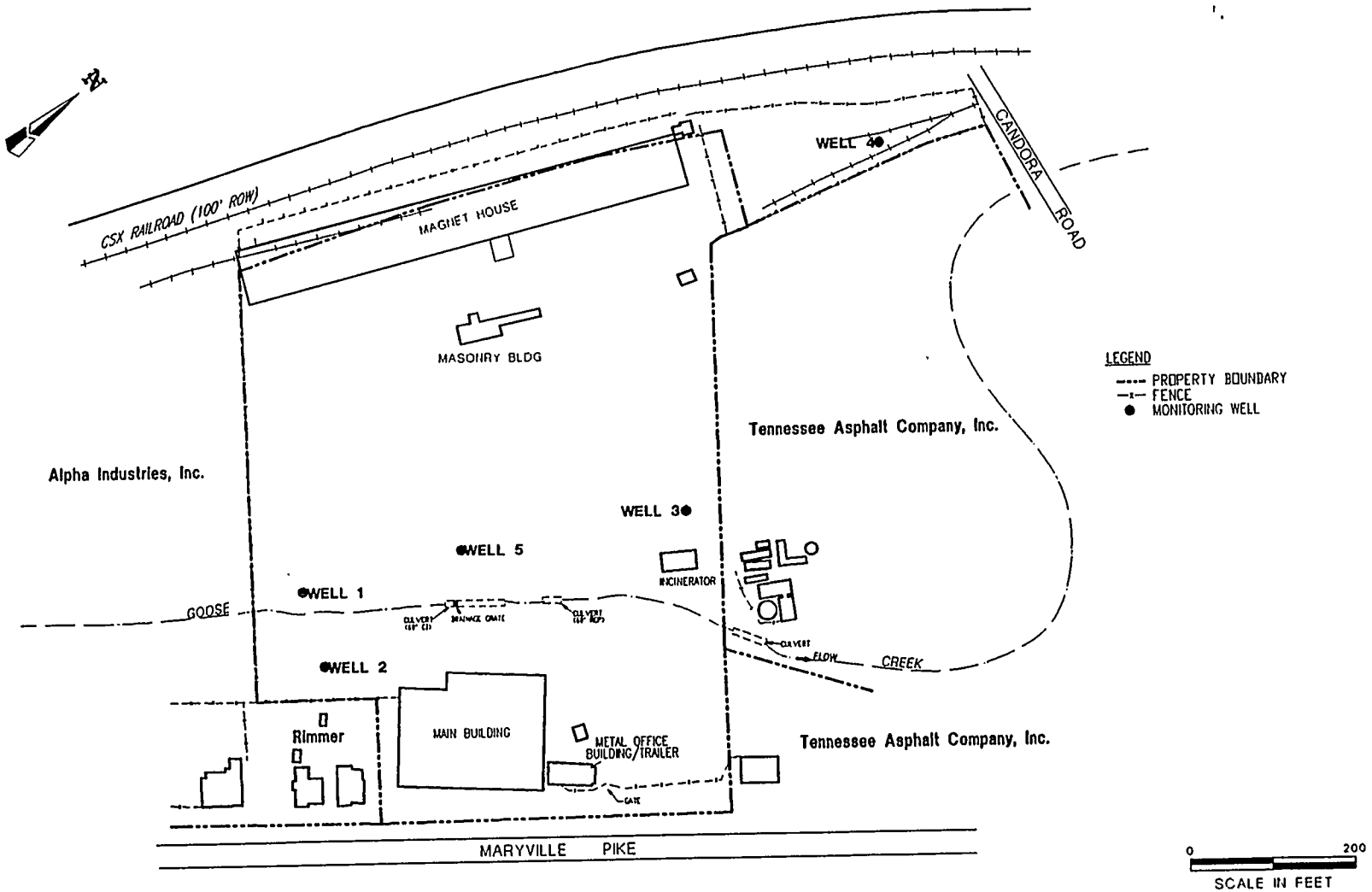
JE

Fig. B.1

Regional location map

DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee

DOCUMENT ID: 35H830 0094-30 / RI/FS	DRAWING ID: 96-12597.CDR-2	DRAWING DATE: AUGUST 12, 1996 sb



MODIFIED FROM Jesse Walker, RLS, PE, Survey, July 29, 1992.

JE	Fig. B.2	**DWI 901 Site layout** DOE - David Witherspoon, Inc. 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-30 / RI/FS	DRAWING ID 96-13181DWG-2	DRAWING DATE OCTOBER 7, 1996 SB

1.4.3 Surface Soil

The surface soil data set is the most complete of all existing data sets. However, the existing database is not sufficient to determine if or to what extent lateral movement of surficial contamination has occurred off site. To complete this data set, a surface soil sampling program will be completed as described in the sampling and analysis plan, Section 2.4. The majority of surface soil samples are intended to determine the quantity of contaminants along the site boundary on three sides (Alpha Industries, CSX Railroad, and Tennessee Asphalt Co.). Off-site sampling of surface soils on the Tennessee Asphalt Co., property below the Candora Road Area railroad spur is planned. Higher than background readings during the radiological survey (Sect. 2.3) will indicate where the preferential overland flow pathways exist. It is assumed that all surface contaminants migrate through surface erosion, transport, and redisposition, including nonradiological contaminants. The migration of radionuclides produces a radiological "signature" that can be measured and used to track the contaminant pathway.

Surface soil samples will also be collected in conjunction with subsurface soils from borings. Soil data from surface samples will be compared to concentrations of contaminants in the subsurface to profile contaminant migration.

1.4.4 Surface Water

Surface water samples collected during previous investigations were not analyzed for the full suite of contaminants of concern (COCs). Therefore, the existing surface water data set is incomplete. To supplement the existing surface water data set, surface water samples will be collected and analyzed for all COCs in accordance with the sampling and analysis plan, Section 2.5.

1.4.5 Subsurface Soil

There are not enough subsurface soil data from previous investigations to fully assess the nature and extent of chemical contamination or the geotechnical properties of soils underlying the DWI 901 Site. To provide adequate chemical and geotechnical data from subsurface soils, a subsurface soil sampling program will be conducted in accordance with the sampling and analysis plan, Section 2.6.

1.4.6 Groundwater

The existing groundwater data set is inadequate to characterize groundwater contamination (if any) because existing monitoring wells are not located in the vicinity of known surface contamination. To supplement the existing groundwater data set, five on-site wells will be installed, developed, and sampled in accordance with the sampling and analysis plan, Section 2.7.

1.4.7 Surface Debris

During previous investigations, one sample from surface debris was collected. The data indicate the presence of metals, semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs). Radiological data were not collected from surface debris, but previous walkover surveys and soil sampling indicate the presence of radionuclides. The existing single data point coupled with the generally poor knowledge of specific processes leaves debris as the most poorly characterized site media. To provide adequate debris characterization, a debris sampling program will be conducted as described in the sampling and analysis plan, Section 2.8. Surface debris data will be used to determine waste disposition and source term characterization.

1.4.8 Aboveground Storage Tanks

The contents of the aboveground storage tanks have been characterized and disposed of by TDEC during recent activities at the site. A total of 22,740 L (6,000 gal) of liquid were removed from these tanks and received for disposal by Laidlan Environmental Services. Sampling results indicated the tanks contained diesel fuel. No other regulated substances were present. No further sampling is required. These tanks will be treated as debris and incorporated into the surface debris sampling task.

1.4.9 Creek Sediment

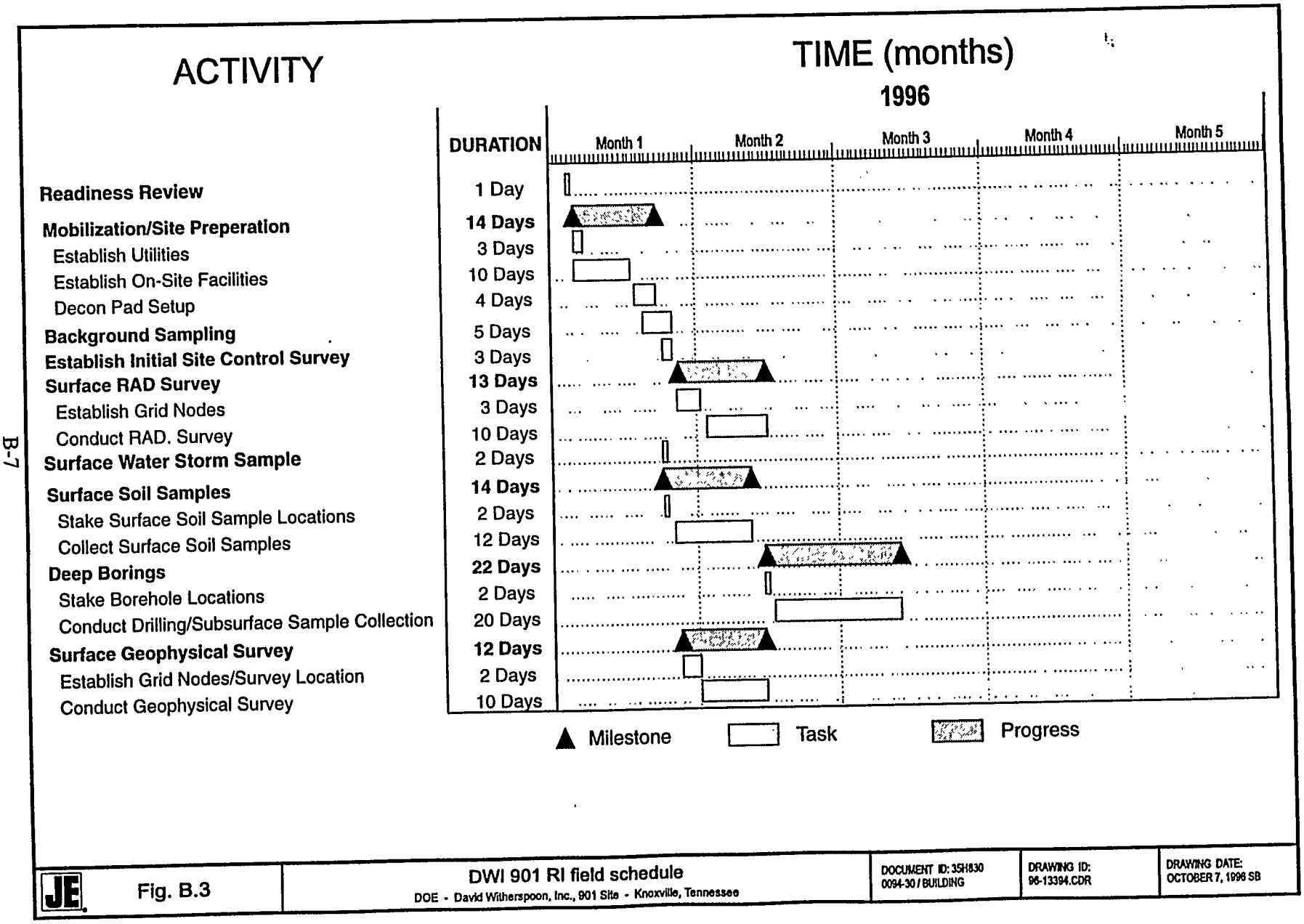
The creek sediment data set is adequate to characterize sediment contamination within Goose Creek. No additional samples will be collected.

1.4.10 Vegetation

No vegetative data are available for the DWI 901 Site. Vegetation volumes are insignificant when compared to the amount of other contaminated media at the site. Therefore, remedial alternative assessments will assume that all vegetation is contaminated, and no sampling will be conducted.

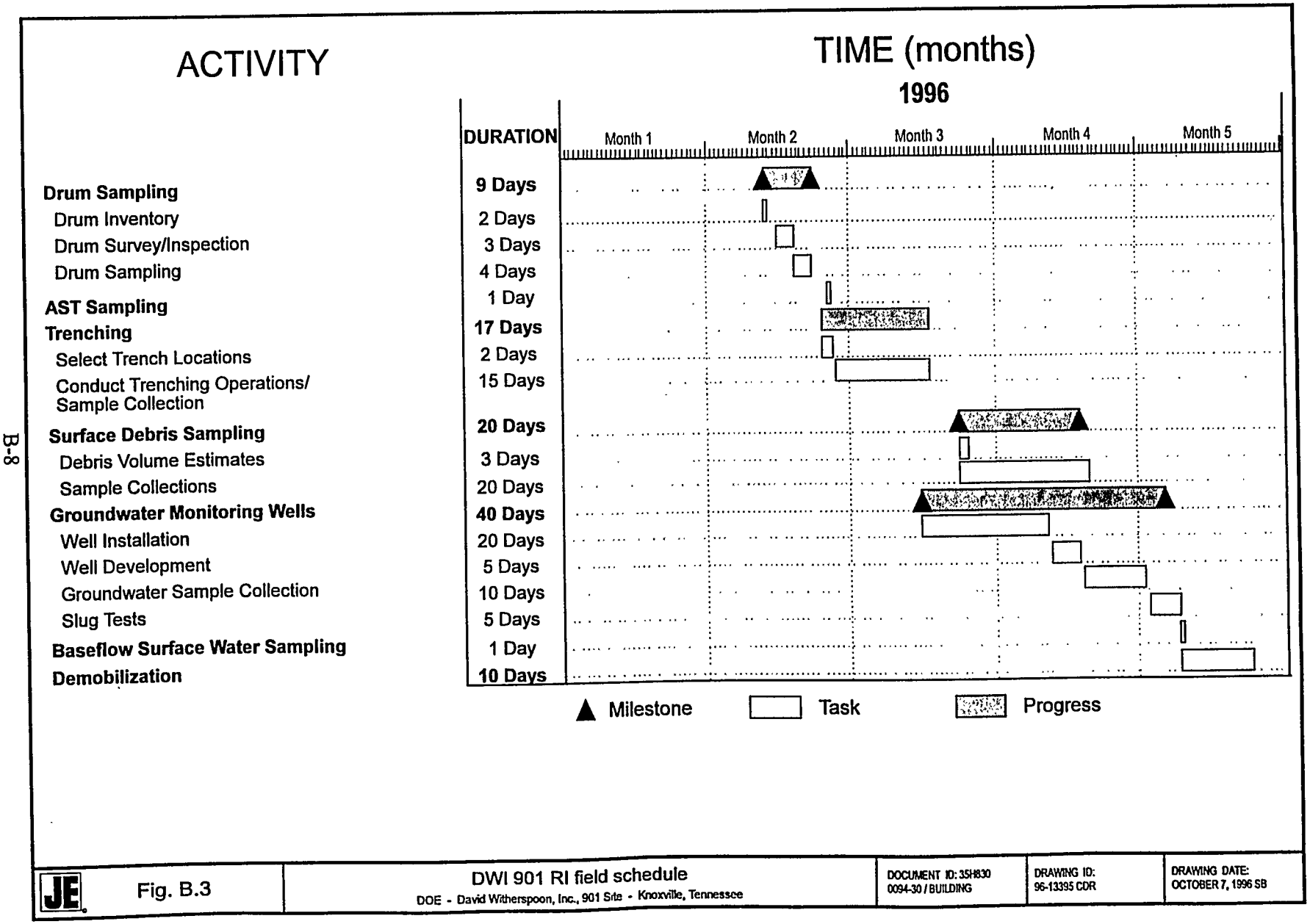
1.5 PROJECT SCHEDULE

The project schedule (Fig. B.3) provides adequate time for each phase of project work. The project schedule presents the lengths of individual tasks, interrelationships between tasks, and key milestones. The surface water sampling schedule may deviate because this task is dependent on highly specific weather conditions. The duration of drum sampling, trenching, and subsurface debris characterization may also deviate significantly depending on the quantity of drums and subsurface anomalies at the site.



B-7

JE Fig. B.3	DWI 901 RI field schedule DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-30 / BUILDING	DRAWING ID: 96-13394.CDR	DRAWING DATE: OCTOBER 7, 1996 SB



JE Fig. B.3	DWI 901 RI field schedule DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-30 / BUILDING	DRAWING ID: 96-13395 CDR	DRAWING DATE: OCTOBER 7, 1996 SB

2. SAMPLING AND ANALYSIS PLAN

This chapter describes the sampling and analysis to be conducted at the DWI 901 Site. All activities are designed to fill data gaps identified during the completion of the preliminary RI/FS. The results will be used to complete a final RI/FS report.

Chapter 1 outlined the general data gaps identified during the preliminary RI/FS. This chapter details the proposed activities. Each section starts with the rationale for the proposed sampling, and where appropriate, refers back to the preliminary RI/FS. This is followed by sample collection methodologies, and where proposed, a summary of the laboratory analysis.

Sample collection methodologies rely heavily on Jacobs Environmental Restoration (ER) Team standard operating procedures (SOPs). Rather than repeating the content of the SOPs, the SOP is simply referenced. Jacobs ER Team SOPs are in compliance with U.S. Department of Energy (DOE) Orders and the 1996 version of the EPA-Region IV QA manual.

2.1 SURFACE GEOPHYSICAL SURVEY

Previous investigations have indicated the possibility of buried debris but have provided few specifics. Additionally, aerial photographs suggest locations of possible subsurface disturbance. Subsurface debris was not included in the preliminary RI/FS.

2.1.1 Geophysical Survey Location

The geophysical survey will be completed over the entire portion of the site where there is no surface debris.

To complete the geophysical survey, the site will be divided into evenly spaced transects. The spatial distribution of the transects will be determined in the field based on site conditions and instrument sensitivity. Each transect will be tied to a known survey control using standard surveying methods.

2.1.2 Geophysical Survey Methodology

The geophysical survey will be conducted using a Geonics EM-61 Metal Locator, or equivalent, in accordance with the manufacturer's operations manual. Geophysical data will be recorded by an external data logger as they are generated. Upon completion of the surface

geophysical survey, a site map will be produced which depicts all magnetic anomalies. The geophysical anomalies map will be used to make the final determination of whether or not buried debris exists and what areas will be further investigated by trench excavation (Sect. 2.2).

2.2 TRENCH EXCAVATION

The trenching program will define the vertical and horizontal boundaries of subsurface debris (if present) and provide characterization as to the nature of buried debris. This will be accomplished by excavating a series of trenches based on the results of the EM-61 survey described in Section 2.1.

2.2.1 Trench Excavation Location

Excavation activities will be conducted in areas where EM-61 Magnetic Survey results indicate the presence of buried debris. The number of trenches will be based on the number and size of the anomalies and will include at least 25 percent of the anomalies identified by the EM-61 survey. This sample population will be used as a representative of all buried debris.

2.2.2 Trench Excavation Methodology

Trenches will be excavated across anomalies. If possible, two transecting trenches will be completed for each area selected.

Trenches will be excavated to a maximum depth of 3.05 m (10 ft) using a rubber tire backhoe. The width of the trench will be kept to a minimum to minimize health and safety concerns and to limit the disturbance of the site but may require excavations greater than one backhoe width to manage large obstructions. At no time will personnel be allowed to enter the open excavation. Levels of personal protective equipment (PPE) to be used for trenching activities are discussed in Chapter 5.

The length of trench dug will be restricted to the area that can be excavated, characterized, and backfilled in 1 day. Excavation of a traverse will resume the next day and continue in this manner until completed. The backhoe bucket will be decontaminated only before trenching at a new debris fill.

Precautions will be taken during excavation to minimize the possibility of puncturing any subsurface sources such as capacitors or drums. Excavation will be performed by scraping small layers rather than making deep incisions. In the event a container with liquids is punctured, that container will be placed in a lined containment structure. The containment structure will always be kept within reach of the backhoe.

The endpoints of each trench transect will be staked, labeled, and surveyed following trenching operations. Trench transects will be designated A through Z. The endpoints for Transect A will be labeled A and A', Transect B will be labeled B and B', and accordingly for each additional transect.

Each bucket load will be spread to allow for observations on the type of material present. The type of material (metal turnings, steel pipe, cardboard, etc.) and the relative percent volume will be recorded. A photograph will be taken whenever a new material is encountered.

A radiation survey of the subsurface debris will be conducted in accordance with Jacobs ER Team SOPs H&S-11.3, "Radiological Instrumentation"; H&S-11.3.1, "Geiger-Müller: Calibration and Usage"; H&S-11.3.5, "Micro-R Meter: Calibration and Usage"; H&S-11.3.6, "Sodium Iodide Radiation Detector"; and H&S-11.4.2, "Radiation Exposure Monitoring."

The debris will first be surveyed using the sodium iodide (NaI) detector. Debris items with elevated readings will then be surveyed using a Gieger Müller detector. Any debris with readings exceeding the minimum detectable activity (MDA) level will be resurveyed after removing caked-on soils, if present, to determine if contamination is limited to the debris or if the soils around the debris have been contaminated.

Radiological wipe samples will be collected from select pieces of debris with elevated radiation readings in accordance with Jacobs ER Team SOP H&S-11.4.1, "Radiological Contamination Surveys." A maximum of 10 samples will be collected per trench with even distribution over the entire length, if possible. The location of each wipe sample will be measured from the trench transect endpoint using a tape measure and will be recorded in the logbook.

Wipe samples will be analyzed using the Alpha-Beta Sample Counter and, on a limited basis, the Scout Mutichannel Analyzer in accordance with Jacobs ER Team SOPs H&S-11.3.3, "Alpha-Beta Sample Counter: Calibration and Usage," and H&S-11.3.7, "Scout Multichannel Analyzer: Operation and Usage."

Soil samples will be collected from the base of three of the excavations to evaluate for the accumulation of contaminants in soils as a result of leaching of the buried debris. Soils will be collected using a hand auger from a platform placed over the excavation and will be submitted for laboratory analysis as described in Section 2.6 "Subsurface Soil Sampling." All debris will be placed back in the trench following characterization.

2.3 SURFACE RADIOLOGICAL SURVEY

Previous investigations have adequately surveyed the main portion of the site (DOE 1996); however, the surveys showed significant changes over time. No studies have addressed possible radioactive contamination beyond the fence boundary. Elevated levels of radioactive contamination have been identified in the soils of the Candora Road Area (Fig. B.4.) Erosion from surface runoff may have transported contaminated material onto the southwestern portion of the Tennessee Asphalt property. Previous operations at the site, before the installation of the fence, may also have resulted in the contamination of this area.

2.3.1 Radiological Survey Locations

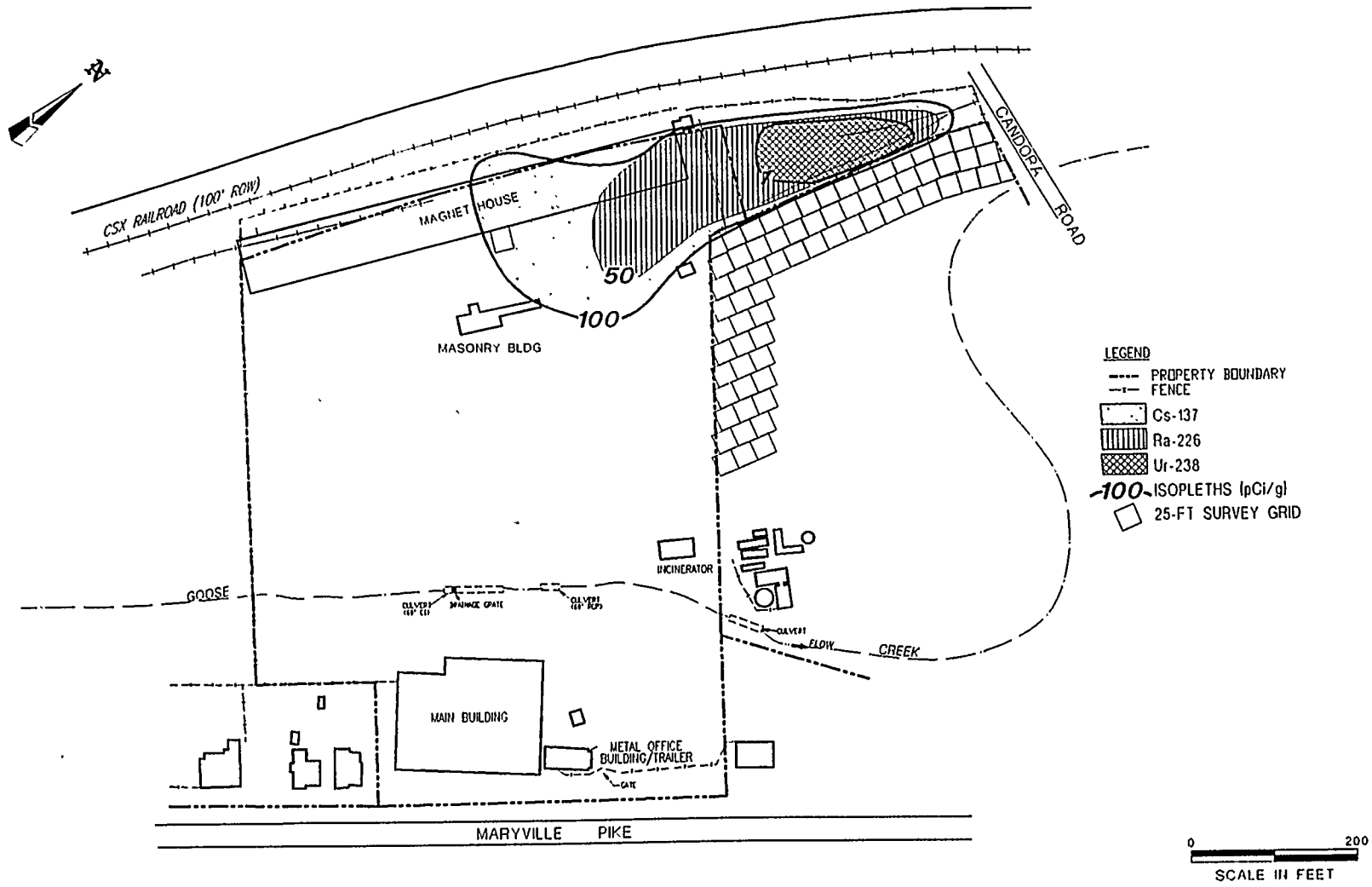
The entire DWI 901 Site will be surveyed to identify changes that have occurred since the last survey. The off-site survey will begin in the grid sections immediately bordering the fence in the Candora Road Area and will continue outward away from the fence. Figure B.4 shows the proposed survey area three grids deep, but the survey will not be limited to three grids if warranted by previous traverses.

2.3.2 Radiological Survey Methodology

The radiological survey will be conducted according to Jacobs ER Team SOPs H&S-11.3, "Radiological Instrumentation"; H&S-11.3.5, "Micro-R Meter: Calibration and Usage"; H&S-11.3.6, "Sodium Iodide Detector: Calibration and Usage"; H&S-11.3.7, "Scout Multichannel Analyzer: Operation and Usage"; and H&S-11.4.2, "Radiation Exposure Monitoring."

To establish background radiation levels for the DWI 901 Site, background data will be collected in the general vicinity of the site in areas known to be free of radiological contamination. Background radiation exposure rates will be recorded using a Micro-R Survey Meter, allowing sufficient time for the needle to stabilize. Background count rates will be recorded using a NaI Radiation Detector set on scaler mode. The radiological support technician (RST) or radiological control technician (RCT) shall determine the count time and number of readings.

Micro-R Survey Meters and NaI Radiation Detectors will be used to conduct the radiological walkover survey. The RST or RCT will walk each grid transect in a slow sinuous path monitoring radiation exposure rates. Exposure rates determined by the RST or RCT to be elevated from background will be recorded on form JOR-H&S-36, "Radiological Survey Form (Map)," the Radiological Survey Grid Map, or another appropriate format, and the location



MODIFIED FROM. Jesse Walker, RLS, PE. Survey, July 29, 1992.

JE	**Fig. B.4**	**Proposed radiological surveying grids** DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID. 35H830 0094-20 / RI/FS	DRAWING ID 96-13187.DWG	DRAWING DATE OCTOBER 18, 1996 SB

designated. A count rate with a minimum 30-second counting time will be taken on each of the grid nodes using the NaI Radiation Detector. Results of each count will be recorded on the Radiological Survey Grid Map and in the field logbook.

A maximum of 10 locations with elevated readings will also be subject to random sampling using the Scout Multichannel Analyzer. The number of readings and length of count time will be determined by the RST or RCT. Results of the sampling, including radionuclides identified and estimated soil activities, will be recorded. Three samples will be submitted for laboratory analysis of radionuclides to verify the accuracy of the Scout analyzer.

2.4 SURFACE SOIL SAMPLING

The existing surface soil data set is the most complete of all data sets; however, it is not adequate to fully characterize on-site contamination because it does not address all COCs. Additional sampling will be conducted to address the uncertainties that exist with regard to the nature and extent of surficial contamination adjacent to property boundaries and to confirm the primary on-site risk drivers. The data obtained from surficial samples will be used to define the lateral extent of contamination along the CSX Railroad main line, Tennessee Asphalt property boundary, and the eastern boundary of the Candora Road Area.

2.4.1 Surface Soil Sampling Locations

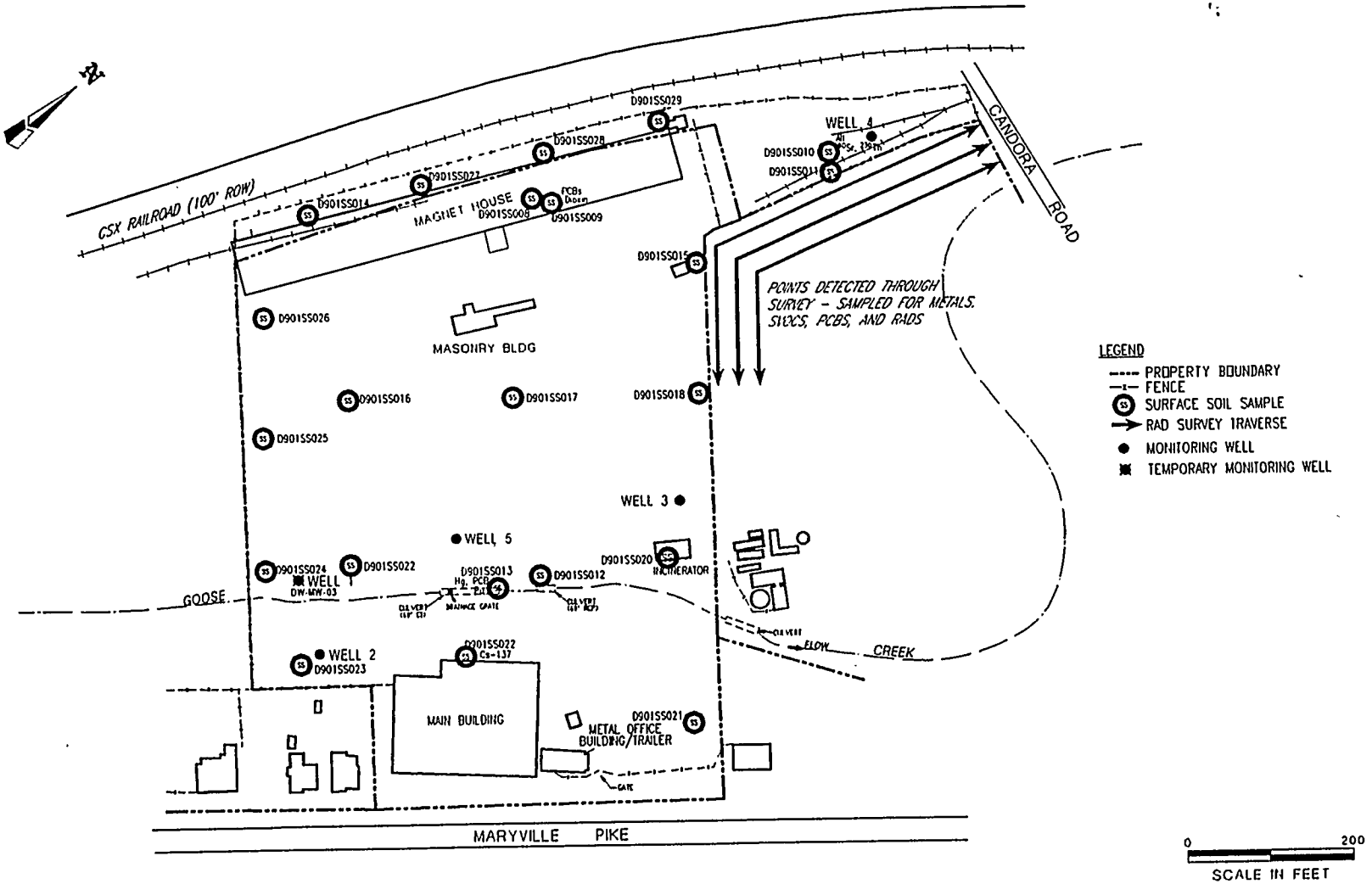
Surface soil samples will be collected at locations illustrated in Figure B.5. Six off-site locations have been selected (four adjacent to the Loading Shed and two in the Candora Road Area) to evaluate the extent of contamination in known problem areas. Additional surface soil samples will be collected at locations on the Tennessee Asphalt property identified by the surface radiological survey, which is described in Section 2.3.2.

2.4.2 Surface Soil Sampling Methodology

Surface soil samples will be collected in accordance with Jacobs ER Team SOP FS-8.1.2, "Soil Sampling with an Auger." Samples will be collected from 0-6 in. and 6-12 in. at each location.

2.4.3 Surface Soil Analysis

Surface soil samples will be submitted for laboratory analysis for PCBs (SW-846 8080), isotopic radionuclides, SVOCs (SW-846 8270), and metals (SW-846 6010 with trace).



MODIFIED FROM. Jesse Walker, RLS, PE, Survey, July 29, 1992.

JE	**Fig. B.5**	**Proposed surface soil sampling locations** DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-20 / RI/FS	DRAWING ID 96-13415.DWG	DRAWING DATE OCTOBER 7 1996 SB

2.5 SURFACE WATER SAMPLING

Previous surface water sampling did not include all COCs from the site (DOE 1996). Additionally, wet weather samples to assess possible pulses of migration has not been completed. Consequently, no remedial action objectives to date address surface water (DOE 1996).

2.5.1 Surface Water Sampling Locations

Figure B.6 shows six surface water sampling locations. The sample locations were selected to represent contaminant levels upstream of the site, on site, downstream of the site, and to identify inputs to Goose Creek from the site.

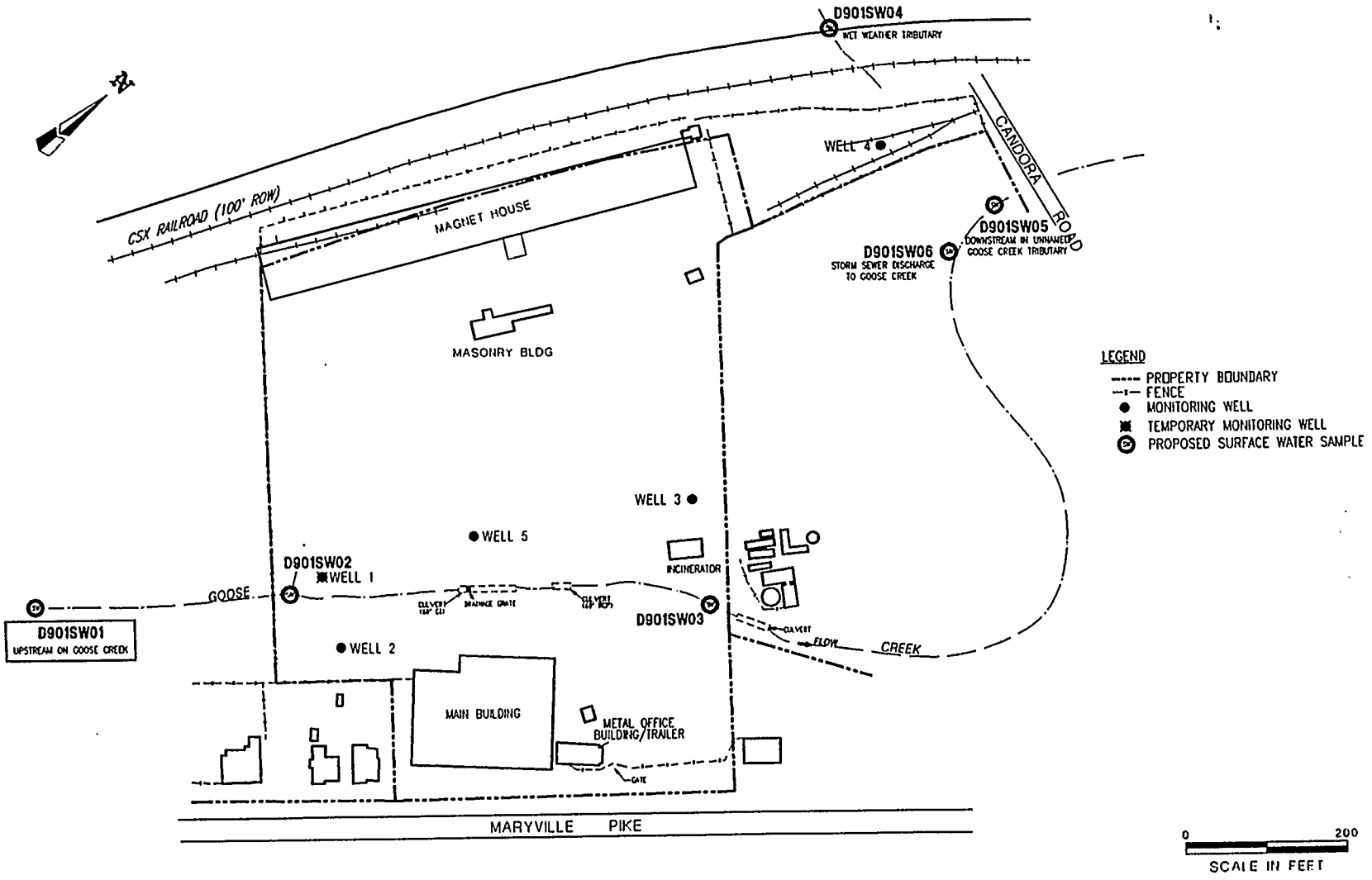
Two of the sampling points are on the unnamed tributary that crosses the Candora Road Area. Overland flow from this area may introduce a significant amount of contaminant flux to the tributary. The off-site locations will be placed as close as possible to the site yet far enough away to account for all overland flow during storms. The upstream location will not be placed above any discharge points entering Goose Creek, and the downstream location will not be placed below any discharge points.

A site walkover will be performed to determine the optimum location of the off-site sampling points. A site walkover will be conducted during a storm to identify preferential overland flow paths and any on-site poststorm seepage points along Goose Creek. Sampling locations will be added or removed as warranted.

2.5.2 Surface Water Sampling Methodologies

Two rounds of surface water samples will be collected; base flow and wet weather. Base flow samples will be collected when 7 days have elapsed with no more than 0.25 cm (0.1 in.) of rainfall. Wet weather sampling will occur as close as possible to the time of peak discharge following a 2.5-cm (1-in.) rain. During initial site preparations, a stream stage will be placed in Goose Creek and a rain gauge will be installed on site. The stream stage will be used to identify when the peak discharge has been reached.

Stream flow measurements will be made in Goose Creek and the unnamed tributary during both rounds of sampling. All stream flow measurements will be completed in accordance with Jacobs ER Team SOP FS-6.2, "Stream Flow Measurements." Surface water samples will be collected in accordance with Jacobs ER Team SOP FS-6.1.1, "Surface Water Sampling: Dipper and Sample Container Submersion."



MODIFIED FROM Jesse Walker, RLS, PE, Survey, July 29, 1992

JE	**Fig. B.6**	**Proposed surface water sampling locations** DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID. 35H830 0094-20 / RI/FS	DRAWING ID 96-13183.DWG	DRAWING DATE OCTOBER 7, 1996 SB

Seep samples will be collected using a small dipping container or a peristaltic pump. The sampling point will first be prepared by removing a small amount of soil from the seep area with a hand trough or shovel. This will form a depression which will fill up with seep water. This depression should not be any larger than is necessary to submerge the dipping container or the silastic tubing if a pump is used. Samples will be collected once the depression has filled with seep water and all sediment has been flushed from the depression.

2.5.3 Surface Water Analysis

Surface water samples will be analyzed for metals (SW-846 6010 with trace), SVOCs (SW-846 8270), and PCBs (SW-846 8080), and gamma and alpha spectrometry. Filtered and unfiltered samples will be collected for metals and radionuclide analyses during wet weather sampling only. All others will be unfiltered. Seep samples will be analyzed for the same parameters as other surface water samples with the addition of volatile organic compounds (VOCs) (SW-846 8260).

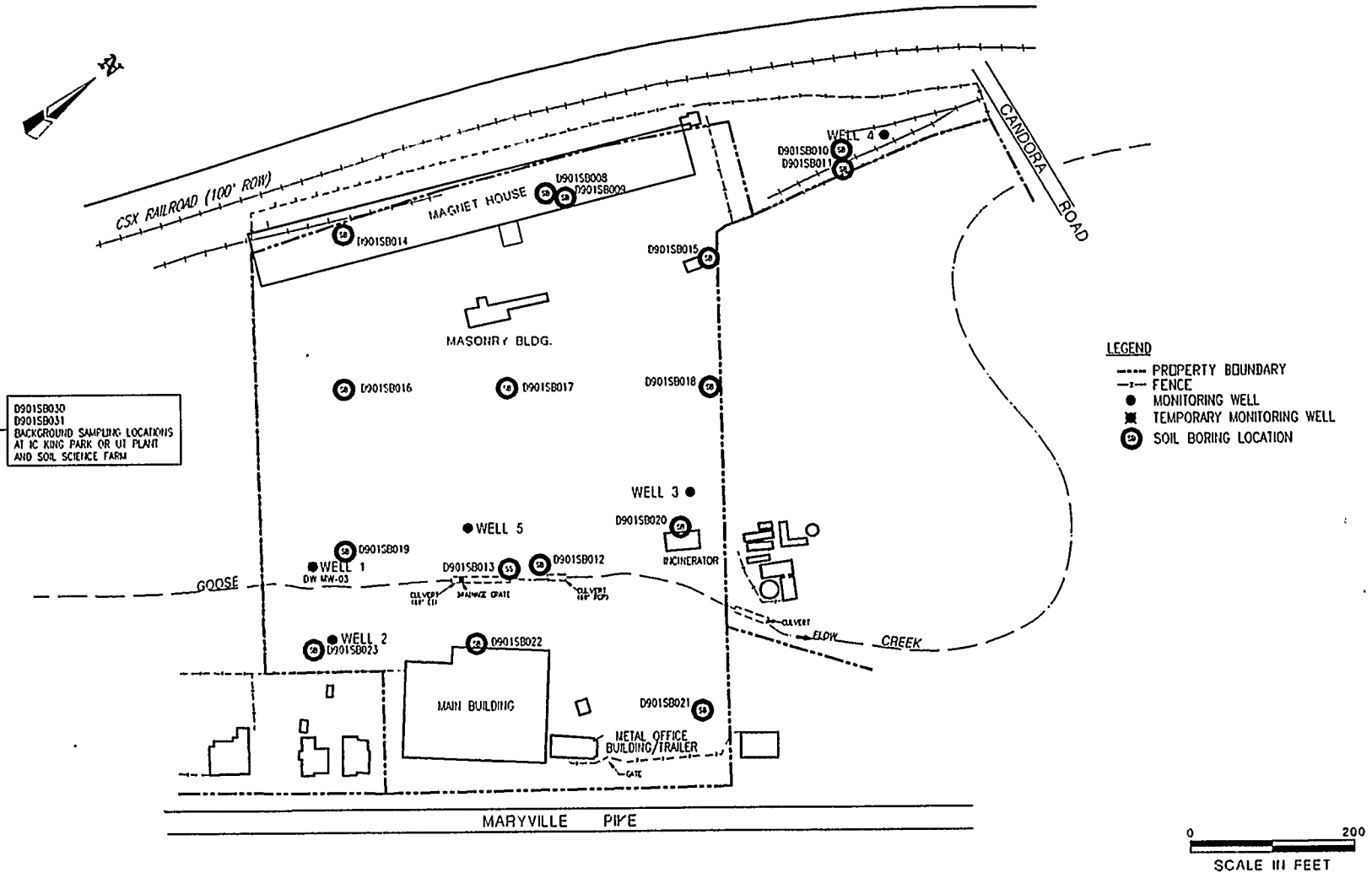
Field screening analysis will be performed on all surface water samples in accordance with Jacobs ER Team SOPs FS-5.6.3, "Field Measurements Procedures: pH, Temperature, and Conductivity," and FS-5.6.4, "Field Measurements Procedures: Dissolved Oxygen." Field screening measurements will include pH, conductivity, temperature, and dissolved oxygen.

2.6 SUBSURFACE SOIL SAMPLING

Subsurface soil data from previous investigations were used to the maximum extent practical for the preliminary RI/FS. However, previous investigations did not collect subsurface data from areas of known surface contamination and no geotechnical data are available. Additional subsurface soil samples will be collected to evaluate the vertical extent of contamination in areas of known surface contamination. Geotechnical analysis will be performed on a limited number of samples to support the sitewide model and remedial alternative assessments. The following sections describe the locations, collection methods, and analysis for subsurface soil samples.

2.6.1 Subsurface Soil Sampling Locations

Figure B.7 illustrates the locations of 18 soil borings. Those locations were selected to target the areas of known surficial contamination. Samples will be collected in each boring at the following intervals: 0.31–0.92-m (1–3-ft), 0.92–1.52-m (3–5-ft), 2.4–3.05-m (8–10-ft), and on 1.52-m (5-ft) centers thereafter until split barrel refusal is reached.



MODIFIED FROM Jesse Walker, RLS, PE, Survey, July 29, 1992

JE	**Fig. B.7**	**Proposed soil boring locations** DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID 35H830 0094-20 / RI/FS	DRAWING ID 96 1316F DWG	DRAWING DATE OCTOBER 22, 1996 TG

Four samples will be collected for geotechnical analysis from two soil borings. In each of the two borings selected for geotechnical analysis, one sample will be collected from the upper 3 m (10 ft), and one from the lower 3 m (10 ft).

2.6.2 Subsurface Soil Sampling Methodology

Subsurface soil samples will be collected in accordance with Jacobs ER Team SOPs FS-8.2.1, "Subsurface Soil Sampling with Shelby Tubes," and FS-8.2.2, "Penetration Tests and Split-Barrel Sampling."

A radiological scan of the soil core will be performed before sampling. Readings above MDA will be noted in the boring log. A sample for VOC analysis will be collected from the center of the soil core so that the remaining soil analyses are not biased high or low for that interval. The remaining soil will be composited in accordance with Jacobs ER Team SOP FS-2.6, "Composite Procedure."

The lithology encountered during the drilling of each soil boring will be recorded on a Soil Boring Log Form by the rig geologist. An example of this form is presented in Jacobs ER Team SOP FS-5.1, "Groundwater Sampling Procedures: Well Installation, Development, and Abandonment."

2.6.3 Subsurface Soil Sample Analysis

Given the absence of a complete subsurface data set, subsurface soil samples will be analyzed for concentrations of VOCs (SW-846 8260), SVOCs (SW-846 8270), Target Analyte List (TAL) metals (SW-846 6010), mercury (SW-846 7471), PCBs (SW-846 8080), and isotopic radionuclides.

Geotechnical samples will be analyzed for moisture content [American Society for Testing and Materials (ASTM) D2216], Atterberg Limits (ASTM D4318), particle size (ASTM D422 and D1140), soil pH (SW-846 9045 or ASTM D4972), permeability (ASTM D5084), porosity (EM 1110-2-1906), cation exchange capacity (SW-846 9081), organic content (ASTM 2974), and relative density (ASTM D4253 and D4254).

2.7 GROUNDWATER MONITORING

Groundwater data generated from previous investigations were used to the maximum practical extent to generate the preliminary RI/FS. However, on-site monitoring wells are not located in the vicinity of known surficial contamination. Additional groundwater data will be collected for use in the final RI/FS.

Five groundwater monitoring wells will be installed to obtain additional data regarding chemical and physical properties of the water-bearing unit underlying the DWI 901 Site. To prevent delays in site characterization, procedures established in this section will apply to any additional monitoring wells deemed necessary as a result of data gaps identified during the course of the investigation.

2.7.1 Groundwater Sampling Locations

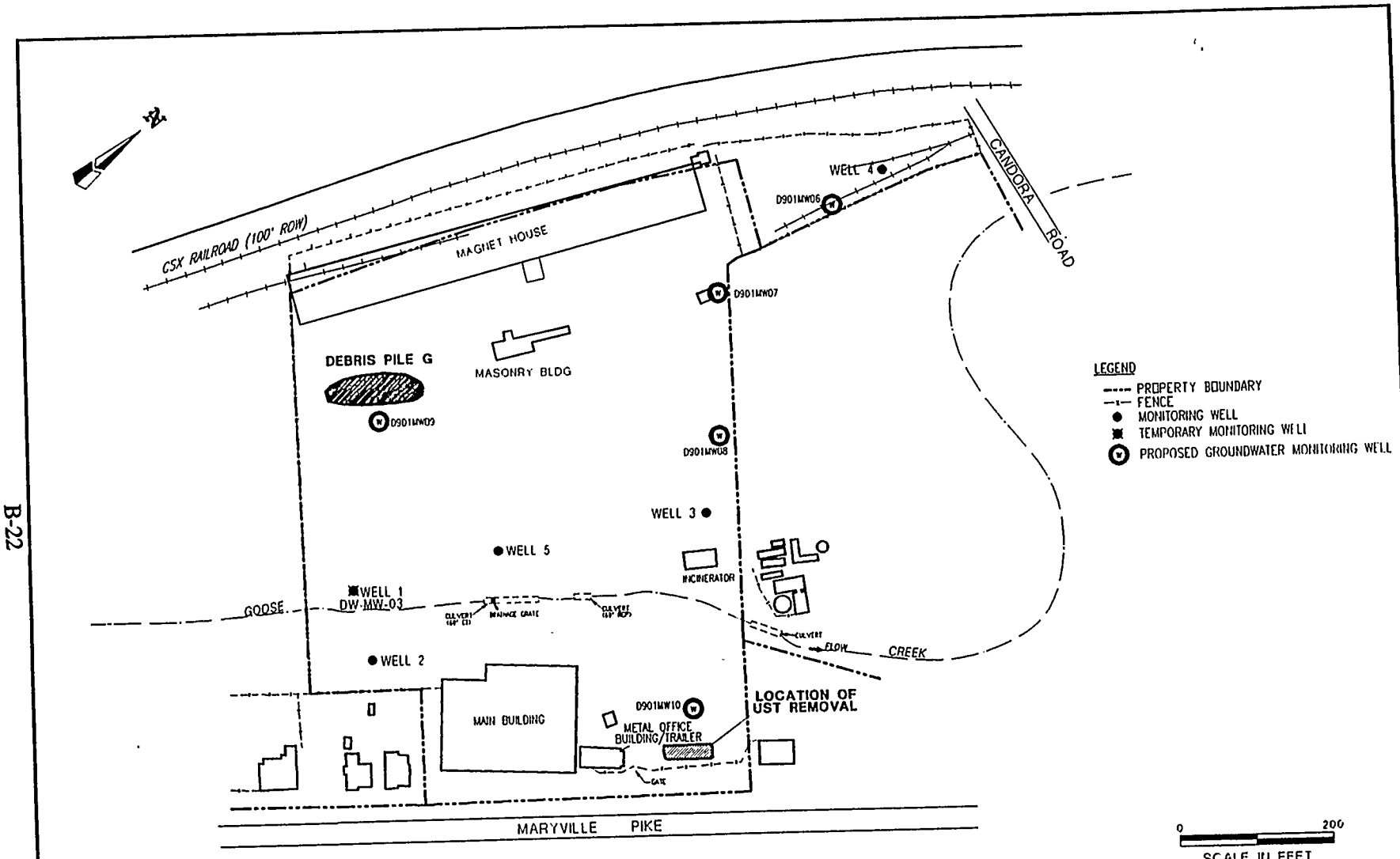
Figure B.8 illustrates the locations of five on-site monitoring wells. Three monitoring wells will be located along the western side of the fence adjacent to the Tennessee Asphalt facility to delineate contamination downgradient of the surface contamination in the Candora Road Area. Two monitoring wells will be installed within the DWI 901 Site property boundary to further assess the on-site contamination associated with the former underground storage tank pit and the largest exposed debris pile. Additional monitoring wells will be installed, if warranted by the initial data.

2.7.2 Groundwater Sampling Methodologies

Monitoring well borings will be drilled to reach the bedrock/unconsolidated layer interface. At the interface, the rig geologist will make the determination as to the proper screen length, slot size, filter pack, and well construction specifications. Well materials will be constructed of stainless steel with a maximum screen length of 3 m (10 ft) and will have lockable casing. All wells will be constructed in accordance with Jacobs ER Team SOP FS-5.1, "Groundwater Sampling Procedures: Well Installation, Development, and Abandonment."

Water level measurements will be obtained in accordance with Jacobs ER Team SOP FS-5.5, "Water Level Measurements Using Water Level Indicator," to support the sitewide hydrogeologic model. Water levels will be recorded on a periodic basis, as determined appropriate by the field technical representative (FTR) and as warranted by site conditions. Water level monitoring will be limited to the 1997 calendar year. This includes the historic wells, if possible. These data will be used to establish hydraulic gradients and identify changes in response to seasonal fluctuations and isolated rains. If warranted, well sentinels coupled to data loggers will be used on a limited basis in accordance with Jacobs ER Team SOP FS-5.7.1, "Slug Testing," and the manufacturers operations manual.

All monitoring wells requiring abandonment will be abandoned during RI activities. Abandonment will be in accordance with local, state, and/or federal regulations and will be approved by the task manager before casing removal or sealing. Once approved, the boring/monitoring well to be abandoned will be sealed by grouting from the bottom of the boring/monitoring well to ground surface as described in Jacobs ER Team SOP FS-5.1.



MODIFIED FROM Jesse Walker, RLS, PE, Survey, July 29, 1992

JE	**Fig. B.8**	**Proposed groundwater monitoring well locations** DOE - David Witherspoon, Inc. 901 Site - Knoxville, Tennessee	DOCUMENT ID 35H830 0094-20 / RI/FS	DRAWING ID 96-13185.DWG	DRAWING DATE OCTOBER 7, 1996 SB

A geologist, geologic engineer, or environmental scientist will be present and responsible at each operating drill rig for monitoring drilling operations; recording of water losses/gains and groundwater data; preparing boring logs and well-construction diagrams; and recording the monitoring well installation procedures. Each geologist will be responsible for only one operating drill rig.

To track construction materials used and to resolve any payment disputes that may arise, the on-site geologist, engineer, or scientist will complete a daily field activity report for each monitoring well in accordance with Jacobs ER Team SOP FS-2.2.2, "Documentation: Daily Field Activity Report." The Jacobs ER Team representative and the authorized subcontractor representative will initial each entry on the form.

To obtain additional data from the saturated zone in the subsurface, groundwater will be collected from the five new monitoring wells and from the five existing monitoring wells, if possible. Grab samples will be collected in accordance with Jacobs ER Team SOP FS-5.4.2, "Groundwater Sampling Procedures: Using a Bladder Pump."

Hydraulic conductivity of water-bearing zones beneath the site will be determined by conducting slug tests within each of the five new groundwater monitoring wells. Slug tests will be conducted in accordance with Jacobs ER Team SOP FS-5.7.1, "Slug Testing."

2.7.3 Groundwater Sample Analysis

Each groundwater sample collected will be analyzed for TAL metals (SW-846 6010) isotopic radionuclides, PCBs (SW-846 8080), VOCs (SW-846 8260), and SVOCs (SW-846 8270). Filtered and unfiltered samples will be collected for metals and radionuclide analysis.

2.8 SURFACE DEBRIS

Surface debris is the single most notable media on site. However, only one sample has been collected. Debris characterization and sampling is critical to making disposal decisions (DOE 1996). There are three broad considerations for debris disposal. They are Resource Conservation and Recovery Act of 1976 (RCRA), Toxic Substances Control Act of 1976 (TSCA), and radionuclides (DOE 1996). In general, radionuclide-contaminated debris and RCRA-characteristic material could be handled at a disposal facility permitted to handle mixed waste. The same debris contaminated with PCBs (TSCA) would have to be treated before disposal.

Also, the size, shape, and nature of the debris must be characterized because most facility waste acceptance criteria (WAC) have limitations on these parameters. Debris sampling will be conducted to determine the appropriate waste disposal alternatives.

2.8.1 Debris Sampling Locations

It is important to note that, because of the extreme heterogeneity of the debris, no amount of sampling can alleviate uncertainty. Determining an appropriate number of debris samples based on a single data set is impossible. Therefore the concentration of the PCB Aroclor-1254 in surface soil was selected on the basis of existing data on PCB concentrations to aid in this determination. This is a reasonable substitution given the following:

- PCBs have a low mobility and tend to readily affix to soil (i.e., they are likely to be close to the source).

- Aroclor-1254 was detected in 22 of 23 previously collected samples and represents a broad range of concentrations across the site.

A statistical elevation of Aroclor-1254 in surface soil was used to calculate an appropriate number of samples to characterize the debris with a 1 percent false positive and 10 percent false negative probability following *A Guide: Methods for Evaluating the Attainment of Cleanup Standards for Soils and Solid Media* (EPA 1991). Using this methodology and the data presented in Table B.1, 92 samples are required.

As presented in Section 3.1.6 of the preliminary RI/FS, the site contains 26 piles of waste with a total estimated volume of 4,663 m^3 (6,136 yd^3). Dividing the total volume by the number of samples yields one sample for each 50.7 m^3 (66.7 yd^3) of debris. Assuming each pile requires at least one sample, Table B.2 shows the total number of debris samples per pile, and Figure B.9 shows the location of the debris piles. Multiple samples within a debris pile will be evenly spaced based on access and professional judgment in the field.

2.8.2 Debris Characterization Methodologies

Because of the heterogeneity of the debris, diverse sampling techniques are required. In general, debris characterization will involve (1) debris pile volume refinement, (2) debris inspection, (3) radiological survey, and (4) debris sampling and analysis.

Table B.1. Debris sample calculations, DWI 901 Site, Knoxville, Tennessee

Analyte	Units	Number detects	Number sampled	Mean*	Minimum detect	Maximum detect	Residential PRG
Aroclor-1242	µg/kg	1	23	10,156.80	200,000	200,000	83
Aroclor-1248	µg/kg	2	23	5,970.07	3,800	100,000	83
Aroclor-1254	µg/kg	22	23	10,210.61	94	160,000	160
Aroclor-1260	µg/kg	20	23	4,119.15	120	43,000	83

Std. deviations, α	False positive (1%) and false negative (90%) normal deviates, $Z_{(1-\alpha)} + Z_{(1-\beta)}$	Cleanup standard, C_s	Alternative clean decision level, m_1	No. of representative samples = $\alpha^2 (Z_{(1-\alpha)} + Z_{(1-\beta)}/C_s - m_1)^2$
(Max-min)/6	(Fixed values)	(Residential PRG)	(Mean)	(Result)
26,651	3.608	160	10,210.6	92

*The mean value was calculated using detected value(s) and half of nondetected value(s)

DWI = David Witherspoon, Inc.
kg = kilogram
µg = microgram
% = percent
PRG = preliminary remediation goal

2.8.2.1 Debris pile volume estimates

Debris disposal charges are one of the largest costs for site remediation (DOE 1996). Debris volume estimates are calculated from site photographs. To refine the disposal costs in the final RI/FS, field measurements of length, width, and height will be completed for each of the 26 piles.

2.8.2.2 Debris inspection

Debris Piles A, E, F, J, and S are homogenous stacks of sorted material. Piles B1, B2, C, D, H, I, K, L, N, O, P, Q, R, T, U, W, X, and Y are quasi-segregated piles of larger debris (e.g., wooden pallets, tires, and meter boxes). Both groups represent larger material. Piles G, M, and V are extremely heterogenous and contain debris ranging from fine wire to large pieces of scrap metal. Piles G and V are the largest piles on site and account for 72 percent of the total debris sampling. Debris is also present inside the buildings, primarily in the Materials Handling and Storage Building, and will be included in the debris characterization task. All debris within the confines of the Magnet House will be considered part of Pile V.

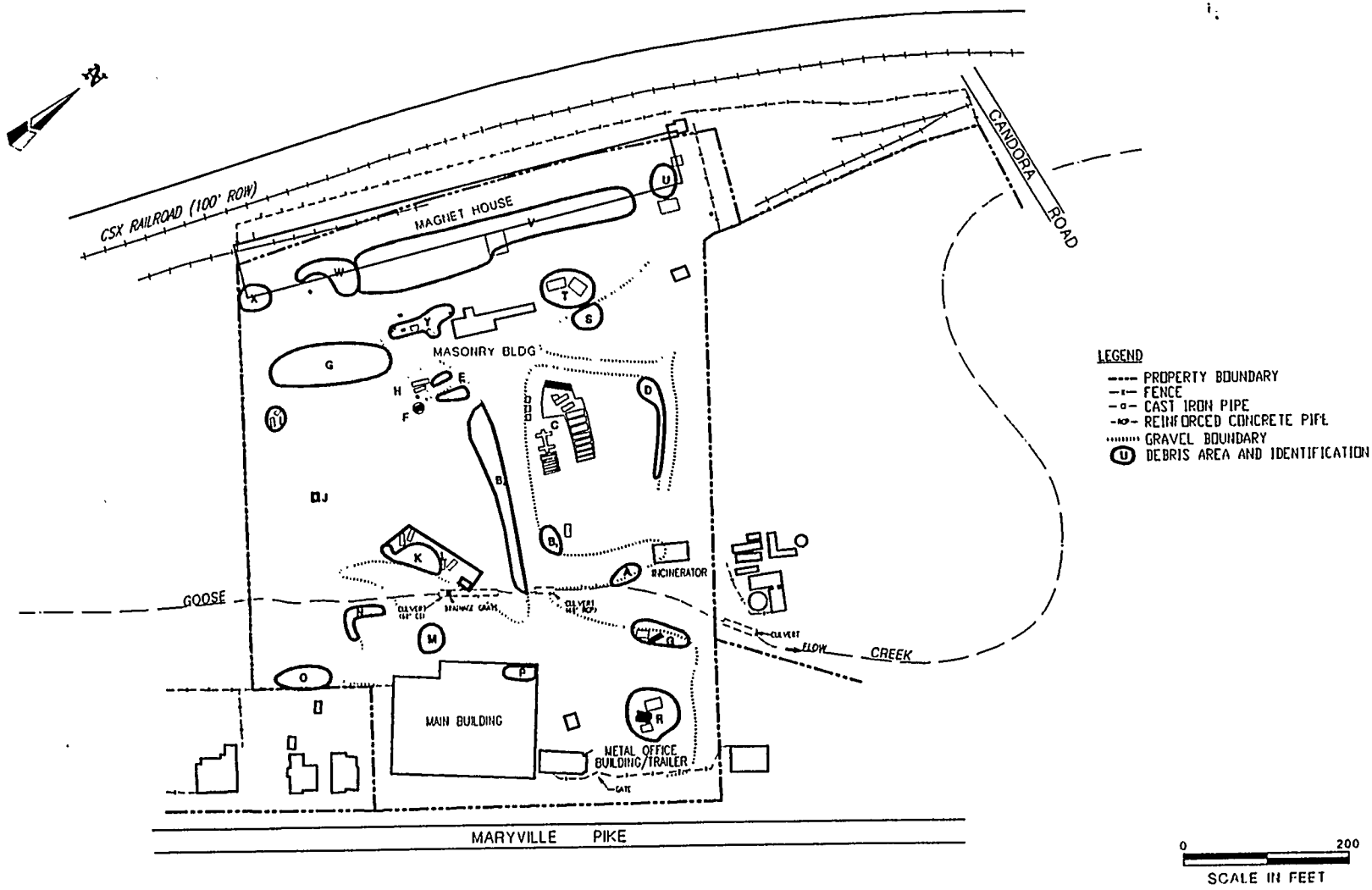
Table B.2. Debris volumes and number of samples, DWI 901 Site, Knoxville, Tennessee

Debris area	Area volume (yd^3)	Number of samples
A	31.6	1
B_1	399.3	6
B_2	20	1
C	157.3	2
D	23.4	1
E	79	1
F	5.7	1
G	1,591.9	24
H	0.9	1
I	4.8	1
J	0	0
K	28.6	1
L	69.6	1
M	95.1	1
N	6.7	1
O	23.4	1
P	16.2	1
Q	11.7	1
R	41	1
S	27.6	1
T	74.1	1
U	16.8	1
V	3,304.9	50
W	35	1
X	4.4	1
Y	67.2	1
Buildings	*	4
Total	6,136.2	107

* = volume unknown

yd = yard

The debris inspection will consist of categorizing the types of debris by material, size, and shape; estimating the volumes of each type; and photographing the various types of materials. A debris inspection and photographic log will be completed for each pile. Descriptions will be recorded in the field logbook.



MODIFIED FROM. Jesse Walker, RLS, PE. Survey, July 29, 1992.

JE	**Fig. B.9**	**Debris pile locations** DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-20 / RI/FS	DRAWING ID 96-13184.DWG	DRAWING DATE OCTOBER 7, 1996 SB

2.8.2.3 Radiological survey

A radiological survey of each pile will be conducted in accordance with Jacobs ER Team SOPs. The surface of each pile will be surveyed for increases in activity above background using the NaI detector. Areas with elevated readings will be resurveyed using a Geiger-Müller detector. Any areas found to be greater than MDA will be scanned using the Alpha Scintillation Detector.

Piles G, M, and V will require a different approach because of their large volume and surface area and because of the extreme heterogeneity of the debris. A backhoe will be used to remove smaller, more manageable amounts of debris from these piles. Debris from each backhoe bucket will be spread out and surveyed in the same manner as the smaller debris piles. The number of backhoe buckets to be retrieved will be in accordance with Table B.2, and the locations will be evenly spaced over the entire pile to provide adequate characterization. Each bucket load of debris will be numbered and recorded in the logbook along with the survey results. Any wipe samples collected will also be noted in the logbook.

Results from these surveys will be recorded in the logbook and on contamination survey forms.

2.8.2.4 Debris sampling and analysis

Radiological wipe samples (number based on Table B.2) will be collected from the surface areas that have readings in excess of MDA in accordance with Jacobs ER Team SOP H&S-11.4.1, not to exceed one wipe sample per pile or per bucket load for the larger piles.

Each pile will be visually surveyed for areas of potential PCB contamination (dirty-oily areas). Biased wipe samples will be collected from these locations (number based on Table B.2) in accordance with Jacobs ER Team SOP FS-11.2.1, "Wipe Sample Collections for Chemical Analysis." If no staining is apparent, a sample area will be randomly selected.

Debris samples will be collected for Toxicity Characteristic Leaching Procedure (TCLP) analysis to support waste disposal options. Because of the nature of the debris, collection of a physical sample may not be possible or practical. TCLP sampling will be limited to items small enough for containerization and may require the use of sheers, snips, hacksaws, or similar equipment, as necessary. Following the logic used elsewhere for the RI, that it is not feasible to eliminate all uncertainty, it is likewise not feasible to characterize all of the debris piles for

TCLP. TCLP analysis will therefore be limited to Piles G and V, which represent 80 percent of the debris on site. Many of the other debris piles would be eliminated from consideration because they are composed entirely of materials too large to sample.

Ten percent of the backhoe removals from Piles G and V will be sampled for TCLP (seven samples). Extensive TCLP sampling is not being performed because it is likely that the waste disposal alternatives will require some form of pretreatment, which will include a TCLP analysis for treatment verification.

Physical samples may also be collected for isotopic radionuclides analysis using the Scout Multichannel Analyzer in the field on a random basis at the discretion of the FTR, RCT, or RST. These samples will be collected on a limited basis and will have size restraints similar to the TCLP samples.

2.8.3 Debris Analysis

Radiological wipe samples will be analyzed in the field in accordance with Jacobs ER Team SOP H&S 11.4.1, "Radiological Contamination Surveys." Wipe samples will be analyzed using the Alpha-Beta Sample Counter and, on a limited basis, the Scout Mutichannel Analyzer in accordance with Jacobs ER Team SOPs H&S-11.3.3, "Alpha-Beta Sample Counter: Calibration and Usage," and H&S-11.3.7, "Scout Multichannel Analyzer: Operation and Usage."

PCB wipe samples will either be analyzed in the field using immunoassay test kits in accordance with Jacobs ER Team SOP FS-5.4.4, "Immunoassay Screening Test for Polychlorinated Biphenyls, Pentachlorophenols, and Polyaromatic Hydrocarbon," or will be submitted for PCB analysis. If the field test kits are used, 10 percent of the samples will be submitted for laboratory confirmation.

TCLP samples will be submitted to a contract laboratory for SVOC, TAL metals, and mercury analysis.

2.9 DRUM SURVEY AND SAMPLE COLLECTION

During previous investigations, a number of drums were reported on the site. Currently, no data exist which characterizes the physical condition or contents of the drums. To determine the physical condition of the drums and the physical/chemical composition of drum contents, a drum survey and sample collection program will be implemented. The proposed drum survey and sample collection activities are based on the premise that most, if not all, drums on the

surface of the DWI 901 Site are empty and have been exposed to the environment for several years. However, the following sections include a plan for sampling only intact drums identified during the drum survey.

2.9.1 Drum Survey and Sample Collection Location

A visual survey of the entire fenced site boundary will be conducted to determine the exact drum locations. The drum locations will be recorded in a designated field logbook and depicted on a site map.

2.9.2 Drum Survey Methodology

Once all drums have been located, a survey will be conducted to evaluate their contents and physical condition. The survey will include identifying the drum locations and plotting these on the site map, field screening for radiological and VOC contaminants, evaluating the physical condition of the drums (e.g., rusting, holes, etc.), and identifying and recording any labeling or numbers that may be on the drums.

Each drum will be photographed in place as part of the survey. Included in the photograph will be a dry erase board that will have the approximate location, exposure number, and roll and film number. After each drum has been surveyed and photographed, a number will be permanently placed on the exposed northern side of each drum to indicate that the drum has been surveyed. A drum inventory log and photolog will be maintained documenting the findings of this survey.

Figure B.10 summarizes the drum survey and drum sample collection activities to be completed for the DWI 901 Site. As indicated in Figure B.10, drums will be handled in four categories based on drum contents and physical condition. The following sections describe procedures for each scenario.

2.9.2.1 Open to environment/empty

Most, if not all, drums at the DWI 901 Site are expected to fall into this category. These drums will be placed upright (if they are lying on their side), placed on pallets, and considered debris. No additional field sampling or sample collection will be conducted for drums in this condition.

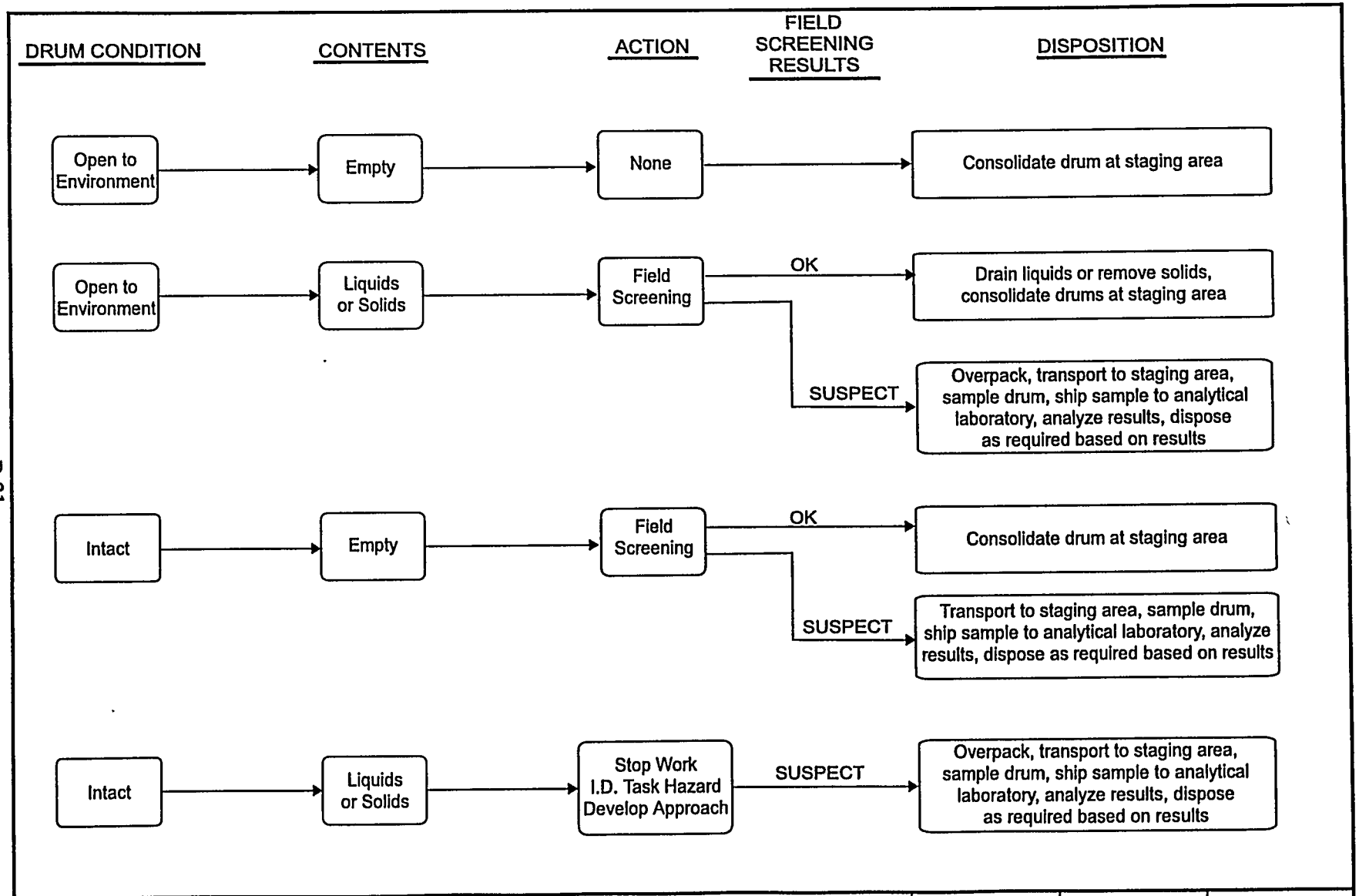


Fig. B.10

Proposed drum characterization activities

DOE - David Witherspoon, Inc. - 901 Site - Knoxville, Tennessee

DOCUMENT ID: 35H830 0094-80 / RI/FS

DRAWING ID: 97-13570.CDR

DRAWING DATE: OCTOBER 17, 1996 TG

2.9.2.2 Open to environment/liquids or solids

This category will most likely include drums that contain rainwater. However, it may be possible that these drums contain sludge, solids, or organic compounds. Field screening will be performed for PCBs using immunoassay test kits, VOCs using a photoionization detector (PID), and radionuclides using a Micro-R Survey Meter and a NaI Radiation Detector.

2.9.2.3 Intact/empty

This category is expected to be rare at the DWI 901 Site. If identified, these drums will be opened using a spark-proof bung wrench. Once opened, the drums will be analyzed using field screening technologies described in Section 2.9.2.2. If field screening results confirm the absence of contamination, the drums will be staged on a pallet. If field screening results indicate the presence of contamination, samples of any residual material will be collected and analyzed as described in Section 2.9.2.4.

2.9.2.4 Intact/liquids or solids

Intact drums containing liquids or solids are not expected to be present at the DWI 901 Site. In the event that such drums are discovered, the field sampling team will stop work and evaluate the approach for characterization and develop an appropriate plan and task hazard analysis.

Drums will be placed in a steel overpack container and opened using spark-proof tools. Once opened, drums will be analyzed using field screening techniques described in Section 2.9.2.2. The results of field screening will be recorded in the field logbook. The contents of each drum will be sampled in accordance with Jacobs ER Team SOP FS-11.2.2, "Container Sampling: Sampling Liquids from Drums and Tanks." Each sample will be analyzed for isotopic radionuclides, pesticides, herbicides, PCBs (SW-846 8080), VOCs (SW-846 8260) SVOCS (SW-846 8270), TAL metals (SW-846 6010), mercury (SW-846 7471), and TCLP (solids only).

2.10 BACKGROUND SAMPLING

Background analytical information is necessary to establish a baseline and to measure cleanup performance. Some background information has been collected at the DWI 901 Site. However, the usefulness of these data is limited for one or more of the following reasons:

- The detection limits for the background samples were set higher than the preliminary remediation goals (PRGs).

- The number of analytes tested for were limited and did not include the full list of COCs.

- Current background information is insufficient to rule out background constituents which may exceed PRG/risk levels.

- Background sampling specific to certain media has not been conducted.

Background data collection is proposed to fill in the data gaps for the DWI 901 Site. Certain background data collected for the DWI 901 Site will be shared with the DWI 1630 Maryville Pike 1630 Site. Both the DWI 901 and 1630 Sites are underlain by similar bedrock and soil material and are expected to be chemically similar. Background data needs common to both sites include groundwater, surface soil, and subsurface soil. Background data for surface water is specific to the DWI 901 Site.

Background data will be collected from two types of settings, naturally occurring and anthropogenic. Naturally occurring background levels are ambient concentrations of chemicals present in the environment that have not been influenced by human activity. Anthropogenic background levels are concentrations of chemicals that are present in the environment due to human-made, nonsite sources (e.g., industry, automobiles).

Anthropogenic background sampling is warranted for the DWI 901 Site because it is located in a light industrial district. PRGs should be based on these levels rather than the naturally occurring levels. Anthropogenic sampling will be limited to surface soils and surface waters because these are the primary media affected by industrial activity.

Naturally occurring background sampling will also be conducted to maintain consistency when performing risk assessments. This sampling will include groundwater, surface soil, and subsurface soil.

2.10.1 Background Sampling Locations

The selection of locations for anthropogenic sampling will be limited to city easements and right of ways. It is unlikely that access to nearby industrial properties will be granted. Ten soil sampling locations will be selected within a 1-mile radius of the DWI 901 and 1630 Sites. When possible, these locations will be placed an appropriate distance from major roadways to correlate with the distances from roadways of the DWI 901 Site. Three surface water samples will be collected upgradient of the DWI 901 Site, two on Goose Creek and one from an unnamed tributary that crosses the Candora Road Area as shown on Figure B.6.

The selection of locations for naturally occurring background sampling will be limited to areas free of industrial/commercial activity that are underlain with the same bedrock as the DWI 901 Site. The north side of Knob Creek in I.C. King Park and the University of Tennessee Plant and Soil Science Farm are both potential sites, access pending. Figure B.11 shows the location of these sites, along with the geology of the area in relationship to the DWI 901 Site. Samples will be collected from three locations for each medium.

2.10.2 Background Sampling Methodologies

For consistency, the methods of collection for each of the identified media are the same as for the media sampled on site. The methodology descriptions for each medium can be found for:

- surface soil—Section 2.4,
- subsurface soil—Section 2.6,
- groundwater—Section 2.7, and
- surface water—Section 2.5.

2.10.3 Background Sampling Analysis

Analysis of surface soil, subsurface soil, and groundwater samples (filtered and unfiltered) will include only metals and isotopic radionuclides.

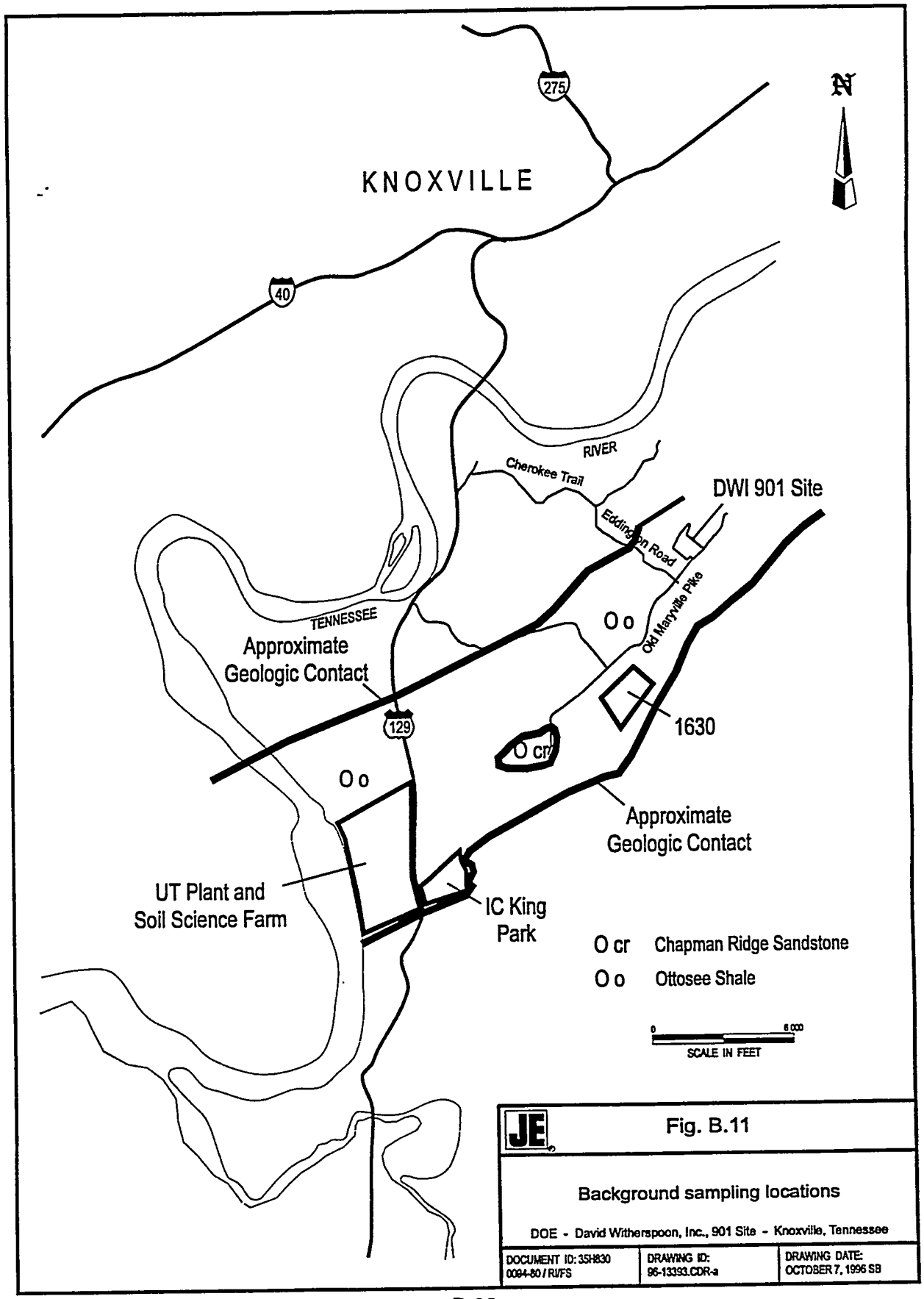
Surface water samples will be analyzed for metals (SW-846 6010), SVOCs (SW-846 8270), PCBs (SW-846 8080), and isotopic radionuclides. Filtered and unfiltered samples will be collected for metals radionuclide analysis during wet weather sampling only.

2.11 SURVEYING

Surface samples, soil borings, monitoring wells, and site features will be located using conventional surveying equipment. All surveying data will be recorded, stored, and transferred to databases and will be associated with sample identification numbers.

2.12 WETLANDS SURVEY

A wetlands survey will be conducted, and an assessment will be performed if any wetlands are identified. The survey will include the DWI 901 Site and adjacent areas potentially affected by off-site contamination.


KNOXVILLE
275
40
129
N
RIVER
Cherokee Trail
DWI 901 Site
Eddington Road
Old Maryville Pike
TENNESSEE
Approximate
Geologic Contact
O o
O cr
1630
Approximate
Geologic Contact
UT Plant and
Soil Science Farm
IC King
Park
O cr Chapman Ridge Sandstone
O o Ottosee Shale
0
6,000
SCALE IN FEET
JE
Fig. B.11
Background sampling locations
DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee
DOCUMENT ID: 35H830
0084-80 / RI/FS
DRAWING ID:
96-13393.CDR-a
DRAWING DATE:
OCTOBER 7, 1996 SB

3. QUALITY ASSURANCE PROJECT PLAN

The quality assurance project plan ensures that the field program is completed by a qualified and trained staff, that work practices will generate defensible data, and that field documentation will be of sufficient detail to allow for reconstruction of field activities. A quality control summary report (QCSR) will be provided along with the final RI/FS. The QCSR will summarize the results of the QA/QC program described in this section.

Table B.3 summarizes the major sample collection activities described in Chapter 2.

3.1 ORGANIZATION, QUALIFICATIONS, AND TRAINING

3.1.1 Project Organization

Figure B.12 shows the organizational structure for this project. The Jacobs ER Team is under contract to DOE to implement this task. There are four key roles for the field staff: FTR, site health and safety officer (SHSO), QA specialist, and field specialist.

3.1.2 Key Field Positions and Responsibilities

3.1.2.1 Field technical representative

The FTR runs the field program. He/she is responsible for implementing all phases of this plan and for setting a tone of efficiency and safety in the field. The FTR reports directly to the Jacobs ER Team task manager and, in some cases, the DOE project manager.

3.1.2.2 Site health and safety officer

The SHSO ensures that all requirements of the health and safety plan (HASP) (Chapt. 5) are followed in the field. The SHSO is empowered with stop-work authority and reports along an independent path directly to the program health and safety manager.

3.1.2.3 QA specialist

The QA specialist oversees the field staff to ensure that all components of this chapter are implemented. The QA specialist is not a full-time field position, but will be on-site often completing oversight and surveillance activities. The QA specialist reports directly to the QA manager.

Table B.3 Sample matrix summary table, DWI 901 Site, Knoxville, Tennessee

Sample type	Number of samples	Field QC samples number/type/parameters	Parameters	Analytical methods
Surface water Baseflow	5	1 FD (all) 1 ER (all)	TAL metals radionuclides SVOCs PCBs	SW-846 6010 with trace isotopic radionuclides SW-846 8270 SW-846 8080
Surface water Storms and seeps	14 7	1 FD (all) 1 FB (VOC only) 1 TB per cooler (VOC only) 1 ER (all)	TAL metals radionuclides SVOCs PCBs VOCs (seeps)	SW-846 6010 with trace (filtered and unfiltered) isotopic radionuclides (filtered and unfiltered) SW-846 8270 SW-846 8080 SW-846 8260
Groundwater	26 10	1 FD (all) 1 ER (all) 1 FD (all) 1 FB (VOCs only) 1 TB per cooler (VOC only) 1 ER (all)	TAL metals radionuclides PCBs VOCs SVOCs	SW-846 6010 (filtered and unfiltered) isotopic radionuclides (filtered and unfiltered) SW-846 8080 SW-846 8260 SW-846 8270
Drums	25	2 FD (all) 2 FB (VOCs only) 1 TB per cooler (VOC only) 2 ER (all)	TAL metals mercury pesticides/herbicides PCBs VOCs SVOCs radionuclides	SW-846 6010 SW-846 7471 SW-846 8080/8150 SW-846 8080 SW-846 8260 SW-846 8270 isotopic radionuclides
Surface soils	35 22	2 FD (all) 2 ER (all)	metals PCBs SVOCs radionuclides	SW-846 6010 with trace SW-846 8080 SW-846 8270 isotopic radionuclides

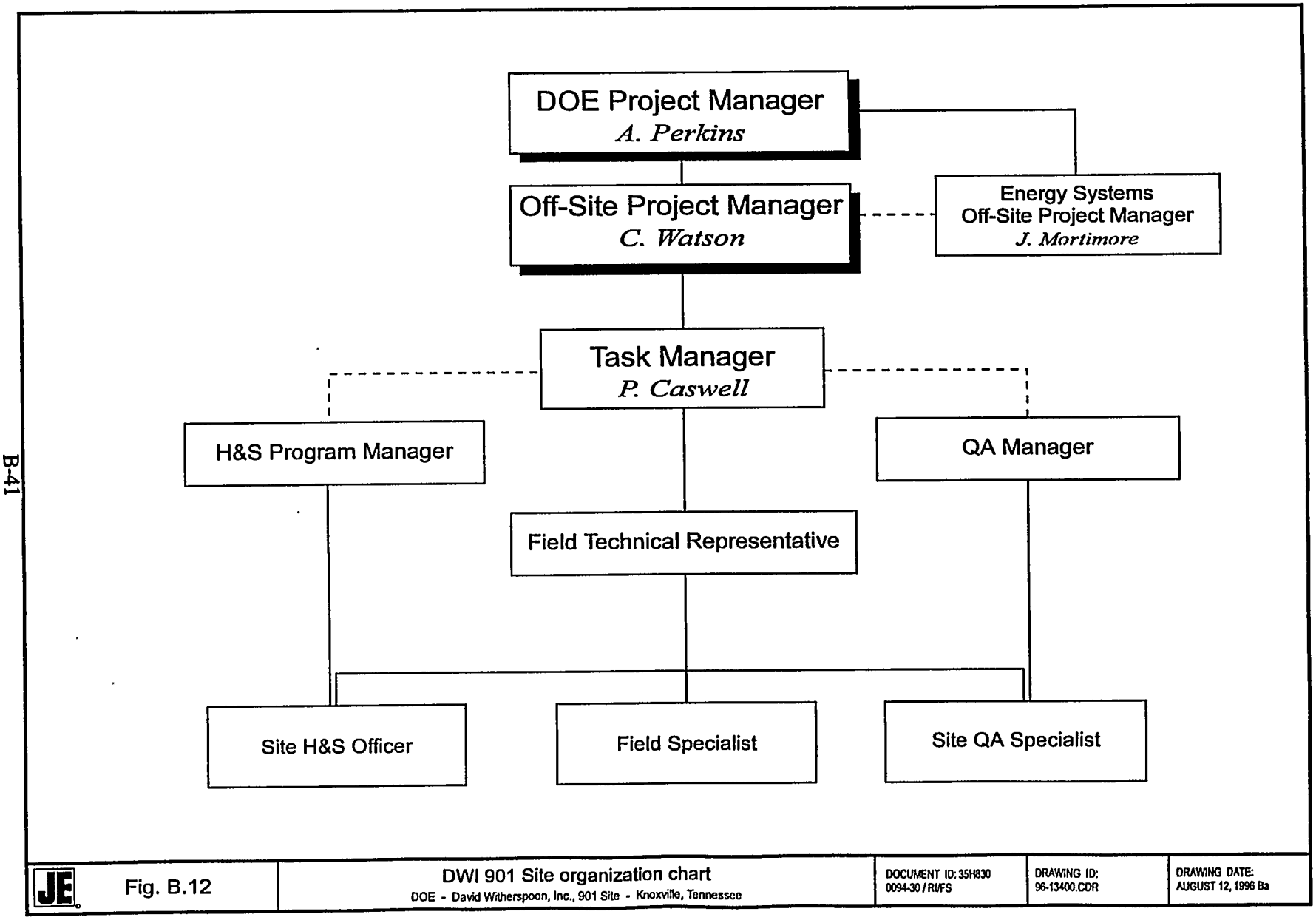
Table B.3. (continued)

Sample type	Number of samples	Field QC samples number/type/parameters	Parameters	Analytical methods
Subsurface soils				
Chemical/radiological	84	5 FD (all) 1 TB per cooler (VOC only) 5 ER (all)	TAL metals mercury radionuclides	SW-846 6010 SW-846 7471 isotopic radionuclides
			PCBs VOCs SVOCs	SW-846 8080 SW-846 8260 SW-846 8270
Geotechnical	69	4 FD (all) 1 TB per cooler (VOC only) 4 ER (all)	moisture content Atterberg Limits particle size soil pH	ASTM D2216 ASTM D4318 ASTM D422 and D1140 SW-846 9045 or ASTM D4972
		(none)	permeability porosity	ASTM D5084 EM 1110-2-1906
	4		CEC organic content relative density	SW-846 9081 ASTM 2974 ASTM D4253 and D4254
Debris				
Wipe samples	107	9-10 (10% laboratory confirmation) 10-20 (lab quantification)	PCBs radiological	Field screening using immunoassay Laboratory confirmation - SW-846 3550/8080 field screening (Jacobs Environmental Restoration Team SOP H&S-11.4.1) Laboratory confirmation
Physical samples	7	(none)	TCLP TAL metals TCLP mercury TCLP SVOCs	SW-846 3010/6010 SW-846 1311/7470 SW-846 3520/8270

Note: All sample totals include background samples.

Table B.3. (continued)

ASTM = American Society for Testing and Materials
CEC = cation exchange capacity
DWI = David Witherspoon, Inc.
EM = environmental management
ER = equipment rinsate
FB = field blank
FD = field duplicate
% = percent
PCB = polychlorinated biphenyl
QC = quality control
SOP = standard operating procedure
SVOC = semivolatile organic compound
TAL = target analyte list
TB = trip blank
TCLP = Toxicity Characteristic Leaching Procedure
VOC = volatile organic compound



JE Fig. B.12	DWI 901 Site organization chart DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee	DOCUMENT ID: 35H830 0094-30 / RI/FS	DRAWING ID: 96-13400.CDR	DRAWING DATE: AUGUST 12, 1996 Ba

3.1.2.4 Field specialist

Field specialists will complete the work described in these plans. They include geologists, hydrologists, ecologists, etc., necessary to implement the program. Field specialists report to the FTR.

3.1.3 Qualifications and Training

Jacobs ER Team personnel selected to work on the DWI 901 Site sampling project will:

- be trained to applicable procedures,
- be physically able to perform the duties and tasks assigned,
- be under a current medical monitoring program, and
- have completed:
  - current 40-hour Occupational Safety and Health Administration (OSHA) or 8-hour refresher training,
  - current 8-hour OSHA supervisor training FTR and SHSO, and
  - first aid and cardiopulmonary resuscitation (CPR) SHSO.

Selected Jacobs ER Team personnel will receive additional site-specific training before sampling activities begin. Site-specific training will include a required reading assignment, performance-oriented equipment training, and health and safety training provided by the health and safety manager or designee. Additional training that may be required includes General Employee Training, and Rad Worker I and II.

Employee training will be determined on a training assignment record as outlined in the Jacobs ER Team SOP QA-3.0, "Training." Training records will be maintained by the Jacobs ER Team training coordinator at the Jacobs Technical Center. A copy of the training records will be maintained by the SHSO while performing work in the field.

3.2 SAMPLE MANAGEMENT

Sample management covers the life of a sample from collection through analysis and reporting.

The Jacobs ER Team field team will interface with the Jacobs ER Team laboratory coordinator. The laboratory coordinator will support the Lockheed Martin Energy Systems (Energy Systems) Sample Management Organization (SMO), who will procure the analytical services.

3.2.1 Sample Identification

All sampling, testing, and monitoring locations where physical, chemical, or radiological samples and/or measurements are taken will be designated using the standard identification system described in Jacobs ER Team SOP FS-1.7 "Designation of Sampling, Testing, and Monitoring Locations."

All sample designations will include a location code, matrix code, and sequence code. The location code for all DWI 901 Site samples, including background samples, will be D901. Additional matrix codes will be used for the sampling media not referenced in Jacobs ER Team SOP FS-1.7 and are as follows:

- surface water base flow—BF
- surface water storm flow—SF
- surface water seeps—SP
- drum liquids—DL
- drum solids—DS
- surface debris—DB
- subsurface debris—DX

The matrix code will be followed by the sequence code or additional location information and qualifiers depending on the media being sampled. Subsurface debris, surface water (storm flow and seeps), subsurface soil, groundwater, and surface debris will have additional qualifiers. Surface soil, surface water (base flow), and drum samples will have only the sequence code.

3.2.1.1 Subsurface debris nomenclature

The sequence code for subsurface debris will be preceded by a qualifier (A—Z), which identifies each trench transect described in Section 2.2.2 "Trench Excavation Methodology." Examples of subsurface debris sample nomenclature are as follows:

- D901DXG02—The second wipe sample collected from Trench G
- D901DXB10—The tenth wipe sample collected from Trench B

3.2.1.2 Surface water storm flow, seeps, and groundwater sample nomenclature

The sequence code for storm flow, seep, and groundwater samples will be followed by a U (unfiltered) or F (filtered) qualifier. Examples of storm flow, seep, and groundwater sample nomenclature are as follows:

- D901SF03U—the unfiltered water sample collected during storm flow from the third sampling point
- D901SP06F—the filtered water sample collected at the sixth seep location
- D901GW06U—the unfiltered groundwater sample collected from monitoring well number six

3.2.1.3 Subsurface soil sample nomenclature

The sequence code for soil boring locations will be followed by a qualifier (A–I) to represent the various sample depths because multiple samples will be collected from the same boring location. An example of subsurface soil sample nomenclature follows:

- D901SB27E—the soil sample collected from the 5.5- to 6-m (18- to 20-ft) zone at boring location number 27.

3.2.1.4 Surface debris sample nomenclature

The sequence code for surface debris samples will be preceded by a qualifier (A–Y) to represent the debris pile from which the sample was collected. Piles B_1, B_2, and the building debris will be designated as follows:

- B_1—1B
- B_2—2B
- Materials Handling Building—MH
- Metal Office Building—MO
- Masonry Building—MB
- Incinerator—IN

Examples of surface debris sample nomenclature are as follows:

- D901DBG45—Wipe sample number 45 collected from Pile G.

- D901DB2B02—Wipe sample number two taken from Debris Pile B_2.

- D901DBMB01—Wipe sample number one taken from debris inside the Masonry Building

3.2.2 Sample Preparation and Shipment

3.2.2.1 Containers

Sample containers will be provided by the subcontract analytical laboratory and shall be new and precleaned with certification of purity. Containers will be checked before fieldwork starts to ensure that containers are the right type, the required number are present, the correct preservative is used (if required), and the containers are clean. Container caps will not be opened until actual sampling time, and then just long enough to fill the container. Sample containers will be kept cool, dust-free, and out of the sun. A summary of sample container requirements is provided in Attachment I of the Jacobs ER Team SOP FS-2.3, "Sample Preservation and Container Materials."

3.2.2.2 Preservation

Samples will be preserved according to analytical method requirements. They will be maintained (as necessary) at approximately 4°C (39°F) for transport to the laboratory for analysis in accordance with Jacobs ER Team SOP FS-2.3. Dry ice will not be used as a cooling agent because of the danger of freezing samples. The type of preservative used will be documented on the chain-of-custody record.

3.2.2.3 Packaging and shipping

All filled sample containers will be sealed, properly labeled, and placed in a cooler in accordance with Jacobs ER Team SOP FS-2.4.3, "Packaging Environmental Samples for Transportation." Required information about the sample will be entered in the field logs and on the chain-of-custody forms in accordance with Jacobs ER Team SOP FS-2.4.2, "Chain-of-Custody Procedures." Sample coolers will be sealed with adhesive tape and chain-of-custody seals will be placed on the cooler so that any tampering can be detected by the receiving laboratory. All samples must remain at approximately 4°C (39°F) during shipment. All samples will be transmitted to the laboratory(ies) by hand, courier, or express mail service. If the samples are shipped via courier or express mail, the shipping number will be entered on the bottom of the chain-of-custody form.

Upon receipt, the laboratory will assume custody of the samples and will indicate so by signing the chain-of-custody form. The chain-of-custody form will be returned to and maintained in the project file by the Jacobs ER Team.

3.2.2.4 Radiological survey

Before any sample is shipped off site, a radiological survey will be conducted on each sample in accordance with Jacobs ER Team SOPs H&S-11.4.1, "Radiological Contamination Surveys," and FS-2.4.3. All activity levels above background will be recorded on the appropriate chain-of-custody form.

3.2.2.5 Chain of custody

The chain-of-custody will document the shipment of samples from the sampler to the laboratory. One form, consisting of an original and three copies, is filled out for each shipment. The original and the first copy are placed in a Ziploc bag and sent in the cooler with the samples. The remaining two copies are retained for the project files. A copy of the chain-of-custody form will be forwarded to the SMO. The following information is shown on the chain-of-custody form:

- project identification and location,
- laboratory identification,
- sampler(s),
- sample matrix,
- sample identity (in accordance with Jacobs ER Team SOP FS-1.7),
- date and time of sampling,
- signature of persons involved in the transfer of the samples and the date and time of possession,
- status of seal,
- type of analysis to be performed,
- type of preservative,

- activity level, and

- delivery method.

A copy of the chain-of-custody form and associated required documentation is contained in Jacobs ER Team SOP 2.4.2, "Chain-of-Custody Procedures."

3.2.3 Field Analysis

3.2.3.1 Analysis

Table B.4 shows the field analysis to be completed. Field data will include screening level and definitive data. While there are no differences in the intended use of the data, the definition of definitive data necessities analyte-specific analysis by instruments of known accuracy and precision. For example, immunoassay test kits of PCBs can only yield screening level data because they test for total PCBs and not a specific one like Aroclor-1254. The following table summarizes the field data quality level.

3.2.3.2 Field QA/QC

To ensure that data quality objectives are achieved, field QA/QC samples will be collected as described in Table B.5.

- Field Duplicate Samples—Duplicate samples provide required variability in field sampling methods and indicate contaminant concentrations within comparable samples. Duplicate solid samples will be obtained by cutting a sample in half and placing it in two sample containers. Methods of analysis will be identical for primary and duplicate samples.

- Equipment Rinsate Samples—Equipment rinsate samples will be collected to evaluate the potential for cross contamination between samplings. Collecting equipment rinsate samples from hand augers or other related sampling devices will provide the needed data. Each rinsate blank will be collected in a manner which duplicates the characteristic sample collection procedure as closely as possible to provide the best check of procedures. Whenever possible, equipment rinsate blanks will be collected immediately following sampling equipment decontamination.

- Trip Blanks—In addition to collecting QA/QC samples, the laboratory performing the analysis will prepare one volatile organic trip blank to be included in each cooler. These trip blanks will accompany the cooler from point of origin to the field, and then

Table B.4. Field analysis summary table, DWI 901 Site, Knoxville, Tennessee

Analysis	Method	Data quality level
pH	Field probe (Ag, Cl)	Screening
Conductivity	Field motor	Screening
Temperature	Thermometer	Screening
Redox	Field probe	Screening
Dissolved oxygen	Field probe	Definitive
PCBs	Immunoassay	Screening
Radioactivity	Beta/gamma rod probe	Screening
VOCs/SVOCs	Photoionizing detector	Screening
Surveying	Conventional	+ or - 2 in. (x,y) - 5 seconds (z)

Ag = silver
Cl = chlorine
DWI = David Witherspoon, Inc.
in. = inch
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

back to the laboratory. Trip blanks will be prepared only for VOCs and will assist in evaluating adsorption of organics through the containers during shipment. Trip blank samples will provide additional confidence in the volatile organic results reported for actual samples, assuming no contamination is detected in the trip blank.

- Field Blanks—Field blanks will be collected at a frequency of 1 per 20 water samples. Analysis of field blanks will provide data needed to determine whether contamination is being introduced via site conditions during sample collection.

3.2.4 Laboratory Analysis

3.2.4.1 Analysis

Table B.6 summarizes the laboratory methods, reporting limits, and where available, provides the PRG for comparison. A definitive data package will be prepared by the contract laboratory. This package is comparable to an EPA Contract Laboratory Program (CLP) deliverable package. For each analytical laboratory method, a definitive data package will include:

- limit of detection,

Table B.5. Field quality control samples, DWI 901 Site, Knoxville, Tennessee

Type	Frequency	Rationale
Field duplicate	1 per 20 samples	Collect data on variability of field-sampling practices and contaminant concentrations
Equipment rinsate blank	1 per 20 samples	Collect data on the efficiency of the decontamination process
Trip blank	1 per cooler containing samples analyzed for volatile organic compounds	Provide data on volatile organic compound contamination associated with sample handling
Field blank	1 per 20 water samples	Provide data on contamination associated site conditions during sample collection

DWI = David Witherspoon, Inc.

- method blanks,
- matrix spikes or analysis of standard reference materials,
- percent recovery/mean data,
- replicate measurements (at least three),
- standard deviation data,
- calibration range,
- method interferences and limitations,
- rate of false positive and false negative results as a function of concentration, and
- uncertainty as a function of concentration.

In addition to the summary forms, the laboratory will provide an analytical narrative describing (1) differences between the analytical method stated in the EPA reference and the actual procedures followed and (2) a list of any problems or outliers encountered during the course of sample preparation and analysis. If there are any deviations from the analytical method, or QA/QC problems with the data, the laboratory must describe the rationale for method changes or corrective actions undertaken for QA/QC problems.

Table B.6. Summary of analytical methods for the DWI 901 Site, Knoxville, Tennessee

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Dioxin/furans (SW-846 8280)						
1,2,3,4,6,7,8 Heptachlorodibenzodioxin	ng/L	ng/g	1.0 ng/g	10.0 ng/L	430	0.057
1,2,3,4,6,7,8 Heptachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	430	0.057
1,2,3,4,7,8 Hexachlorodibenzodioxin	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
1,2,3,4,7,8 Hexachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
1,2,3,4,7,8,9 Heptachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	430	0.057
1,2,3,6,7,8 Hexachlorodibenzodioxin	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
1,2,3,6,7,8 Hexachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
1,2,3,7,8 Pentachlorodibenzodioxin	ng/L	ng/g	1.0 ng/g	10.0 ng/L	8.6	0.011
1,2,3,7,8 Pentachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	8.6	0.011
1,2,3,7,8,9 Hexachlorodibenzodioxin	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
1,2,3,7,8,9 Hexachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
2,3,4,6,7,8 Hexachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.057
2,3,4,7,8 Pentachlorodibenzofuran	ng/L	ng/g	1.0 ng/g	10.0 ng/L	86	0.011
2,3,7,8-TCDD	ng/L	ng/g	1.0 ng/g	10.0 ng/L	4.3	0.00057
2,3,7,8-TCDF	ng/L	ng/g	1.0 ng/g	10.0 ng/L	43	0.00057
Total-TCDD	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-PeCDD	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-HXCDD	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-HPCDD	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Total-TCDF	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-PECDF	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-HXCDF	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	NA
Total-HPCDF	ng/L	ng/g	1.0 ng/g	10.0 ng/L	NA	
OCDD (total)	ng/L	ng/g	1.0 ng/g	10.0 ng/L	4,300	0.57
OCDF (total)	ng/L	ng/g	1.0 ng/g	10.0 ng/L	4,300	0.57
Metals [SW-846] (soil/water method number)						
Aluminum (6010/6010)	mg/kg	µg/L	1.4	45	NA	NA
Antimony (6020/ICP-MS)	mg/kg	µg/L	0.1	0.02	3.1	1.5
Arsenic (7060/7060)	mg/kg	µg/L	0.4	1	0.43	1.1
Barium (6010/6010)	mg/kg	µg/L	0.2	2	550	260
Beryllium (6010)	mg/kg	µg/L	0.1	NA	0.075	0.02
Cadmium (6020/ICP-MS)	mg/kg	µg/L	0.1	0.07	39	1.8
Calcium (6010/6010)	mg/kg	µg/L	1	10	NA	NA
Chromium (6020/6010)	mg/kg	µg/L	0.1	7	39	18
Cobalt (6020/6010)	mg/kg	µg/L	0.1	7	NA	NA
Copper (6020/6010)	mg/kg	µg/L	0.1	6	NA	NA
Cyanide (9012/9012)	mg/kg	µg/L	20	20	160	0.073
Iron (6010/6010)	mg/kg	µg/L	0.5	7	NA	NA
Lead (6020/6010)	mg/kg	µg/L	0.1	42	NA	NA
Magnesium (6010/6010)	mg/kg	µg/L	1	30	NA	NA
Manganese (6010/6010)	mg/kg	µg/L	0.3	2	1,100	18
Mercury (7471/7470)	mg/kg	µg/L	0.035	0.035	2.3	1.1
Nickel (6020/6010)	mg/kg	µg/L	0.1	15	NA	73
Potassium (6010/AA 7000-series)	mg/kg	µg/L	5	10	NA	NA
Selenium (7740-AA 7000-series)	mg/kg	µg/L	0.3	2	39	18

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Silver (6020/6010)	mg/kg	µg/L	0.1	7	39	18
Sodium (6010/6010)	mg/kg	µg/L	25	29	NA	NA
Thallium (6020/6010)	mg/kg	µg/L	0.1	40	NA	NA
Vanadium (6010/6010)	mg/kg	µg/L	0.1	8	55	26
Zinc (6020/6010)	mg/kg	µg/L	0.1	2	2,300	1,100
PCBs (SW-846 8080)						
Aroclor-1016	µg/kg	µg/L	33	1	550	0.26
Aroclor-1221	µg/kg	µg/L	67	2	83	0.011
Aroclor-1232	µg/kg	µg/L	33	1	83	0.011
Aroclor-1242	µg/kg	µg/L	33	1	83	0.011
Aroclor-1248	µg/kg	µg/L	33	1	83	0.011
Aroclor-1254	µg/kg	µg/L	33	1	1,600	0.073
Aroclor-1260	µg/kg	µg/L	33	1	83	0.011
Pesticides (SW-846 8080)						
4,4'-DDD (P,P'-DDD)	µg/kg	µg/L	3.3	0.1	2,700	0.37
4,4'-DDE (P,P'-DDE)	µg/kg	µg/L	3.3	0.1	1,900	0.3
4,4'-DDT (P,P'-DDT)	µg/kg	µg/L	3.3	0.1	38	0.25
Aldrin	µg/kg	µg/L	1.7	0.05	NA	0.005
Alpha-BHC	µg/kg	µg/L	1.7	0.05	NA	NA
Alpha-chlordane/2	µg/kg	µg/L	1.7	0.05	NA	NA
Beta-BHC	µg/kg	µg/L	1.7	0.05	NA	NA
Delta-BHC	µg/kg	µg/L	1.7	0.05	NA	NA
Dieldrin	µg/kg	µg/L	3.3	0.1	40	0.0053
Endosulfan I	µg/kg	µg/L	1.7	0.05	47,000	22
Endosulfan II	µg/kg	µg/L	3.3	0.1	NA	NA
Endosulfan sulfate	µg/kg	µg/L	3.3	0.1	NA	NA
Endrin	µg/kg	µg/L	3.3	0.1	2,300	1.1

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Endrin aldehyde	µg/kg	µg/L	3.3	0.1	NA	NA
Endrin ketone	µg/kg	µg/L	3.3	0.1	NA	NA
Gamma-BHC (lindane)	µg/kg	µg/L	1.7	0.05	NA	NA
Gamma-chlordane /2	µg/kg	µg/L	1.7	0.05	NA	NA
Heptachlor	µg/kg	µg/L	1.7	0.05	140	0.019
Heptachlor expoxide (isomer B only)	µg/kg	µg/L	1.7	0.05	70	NA
Methoxychlor	µg/kg	µg/L	17	0.5	39,000	18
Toxaphene	µg/kg	µg/L	170	5	580	0.077
Radionuclides (various methods) (Radiation detection limits are a function of count time and minimization of background)						
Bismuth-212	pCi/g	pCi/L	lab specific	lab specific	1,300	77
Bismuth-214 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	4,100	240
Cesium-137 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	25	1.5
Lead-212 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	44	2.6
Lead-214 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	2,700	160
Plutonium-238 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	2.7	0.16
Plutonium-239 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	2.5	0.15
Potassium-40 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	63	3.8
Protactinium-234 (beta emitter)	pCi/g	pCi/L	lab specific	lab specific	370	22
Protactinium-234m (beta emitter)	pCi/g	pCi/L	lab specific	lab specific	170,000	10,000
Radium-226 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	2.7	0.16
Radium-228 (beta counting)	pCi/g	pCi/L	lab specific	lab specific	3.2	0.19
Strontium-89 (beta counting)	pCi/g	pCi/L	lab specific	lab specific	77	4.6
Strontium-90 (beta counting)	pCi/g	pCi/L	lab specific	lab specific	19	1.2
Thallium-208 (gamma spec)	pCi/g	pCi/L	lab specific	lab specific	45,000	2,700
Thorium-232 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	24	1.5
Thorium-234 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	41	2.5
Uranium-234 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	18	1.1

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Uranium-235 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	18	1.1
Uranium-238 (alpha spec)	pCi/g	pCi/L	lab specific	lab specific	18	1.1
Semivolatiles (SW-846 8270)						
1,2,4-Trichlorobenzene	µg/kg	µg/L	330	10	7.80E+04	37
1,2-Dichlorobenzene	µg/kg	µg/L	330	10	7.00E+05	330
1,3-Dichlorobenzene	µg/kg	µg/L	330	10	NA	NA
1,4-Dichlorobenzene	µg/kg	µg/L	330	10	27,000	3.5
2,2'-Chloroisopropylether	µg/kg	µg/L	330	10	NA	NA
2,4,5-Trichlorophenol	µg/kg	µg/L	330	10	7.80E+05	370
2,4,6-Trichlorophenol	µg/kg	µg/L	330	10	58,000	7.7
2,4-Dichlorophenol	µg/kg	µg/L	330	10	2.30E+04	11
2,4-Dimethylphenol	µg/kg	µg/L	330	10	1.60E+05	73
2,4-Dinitrophenol	µg/kg	µg/L	1,600	50	1.60E+04	7.3
2,4-Dinitrotoluene	µg/kg	µg/L	330	10	940	0.13
2,6-Dinitrotoluene	µg/kg	µg/L	330	10	940	0.13
2-Chloronaphthalene	µg/kg	µg/L	330	10	6.30E+05	290
2-Chlorophenol	µg/kg	µg/L	330	10	3.90E+04	18
2-Methyl-4,6-dinitrophenol	µg/kg	µg/L	330	10	NA	NA
2-Methylnaphthalene	µg/kg	µg/L	330	10	NA	NA
2-Methylphenol	µg/kg	µg/L	330	10	NA	NA
2-Nitroaniline	µg/kg	µg/L	1,600	50	15,000	53
2-Nitrophenol	µg/kg	µg/L	1,600	50	NA	NA
3,3'-Dichlorobenzidine	µg/kg	µg/L	660	20	1,400	0.19
3-Nitroaniline	µg/kg	µg/L	1,600	50	NA	NA
4,6-Dinitro-2-methylphenol	µg/kg	µg/L	1,600	50	NA	NA
4-Bromophenyl phenyl ether	µg/kg	µg/L	330	10	NA	NA
4-Chloro-3-methylphenol	µg/kg	µg/L	330	10	NA	NA
4-Chloroaniline	µg/kg	µg/L	330	10	3,100	15

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
4-Chlorophenyl phenyl ether	µg/kg	µg/L	330	10	NA	NA
4-Methylphenol	µg/kg	µg/L	330	10	NA	NA
4-Nitroaniline	µg/kg	µg/L	1,600	50	NA	NA
4-Nitrophenol	µg/kg	µg/L	330	10	NA	NA
Acenaphthene	µg/kg	µg/L	330	10	4.70E+05	220
Acenaphthylene	µg/kg	µg/L	330	10	NA	NA
Anthracene	µg/kg	µg/L	330	10	2.30E+06	1,100
Benzo(a)anthracene	µg/kg	µg/L	330	10	880	0.018
Benzo(a)pyrene	µg/kg	µg/L	330	10	88	0.0012
Benzo(b)fluoranthene	µg/kg	µg/L	330	10	880	0.012
Benzo(g,h,i)perylene	µg/kg	µg/L	330	10	NA	NA
Benzo(k)fluoranthene	µg/kg	µg/L	330	10	NA8.6+3	0.2
Benzoic acid	µg/kg	µg/L	1,600	50	3.10E+07	1.4E+04
Benzyl alcohol	µg/kg	µg/L	330	10	2.30E+06	1.1E+03
Benzyl butyl phthalate	µg/kg	µg/L	330	10	1.60E+06	730
Bis(2-chloroethoxy)methane	µg/kg	µg/L	330	10	NA	NA
Bis(2-chloroethyl) ether	µg/kg	µg/L	330	10	580	0.077
Bis(2-chloroisopropyl) ether	µg/kg	µg/L	330	10	1.8E+06	140
Bis(2-ethylhexyl)phthalate	µg/kg	µg/L	330	10	46,000	6.1
Carbazole	µg/kg	µg/L	330	10	3.20E+04	4.3
Chrysene	µg/kg	µg/L	330	10	88,000	1.8
Di-n-butylphthalate	µg/kg	µg/L	330	10	NA	NA
Di-n-octylphthalate	µg/kg	µg/L	330	10	NA	NA
Dibenzo(a,h)anthracene	µg/kg	µg/L	330	10	88	NA
Dibenzofuran	µg/kg	µg/L	330	10	NA	NA
Diethyl phthalate	µg/kg	µg/L	330	10	6.30E+06	2,900
Dimethyl phthalate	µg/kg	µg/L	330	10	NA	NA
Fluoranthene	µg/kg	µg/L	330	10	3.10E+05	520
Fluorene	µg/kg	µg/L	330	10	3.10E+05	150

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Hexachlorobenzene	µg/kg	µg/L	330	10	400	0.053
Hexachlorobutadiene	µg/kg	µg/L	330	10	8,200	1.1
Hexachlorocyclopentadiene	µg/kg	µg/L	330	10	55,000	26
Hexachloroethane	µg/kg	µg/L	330	10	46,000	6.1
Indeno(1,2,3-cd)pyrene	µg/kg	µg/L	330	10	880	0.0078
Isophorone	µg/kg	µg/L	330	10	670,000	90
N-nitroso-di-n-propylamine	µg/kg	µg/L	330	10	91	0.012
N-nitrosodiphenylamine	µg/kg	µg/L	330	10	130,000	92
Naphthalene	µg/kg	µg/L	330	10	NA	NA
Nitrobenzene	µg/kg	µg/L	330	10	3,900	1.8
Pentachlorophenol	µg/kg	µg/L	1,600	50	5,300	0.71
Phenanthrene	µg/kg	µg/L	330	10	NA	NA
Phenol	µg/kg	µg/L	330	10	4.70E+06	2,200
Pyrene	µg/kg	µg/L	330	10	2.30E+05	43
Volatiles (SW-846 8260)						
1,1,1-Trichloroethane	µg/kg	µg/L	MDL	MDL	NA	NA
1,1,1,2-Tetrachloroethane	µg/kg	µg/L	MDL	MDL	2,200	0.071
1,1,2,2-Tetrachloroethane	µg/kg	µg/L	10	1	3,200	0.43
1,1,2-Trichloroethane	µg/kg	µg/L	10	1	11,000	1.5
1,1-Dichloroethane	µg/kg	µg/L	10	1	7.80E+05	370
1,1-Dichloroethene (1,1-dichloroeth)	µg/kg	µg/L	10	1	1,100	0.14
1,1-Dichloropropene	µg/kg	µg/L	MDL	MDL	NA	NA
1,2-Dibromo-3-chloropropane	µg/kg	µg/L	MDL	MDL	730	0.059
1,2-Dibromoethane	µg/kg	µg/L	MDL	MDL	12	0.00094
1,2-Dichlorobenzene	µg/kg	µg/L	MDL	MDL	5.1E+03	36
1,2-Dichloroethane	µg/kg	µg/L	10	1	7,000	0.94
1,2-Dichloroethene (total)—8240	µg/kg	µg/L	5	5	70,000	33
1,2-Dichloropropane	µg/kg	µg/L	10	1	9,400	1.3

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
1,2,3-Trichlorobenzene	µg/kg	µg/L	MDL	MDL	NA	NA
1,2,3-Trichloropropane	µg/kg	µg/L	MDL	MDL	150	0.00052
1,2,4-Trichlorobenzene	µg/kg	µg/L	MDL	MDL	4.4E+05	17
1,2,4-Trimethylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
1,3-Dichlorobenzene	µg/kg	µg/L	MDL	MDL	NA	NA
1,3-Dichloropropane	µg/kg	µg/L	MDL	MDL	NA	NA
1,3,5-Trimethylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
1,4-Dichlorobenzene	µg/kg	µg/L	MDL	MDL	3.2E+04	3.0
2,2-Dichloropropane	µg/kg	µg/L	MDL	MDL	NA	NA
2-Chlorotoluene	µg/kg	µg/L	MDL	MDL	8.8E+05	58
4-Chlorotoluene	µg/kg	µg/L	MDL	MDL	NA	NA
Acetone-8240	µg/kg	µg/L	10	10	7.80E+05	370
Benzene	µg/kg	µg/L	10	1	22,000	2.9
Bromobenzene (phenyl bromide)	µg/kg	µg/L	MDL	MDL	NA	NA
Bromochloromethane	µg/kg	µg/L	MDL	MDL	NA	NA
Bromodichloromethane	µg/kg	µg/L	10	1	10,000	1.4
Bromoform	µg/kg	µg/L	10	1	81,000	11
Bromomethane	µg/kg	µg/L	10	1	11,000	5.1
Carbon disulfide-8240	µg/kg	µg/L	5	5	7.80E+05	370
Carbon tetrachloride	µg/kg	µg/L	10	1	4,900	0.66
Chlorobenzene	µg/kg	µg/L	10	1	1.60E+05	73
Chloroethane	µg/kg	µg/L	MDL	MDL	NA	NA
Chloroform	µg/kg	µg/L	10	1	100,000	14
Chloromethane	µg/kg	µg/L	10	1	49,000	6.6
Cis-1,2-dichloroethene	µg/kg	µg/L	MDL	MDL	4.8E+05	36
Cis-1,3-dichloropropene	µg/kg	µg/L	10	1	3,500	0.47
Dibromochloromethane	µg/kg	µg/L	10	1	NA	1
Dichlorodifluoromethane	µg/kg	µg/L	MDL	MDL	NA	NA
Ethylbenzene	µg/kg	µg/L	10	1	7.80E+05	370

Table B.6. (continued)

Analyte	Soil units	Water units	Soil reporting limits	Water reporting limits	PRG soil	PRG water
Hexachlorobutadiene	µg/kg	µg/L	MDL	MDL	13,000	0.17
Isopropylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
Methyl butyl ketone	µg/kg	µg/L	MDL	MDL	NA	NA
Methyl ethyl ketone-8240	µg/kg	µg/L	10	10	4.70E+06	2,200
Methyl isobutyl ketone-8240	µg/kg	µg/L	MDL	MDL	6.30E+05	290
Methylene chloride	µg/kg	µg/L	5	1	85,000	11
N-butylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
N-propylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
Naphthalene	µg/kg	µg/L	MDL	MDL	1.6E+06	110
P-isopropyltoluene	µg/kg	µg/L	MDL	MDL	NA	NA
Sec-butylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
Styrene	µg/kg	µg/L	10	1	1.60E+06	730
Tert-butylbenzene	µg/kg	µg/L	MDL	MDL	NA	NA
Tetrachloroethene	µg/kg	µg/L	MDL	MDL	7.80E+04	NA
Toluene	µg/kg	µg/L	10	1	1.60E+06	730
Trans-1,2-dichloroethene	µg/kg	µg/L	MDL	MDL	9.5E+05	73
Trans-1,3-dichloropropene	µg/kg	µg/L	5	1	3,500	0.47
Trichloroethene (trichloroethylene)	µg/kg	µg/L	MDL	MDL	58,000	NA
Trichlorofluoromethane	µg/kg	µg/L	MDL	MDL	4,0E+05	130
Vinyl chloride	µg/kg	µg/L	10	1	3.40E+02	0.045
Xylenes	µg/kg	µg/L	10	2	1.60E+07	7,300

DWI = David Witherspoon, Inc.
g = gram
ICP = inductively coupled plasma
kg = kilogram
L = liter
MDL = minimum detection limit
mg = milligram
MS = mass spectroscopy
NA = not available
ng = nanogram
PCB = polychlorinated biphenyl
pCi = picocurie
PRG = preliminary remediation goal
µg = migrogram

3.2.4.2 Laboratory QA/QC

Laboratory QA/QC will include, but is not limited to, the following:

- Matrix Spikes—Procedure performed as standard QA protocol. These are aliquots of a sample spiked with known quantities of specific compounds, which are subjected to the entire analytical procedure to indicate the appropriateness of the method for the matrix by measuring the recovery of the spike.

- Blanks—Artificial samples designed to monitor the introduction of artifacts into the measurement process. A laboratory blank is taken through sample preparation and analysis to test for contamination introduced during these steps.

- Replicate Analyses—Measurements performed periodically to ensure instrumental precision. These measurements are duplicate runs of a single sample. Replicates are recommended at a frequency of 1 per 20 samples.

- Calibration Standards—Tests run to systematically determine the relationship between the instrument's response and the analyte concentration. Instrument calibration performed before any samples are analyzed is called the initial calibration. Subsequent checks of the instrument calibration are called continuing calibration.

The definitive data packages provided by the laboratory will include calibration charts, blank results, replicate sample results, and matrix spike data.

3.2.5 Calibration Procedures and Frequency

3.2.5.1 Field equipment

All field measuring and testing equipment requiring calibration will be identified by a serial number or control identification number. A record of all equipment requiring calibration, including the maintenance schedules, will be maintained by the FTR. Maintenance will be conducted in accordance with approved procedures, and calibration records and schedules will be maintained for each item of equipment requiring calibration. Should the accuracy of an instrument be questioned, it will be tagged "inoperable" and will be recalibrated before reuse. Radiological survey meters will be source-checked daily. The Jerome 411 Mercury Vapor Analyzer should be calibrated as described in Jacobs ER Team SOP FS-9.2, "Use of Jerome Model 411 Mercury Vapor Analyzer." Proper calibration and use of a flame ionization detector is described in Jacobs ER Team SOP FS-3.1. Procedures for operation and maintenance of rental

instrumentation and equipment are detailed in Jacobs ER Team SOP FS-2.7. Procedures for calibration and maintenance of radiological instrumentation are described in Jacobs ER Team SOP H&S-11.3, "Radiological Instrumentation."

3.2.5.2 Laboratory equipment

Calibration procedures and frequencies used by subcontract analytical laboratories will be in accordance with their internal quality assurance program plans (QAPPs) and supporting procedures. The contract laboratory will submit a laboratory QA plan for review during the contract laboratory selection process. All calibration procedures will be, at a minimum, in accordance with the calibration requirements and frequencies specified in the EPA methods.

3.2.6 Preventive Maintenance

3.2.6.1 Field instrumentation equipment

A record of all maintenance and calibration activities will be maintained to ensure that all field instrumentation equipment is kept in proper working order.

In the event that the performance of any instrumentation equipment becomes questionable, the equipment will be replaced immediately. Should a problem arise with rented equipment, the vendor will be notified immediately for billing to be adjusted appropriately.

3.2.6.2 Laboratory equipment

Preventive maintenance for subcontract laboratory equipment will be described in the laboratory's QAPP. Maintenance of each instrument will be conducted in accordance with the manufacturer's recommendations. All instrument maintenance will be recorded in individual maintenance logs maintained for each instrument. In addition, the results of instrument performance samples will be available to the analysts and kept as an integral part of the instrument log. A complete list of laboratory instruments and the specific maintenance requirements will be outlined in the laboratory QA plan and provided to the Jacobs ER Team before a subcontract or purchase order is awarded.

3.2.7 Data Reporting, Reduction, and Validation

3.2.7.1 Data reporting

All data will be calculated and prepared in conventional units to allow for comparability of data. The procedures for quantification of analytes are discussed in the appropriate laboratory SOPs and the specific analytical method SW-846 (EPA 1986).

The subcontracted analytical laboratory for this project will be required to submit data supported by sufficient QA and QC backup information to enable data reviewers to determine conclusively the data quality. Data generated by the subcontracted analytical laboratory will be submitted to the Jacobs ER Team in hard copy and electronic forms.

3.2.7.2 Data reduction

Data will be reduced or condensed into summary tables by the Jacobs ER Team. The analytical data packages will be checked for completeness (i.e., all deliverables required for data validation must be in the package) and reasonability. Laboratory data will be reconciled with field records before data validation. The Jacobs ER Team project manager or his/her designee will ensure that all data transferred to tables, spreadsheets, logbooks, maps, figures, etc., are transferred correctly. Checking will be performed by comparing the raw data with the transferred data. All computer programs used for calculations or analysis will be checked at least once with a data set of known results before the program is used to process data for any site.

3.2.7.3 Precision, accuracy, representativeness, completeness, and compatibility parameters

Precision, accuracy, representativeness, completeness, and compatibility (PARCC) will be established for the laboratory analytical results. The results will be presented in the QCSR so that decision-makers can weigh the level of certainty associated with the result.

3.2.7.4 Validation of field data packages

The field data package will include all of the field records and measurements developed by the field sampling team. The field data package will be reviewed by the Jacobs ER Team for completeness. Evaluation of the field data package will include the following:

- review of field data contained in sampling logs;
- verification that equipment blanks and field blanks were properly prepared, identified, and analyzed;
- checks on field records documenting equipment calibration and instrument condition;
- review of chain-of-custody forms for proper completion; and
- confirmation that all the required information detailed in the section titled "Documentation" is recorded.

A failure in any of the above areas may result in data being classified as unusable if records cannot be obtained or verified.

3.2.7.5 Validation of analytical data packages

Definitive data with the required EPA CLP-like deliverables package (formerly Level D) shall undergo full validation.

Qualifiers can only be assigned as defined by the latest revision of *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1994a) and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994b). The criteria for qualifying data will be established by the analytical method, program statement of work (SOW), task laboratory SOW, and any other regulatory requirements.

The analytical, data-package validation procedure may include, but will not be limited to, the following:

- A comparison of the data package to the reporting level requirements specified in the appropriate laboratory SOPs and the specific analytical Method SW-846 (EPA 1986)

- A comparison of sampling dates, sample extraction dates, and analysis dates to ensure that samples were extracted and/or analyzed within proper holding times.

- A review of analytical methods and required detection limits to verify that they agree with the methods and limits specified.

- A review of field and laboratory blanks to evaluate possible contamination sources. Preparation techniques and frequencies and the analytical results (if appropriate) will be considered.

- Surrogate spikes must be within allowable control limits specified for the method.

- Matrix spike recoveries for organic analyses are considered advisory by the EPA. Matrix spike analyses will be performed and documented to evaluate the presence of matrix interferences that may be affecting recovery of a particular analyte. Control limits will be reported when matrix spike data are reported. When matrix spike duplicates are performed and/or reported, the relative percent difference (RPD) will be calculated and RPD control limits reported.

- Matrix spike recoveries for inorganic analyses are definitive (EPA 1993). If matrix recoveries are outside control limits, the data will be flagged as either a quantitatively suspect value or an estimated value.

3.3 FIELD DOCUMENTATION

3.3.1 Field Records

Field records are the principal source of information supporting the quality of field activities. Field logbooks serve as the principal field record. The FTR logbook will serve as a master, referencing other logs when necessary to adequately reconstruct the activities. Logbooks will be maintained in accordance with FS-2.2.1, "Field Logbooks."

Numerous other field forms (e.g., training records, trench inspection forms, water sampling logs, etc.) will be generated during the effort. All records will be QC-checked for completeness. The data and reviewers initials will be included.

3.3.2 Control and Submittal of Field Records

The FTR will establish a field filing system and ensure that all field records are filed before departing each day. The FTR will ensure that the field records are removed (or copied) each week and submitted to the Jacobs ER Team Document Control Center in accordance with Jacobs ER Team SOP DC-1.0, "Administration and Control of Technical Support Contractor (TSC) Environmental Restoration (ER) Project Documents."

3.4 DECONTAMINATION

The Jacobs ER Team uses a rigorous decontamination program in accordance with the EPA-Region IV QA manual. All sampling devices and equipment will be decontaminated in accordance with Jacobs ER Team SOPs FS-12.1, "Cleaning and Decontaminating Sampling Devices" and FS-12.2, "Equipment Decontamination."

3.5 INTERNAL QC CHECKS

3.5.1 Field Readiness Assessment

Before mobilization, a field readiness assessment will be conducted to determine the status of the preparation necessary to complete the task. The assessment will be completed in

accordance with Jacobs ER Team SOP FS-1.5, "Field Readiness Review Checklist." The SOP covers approved plans, clearances, site access, other applicable SOPs, training, assembly of materials and equipment, waste management, health and safety, analytical services, and QA.

3.5.2 Field Assessments

This assessment includes a careful review of all data-gathering activities and an assessment of the degree of compliance with approved SOPs.

The Jacobs ER Team QA manager or designee shall make at least one visit to the site to observe the performance of field teams during the project. Field system assessments typically consist of an evaluation of SOPs and the degree to which they are being followed; an evaluation of work areas and activities; and a review of project documentation. Assessments may address (1) subcontractor performance and compliance with the subcontract scope of work, (2) field operations and documentation, (3) identification and control of samples, (4) transmittal of information, (5) document control and retention, and (6) health and safety procedures. Assessments of field operations may address (1) implementation of approved SOPs; (2) calibration and operation of equipment; (3) labeling, packaging, storage, and shipping of samples; and (4) documentation of subcontractor performance and compliance with the subcontract scope of work.

The records of all field activities will be reviewed to verify that field-related operations were performed according to appropriate project SOPs. Items reviewed will include, but are not limited to, (1) field equipment logs, (2) daily field activity logs, (3) all field data logs, and (4) checklists resulting from field operations.

Field assessments will examine the following procedures:

- cleaning/decontamination and storage of sampling equipment and containers;
- sample collection, preservation, custody, and shipping procedures;
- preparation and frequency of collection of QC samples;
- calibration, operations, and maintenance procedures; and
- documentation of field activities in the field logbook or appropriate data forms.

3.5.3 Laboratory Evaluations

As a prime technical support contractor to DOE, and under the existing scope of work, the Jacobs ER Team will provide technical support to assist DOE in executing their Laboratory Performance Evaluation Program. This evaluation program, combined with the sample

management office operations, will cover laboratory evaluation and management requirements deemed necessary for effective and efficient assurance of quality analytical laboratory services on all DOE Oak Ridge Environmental Management Projects.

3.6 NONCONFORMANCE AND CORRECTIVE ACTION

3.6.1 Nonconformances

A nonconformance is a variance from regulations, approved requirements, or procedures that adversely affects safety, durability, performance, or any other basic objective impacting the quality of work performed. Nonconformances can be identified by field personnel and by QA personnel. Jacobs ER Team QA assessments will be handled in accordance with Jacobs ER Team SOP QA-4.0, "Quality Assessments." Nonconformances identified by DOE QA personnel will be immediately brought to the attention of the Jacobs ER Team QA manager, who will take immediate corrective action and report on such action within the time period designated by DOE.

If a nonconformance is identified in action and it can be brought into conformance, the problem may be rectified by verbal instruction and noted in the field logbook. If a nonconformance is identified after the procedure is complete, a nonconformance report (NCR) will be originated by the person who identified the nonconformance.

If an NCR is required, the report will be initiated and handled in accordance with Jacobs ER Team SOP QA-7.0, "Control of Nonconforming Items and Services." The system is designed to ensure that nonconformances will be documented and segregated and that corrective action will be taken.

3.6.2 Corrective Action

If a nonconformance is identified, corrective action may be required to rectify the situation. If corrective action is required, a corrective action request will be prepared by the QA manager or designee. This form will be completed, handled, and implemented in accordance with Jacobs ER Team SOP QA-8.0, "Corrective Action."

3.7 QC SUMMARY REPORT

A QCSR will be drafted and included as an appendix to the final RI/FS. The QCSR will include all items of consequence to evaluating the overall quality of the program and data. The QCSR will cover the following:

- NCRs and corrective action,
- field audit and surveillance reports,
- PARCC results, and
- data validation summary reports.

4. WASTE MANAGEMENT PLAN

4.1 PURPOSE AND APPROACH

This waste management plan describes the methods and responsibilities for containing, handling, and storing IDW during data collection activities. The general outline was taken from *Guidance Document for the Preparation of Waste Management Plans for the Environmental Restoration Program at Oak Ridge National Laboratory* (Energy Systems 1993b). This waste management plan was drafted using the requirements and considerations presented in the *Guide to Management of Investigation-Derived Wastes* (EPA 1992).

Previous investigations show that sitewide surficial contamination exists. Consequently, cross-contamination from contaminated media to uncontaminated media is unlikely. Also, the site is controlled by a security fence and trespassing has been minimized. Given these facts, only those wastes introduced to the site as a result of RI activities will be containerized. All soil cuttings, purge water, and solvent-free decontamination water will be dispersed on the ground surface near its origin. This approach is consistent with the *Guide to Management of Investigation-Derived Waste* (EPA 1992) provided the IDW remains within the area of contamination. No incremental risks to human health or the environment above those already posed by the site will result from this approach.

4.2 ROLES AND RESPONSIBILITIES

4.2.1 U.S. Department of Energy

DOE will coordinate overall activities with the TDEC, Energy Systems, and the Jacobs ER Team to ensure that the project is accomplished in a safe, compliant, quality-oriented, and expedient manner. DOE will provide the necessary interface with EPA to ensure compliance with those regulatory issues not under the purview of TDEC or DOE. DOE will be responsible for obtaining necessary licenses and right-of-entry agreements with the site owners before mobilization.

4.2.2 Jacobs ER Team

The Jacobs ER Team is responsible for preparing the supplemental fieldwork planning document, which includes this waste management plan. The Jacobs ER Team is also responsible for the site investigation, including managing subcontractors performing fieldwork and for inspecting the IDW while it remains on site.

4.2.3 Lockheed Martin Energy Systems

Energy Systems (off-site ER) will coordinate with Energy Systems Waste Management personnel to identify WAC and accept waste, should off-site disposal be required before remedial action. Energy Systems will provide drums and labels for the containers.

4.3 WASTE STREAM IDENTIFICATION AND WASTE VOLUMES

All used PPE, field analysis reagents, and decontamination solvent waste will be containerized and managed as described in Section 4.4. Table B.7 provides an estimate of the volume and waste types to be containerized.

Sanitary waste generated in areas with potential radioactive contamination will be surveyed for beta-gamma and alpha-emitting contaminants before being released for disposal. If radioactivity is detected, the waste will be handled in the same manner as radioactive PPE. These measurements and other pertinent information relative to the waste will be recorded in the field logbook for each bag of sanitary waste scheduled for disposal.

Waste minimization and pollution prevention processes and techniques will be implemented to the greatest extent practicable for this project. These processes and techniques are discussed in Jacobs ER Team SOP FS-11.1, "Minimization, Collection, and Storage of Investigation-Derived Waste."

It is Jacobs ER Team policy to minimize the amount of waste generated during field sampling activities. Use of Tyvek coveralls will be limited to those activities presenting a threat of external contamination to the participant. While coveralls are not meant to be worn longer

Table B.7. Waste volume estimates, DWI 901 Site, Knoxville, Tennessee

Waste-generating activity	Waste stream	Volume
PCB immunoassay field analysis	Miscellaneous reagents	1 drum
Miscellaneous investigative activities	PPE	15 drums
Equipment decontamination	Solvent waste	1 drum

DWI = David Witherspoon, Inc.
PCB = polychlorinated biphenyl
PPE = personal protective equipment

than a single work shift, every attempt will be made to minimize changes during the shift. Other waste minimization and waste reduction techniques will include segregation, decontamination, selection of PPE, material recycling, and selection of equipment.

4.4 CONTAINERIZATION AND LABELING OF IDW

The field investigation team will comply with all federal and state regulatory requirements for proper containerization of IDW. Every attempt will be made to keep IDW to a minimum by following Jacobs ER Team SOP FS-11.1, "Minimization, Collection, and Storage of Investigation Derived Waste," as described in Section 4.6. The team will containerize and provide an on-site staging area for all waste streams. All decontamination solvent waste will be placed in 55-gal drums and placed in a bermed area. PPE will also be containerized in 55-gal drums. When filled to approximately 90 percent capacity, each drum will be secured with security tags or security tape to verify the certification of the waste stream. Waste container logs will be completed each time the drum is filled for storage with IDW materials. The drums will be labeled in accordance with Jacobs ER Team SOP FS-11.1, "Minimization, Collection, and Storage of Investigation-Derived Waste."

4.5 IDW STAGING AREA

Based on the preliminary assessment of the site, a waste container staging area will be established for the storage of IDW. The staging area will be capable of accommodating the projected volumes of wastes that will be generated during the field investigation. The staging area will be located north of the metal building near the entrance gate or, if possible, within the main warehouse.

Drum and staging area inspections will be completed weekly during fieldwork and monthly thereafter in accordance with Jacobs ER Team SOP FS-11.1 "Minimization, Collection, and Storage of Investigation-Derived Waste."

4.6 SPILL PREVENTION CONTROL

The following sections will provide prudent management practices of IDW storage, preventive measures, and corrective actions to implement in case of spills or releases. However, it should be noted that a spill or release is not anticipated during sampling or in the interim while awaiting remedial action. Only two drums of liquid wastes are anticipated to be generated during this field effort.

4.6.1 Management Practices/Preventive Measures

An area will be identified and established within the site for temporary staging. Hay bales and/or silt fences will be installed around this area as a preventive measure and best management practice. Certain logistics will be considered when moving these containers to the desired staging area to minimize or prevent handling of the containers storing liquid. These containers will be moved to the area and will remain at the staging area until remedial action. To properly manage these containers, periodic inspections will be performed during and after site characterization activities. Emergency telephone numbers will be posted in case of a spill.

4.6.2 Spill Response

The corrective action in response to accidental spills or releases of liquids will be specific to the incident. However, in general terms, all spills are considered significant and must be addressed by the FTR. The FTR will contact the task manager in the unlikely event that a potentially hazardous spill has occurred. Depending on the nature of the spill, DOE may also be contacted for notification and instruction. This activity will be coordinated, documented, and implemented according to the FTR's judgment.

Spill containment equipment will be available on site to mitigate the migration of potential contaminants off site or to sensitive areas such as waters of the state. Equipment to control spills include sorbent sheets, hay bales, and/or silt fences. Also, equipment will be available on site to provide berming or trenching to contain surface runoff of potential spills. All efforts will be made to contain the spilled material.

4.7 TRANSFERRING THE IDW TO ENERGY SYSTEMS

The current plan is to leave the IDW on site until the remedial action. However, if it becomes necessary to remove the IDW, it will likely be transported to Oak Ridge Reservation (ORR) for storage and/or disposal. This section addresses this contingency.

4.7.1 Waste Acceptance Criteria

The TSCA Incinerator at the Oak Ridge K-25 Site has been identified as a potential treatment option for decontamination liquids generated during the DWI 901 Site characterization. *Waste Acceptance Plan and Analytical Protocol for the Toxic Substances Control Act Incinerator* (Energy Systems 1994c) or the most recent version will be used to determine the analytical parameters needed to fully characterize this waste stream for this facility.

The K-25 Site has been identified as a potential storage location for the solids. *Waste Acceptance Criteria for Storage for K-25 Site Waste Management Division* (Energy Systems 1993a) or the most recent version will be used to determine the analytical parameters needed to characterize this waste stream for this facility. Also, PPE will be evaluated against the Oak Ridge Y-12 Plant sanitary landfill WAC.

4.7.2 Characterization of Waste

PPE/trash, field analysis reagents, and solvent waste will be characterized by radiation screening of the package's exterior and by using process knowledge. The radioactivity content of the PPE will be determined by converting surface radiation level measurements made with calibrated portable radiation detection instruments into curies. The efficiency of each instrument type used for detection of the radiation type present will be used to make the conversions.

Table B.8 (DOE 1992) lists the radiation release limits for solids for isotopes of concern at the DWI 901 Site. Activities above the limits in Table B.8 will require storage. For those items determined to be contaminated through field screening, radioactivity measurements will be converted to activity in curies. For example,

$$\frac{\dfrac{1000\ cpm/15\ cm^2}{0.2\ cpm/dpm}}{2.2 \times 10^6\ \dfrac{dpm}{\mu Ci}} = 2.27 \times 10^{-3}\ \mu Ci/15\ cm^2$$

where

cpm = counts per minute
dpm = disintegrations per minute
μCi = microcurie

This represents the activity over a 15 cm^2 (approximately 2.35 in.^{2}) area (the surface area of the probe). Knowing the total surface area contaminated in square centimeters, divide that area by 15 and multiply by 2.27×10^{-3} to arrive at the total activity in μCi. Each set of circumstances may be different (count rate, surface area, and instrument detection efficiency for the isotope being measured), requiring individual measurement calculations to determine the curie quantity of contamination present. Instrument readings will be made as near the surfaces being

Table B.8. Radiation release limit guidance for solid wastes, DWI 901 Site, Knoxville, Tennessee

Isotope	Detection technique	Release limit for total contamination[a]	Release limit for removable contamination
		(dpm/100 cm²)	
Beta-gamma emitters	Pancake probe Geiger-Müller survey meter	5,000	1,000
Natural uranium and depleted uranium	Alpha survey meter	5,000	1,000

Source: U.S. Department of Energy. 1992. *Radiological Control Manual.* Washington, DC.

[a]The direct readings may be averaged over 1 m², provided the activity in any area of 100 cm² is less than three times the value in this column. Detection efficiencies must be taken into account for low energy betas.

cm = centimeter
dpm = disintegrations per minute
DWI = David Witherspoon, Inc.
m = meter

measured as practicable [within approximately 1.27 cm (0.5 in.) for beta-gamma surveys and approximately 0.64 cm (0.25 in.) for alpha surveys]. Caution will be exercised to prevent the probe from becoming contaminated or damaged.

4.7.3 Completion of Disposal Forms

The Jacobs ER Team is responsible for working with Energy Systems to complete the necessary forms for the treatment, storage, and disposal (TSD) facility. These may include:

- reference dose forms UCN-2109,
- EPA hazardous waste manifest document,
- any attachments to these documents (laboratory analysis, etc.),
- shipping papers,
- field logbooks,
- inspection records,
- chain-of-custody documentation, and
- land disposal restriction forms.

4.7.4 TRANSPORTING IDW

All waste streams will be marked and transported to an ORR treatment facility in accordance with U.S. Department of Transportation and EPA regulations [40 *Code of Federal Regulations* (CFR) 263 and 761].

Wastes will be transported to a designated ORR TSD facility by motor freight vehicles. The vendor selected to transport the containers will have the necessary licenses and permits to transport the waste. Health physics will monitor for radiological contamination before each entry and exit of vehicles at the DWI 901 Site. All radiological contamination survey locations and results will be documented in a logbook and on a survey sheet completed for each activity. The survey sheet will accompany the vehicle and cargo to the ORR site for comparisons during the follow-up surveys. Loading of the vehicle will occur near the entrance to the site. A forklift will bring waste containers from the waste staging area to the vehicle. A radiological contamination survey will be conducted of all containers before leaving the site. Other loading options may be implemented as necessary.

The Jacobs ER Team will prepare the shipping papers and labeling using characterization data supplied by field investigations. The Jacobs ER Team, on behalf of DOE, will sign all shipping papers and hazardous waste manifests, if required. Before actual shipment, an advance copy of the completed shipping papers will be forwarded to the ORR site point-of-contact for verification. The Jacobs ER Team waste management coordinator will contact Energy Systems to schedule the shipment to ORR. The cargo weight will be estimated at the site to ensure that the vehicle and cargo are within allowed limits for transport. The transporter will be responsible for transporting the waste directly to the ORR site and for signing the manifest. Energy Systems personnel may be stationed within a buffer zone just outside the DWI 901 Site (at mutual discretion of DOE, the Jacobs ER Team, and the ORR site point-of-contact) to visually inspect the shipments as they leave the site. The Energy Systems representative will also inspect the waste manifest, shipping papers, and labels for accuracy and completeness.

5. HEALTH AND SAFETY PLAN

5.1 INTRODUCTION

5.1.1 Purpose

This HASP provides a written assessment of potential safety and health hazards associated with the environmental sampling of the DWI 901 Site by the Jacobs ER Team. This plan specifies the work practices and engineering controls that will be used and procedures that will be followed during sampling activities, including, site control, medical surveillance, exposure monitoring, decontamination, emergency planning, and minimum acceptable PPE.

The Jacobs ER Team, in conjunction with DOE, is committed to a safe work environment and to limiting chemical and radiation exposures to levels that are as low as reasonably achievable (ALARA). This safety policy applies the ALARA principles to all activities during field implementation. Personnel working on the project will be informed of known and potential hazards to effectively apply required safety precautions. Completion of an OSHA-mandated training course in accordance with the regulations presented in 29 CFR 1910.120 and Section 5.4 of this HASP is required for workers participating in this sampling activity.

5.1.2 Scope

The scope of this HASP includes all fieldwork performed by the Jacobs ER Team in support of the DWI 901 Site environmental sampling. This HASP follows guidance established by Jacobs ER Team management and the ER Division of DOE. This ensures no aspect of health and safety will remain unscrutinized.

5.1.3 Overview

The DWI 901 Site is comprised of roughly 3.8 ha (9.5 acres) in the Vestal Community, a mixed residential and light industrial use area south of the Tennessee River in Knoxville, Tennessee. The site was operated primarily as a scrap metal recovery and recycling facility. The DWI 901 Site is known to have accepted hazardous materials and substances outside the scope of Atomic Energy Commission, U.S. Nuclear Regulatory Commission, and TDEC permits and with contaminant levels exceeding licenses held by DWI. Contaminants potentially present on this site include radioactive metals (principally U, Th, Ra, and Pu from U.S. government facilities), various heavy and intermediate metals, PCBs, SVOCs, and dioxin/furan compounds.

Potential hazards associated with the DWI 901 Site sampling activity include physical, biological, radiological, and chemical hazards. The physical and biological hazards exist because

the sampling occurs outdoors. Radiological hazards include residual contamination of scrap metal and debris and radiological contaminants that have potentially leached into soil, groundwater, and surface water. Chemical hazards on this site include contaminants associated with decontamination fluids, sample preservatives, and residual site contamination in surface and subsurface soil, sediment, and water.

Activities associated with environmental sampling include the following:

- extracting surface water samples, vegetation samples, sediment soil, subsurface soil, and groundwater samples to determine levels of contamination;
- geophysical survey;
- installing, developing, and sampling groundwater monitoring wells;
- sampling various debris media for residual contamination and leachability;
- sorting, characterizing, and surveying various debris media;
- surveying and sampling drums;
- drum survey and sampling plan;
- exploratory trenching;
- performing chemical decontamination of sampling equipment; and
- packaging and shipping samples to laboratories.

A task hazard analysis will be performed and approved in writing before initiating activities not specified in this plan. Because of potentially harmful impacts to workers and the environment from failure to adhere to procedural requirements, health and safety violations will not be tolerated. All personnel participating in the DWI 901 Site project will read this document before beginning work at the site.

The most likely avenues of chemical exposure are direct contact with the waste or contaminated material (possible dermal adsorption or ingestion) and inhalation of gases, vapors, or contaminated dust. The possibility of chemical exposure will be mitigated through appropriate

protective clothing and respirators, as determined necessary by real-time, on-site air monitoring. Table B.9 includes a list of suspected chemical contaminants at the DWI 901 Site, exposure limits, physical and chemical properties, route of entry, symptoms, and target organs.

5.2 KEY PERSONNEL

5.2.1 Task-Specific Organization

5.2.1.1 Task manager

The task manager is responsible for executing the overall task, preparing documents, coordinating task activities, and resolving any problems. The task manager will also ensure the health and safety of all project personnel and is accountable for adherence to this HASP.

5.2.1.2 Field technical representative

The FTR is responsible for implementing the sampling plan and the HASP in the field. The FTR is also responsible for maintaining field logbooks and resolving any discrepancies that may arise in the field.

5.2.1.3 Program health and safety manager

The program health and safety manager is responsible for oversight of the policies and procedures of this HASP. The program health and safety manager verifies that personnel have completed health and safety training consistent with 29 CFR 1910.120, qualifying them to work at the site. The program health and safety manager is responsible for the identification and availability of the appropriate monitoring and safety equipment necessary for the implementation of this plan. No changes to the HASP will be allowed without written approval by the program health and safety manager and the task manager.

5.2.1.4 Site health and safety officer

SHSO duties during sampling activities will be performed by a designated and qualified person. The SHSO reports to and receives direction from the program health and safety manager, or designee. The SHSO is responsible for controlling all aspects of health and safety during field activities and has the authority to stop work because of health and safety issues. If this authority is exercised, the SHSO will notify the program health and safety manager and task manager as soon as practicable. The task manager will notify the DOE program manager. Work will not resume without approval of the program health and safety manager. Additionally, the

Table B.9. Physical and chemical characteristics and safety information for preliminary contaminants of concern, DWI 901 Site, Knoxville, Tennessee

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Antimony SYN: Antimony metal, antimony powder, stibium	TWA—0.5 mg/m³ IDLH—50 mg/m³ (as Sb)	Silver-white, lustrous, hard, brittle solid; or a dark gray, lustrous powder	BP: 2,975°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Ingestion Skin and/or eye contact	Irritation to eyes, skin, nose, throat, mouth; coughing, dizziness, vomiting, headache, diarrhea, cramps, insomnia, inability to smell properly	Eyes, skin, respiratory system, central nervous system
NAME: Arsenic SYN: Arsenic metal, inorganic arsenic, arsenia	TWA—Ca 0.002 mg/m³ (15 min) OSHA—0.010 mg/m³ IDLH—Ca 5 mg/m³ (as As)	Metal; silver-gray or tin white, brittle, odorless solid	BP: Sublimes SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Absorption Skin and/or eye contact Ingestion	Ulceration of nasal septum, derm, GI disturbances, peri neurological respiratory irritation, hyperpigmentation of skin	Liver, kidneys, skin, lungs, lymphatic system
NAME: Beryllium SYN: Beryllium metal	TWA—Ca 0.0005 mg/m³ IDLH Ca 4 mg/m³ (as Be)	Metal; a hard brittle, gray-white solid	BP: 4,532°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Skin and/or eye contact	Berylliosis (chronic exposure), anorexia, low weight, weakness, chest pain, cough, clubbing of fingers, cyan., pulmonary insufficiency, irritation of eyes, derm.	Eyes, skin, respiratory system

Table B.9. (continued)

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Cadmium SYN: Cadmium dust, Cadmium metal	TWA—Ca OSHA—0.005 mg/m³ IDLH—9 mg/m³ (as Cd)	Metal; silver-white, blue-tinged, lustrous, odorless solid	BP: 1,409°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Ingestion	Pulmonary edema, dysp, cough, chest tightness, substantial pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, emphy, mild anemia, carcinogen	Respiratory system, kidneys, prostate, blood
NAME: Chromium SYN: Chromium metal, chrome	TWA—0.5 mg/m³ IDLH—250 mg/m³ (as Cr)	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid	BP: 4,788°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Ingestion Skin and/or eye contact	Irritates eyes, skin; lung fib (histologic)	Eyes, skin, respiratory system
NAME: Lead SYN: Lead metal, plumbum	TWA—0.100 mg/m³ IDLH—100 mg/m³ (as Pb)	A heavy, ductile soft, gray solid	BP: 3,164°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Ingestion Skin and/or eye contact	Weakness, lassitude, insomnia, facial pallor, pale eye, anorexia, low weight, malnutrition, constipation, abdominal pain, anemia, gingivival, lead line, tremor, encephalopathy, paralysis of wrist and/or ankles, kidney disease, irritation of eyes, hypotension	Eyes, GI tract, central nervous system, kidneys, blood, gingivival tissue

Table B.9. (continued)

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Manganese SYN: Manganese metal	TWA—1 mg/m³ STEL—3 mg/m³ OSHA—Carc. 5 mg/m³ IDLH—500 mg/m³ (as Mn)	Metal; a lustrous, brittle, silvery solid	BP: 3,564°F SOL: Insoluble FP: N/A VP: 0 mm (approx)	Inhalation Ingestion	Parkinson's Disease, asthenia, insomnia, mental confusion, metal fume fever, dry throat, cough, chest tightness, dysp., rales flu-like fever, low-back pain, vomiting, malaise, fatigue, kidney damage	Respiratory system, central nervous system, blood, kidneys
NAME: Mercury SYN: Mercury metal, colloidal mercury, elemental mercury, metallic mercury, quicksilver	TWA—Hg vapor: 0.05 mg/m³ (skin); Carcinogen: 0.1 mg/m³ (skin) IDLH—10 mg/m³ (as Hg)	Metal; silver, white, heavy, odorless liquid	BP: 674°F SOL: Insoluble FP: N/A VP: 0.0012 mm	Inhalation Absorption Ingestion Skin and/or eye contact	Irritation of eyes, skin, cough, chest pain, dysp. bronchitis, pneultis, tremor, insomnial irritability, indecision, headache, fatigue, weakness, stomatitis, salv, GI disturbances, anorexia, low weight, proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys
NAME: Uranium (Insoluble compounds) SYN: Varies depending on specific compound	TWA—0.2 mg/m³ STEL—0.6 mg/m³ IDLH—30 mg/m³	Silver-white metal, malleable, ductile, lustrous solid	BP: 6,895°F SOL: Insoluble FP: Not combustible VP: 0 m	Inhalation Skin and/or eye contact Ingestion	Damage to skin, lungs, lymphatic system, carcinogenic	Skin, lungs, lymphatic system, bone marrow

Table B.9. (continued)

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Uranium (Soluble compounds) SYN: Varies depending on specific compound	TWA—0.2 mg/m³ STEL—0.2 mg/m³ IDLH—0.6 mg/m³	Varies depending on specific compound	Properties vary depending on specific compound	Inhalation Skin and/or eye contact Ingestion	Lacrimation, conjunctivitis, shortness of breath, chest rales, nausea, vomiting, skin burns, RBC, casts in urine, album, high BUN, carcinogenic	Respiratory system, blood, liver, kidneys, lymphaticus, skin, bone marrow
NAME: PCB SYN: Aroclor-1254, Aroclor-1242, Aroclor-1248, Aroclor-1260	TWA—0.5 mg/m³ (0.04 ppm) IDLH—5 mg/m³	Colorless to pale yellow, viscous liquid with a mild hydrocarbon odor	BP: 689–734°F SOL: insoluble FP: nonflammable VP: 0.00006 mm	Inhalation Skin adsorption Skin and/or eye contact Ingestion	Irritated eyes and skin, liver damage	Skin, eyes, liver
NAME: Furan SYN: Dibenzofuran	TWA—N/A IDLH—N/A	Aromatic liquid	BP: N/A SOL: N/A FP: N/A VP: N/A	Skin adsorption Inhalation Ingestion Skin and/or eye contact	Vapors are narcotic, suspected carcinogen	N/A
NAME: Dioxin SYN: TCDD, TCDBD, 2,3,7,8-Tetrachlorodiben-zo-p-dioxin	TWA—N/A IDLH—N/A	Crystalline solid created in manufacture of Agent Orange	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Ingestion Skin and/or eye contact	Anorexia, hepatotoxicity, hepatoporphyria, vascular lesions, chloracne, gastric ulcers, teratogenic, and carcinogenic	Skin, liver, gastrointestinal tract
NAME: Benzo(a)athracene SYN: Benzanthracene, Benzanthrene RCRA # V018, others	TWA—N/A IDLH—N/A	Colorless solid leaflets or plates	BP: 400°F SOL: N/A FP: N/A VP: N/A	Ingestion Skin and/or eye contact Absorption Inhalation	Confirmed carcinogen, intravenous poison	N/A

Table B.9. (continued)

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Benzo(a)pyrene SYN: Benzo(d,e,f)chrysene, B(a)P RCRA # V022, others	TWA—0.2 mg/m³ IDLH—N/A	Solid yellow crystals	BP: 312°F SOL: Insoluble FP: N/A VP: 10 mm	Ingestion Absorption Inhalation	Confirmed carcinogen, skin irritant, intravenous poison	N/A
NAME: Benzo(b)fluoranthene SYN: Benz(e)acephenanthrylen, B(b)F, 3,4-Benz(e)acephenanthrylene, others	TWA—N/A IDLH—N/A	N/A	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Ingestion Absorption	Confirmed carcinogen, skin irritant	N/A
NAME: Dibenzo(a,h)anthracene SYN: DBA Dibenz(a,h)anthracene DB(a,h)A, others	TWA—N/A IDLH—N/A	N/A	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Absorption Ingestion	Confirmed carcinogen, skin irritant	N/A
NAME: Indeno(1,2,3cd)-pyrene SYN: 2,3-Phenylenepyrene, 1,10-(1,2-Phenylene)Pyrene, RCRA # U137, others	TWA—N/A IDLH—N/A	N/A	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Absorption Ingestion	Confirmed carcinogen, skin irritant	N/A
NAME: Benzo(b)fluoranthene SYN: Benz(e)acephenanthrylene, 2,3 Benzfluoranthene, others	TWA—N/A IDLH—N/A	N/A	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Absorption Ingestion	Confirmed carcinogen, skin irritant	N/A

Table B.9. (continued)

Compound	Exposure limits[a]	Physical description	Chemical and physical properties	Route of entry	Symptoms	Target organs
NAME: Dibenzo(a,h)anthracene SYN: 1,2,5,6-Benzanthracene, D,B(a,h)A, others	TWA—N/A IDLH—N/A	N/A	BP: N/A SOL: N/A FP: N/A VP: N/A	Inhalation Absorption Ingestion	Confirmed carcinogen, skin irritant	N/A

[a]American Council of Governmental Industrial Hygienists.

approx = approximately
As = arsenic
Be = beryllium
BP = boiling point
BUN = blood urea nitrogen
Ca = calcium
Cd = cadmium
Cr = chromium
DWI = David Witherspoon, Inc.
°F = degrees Fahrenheit
Dens = density
FP = flash point
GI = gastrointestinal
Hg = mercury
IDLH = immediately dangerous to life or health
m = meter
mg/m^3 = milligram per cubic meter
min = minute
mm = millimeter
Mn = manganese
N/A = not available or/not applicable
OSHA = Occupational Safety and Health Administration
Pb = lead
PCB = polychlorinated biphenyl
ppm = parts per million
RBC = red blood cell
RCRA = Resource Conservation and Recovery Act of 1976
Sb = antimony
SOL = solubility in water
STEL = short-term exposure limit, 15-min limit unless otherwise noted
TWA = time-weighted average, 8-hour limit unless otherwise noted
VP = vapor pressure

SHSO will ensure that all workers exposed to hazardous materials receive physician clearance and are on medical monitoring before and during hazardous materials exposure. The SHSO will be certified in CPR and first aid.

5.2.1.5 Field personnel

Project personnel involved in the on-site execution of sampling activities are responsible for taking all reasonable precautions to prevent injury to themselves and to their fellow employees by being alert to potentially harmful situations. They will also perform only those tasks that they believe they can do safely and immediately report any accidents and/or unsafe conditions to the SHSO. They will notify the SHSO of any special medical conditions (i.e., allergies, contact lenses, pregnancy, or diabetes) and, if necessary, ensure that all on-site personnel are aware of the condition. The Jacobs ER Team has a commitment to protect declared pregnant workers. A declared pregnant worker is a female worker who voluntarily notifies her employer in writing that she is pregnant for the purposes of fetal/embryo dose protection. The Jacobs ER Team program manager will provide the declared pregnant worker the option of a mutually agreeable assignment of work tasks without loss of pay or promotional opportunity so that further occupational radiation exposure is unlikely. Field personnel are also responsible for practicing good housekeeping by keeping their work area neat, clean, and orderly to the extent possible and meeting all requirements of this site HASP.

5.2.1.6 Radiological control manager

The radiological control (RADCON) manager provides oversight to ensure that the policies in the Jacobs ER Team RADCON manual and the requirements of the Jacobs ER Team Radiation Protection Program are met. The RADCON manager approves radiological work permits, if needed, as provided in the Jacobs ER Team RADCON manual.

5.2.1.7 Radiological control technician

The RCT is responsible for ensuring that all personnel on site comply with the Jacobs ER Team Radiation Protection Program. Additionally, it is the RCT's responsibility to monitor the site for radiation, radioactive contamination, and airborne radioactivity according to the radiation work permits and all applicable procedures. The RCT reports to and receives direction from the RADCON manager.

5.2.1.8 Radiological support technicians

RSTs assist the RCT in ensuring that all personnel on site comply with the Jacobs ER Team Radiation Protection Program. Additionally, RSTs may monitor the site for radiation, radioactive contamination, and airborne radioactivity according to the radiation work permits and all applicable procedures. The RSTs report to and receive direction from the RCT.

5.2.1.9 Subcontractor responsibilities

Subcontractors (i.e., drillers, surveyors, construction contractors, etc.) used by Jacobs ER Team to perform field activities are responsible for complying with elements of this HASP that cover their specific project assignments. Jacobs ER Team personnel will monitor the subcontractors to ensure that health and safety procedures are performed in accordance with Energy Systems' Clause H.17 when working at the DWI 901 Site. Failure of the subcontractor to adhere to these requirements can cause work to stop until compliance is ensured. Subcontractors repeatedly failing to adhere to these requirements will be banned from the site.

Analytical results of soil, sediment, and surface water samples collected during previous environmental investigations at the site indicate that detectable concentrations of uranium, mercury, PCBs, dioxins, furans, and various volatile and SVOCs may be present. A site radiological survey indicated that gamma activity was above background level in surficial soil in the western portion of the site.

5.3 HAZARD CHARACTERIZATION AND ASSESSMENT

5.3.1 Preliminary Evaluation

Physical, biological, radiological, and chemical hazards are potentially associated with the DWI 901 Site sampling activity. The physical and biological hazards include temperature extremes, adverse weather, sunburns, animals and insects, and other hazards associated with working outdoors. There are some sampling activities in the work plan that could potentially expose personnel to an airborne chemical hazard. The chemical hazards anticipated for this task are of a moderate order of acute risk and are expected to be primarily associated with sample preservation and contaminants contained in the various matrices to be sampled, such as surface water, sediment, surface soil, and vegetation.

Weston performed an Phase II RI summarized in the report, *Expanded Site Investigation* (Haliburton 1995). The results of this RI indicate that there are levels of radiological

contaminants higher than background. The RI also indicates that there is heavy metals contamination with concentrations in soil and surface water at or moderately above background levels. This is fairly typical when dealing with this type of site.

5.3.2 Hazard Identification and Assessment

The hazards associated with the sampling activities can be identified and assessed as they apply to one sampling event. A sampling event consists of several steps: well installation, sample collection; decontaminating the sampling equipment; packing and shipping the sample; and drum survey sampling; and trenching. The hazards associated with each step are discussed in Sections 5.3.2.1–5.3.2.4. The activity, hazards, controls, and monitoring are listed in Table B.10.

5.3.2.1 Physical hazards

The fieldwork is expected to begin in the winter of 1997 and will run for several months. The physical hazards associated with this task arise from site conditions and the way the work will be performed. These include the following:

- Environmental Stresses—Arising from personnel work load and the weather conditions at the site (depending on the season). There is a moderate to high level of risk depending on the season. This includes heat stress, sun exposure, cold stress, and adverse weather conditions. Weather conditions may change from day to day and will be addressed as part of the daily "tailgate" health and safety briefing. Conditions that can affect safety include high winds, lightning, rain, hail, dense fog, sleet, snow, and ice. The SHSO will determine daily whether work will proceed as dictated by current weather conditions.

- Noise—There is a potential for exposure to hazardous noise sources during activities involving heavy equipment (drill rigs, forklift, bulldozers, etc.). Noise levels will be monitored within the work zone in the vicinity of the equipment, which may create noise levels exceeding 85 dBA. Where this level is exceeded, hearing protection will be worn by all personnel working in the vicinity of the equipment. The only equipment to be used on this project which is expected to exceed 85 dBA is the air rotary drill rig used to install the groundwater monitoring wells. Potential hazardous noise producers will either be surveyed using a sound level meter or will be assumed to be hazardous noise producers, and hearing protection will be required for personnel working in the vicinity of the equipment.

Table B.10. Hazard identification and control, DWI 901 Site, Knoxville, Tennessee

Step	Hazard	Controls
General (mobilization and demobilization)	Temperature extremes/adverse weather	Work practices (Sect. 5.6)
	Unsafe walking/working surfaces	Training; avoidance (Sect. 5.3.2.1)
	Poisonous plants	Training; avoidance (Sect. 5.3.2.2)
	Physically damaging plants	Training; avoidance (Sect. 5.3.2.2)
	Wildlife	Training; avoidance (Sect. 5.3.2.2)
	Biting and stinging insects	Training; avoidance (Sect. 5.3.2.2)
	Mechanical hazards	Training; avoidance (Sect. 5.3.2.1)
	Electrical hazards	Training; avoidance (Sect. 5.3.2.1)
	Noise	Training; avoidance (Sect. 5.3.2.1)
Subsurface soil sampling	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
Installing, developing, and sampling monitoring wells	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
	Hazards discussed under "General" section	Controls discussed under "General" section
Geophysical logging of site	Hazards discussed under "General" section	Controls discussed under "General" section
Debris sampling	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
	Hazards discussed under "General" section	Controls discussed under "General" section
Debris sorting, characterizing, and surveying	Contact with chemicals	PPE (Sect. 5.5)

Table B.10. (continued)

Step	Hazard	Controls
	Radiological contamination	Training, work practices, PPE (Section 5.8)
	Hazards discussed under "General" section	Controls discussed under "General" section
Drilling	Heavy equipment	PPE, administrative controls (Sect. 5.3.2.1)
	Noise	PPE (Sect. 5.3.2.1)
	Electrical hazards	Utility clearances (Sect. 5.3.2.1)
	Dusts	Engineering controls, PPE (Sect. 5.5.1)
	Fire/explosion	Source and flammable material control, fire fighting equipment (Sect. 5.3.2.1)
	Splashing hazards discussed under "General" section	PPE (Sect. 5.8) controls discussed under "General" section
Trenching	Contact with chemicals	PPE (Sec. 5.5)
	Noise	Training; avoidance (Sect. 5.3.2.1)
	Radiological contamination	Training; avoidance (Sect. 5.8)
	Electrical hazards	Training; avoidance (Sect. 5.3.2.1)
	Heavy equipment	PPE, administrative controls (Sect. 5.3.2.1)
	Fire/explosion	Source and flammable material control, fire fighting equipment (Sect. 5.3.2.1)
Surface water/sediment sampling	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
	Hazards discussed in under "General" section	Controls discussed under "General" section

Table B.10. (continued)

Step	Hazard	Controls
Equipment and personnel decontamination	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
	High-pressure steam	PPE (Sect. 5.5)
	Hazards discussed under "General" section	Controls discussed under "General" section
Drum survey and sampling	Drum and container handling	PPE, use of appropriate lifting equipment as needed (Sect. 5.3.2.1)
	Contact with chemicals	PPE (Sect. 5.5), monitoring (Sect. 5.8.3)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8), monitoring (Sect. 5.3.2.3)
	Fire/explosion	Use of nonsparking tool, source control, fire fighting equipment (Sect. 5.3.2.1)
Waste management	Contact with chemicals	PPE (Sect. 5.5)
	Radiological contamination	Training, work practices, PPE (Sect. 5.8)
	Hazards discussed under "General" section	PPE, use of appropriate lifting equipment as needed (Sect. 5.3.2.1)
		Controls discussed under "General" section

DWI = David Witherspoon, Inc.
PPE = personal protective equipment
Sect. = section

- Mechanical Hazards—During activities involving heavy equipment (drill rig, etc.) care will be taken to avoid falling or flying objects and being caught between moving and idle pieces of machinery. Caution will be exercised when operating heavy machinery on slopes; secondary restraints and/or regrading may be necessary. Hard hats, safety glasses, and steel-toed boots will be worn at all times by all personnel working in close proximity to such equipment. Personnel operating such equipment will be required to have certification or other evidence of training that qualifies them to operate the specific equipment. Equipment, such as the drill rig, will be inspected before it is delivered to the site and daily thereafter. Also, moving parts on any of the sampling equipment (i.e., JMC backsaver) could pose a mechanical hazard, resulting in cuts, abrasions, and pinch points.

- Electrical Hazards—Any requirement for using electrically powered sampling equipment or meters while in the field during a rain storm could pose a potential electrocution hazard. Before the start of any drilling or excavations, all underground utility lines, other underground structures, and aboveground utility lines will be identified and clearly delineated in the selected work areas. A safe distance [at least 4.57 m (15 ft)] from overhead utility lines must be maintained at all times. The task manager will ensure that a check for utilities is made by contacting the necessary utility companies and the appropriate permits will be obtained. Field activities will be conducted in compliance with Jacobs ER Team SOP 7.7: "Utility Clearance."

- Fire—The potential for fire and/or explosion is present during intrusive activities at the DWI 901 Site. During subsurface operations, lower exposure level (LEL) meters will be used to monitor levels of potentially combustible gases. Combustible vapor measurements above 10 percent of the LEL will require that work be immediately stopped and the site evacuated. The SHSO will continue to monitor the area, and work can resume after combustible vapors have diminished to levels below 10 percent LEL for at least 10 minutes. Fire extinguishers (see Sect. 5.13.1.3 for requirements) will be required within the exclusion zone at each work site.

- Unsafe Walking/Working Surfaces—Wet, marshy ground, uneven terrain, and vegetation overgrowth pose the risk of slips, trips, and falls. This should be considered a potential problem during all phases of fieldwork.

- Drums—Extreme caution will be observed during the drum survey and sample collection to minimize the potential of chemical/radiological exposure to the personnel performing the sampling. Figure B.10 provides several methods of dealing with the

drums, depending on the condition, contents, and actions to be taken. The SHSO will collect field measurements using a PID, Micro-R Survey Meter, and NaI Radiation Detector before working with or sampling a drum. A nonsparking bung wrench will be used to open sealed drums. Personnel will be required to wear safety glasses, appropriate chemical-resistant gloves, and steel-toed boots, as a minimum, when working with or sampling the drums. Intact drums containing liquids or solids are not expected to be present at the DWI 901 Site. In the event that such drums are discovered, the SHSO wills top work and consult the program health and safety manager (PHSM) to evaluate the approach for characterization and will develop the appropriate plan and task hazard analysis to safely complete the unfinished work.

- Trenching—Extreme caution will be observed during the trenching operations to minimize the potential of puncturing a buried drum. At no time will personnel be allowed to enter the open excavation. The equipment operator should not dig straight down, but should use more of a scraping motion so that any buried drums can be made visible, thus minimizing the potential for puncturing a drum. Personnel should remain away from the trench until the equipment operator has made the equipment safe. Personnel may then proceed toward the trench, staying well back from the edges of the trench [approximately 0.6–1 m (2–3 ft)].

  During sample collection, a platform should be constructed with a sampling hole in the center of the platform. The platform should have approximately 1.5 m (5 ft) of overlap on each side of the trench. No more than two people will be allowed on the platform while it is in use over the trench. Personnel within the established work zone for trenching activities, will be required to wear hard hats, hearing protection, safety glasses, and steel-toed boots. In the event that a buried drum is punctured during trenching activities, the SHSO will exercise work-stop authority and consult with the program health and safety manager on how to proceed.

  During all trenching operations, continuous air monitoring will be conducted using a PID and a dust mass monitor. Other types of monitoring, such as the LEL/oxygen meter and radiation dose rate meter, may be required at the discretion of the SHSO, RADCON technician, RADCON manager, or program health and safety manager. This decision will be based on conditions at the specific location where trenching is to be performed.

5.3.2.2 Biological hazards

One of the greatest concerns for health and safety is the biological hazards that might be encountered during this sampling activity. Types of biological hazards include the following:

- Poisonous Plants—There is a strong possibility that poison ivy may be encountered when installing the wells or collecting the various samples. Poison ivy presents a risk of skin irritation to those persons who come in contact with it. Poison oak and poison sumac are also indigenous to this region of the country and are also a risk for skin irritation to workers. Poison ivy, poison oak, and poison sumac are identified by three or five leaves radiating from a stem. Poison ivy is a vine, while poison oak and poison sumac are bush-like. The plant tissues have an oleoresin that is active in live, dead, and dried parts. The oleoresin may be carried via smoke, dust, contaminated clothing, and animal hair. All work areas (sampling locations and well locations) will be cleared during the site preparation. All poisonous plants will be removed during the cleaning process.

- First Aid for Poisonous Plants—Signs and symptoms of contacting poisonous plants include redness, swelling, and sometimes intense itching. Blisters form during the subsequent 24 hours; crusting and scaling occurs within a few days. In the absence of complications, healing is complete in about 10 days. Wash any exposed skin with a mild soap and water, but do not scrub the area.

- Physically Damaging Plants—Plants with thorns, such as briars and thistles, also may be encountered when working near overgrown areas or along any fence lines. These pose a risk of causing damage to the skin, clothes, or the PPE being worn on site.

- Potentially Hazardous Wildlife—This includes poisonous and nonpoisonous snakes, some types of birds, and some types of mammals that can be found under debris, manhole covers, or overgrown vegetation. Snakes are always a concern when working outdoors, especially when working in conditions with limited visibility. Extreme caution must be observed when collecting all of the samples from the DWI 901 Site. The best avoidance procedure is to be familiar with snake habitat and observant in the field. Wildlife found on the site (e.g., coyotes, raccoons, foxes, and birds) usually avoid people. Unhealthy or threatened wildlife may become aggressive, especially if cornered or defending their territory or offspring.

- Biting and Stinging Insects—A wide variety of biting and stinging insects will undoubtedly be encountered while working on site. Notable among these are mosquitoes, biting flies, wasps, hornets, and bees. Insect repellant may be worn by the field sampling team if it does not impact the results or validity of the samples being collected. Ticks may also be a problem while working in any vegetated area. Infected ticks can carry diseases such as Lyme disease or Rocky Mountain spotted fever. Personnel should perform a personal inspection for ticks after being in a suspected tick area, closely inspecting legs, groin, arms, neck, ears, and hair. Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, but firmly, until it releases its hold on the skin. Save the tick in a jar labeled with the date, body location of the bite, and the place where it may have been acquired. Wipe the bite thoroughly with an antiseptic and seek medical attention as soon as possible. The various stages and symptoms of both diseases are well recognized and, if detected, can be treated with antibiotics. Early detection and treatment with antibiotics significantly reduces the severity of both Lyme disease and Rocky Mountain spotted fever.

  Almost all of the 30,000 species of spiders are venomous, but only a relatively small number have fangs long and strong enough to penetrate the human skin. There are two species of spiders found locally, the black widow and the brown recluse, that have venom of sufficient toxicity to cause potentially severe health effects in humans who are bitten. Spiders are generally found in dark protected areas such as access ways to sanitary sewers, under ledges, in protective casings of monitoring wells, pump housings, buildings, portable toilets, and manhole covers.

  First aid for spider bites includes applying ice to the bitten area and keeping that area below the heart level to slow circulation of the venom. The individual should seek medical advice.

- Microorganisms—Certain types of soil and water microorganisms that may be encountered in marshy conditions such as the wetland may pose a risk of causing disease in exposed individuals. These are mainly a concern if ingested or in cases of contact with open wounds or unhealed sores.

5.3.2.3 Radiological hazards

The activities to be performed at the DWI 901 Site involve tasks that may present radiological hazards to crew personnel. Sources of radiation, exposure to radioactive contamination, and exposure to airborne radioactivity are concerns because of the nature of activities at the site.

- There is a potential for exposure to sources of radiation at DWI 901 Site. During an investigation conducted by Halliburton NUS Corporation in 1994, a radiological survey was performed and radiation dose ranged from 20 to 210 μR/hour. Consequently, thermoluminescent dosimeters will be worn by all personnel in accordance with Jacobs ER Team SOP H&S-11.2.1, "External Dosimetry." Additionally, the SHSO or the RCT will monitor for radiation in accordance with Jacobs ER Team SOP H&S-11.4.2, "Radiation Exposure Monitoring."

- The potential for exposure to airborne radioactivity is low for most of the activities that will be conducted at this site (i.e., sediment sampling, soil sampling, etc.). However, by their very nature some activities (well drilling, drum, and tank sampling) require extra precautions. For these activities, modified Level C as specified in Section 5.5, "Personal Protective Equipment," of this HASP will be worn. Also, if questionable conditions exist during any part of the project (e.g., dry topsoil in combination with high winds in a high-contamination area), the SHSO or RCT may monitor for airborne radioactivity according to Jacobs ER Team SOP H&S-11.4.3, "Radiological Air Sampling and Monitoring."

- Radioactive contamination can enter the body through absorption, inhalation, or ingestion. Contamination levels in the soil have been detected at greater than 100,000 pCi/g of ^{238}U. Exposure can be mitigated through appropriate PPE and monitoring. The SHSO or RCT will monitor for contamination according to Jacobs ER Team SOP H&S-11.4.1, "Radiological Contamination Surveys." Additionally, all personnel must monitor for personal contamination according to Jacobs ER Team SOP H&S-11.4.4, "Personnel Contamination Monitoring (Frisking)," when leaving the site. Personnel working on the site will participate in the Jacobs ER Team bioassay program in accordance with Jacobs ER Team SOP H&S-11.2.2, "Internal Dosimetry."

  To minimize radiation exposure, the Jacobs ER Team adopted an ALARA policy similar to the DOE policy as spelled out in the *Jacobs ER Team Radiological Control*

(RADCON) Manual, Oak Ridge, Tennessee (Jacobs ER Team 1996). Implementation of this policy can be found in Jacobs ER Team SOP H&S-11.1.1, "ALARA Implementation."

5.3.2.4 Chemical hazards

The chemical hazards anticipated for this project are of a relatively low order of acute risk and are expected to be primarily associated with sample preservation and contaminants contained in the various matrices to be sampled: surface water, subsurface water, sediment, debris, and drums. The chemical hazards of concern include the following:

- Contact with Chemicals—Organic chemicals and metals in water, sediment, vegetation, or drum sampling can pose a potential risk of exposure through skin contact or ingestion. Based on the results of the RI the probability of encountering acutely toxic chemical levels during work on this project are extremely low. The possibility of contact exposure will be mitigated through the use of appropriate PPE and monitoring.

  There is a potential for chemical exposure during equipment decontamination sample preservation, drum sampling, and trenching. Reagents used for decontamination include Liquinox and isopropanol. Sulfuric and nitric acid may be added to the samples in small quantities to stabilize the pH of the samples. Baking soda will be available at the site to neutralize any minor drips or spills of the acid. These chemicals will be used with the proper PPE and under the direct supervision of the SHSO.

- Airborne Particulates—There is a potential for exposure to airborne chemical exposure at DWI 901 Site during the installation of the monitoring wells and trenching. Airborne chemical exposure is generated through some action that causes chemically contaminated material to become suspended in the air. The amount of chemical contamination in the DWI 901 Site sediment is moderate, and the SHSO will be monitoring the total airborne dust level during the well installation and other related activities. The action level for total airborne dust will be 3 mg/m^3. If dust levels reach this action level, engineering controls and or PPE will be used to minimize this potential hazard. Airborne constituents associated with drum sampling have not been fully evaluated and a determination for the appropriate PPE will be made based on the initial findings from the drum survey by the program health and safety officer, SHSO, and RADCON manager as appropriate.

5.3.2.5 Hazard communication

All field personnel will receive hazard communication (HAZCOM) training before beginning work. The Jacobs ER Team HAZCOM Program complies with the OSHA HAZCOM Standard, 29 CFR 1910.1200 and 29 CFR 1926.59, "Hazard Communication." The following Jacobs ER Team SOPs will be followed during the field activities:

- H&S-8.1.1, "Central Chemical Inventory and Material Safety Data Sheets File"
- H&S-8.1.2, "Department and Site MSDS Collection"
- H&S-8.1.3, "Hazard Communication Training"
- H&S-8.1.4, "Use, Approval, Order, and Receipt of Hazardous Chemicals"
- H&S-8.1.5, "Labeling Hazardous Material Containers"

5.3.2.6 Materials Safety Data Sheets

Materials Safety Data Sheets (MSDSs) for any chemical that will be brought to the site for use during sampling activities will be discussed during the preproject health and safety briefing. These MSDSs will be maintained on site as part of the site HASP. Copies of the chemical list and the MSDSs will be maintained in the field equipment storage and supplies room by the HAZCOM program coordinator.

5.3.2.7 Controls

Control methods for the various hazards previously listed are selected based on the nature of the hazard, its likelihood of occurrence, and its potential severity. Feasibility of implementation is also a factor. The controls to be used for this project can be divided into three general types:

- training and proper work practices,
- monitoring for action levels, and
- PPE and related items.

5.4 TRAINING REQUIREMENTS

5.4.1 Hazardous Waste Operations Training

All personnel who participate in fieldwork on this project must have completed either the initial 40-hour OSHA training or the annual 8-hour OSHA update training within the last year in compliance with 29 CFR 1910.120.

Supervisory personnel with field oversight responsibility on the project will be required to have completed an 8-hour manager/supervisor training course for hazardous waste operations in addition to OSHA training.

Upon initial mobilization to the site, field personnel shall receive 3 days of supervised experience on site under the direction of the FTR or the SHSO before being allowed to work in independent teams. This supervised experience will be documented by the FTR and the SHSO. Visitors to the site will receive a site-specific health and safety briefing and be escorted by the FTR or the SHSO during the duration of their visit to the site.

All personnel performing work in an exclusion zone at the DWI 901 Site will have current Radiation Worker II training.

5.4.2 Corporate Training Required

The SHSO and one other person on the field team must have current certification in first aid and CPR and must have completed a training course on bloodborne pathogens exposure control within the last year.

5.4.3 HAZCOM Training

All field team members will receive HAZCOM refresher training in accordance with the Jacobs ER Team HAZCOM Program.

5.4.4 Project-Specific Training

A premobilization training session covering the potential hazards associated with planned work activities will be held before mobilization to the work site. This training will focus on specific site conditions, including:

- poisonous and damaging plants,
- wildlife hazards,
- mechanical and electrical hazards,
- proper use of PPE, and
- proper work practices for mitigating these hazards.

In particular, exercise of care and avoidance of unsafe walking/working surface hazards will be stressed, as will proper field clothing, environmental stresses, and work practices. This training will also cover all other aspects of the HASP and any associated SOPs.

Daily "tailgate" health and safety meetings will be held each morning before the start of work by the SHSO who will emphasize the important health and safety considerations for that day's activities.

All training will be recorded and filed according to Jacobs ER Team SOP QA-3.0, "Training."

5.5 PERSONAL PROTECTIVE EQUIPMENT

Potential for exposure to chemical contaminants is expected to be low for this project. Accordingly, most work will be performed in a modified EPA Level D ensemble, adjusted for the type of work and seasonal changes. Upgrading to EPA Level C may be warranted if airborne chemical contaminants go above prescribed levels or during the sampling of the drums. Jacobs ER Team SOP H&S-6.2.3, "Donning and Doffing Level C Ensemble," will be followed if Level C is needed. The basic clothing ensemble may consist of the following for winter months:

- long pants, winter apparel, and steel toe and shank boots;
- chemical-resistant gloves when contact with potentially contaminated sample matrices is required;
- safety glasses, splash goggles, or face shields;
- work gloves (as needed);
- hearing protection (as needed); and
- hard hats (as needed).

When sampling activities are being performed, personnel will typically wear two layers of protective gloves: an inner latex glove and either a second latex glove or a larger chemical-resistant glove. Exact composition of the outer glove will be based on anticipated contaminants, though nitrile, neoprene, butyl rubber, polyvinyl chloride, or Saranex gloves will be acceptable for working with nitric acid. Latex gloves will be adequate to protect against any microorganisms that may be in soil or water.

5.5.1 Respiratory Protection

Respiratory protection may be required during the well installation. If respirators are required, the Jacobs ER Team SOP manual, Section H&S-7.0, "Respiratory Protection Program," will be followed.

5.5.2 Preliminary PPE Selection

Because of weather factors or contaminant levels, the SHSO may need to modify the PPE requirements for field personnel involved in sampling activities. PPE will be modified Level D, including proper gloves and eye protection. PPE selected for each sampling event will be annotated by the SHSO in the health and safety logbook.

5.6 TEMPERATURE EXTREMES

5.6.1 Hot Weather Conditions

Heat stress is a potential hazard to field workers when air temperature exceeds 21°C (70°F) and can possibly result in a life-threatening injury. This potential can be mitigated through the use of proper monitoring and work practice controls. The Jacobs ER Team SOP H&S-9.3.1, "Heat Stress Monitoring," shall be followed to control the potential for heat stress on this task.

Overexposure to sunlight can result in sunburn, particularly in individuals with lighter skin pigment or who are taking certain light-sensitizing medications. In addition to being painful and increasing one's long-term risk of developing skin cancer, sunburn also increases the risk of illness from heat stress. The most effective controls for sun exposure are wearing an appropriate sunscreen and dressing to cover as much of the skin as feasible. Sunscreens used for outdoor work should be of as high a solar protection factor as possible and water-resistant. Personnel should be encouraged to use sunscreen and to reapply it after the lunch break.

If a field team member becomes sunburned, the SHSO must take extra care in monitoring the affected individual for signs of heat stress. In cases of severe sunburn, the individual will be restricted from field duty until the burn has healed.

5.6.2 Cold Weather Conditions

Prevention of cold weather injuries (frostbite and hypothermia) is a vital part of the project HASP during spring, fall, or winter sampling activities. The most important factor in the evaluation of cold exposure is the windchill index. The windchill index estimates the relative

cooling ability of a combination of low air temperature and wind velocity. It is measured as the equivalent chill temperature. The same factors that predispose people to heat injury also predispose them to cold weather injuries. The SHSO will be responsible for implementing Jacobs ER Team SOP H&S-9.3.2, "Cold Stress Monitoring," depending on air temperature and wind speed. The SOP provides guidance on cold stress warning signs and symptoms and evaluation and control of cold stress.

5.6.3 Adverse Weather Conditions

Electrical storms commonly occur during the spring, summer, and fall. The resulting lightning poses a safety hazard to field personnel. Because the storms are often fast moving, field personnel should watch for indications of electrical storms. The distance to an electrical storm can be estimated by observing the interval between the lightning flash and the sound of thunder. Because sound travels approximately 334 m (1,100 ft)/second, an interval of 5 seconds corresponds to a storm distance of approximately 1.6 km (1 mile). If an electrical storm is observed while at the DWI 901 Site, all field work will be suspended and the field crew will seek shelter in the on-site trailer or a vehicle.

Fog, haze, high winds, heavy rain, snow, ice, sleet, and hail also pose potential hazards. The previously mentioned controls should be followed in the event that any of these events occur. The SHSO will be responsible for monitoring weather conditions and determining when work should be suspended and when it may resume.

5.7 MEDICAL SURVEILLANCE

All personnel who participate in fieldwork for this task must be enrolled in the Jacobs ER Team Medical Surveillance Program, as administered by the Jacobs ER Team program health and safety manager. A physical examination and a physician's clearance for fieldwork within the last year is required for each member of the field team.

5.8 EXPOSURE MONITORING AND AIR SAMPLING

5.8.1 Radiation Sampling Strategy

Radiological monitoring will be handled according to the *Jacobs ER Team Radiological Control (RADCON) Manual* and the series of the Jacobs ER Team SOP H&S-11.0, "Radiation Protection."

The RADCON manager will establish monitoring frequencies through the use of radiological work permits written according to Jacobs ER Team SOP H&S-11.1.2, "Radiological Work Permits." The RCT and RSTs will obtain techniques for monitoring from the following applicable SOPs:

- H&S-11.4.1, "Radiological Contamination Surveys"
- H&S-11.4.2, "Radiation Exposure Monitoring"
- H&S-11.4.3, "Radiological Air Sampling and Monitoring"
- H&S-11.4.4, "Personnel Contamination Monitoring (Frisking)"

5.8.2 Instrumentation and Equipment

Ludlum Model 2221 scaler rate meters will be used with appropriate beta/gamma probes. A Ludlum Model 2929 scaler will be used for smear counting. Following is a list of the radiological instrumentation SOPs that may be used on this task:

- H&S-11.3, "Radiological Instrumentation"
- H&S-11.3.1, "Geiger-Müller Detector: Calibration, Operation, and Usage"
- H&S-11.3.2, "Alpha Detector: Calibration, Operation, and Usage"
- H&S-11.3.3, "Alpha-Beta Sample Counter: Calibration and Usage"
- H&S-11.3.4, "Ionization Chamber: Calibration and Usage"
- H&S-11.3.5, "MicroR Meter: Calibration and Usage"
- H&S-11.3.6, "Sodium Iodide Detector: Calibration and Usage"
- H&S-11.3.7, "Scout Multichannel Analyzer: Operation and Usage"

5.8.3 Chemical Monitoring

Action levels for personal protection from total airborne dust have been established during the well installation at the DWI 901 Site to determine the appropriate level of respiratory protection for site workers. This monitoring will be performed using a total dust mass monitor (i.e., MINIRAM). Results of this monitoring will be used to determine when an action level has been reached that requires additional precautions (i.e., upgrading the level of PPE being used).

Action levels to be used during field activities at the DWI 901 Site are based on permissible exposure limits, as defined by OSHA permissible exposure limits or American Conference of Governmental Industrial Hygienists threshold limit values. During drilling, soil sampling, and trenching, total airborne dust measurements will be made in the breathing zone when the bit first enters the ground and at 15-minute intervals thereafter.

Air monitoring for personal protection from organic and inorganic vapors will be conducted during drum sampling activities at the DWI 901 Site. This monitoring will be performed using a PID. Results of this monitoring will be used to determine when an action level has been reached that requires additional control measures (i.e., work stoppage, until new task hazard analysis is completed).

Action levels to be used during drum sampling activities at the DWI 901 Site will be based on permissible exposure limits, as defined by OSHA. During drum sampling, PID measurements will be made near the bung hole on top of the drum and in the breathing zone when the drums are first opened and at intervals deemed appropriate by the SHSO thereafter.

Of the VOCs which have the potential to be present at the site, benzene has the lowest 8-hour time-weighted average 1 ppm. Because it is not possible to differentiate specific compounds with a PID, a conservative assumption will be made that all PID readings correlate directly to benzene concentrations. Hence a PID reading 5 units above background for a sustained period (5 minutes) will indicate the need to stop work and consult the PHSM to re-evaluate the situation.

The chemical monitoring instruments used on this task shall be maintained, calibrated, and operated according to the manufacturer's instructions. Daily operational checks and calibrations will be documented in the appropriate logbook.

In the event that total airborne dust levels exceed the action levels, the program health and safety manager will be consulted to discuss the monitoring results and to reach an agreement on start-up conditions before resuming work.

5.8.4 Exposure Control for PCBs, Dioxins, and Furans

Exposure control measures for radiological elements (Sect. 5.8.1) will also be used to control exposure to PCBs, dioxins, and furans. Because these materials are expected to occur as low-level contaminants in dust, monitoring and control measures used for radionuclides should be adequate.

5.9 SITE CONTROL

All site workers will be required to provide necessary training records to the project health and safety officer before starting work on the project. Potential subcontractors that may work on a given project could include, but are not limited to, drilling crews, sampling teams, and

survey crews. Each of the subcontractors and visitors will be under the direct supervision of the FTR or his/her representative. Subcontractors and visitors will be subject to all applicable Jacobs ER Team health and safety regulations during field operations at the DWI 901 Site.

At the work site, only those personnel directly involved with site activities will be allowed in the exclusion zone. The Jacobs ER Team will clearly define and identify the following areas at each work site and will specify the equipment, operations, and personnel in the areas as defined below:

- Exclusion Zone—The exclusion zone is the area where physical, chemical, and/or radiological hazards exist or could occur. The purpose of this zone is to limit the spread of contaminated materials to clean areas and to provide for the safety of those personnel not authorized to enter the exclusion zone. The exclusion zone will be delineated by flagging tape, and the flow of personnel and equipment into and out of the zone will be restricted to the contamination reduction corridor. RADCON areas will be defined by the RCT and marked with magenta/yellow rope and appropriate warning signs.

- Contamination Reduction Zone—The area between the exclusion zone and the support zone is the contamination reduction zone. This zone serves as a buffer to further reduce the possibility of the support zone (clean area) from being contaminated. It provides additional assurance that the physical transfer of contaminated materials is limited by decontamination, distance, dilution, and work functions. At the boundary between the exclusion zone and the contamination reduction zone, decontamination stations will be established as described in the decontamination procedures.

- Support Zone—This area is defined as the area outside the zone of potential contamination. The functions of the support zone are to provide an entry and exit area for personnel, material, and equipment to the area of site operations; for storage of uncontaminated safety and work equipment; and for rest breaks, food and beverage consumption, and all other activities that serve in a supportive role to the investigating team.

5.10 DECONTAMINATION

5.10.1 Personnel Decontamination

Personnel will be decontaminated, as necessary, according to Jacobs ER Team SOP H&S-11.6.1, "Personnel, Equipment, and Materials Radiological Decontamination." If Level C Ensemble is needed, Jacobs ER Team SOP H&S 5.2.3, "Level C Decontamination," will be followed.

5.10.2 Equipment Decontamination

Equipment will be decontaminated according to Jacobs ER Team SOP H&S-11.6.1 as well as Jacobs ER Team SOP FS-12.1 and Jacobs ER Team SOP FS-12.2, "Equipment Decontamination."

5.11 EMERGENCY RESPONSE/CONTINGENCY PLAN

5.11.1 Emergency Contingency Plan

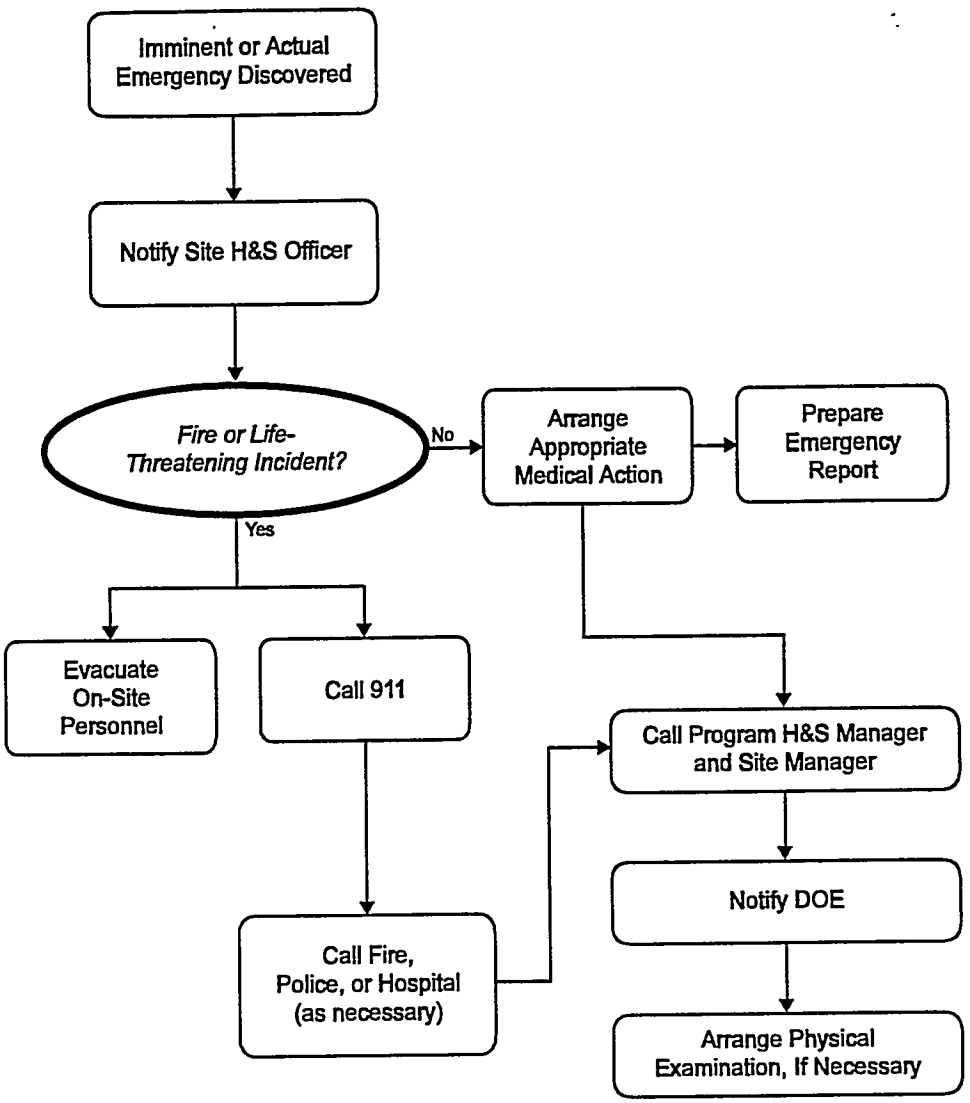
Any person discovering an emergency will immediately notify other employees, the SHSO, and the FTR to protect personnel, property, and the environment. During emergencies, the office trailer or any other location upwind of the emergency and outside of the exclusion and contamination reduction zones will be used as the assembly area. An air horn will be used to alert field personnel of emergency situations.

The SHSO will verify that emergency notification information is available at each site and that field crew personnel are adequately trained. An emergency situation action plan decision chart is presented in Figure B.13.

5.12 EMERGENCY ACTION PLAN

5.12.1 Communication

A cellular telephone will be made available to the on-site field team. Any emergency should first be reported to the SHSO, who will in turn call 911 as necessary. However, any field team member can call 911 if the situation dictates. In the event of an evacuation from the DWI 901 Site, established evacuation routes will be used.



JE

Fig. B.13

Emergency situation action plan

DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee

DOCUMENT ID: 35H830 0094-30 / RI/FS	DRAWING ID: 96-13185.CDR	DRAWING DATE: OCTOBER 22, 1996 TG

5.12.2 Emergency Telephone Numbers

Following is a list of telephone numbers for use during work at the DWI 901 Site. It will be maintained in the support trailer as well as in each field vehicle. When dialing emergency numbers from a cellular phone for services to be rendered in Knox County, it is not necessary to dial the direct number, because dialing 911 will reach emergency numbers in Knox County.

- Ambulance: 911 or 546-4821
- Fire Department: 911 or 573-2031
- University of Tennessee Medical Center: 911 or 544-9401
- Police Department: 911 or 521-1200
- Jacobs ER Team: 220-4800
- Program health and safety manager: 220-4851, pager 996-6375
- Project manager: 220-4856
- Task manager: 220-4861
- QA manager: 220-4849
- RADCON program manager: 220-4839

5.12.3 Emergency Route to the Hospital

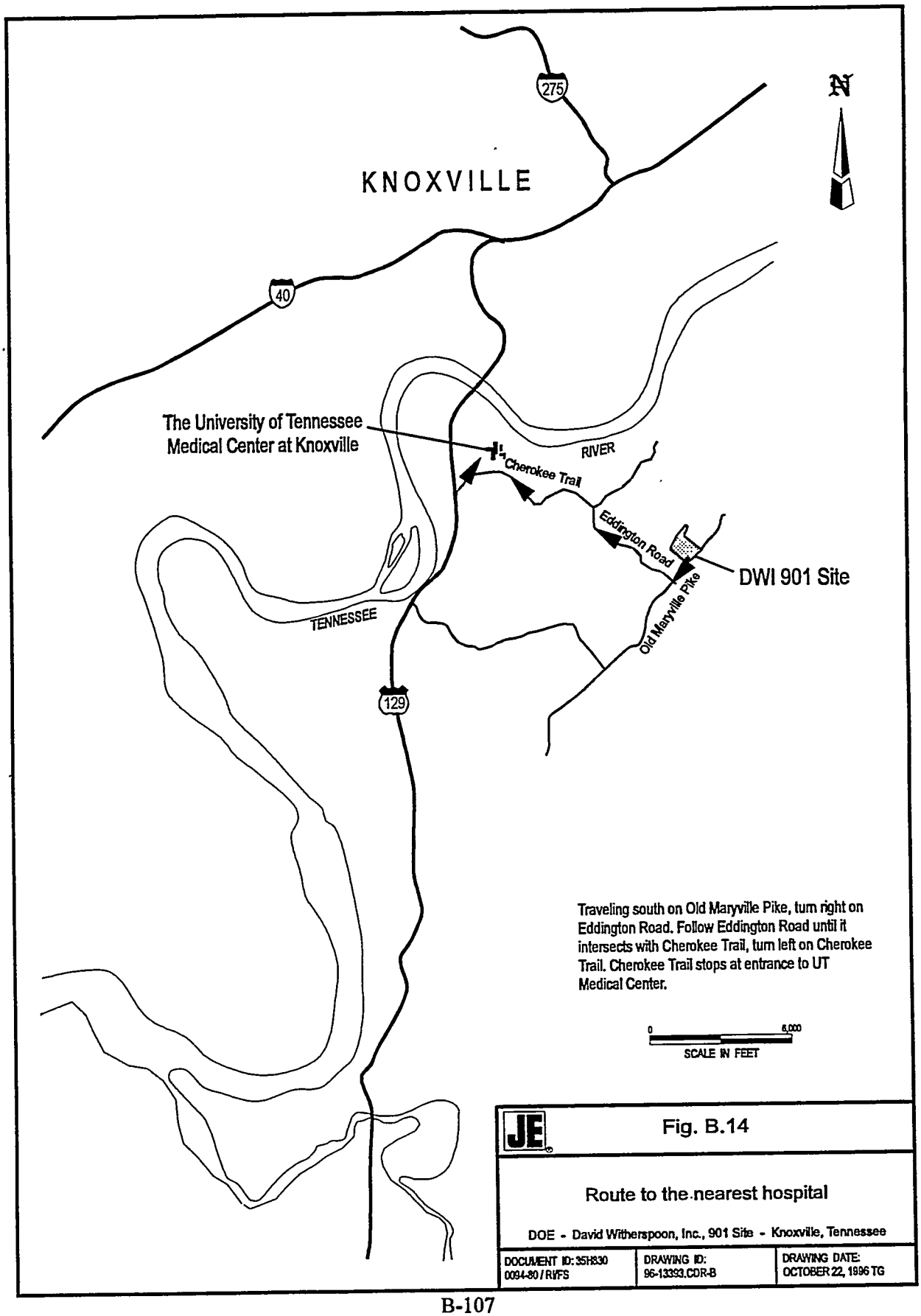
Traveling south on Old Maryville Pike, turn right onto Eddington Road. Follow Eddington Road until it intersects with Cherokee Trail, turn left on Cherokee Trail. Cherokee Trail stops at entrance to UT Medical Center. Follow signs to the emergency room. See Figure B.14 for the map and directions to the hospital.

5.12.4 Emergency Precautions

Because of the potential for cuts and scrapes while working in the field, a first aid kit (minimum 10-unit, construction type) must accompany the field crew. The first aid kit will be inspected before sampling and weekly thereafter. The results will be documented in the health and safety logbook. In the event of serious injury, call 911 immediately. Report the incident and give the location area and name. Then proceed to entrance of the DWI 901 Site to meet the emergency response team.

5.12.5 Documentation

Accident/incident notifications will be documented in accordance with Jacobs ER Team SOP H&S-1.3.2, "Event Investigations."



JE

Fig. B.14

Route to the nearest hospital

DOE - David Witherspoon, Inc., 901 Site - Knoxville, Tennessee

DOCUMENT ID: 35H830 0094-80 / RI/FS	DRAWING ID: 96-13393.CDR-B	DRAWING DATE: OCTOBER 22, 1996 TG

All safety equipment mentioned in this HASP will be inspected before each sampling event. The SHSO will perform the inspections and document them in the health and safety logbook.

5.13 WORK PRACTICES

5.13.1 General Work Site Requirements

5.13.1.1 Illumination

All fieldwork will be performed outdoors during daylight hours, therefore removing any potential insufficient lighting situations.

5.13.1.2 Security

The field team will be leaving equipment and supplies at the site overnight, so security at the site is a potential concern. All equipment and supplies that can be stored inside the trailer should be stored in the trailer. Larger pieces of equipment should be chained to some type of fixed object to minimize the potential for theft. The government vehicle will not be left at the site overnight. Unauthorized, after-hours access will be deterred by locked gates and fences, as is practical and appropriate for the site. The restricted and unrestricted areas of the site will be posted with warning and/or no trespassing signs, subject to community relations considerations.

5.13.1.3 Fire protection

A single 20-lb or two 10-lb ABC fire extinguishers will be available on the DWI 901 Site whenever the field crew is working. The on-site vehicle will be equipped with a minimum of a 5-lb ABC fire extinguisher. The SHSO will inspect the fire extinguishers in accordance with the Jacobs ER Team SOP H&S-9.1.1, "Portable Fire Extinguishers," and properly document the inspections in the health and safety logbook.

5.13.1.4 First aid

Because of the potential for cuts and scrapes while working in the field, a first aid kit (minimum 10-unit, construction type) must accompany the field crew. The first aid kit will be inspected. The results will be documented in the health and safety logbook in accordance with Jacobs ER Team SOP H&S-4.2.1, "Site First Aid and Emergency Response Supplies."

5.13.1.5 Personal hygiene

There will be a collapsible water jug with potable water in it or wet wipes for washing hands/face, etc., near the on-site vehicle at the DWI 901 Site. There will be a 3-gal minimum, drinking water jug taken to the site whenever sampling activities are being conducted. There will be no eating, drinking, smoking, or chewing allowed in the exclusion or contamination reduction zones. If lunch is to be eaten on the site, it will be eaten in the support zone, away from the sampling area, and only after personnel have washed their hands/face. A temporary office trailer will be set up on site for use by field personnel.

5.13.1.6 Eyewash station

An American National Standards Institute Z358.1-approved eyewash station will be located near the location of the sample collection. The eyewash will be inspected in accordance with Jacobs ER Team SOP H&S-4.2.2, "Inspection of Emergency Showers and Eyewash Units." The SHSO will document the results of the inspection in the health and safety logbook.

5.13.1.7 General field project safety

The following safe work practices will be adhered to during field operations at the DWI 901 Site:

- A copy of this HASP will be readily available.
- A site map with emergency route will be available.
- All injuries, no matter how trivial they may seem to the individual, will be reported as soon as possible to the SHSO.
- All field team personnel rendering first aid will follow the Jacobs ER Team Bloodborne Pathogen Program.
- The buddy system (i.e., each worker must have another worker in the immediate area with visual contact) will be used.
- On-site buddies must maintain visual contact.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of potentially contaminated material is prohibited within the exclusion zone and the contamination reduction zone.

- Personnel should not take prescription drugs where the potential for contact with toxic substances exists, unless specifically approved by a qualified physician. In addition, individuals using prescription drugs will inform the SHSO before work at the site.

- Jacobs ER Team has established a corporate workplace substance abuse program that is consistent with 10 CFR 707 and DOE Acquisition Regulation 970.5204-58. The Jacobs ER Team will handle substance abuse cases in accordance with this program.

- Alcoholic beverage intake is prohibited during the work day.

- Personnel will use disposable clothing whenever possible to minimize the risk of cross-contamination.

- The number of personnel and amount of equipment in any contaminated area should be minimized, but effective site operations must be considered.

- Work areas for various operational activities (equipment testing, decontamination) will be established.

- Procedures for leaving any contaminated area will be planned, reviewed, and operational before entering exclusion or radiation control areas.

- Work areas and decontamination procedures will be established based on prevailing site conditions and will be subject to change.

- Contact with contaminated or potentially contaminated surfaces should be avoided. Whenever possible, personnel will not walk through puddles, mud, or discolored ground surface; kneel on the ground; lean; sit; or place equipment on drums, containers, vehicles, or the ground.

- Personnel will not be allowed to enter the site without the proper safety equipment.

- Personnel will follow proper decontamination procedures before leaving the site, except in medical emergencies. Rescue and medical care providers must be informed of possible contamination if decontamination is not performed.

- Personnel must comply with established safety procedures. Any staff member or visitor who does not comply with safety policy, as established by the project health and safety officer, will be immediately dismissed from the site.

- Any medical emergency supersedes routine safety requirements.

APPENDIX C

RISK ASSESSMENT

1. DATA EVALUATION SUMMARIES

This chapter contains data summaries used in the risk assessment, screening methodologies, and chemicals of potential concern (COPC) identified for the DWI 901 Site.

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
Surface Soil DWI-901 Site										
DIOXINS										
1,2,3,4,6,7,8 HEPTACHLORODIBENZODIO	ng/kg	5	5	35		1400		430	Yes	A
1,2,3,4,6,7,8 HEPTACHLORODIBENZOFUR	ng/kg	5	4	18		440		430	Yes	A
1,2,3,4,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	5	0	10	U	20	U	43	No	I
1,2,3,4,7,8 HEXACHLORODIBENZOFURAN	ng/kg	5	5	5.4	J	46		43	Yes	A
1,2,3,4,7,8,9 HEPTACHLORODIBENZOFUR	ng/kg	5	5	2.2	J	32		430	No	C
1,2,3,6,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	5	3	17		31		43	No	C
1,2,3,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	5	5	2.3	J	33		43	No	C
1,2,3,7,8 PENTACHLORODIBENZODIOXIN	ng/kg	5	0	10	U	20	U	8.6	Yes	H
1,2,3,7,8 PENTACHLORODIBENZOFURAN	ng/kg	5	2	13		17		8.6	Yes	A
1,2,3,7,8,9 HEXACHLORODIBENZODIOXIN	ng/kg	5	1	18		18		43	No	C
1,2,3,7,8,9 HEXACHLORODIBENZOFURAN	ng/kg	5	0	10	U	20	U	43	No	I
2,3,4,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	5	3	8.9	J	36		43	No	C
2,3,4,7,8 PENTACHLORODIBENZOFURAN	ng/kg	5	5	2.2	J	38		86	No	C
2,3,7,8-TCDD	ng/kg	5	3	1.3		2.2	J	4.3	No	C
2,3,7,8-TCDF	ng/kg	5	5	3.4		71	J	43	Yes	A
OCDD (TOTAL)	ng/kg	5	5	200		9400	J	4300	Yes	A
OCDF (TOTAL)	ng/kg	5	5	25		1100		4300	No	C
METALS										
ALUMINUM	mg/kg	23	23	3700		34900		NA	Yes	E
ANTIMONY	mg/kg	23	11	6.6		102		3.1	Yes	A
ARSENIC	mg/kg	23	23	2.7	J	24	J	0.43	Yes	A
BARIUM	mg/kg	23	23	28		986		550	Yes	B
BERYLLIUM	mg/kg	23	8	0.57		1.5		0.075	Yes	A
CADMIUM	mg/kg	23	22	1.3	J	41		39	Yes	B
CALCIUM	mg/kg	23	23	879		290000		NA	Yes	E
CHROMIUM	mg/kg	23	23	9.8		3480		39	Yes	B
COBALT	mg/kg	23	21	3.2		44		NA	Yes	E
COPPER	mg/kg	23	23	33.3		8370		NA	Yes	E
CYANIDE	mg/kg	23	1	1.6		1.6		160	No	D

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
IRON	mg/kg	23	23	9600		112000		NA	Yes	E
LEAD	mg/kg	23	23	46.2		6270		NA	Yes	E
MAGNESIUM	mg/kg	23	23	1420		55000		NA	Yes	E
MANGANESE	mg/kg	23	23	260		14600		1100	Yes	B
MERCURY	mg/kg	23	22	0.31		1660		2.3	Yes	B
NICKEL	mg/kg	23	23	19.6		3160		NA	Yes	E
POTASSIUM	mg/kg	23	16	580		1400	J	NA	Yes	E
SELENIUM	mg/kg	16	1	0.77		0.77		39	No	D
SILVER	mg/kg	23	1	1.3		1.3		39	No	D
SODIUM	mg/kg	23	4	220		1300		NA	No	F
THALLIUM	mg/kg	23	0	0.59	UJ	1.4	U	NA	No	G
VANADIUM	mg/kg	23	20	6.7		33		55	No	D
ZINC	mg/kg	23	23	95.5		16000		2300	Yes	B
PCBs										
AROCLOR-1016	ug/kg	23	0	38	U	49000	U	550	Yes	H
AROCLOR-1221	ug/kg	23	0	77	U	49000	U	83	Yes	H
AROCLOR-1232	ug/kg	23	0	38	U	49000	U	83	Yes	H
AROCLOR-1242	ug/kg	23	1	200000	C	200000	C	83	Yes	A
AROCLOR-1248	ug/kg	23	2	3800	CN	100000	C	83	Yes	A
AROCLOR-1254	ug/kg	23	22	94		160000		1600	Yes	A
AROCLOR-1260	ug/kg	23	20	120		43000		83	Yes	A
PESTICIDES										
4,4'-DDD (P,P'-DDD)	ug/kg	7	0	3.8	U	960	U	2700	No	I
4,4'-DDE (P,P'-DDE)	ug/kg	7	0	3.8	U	960	U	1900	No	I
4,4'-DDT (P,P'-DDT)	ug/kg	7	0	3.8	U	960	U	38	Yes	H
ALDRIN	ug/kg	7	0	2	U	490	U	NA	No	G
ALPHA-BHC	ug/kg	7	0	2	U	490	U	NA	No	G
ALPHA-CHLORDANE /2	ug/kg	7	0	2	U	490	U	NA	No	G
BETA-BHC	ug/kg	7	0	2	U	490	U	NA	No	G
DELTA-BHC	ug/kg	7	0	2	U	490	U	NA	No	G
DIELDRIN	ug/kg	7	0	3.8	U	960	U	40	Yes	H
ENDOSULFAN I	ug/kg	7	0	2	U	490	U	47000	No	I
ENDOSULFAN II	ug/kg	7	0	3.8	U	960	U	NA	No	G

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
ENDOSULFAN SULFATE	ug/kg	7	0	3.8	U	960	U	NA	No	G
ENDRIN	ug/kg	7	0	3.8	U	960	U	2300	No	I
ENDRIN ALDEHYDE	ug/kg	7	0	3.8	U	960	U	NA	No	G
ENDRIN KETONE	ug/kg	7	0	3.8	U	960	U	NA	No	G
GAMMA-BHC	ug/kg	7	0	2	U	490	U	NA	No	G
GAMMA-CHLORDANE /2	ug/kg	7	0	2	U	490	U	NA	No	G
HEPTACHLOR	ug/kg	7	0	2	U	490	U	140	Yes	H
HEPTACHLOR EXPOXIDE	ug/kg	7	0	2	U	490	U	70	No	I
METHOXYCHLOR	ug/kg	7	0	20	U	4900	U	39000	No	I
TOXAPHENE	ug/kg	7	0	200	U	49000	U	580	Yes	H
RADIONUCLIDES										
BISMUTH-212	pCi/g	6	6	0.206		1.19		1300	No	C
BISMUTH-214	pCi/g	7	7	0.423		1.09		4100	No	C
CESIUM-137	pCi/g	10	10	0.0176		19.9		25	No	C
LEAD-212	pCi/g	7	7	0.412		1.89		44	No	C
LEAD-214	pCi/g	7	7	0.484		1.21		2700	No	C
PLUTONIUM-238	pCi/g	2	0	0.18	U	0.19	U	2.7	No	I
PLUTONIUM-239	pCi/g	2	2	0.2		7.54		2.5	Yes	A
POTASSIUM-40	pCi/g	7	7	3.54		22.3		63	No	C
PROTACTINIUM-234	pCi/g	3	3	2		34.5		370	No	C
PROTACTINIUM-234M	pCi/g	7	7	2.37		28.2		170000	No	C
RADIUM-226	pCi/g	5	5	0.84		5.68		2.7	Yes	A
RADIUM-228	pCi/g	7	7	0.438		1.84		3.2	No	C
STROTIUM-89	pCi/g	1	0	0.72	U	0.72	U	0.39	Yes	H
STROTIUM-90	pCi/g	1	1	2.5		2.5		0.097	Yes	A
THALLIUM-208	pCi/g	7	7	0.123		0.583		45000	No	C
THORIUM-232	pCi/g	7	7	0.27	J	0.62		24	No	C
THORIUM-234	pCi/g	11	4	96.5		962.2		41	Yes	A
URANIUM-234	pCi/g	11	9	3.8		445.1		18	Yes	A
URANIUM-235	pCi/g	11	5	0.19		15.35		18	No	C
URANIUM-238	pCi/g	11	9	3.5		687.3		18	Yes	A
SEMIVOLATILES										
(3-AND/OR 4-) METHYLPHENOL	ug/kg	7	1	78	J	78	J	NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
1,2,4-TRICHLOROBENZENE	ug/kg	19	0	340	U	15000	U	7.80E+04	No	I
1,2-DICHLOROBENZENE	ug/kg	19	0	340	U	15000	U	7.00E+05	No	I
1,3-DICHLOROBENZENE	ug/kg	19	0	340	U	15000	U	NA	No	G
1,4-DICHLOROBENZENE	ug/kg	19	0	340	U	15000	U	27000	No	I
2,2'-CHLOROISOPROPYLETHER	ug/kg	7	0	360	U	4800	U	NA	No	G
2,4,5-TRICHLOROPHENOL	ug/kg	19	0	880	U	77000	U	7.80E+05	No	I
2,4,6-TRICHLOROPHENOL	ug/kg	19	0	340	U	15000	U	58000	No	I
2,4-DICHLOROPHENOL	ug/kg	19	0	340	U	15000	U	2.30E+04	No	I
2,4-DIMETHYLPHENOL	ug/kg	19	0	340	U	15000	U	1.60E+05	No	I
2,4-DINITROPHENOL	ug/kg	19	0	880	U	77000	U	1.60E+04	No	I
2,4-DINITROTOLUENE	ug/kg	19	0	340	U	15000	U	940	Yes	H
2,6-DINITROTOLUENE	ug/kg	19	0	340	U	15000	U	940	Yes	H
2-CHLORONAPHTHALENE	ug/kg	19	0	340	U	15000	U	6.30E+05	No	I
2-CHLOROPHENOL	ug/kg	19	0	340	U	15000	U	3.90E+04	No	I
2-METHYL-4,6-DINITROPHENOL	ug/kg	7	0	880	U	12000	U	NA	No	G
2-METHYLNAPHTHALENE	ug/kg	20	11	38	J	3100	J	NA	No	G
2-METHYLPHENOL	ug/kg	19	0	340	U	15000	U	NA	No	G
2-NITROANILINE	ug/kg	19	0	880	U	77000	U	15000	Yes	H
2-NITROPHENOL	ug/kg	19	0	340	U	15000	U	NA	No	G
3,3'-DICHLOROBENZIDINE	ug/kg	20	1	540	J	540	J	1400	No	D
3-NITROANILINE	ug/kg	19	0	880	U	77000	U	NA	No	G
4,6-DINITRO-2-METHYLPHENOL	ug/kg	12	0	1700	U	77000	U	NA	No	G
4-BROMOPHENYL PHENYL ETHER	ug/kg	19	0	340	U	15000	U	NA	No	G
4-CHLORO-3-METHYLPHENOL	ug/kg	19	0	340	U	15000	U	NA	No	G
4-CHLOROANILINE	ug/kg	19	0	340	U	15000	U	3100	No	I
4-CHLOROPHENYL PHENYL ETHER	ug/kg	19	0	340	U	15000	U	NA	No	G
4-METHYLPHENOL	ug/kg	12	0	340	U	15000	U	NA	No	G
4-NITROANILINE	ug/kg	19	0	880	U	77000	U	NA	No	G
4-NITROPHENOL	ug/kg	19	0	880	U	77000	U	NA	No	G
ACENAPHTHENE	ug/kg	20	10	42	J	9800	J	4.70E+05	No	D
ACENAPHTHYLENE	ug/kg	19	3	140	J	280	J	NA	Yes	E
ANTHRACENE	ug/kg	23	14	68	J	19000		2.30E+06	No	D
BENZO(A)ANTHRACENE	ug/kg	23	14	74	J	44000		880	Yes	A
BENZO(A)PYRENE	ug/kg	23	18	42	J	43000		88	Yes	A
BENZO(B)FLUORANTHENE	ug/kg	23	22	67	J	42000		880	Yes	A

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
BENZO(G,H,I)PERYLENE	ug/kg	23	14	190	J	31000		NA	Yes	E
BENZO(K)FLUORANTHENE	ug/kg	16	15	70	J	41000		NA	Yes	E
BENZOIC ACID	ug/kg	12	0	1700	U	77000	U	3.10E+07	No	I
BENZYL ALCOHOL	ug/kg	12	0	340	U	15000	U	2.30E+06	No	I
BENZYL BUTYL PHTHALATE	ug/kg	7	0	360	U	4800	U	1.60E+06	No	I
BIS(2-CHLOROETHOXY)METHANE	ug/kg	19	0	340	U	15000	U	NA	No	G
BIS(2-CHLOROETHYL) ETHER	ug/kg	19	0	340	U	15000	U	580	No	I
BIS(2-CHLOROISOPROPYL) ETHER	ug/kg	12	0	340	U	15000	U		No	I
BIS(2-ETHYLHEXYL)PHTHALATE	ug/kg	23	14	54	JB	19000	B	46000	No	C
BUTYLBENZYLPHTHALATE	ug/kg	12	2	290	J	1100		1.60E+06	No	D
CARBAZOLE	ug/kg	7	2	220	J	540		3.20E+04	No	C
CHRYSENE	ug/kg	23	21	130	J	53000		88000	No	C
DI-N-BUTYLPHTHALATE	ug/kg	19	10	170	JB	2000	B	NA	Yes	E
DI-N-OCTYLPHTHALATE	ug/kg	19	1	390		390		NA	Yes	E
DIBENZO(A,H)ANTHRACENE	ug/kg	23	10	61	J	570		88	Yes	A
DIBENZOFURAN	ug/kg	19	8	36	J	8100	J	NA	Yes	E
DIETHYL PHTHALATE	ug/kg	19	0	340	U	15000	U	6.30E+06	No	I
DIMETHYL PHTHALATE	ug/kg	19	2	94	J	1100	J	NA	Yes	E
FLUORANTHENE	ug/kg	23	22	190	J	130000		3.10E+05	No	D
FLUORENE	ug/kg	20	9	63	J	14000	J	3.10E+05	No	D
HEXACHLOROBENZENE	ug/kg	19	1	99	J	99	J	400	No	C
HEXACHLOROBUTADIENE	ug/kg	19	0	340	U	15000	U	8200	Yes	H
HEXACHLOROCYCLOPENTADIENE	ug/kg	19	0	340	U	15000	U	55000	No	I
HEXACHLOROETHANE	ug/kg	19	0	340	U	15000	U	46000	No	I
INDENO(1,2,3-CD)PYRENE	ug/kg	23	13	170	J	28000		880	Yes	A
ISOPHORONE	ug/kg	19	0	340	U	15000	U	670000	No	I
N-NITROSO-DI-N-PROPYLAMINE	ug/kg	19	0	340	U	15000	U	91	Yes	H
N-NITROSODIPHENYLAMINE	ug/kg	19	1	44	J	44	J	130000	No	C
NAPHTHALENE	ug/kg	19	9	38	J	10000	J	NA	Yes	E
NITROBENZENE	ug/kg	19	0	340	U	15000	U	3900	Yes	H
PENTACHLOROPHENOL	ug/kg	19	0	880	U	77000	U	5300	Yes	H
PHENANTHRENE	ug/kg	23	21	110	J	120000		NA	Yes	E
PHENOL	ug/kg	19	1	240	J	240	J	4.70E+06	No	D
PYRENE	ug/kg	22	19	160	J	99000		2.30E+05	No	D

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
VOLATILES										
1,1,1-TRICHLOROETHANE	ug/kg	7	0	11	U	14	U	NA	No	G
1,1,2,2-TETRACHLOROETHANE	ug/kg	7	0	11	U	14	U	3200	No	I
1,1,2-TRICHLOROETHANE	ug/kg	7	0	11	U	14	U	11000	No	I
1,1-DICHLOROETHANE	ug/kg	7	0	11	U	14	U	7.80E+05	No	I
1,1-DICHLOROETHENE (1,1-DICHLOROETH	ug/kg	7	0	11	U	14	U	1100	No	I
1,2 -DICHLOROETHANE	ug/kg	7	0	11	U	14	U	7000	No	I
1,2-DICHLOROETHENE (TOTAL)	ug/kg	7	0	11	U	14	U	70000	No	I
1,2-DICHLOROPROPANE	ug/kg	7	0	11	U	14	U	9400	No	I
ACETONE	ug/kg	7	0	11	U	30	U	7.80E+05	No	I
BENZENE	ug/kg	7	0	11	U	14	U	22000	No	I
BROMODICHLOROMETHANE	ug/kg	7	0	11	U	14	U	10000	No	I
BROMOFORM	ug/kg	7	0	11	U	14	U	81000	No	I
BROMOMETHANE	ug/kg	7	0	11	U	14	U	11000	No	I
CARBON DISULFIDE	ug/kg	7	0	11	U	14	U	7.80E+05	No	I
CARBON TETRACHLORIDE	ug/kg	7	0	11	U	14	U	4900	No	I
CHLOROBENZENE	ug/kg	7	0	11	U	14	U	1.60E+05	No	I
CHLOROETHANE	ug/kg	7	0	11	U	14	U	NA	No	G
CHLOROFORM	ug/kg	7	0	11	U	14	U	100000	No	I
CHLOROMETHANE	ug/kg	7	0	11	U	14	U	49000	No	I
CIS-1,3-DICHLOROPROPENE	ug/kg	7	0	11	U	14	U	3500	No	I
DIBROMOCHLOROMETHANE	ug/kg	7	0	11	U	14	U	NA	No	G
ETHYLBENZENE	ug/kg	7	0	11	U	14	U	7.80E+05	No	I
METHYL BUTYL KETONE	ug/kg	7	0	11	U	14	U	NA	No	G
METHYL ETHYL KETONE	ug/kg	7	0	11	U	14	U	4.70E+06	No	I
METHYL ISOBUTYL KETONE	ug/kg	7	0	11	U	14	U	6.30E+05	No	I
METHYLENE CHLORIDE	ug/kg	7	0	20	U	80	U	85000	No	I
STYRENE	ug/kg	7	0	11	U	14	U	1.60E+06	No	I
TETRACHLOROETHENE	ug/kg	7	0	11	U	14	U	7.80E+04	No	I
TOLUENE	ug/kg	7	0	11	U	14	U	1.60E+06	No	I
TRANS-1,3-DICHLOROPROPENE	ug/kg	7	0	11	U	14	U	3500	No	I
TRICHLOROETHENE (TRICHLOROETHYLENE)	ug/kg	7	0	11	U	14	U	58000	No	I
VINYL CHLORIDE	ug/kg	7	0	11	U	14	U	3.40E+02	No	I
XYLENES	ug/kg	7	0	11	U	14	U	1.60E+07	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
SURFACE SOILS CANDORA ROAD AREA										
DIOXINS										
1,2,3,4,6,7,8 HEPTACHLORODIBENZODIO	ng/kg	1	1	2600	J	2600	J	430	Yes	A
1,2,3,4,6,7,8 HEPTACHLORODIBENZOFUR	ng/kg	1	1	420		420		430	No	C
1,2,3,4,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	1	0	30	U	30	U	43	No	I
1,2,3,4,7,8 HEXACHLORODIBENZOFURAN	ng/kg	1	1	88		88		43	Yes	A
1,2,3,4,7,8,9 HEPTACHLORODIBENZOFUR	ng/kg	1	1	57		57		430	No	C
1,2,3,6,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	1	1	91		91		43	Yes	A
1,2,3,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	1	1	35		35		43	No	C
1,2,3,7,8 PENTACHLORODIBENZODIOXIN	ng/kg	1	0	10	U	10	U	8.6	Yes	H
1,2,3,7,8 PENTACHLORODIBENZOFURAN	ng/kg	1	1	20		20		8.6	Yes	A
1,2,3,7,8,9 HEXACHLORODIBENZODIOXIN	ng/kg	1	1	34		34		43	No	C
1,2,3,7,8,9 HEXACHLORODIBENZOFURAN	ng/kg	1	0	10	U	10	U	43	No	I
2,3,4,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	1	1	26		26		43	No	C
2,3,4,7,8 PENTACHLORODIBENZOFURAN	ng/kg	1	1	41		41		86	No	C
2,3,7,8-TCDD	ng/kg	1	1	4.6	J	4.6	J	4.3	Yes	A
2,3,7,8-TCDF	ng/kg	1	1	66		66		43	Yes	A
OCDD (TOTAL)	ng/kg	1	1	16000		16000	J	4300	Yes	A
OCDF (TOTAL)	ng/kg	1	1	1600		1600		4300	No	C
METALS										
ALUMINUM	mg/kg	8	8	3810		17500		NA	Yes	E
ANTIMONY	mg/kg	8	3	24	J	162		3.1	Yes	A
ARSENIC	mg/kg	8	8	6.2		30	J	0.43	Yes	A
BARIUM	mg/kg	8	8	52.2		830		550	Yes	B
BERYLLIUM	mg/kg	8	1	0.55		0.55		0.075	Yes	A
CADMIUM	mg/kg	8	8	2.3		45	JN	39	Yes	B
CALCIUM	mg/kg	8	8	40000		201000		NA	Yes	E
CHROMIUM	mg/kg	8	8	38.1		464		39	Yes	B
COBALT	mg/kg	8	8	7.4		59	J	NA	Yes	E
COPPER	mg/kg	8	8	283		14100		NA	Yes	E
CYANIDE	mg/kg	8	2	0.82		2		160	No	D
IRON	mg/kg	8	8	26300		190000	J	NA	Yes	E
LEAD	mg/kg	8	8	98.2		8320		NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
MAGNESIUM	mg/kg	8	8	4100		10200		NA	Yes	E
MANGANESE	mg/kg	8	8	531		2800	J	1100	Yes	B
MERCURY	mg/kg	8	8	16		430	J	2.3	Yes	B
NICKEL	mg/kg	8	8	111		466		NA	Yes	E
POTASSIUM	mg/kg	8	3	530	J	1100		NA	Yes	E
SELENIUM	mg/kg	7	2	0.63		12.4		39	No	D
SILVER	mg/kg	8	1	3.8	JN	3.8	JN	39	No	D
SODIUM	mg/kg	8	1	1650		1650		NA	No	F
THALLIUM	mg/kg	8	0	0.65	UJ	1.4	U	NA	No	G
VANADIUM	mg/kg	8	7	5.5		32		55	No	D
ZINC	mg/kg	8	8	448		10600		2300	Yes	B
PCBs										
AROCLOR-1016	ug/kg	8	0	880	U	42000	U	550	Yes	H
AROCLOR-1221	ug/kg	8	0	880	U	42000	U	83	Yes	H
AROCLOR-1232	ug/kg	8	0	880	U	42000	U	83	Yes	H
AROCLOR-1242	ug/kg	8	0	880	U	42000	U	83	Yes	H
AROCLOR-1248	ug/kg	8	1	140000		140000		83	Yes	A
AROCLOR-1254	ug/kg	8	7	1100		52000	C	1600	Yes	A
AROCLOR-1260	ug/kg	8	6	1900		28000		83	Yes	A
PESTICIDES										
4,4'-DDD (P,P'-DDD)	ug/kg	3	0	240	U	800	U	2700	No	I
4,4'-DDE (P,P'-DDE)	ug/kg	3	0	240	U	800	U	1900	No	I
4,4'-DDT (P,P'-DDT)	ug/kg	3	0	240	U	800	U	38	Yes	H
ALDRIN	ug/kg	3	0	120	U	410	U	NA	No	G
ALPHA-BHC	ug/kg	3	0	120	U	410	U	NA	No	G
ALPHA-CHLORDANE /2	ug/kg	3	0	120	U	410	U	NA	No	G
BETA-BHC	ug/kg	3	0	120	U	410	U	NA	No	G
DELTA-BHC	ug/kg	3	0	120	U	410	U	NA	No	G
DIELDRIN	ug/kg	3	0	240	U	800	U	40	Yes	H
ENDOSULFAN I	ug/kg	3	0	120	U	410	U	47000	No	I
ENDOSULFAN II	ug/kg	3	0	240	U	800	U	NA	No	G
ENDOSULFAN SULFATE	ug/kg	3	0	240	U	800	U	NA	No	G
ENDRIN	ug/kg	3	0	240	U	800	U	2300	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
ENDRIN ALDEHYDE	ug/kg	3	0	240	U	800	U	NA	No	G
ENDRIN KETONE	ug/kg	3	0	240	U	800	U	NA	No	G
GAMMA-BHC	ug/kg	3	0	120	U	410	U	NA	No	G
GAMMA-CHLORDANE /2	ug/kg	3	0	120	U	410	U	NA	No	G
HEPTACHLOR	ug/kg	3	0	120	U	410	U	140	Yes	H
HEPTACHLOR EXPOXIDE	ug/kg	3	0	120	U	410	U	70	Yes	H
METHOXYCHLOR	ug/kg	3	0	1200	U	4100	U	39000	No	I
TOXAPHENE	ug/kg	3	0	12000	U	41000	U	580	Yes	H
RADIONUCLIDES										
ACTINIUM-228	pCi/g	1	1	30.3		30.3		8400	No	C
BISMUTH-212	pCi/g	2	2	16.2		79.3		1300	No	C
BISMUTH-214	pCi/g	3	3	2.45		33		4100	No	C
CESIUM-137	pCi/g	6	5	0.196		1.72		25	No	C
LEAD-212	pCi/g	3	3	1		149		44	Yes	A
LEAD-214	pCi/g	3	3	3.18		35.5		2700	No	C
PLUTONIUM-238	pCi/g	3	0	0.24	U	0.28	U	2.7	No	I
PLUTONIUM-239	pCi/g	3	2	0.24		0.42		2.5	Yes	A
POTASSIUM-40	pCi/g	2	2	4.37		6.81		63	No	C
PROTACTINIUM-234	pCi/g	2	2	1618		12380		370	No	C
RADIUM-226	pCi/g	3	3	74.4		1710		2.7	Yes	A
RADIUM-228	pCi/g	3	3	1.3		154		3.2	Yes	A
STROTIUM-89	pCi/g	1	0	0.69	U	0.69	U	0.39	Yes	H
STROTIUM-90	pCi/g	1	1	260		260		0.097	Yes	A
THALLIUM-208	pCi/g	5	5	0.289		47.6		45000	No	C
THORIUM-228	pCi/g	1	1	11.8		11.8		38	No	C
THORIUM-230	pCi/g	1	1	52.8		52.8		63	No	C
THORIUM-232	pCi/g	4	4	0.87		73	J	24	Yes	A
THORIUM-234	pCi/g	6	5	0.67	J	55240		41	Yes	A
URANIUM-234	pCi/g	6	6	52.99		92530		18	Yes	A
URANIUM-235	pCi/g	6	5	3.1	J	3727		18	No	C
URANIUM-238	pCi/g	6	6	54.94		98530		18	Yes	A
SEMIVOLATILES										
(3-AND/OR 4-) METHYLPHENOL	ug/kg	3	0	390	U	510	U	NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
1,2,4-TRICHLOROBENZENE	ug/kg	8	0	350	U	3500	U	7.80E+04	No	I
1,2-DICHLOROBENZENE	ug/kg	8	0	350	U	3500	U	7.00E+05	No	I
1,3-DICHLOROBENZENE	ug/kg	8	0	350	U	3500	U	NA	No	G
1,4-DICHLOROBENZENE	ug/kg	8	0	350	U	3500	U	27000	No	I
2,2'-CHLOROISOPROPYLETHER	ug/kg	3	0	390	U	510	U	NA	No	G
2,4,5-TRICHLOROPHENOL	ug/kg	8	0	950	U	18000	U	7.80E+05	No	I
2,4,6-TRICHLOROPHENOL	ug/kg	8	0	350	U	3500	U	58000	No	I
2,4-DICHLOROPHENOL	ug/kg	8	0	350	U	3500	U	2.30E+04	No	I
2,4-DIMETHYLPHENOL	ug/kg	8	0	350	U	3500	U	1.60E+05	No	I
2,4-DINITROPHENOL	ug/kg	8	0	950	U	18000	U	1.60E+04	No	I
2,4-DINITROTOLUENE	ug/kg	8	0	350	U	3500	U	940	Yes	H
2,6-DINITROTOLUENE	ug/kg	8	0	350	U	3500	U	940	Yes	H
2-CHLORONAPHTHALENE	ug/kg	8	0	350	U	3500	U	6.30E+05	No	I
2-CHLOROPHENOL	ug/kg	8	0	350	U	3500	U	3.90E+04	No	I
2-METHYL-4,6-DINITROPHENOL	ug/kg	3	0	950	U	1200	U	NA	No	G
2-METHYLNAPHTHALENE	ug/kg	8	6	54	J	500		NA	Yes	E
2-METHYLPHENOL	ug/kg	8	0	350	U	3500	U	NA	No	G
2-NITROANILINE	ug/kg	8	0	950	U	18000	U	15000	Yes	H
2-NITROPHENOL	ug/kg	8	0	350	U	3500	U	NA	No	G
3,3'-DICHLOROBENZIDINE	ug/kg	8	0	390	U	7100	U	1400	Yes	H
3-NITROANILINE	ug/kg	8	0	950	U	18000	U	NA	No	G
4,6-DINITRO-2-METHYLPHENOL	ug/kg	5	0	1800	U	18000	U	NA	No	G
4-BROMOPHENYL PHENYL ETHER	ug/kg	8	0	350	U	3500	U	NA	No	G
4-CHLORO-3-METHYLPHENOL	ug/kg	8	0	350	U	3500	U	NA	No	G
4-CHLOROANILINE	ug/kg	8	0	350	U	3500	U	3100	Yes	H
4-CHLOROPHENYL PHENYL ETHER	ug/kg	8	0	350	U	3500	U	NA	No	G
4-METHYLPHENOL	ug/kg	5	0	350	U	3500	U	NA	No	G
4-NITROANILINE	ug/kg	8	0	950	U	18000	U	NA	No	G
4-NITROPHENOL	ug/kg	8	0	950	U	18000	U	NA	No	G
ACENAPHTHENE	ug/kg	8	4	79	J	2400		4.70E+05	No	D
ACENAPHTHYLENE	ug/kg	8	1	36	J	36	J	NA	Yes	E
ANTHRACENE	ug/kg	8	6	100	J	3300		2.30E+06	No	D
BENZO(A)ANTHRACENE	ug/kg	8	5	440		13000		880	Yes	A
BENZO(A)PYRENE	ug/kg	8	6	360	J	10000		88	Yes	A
BENZO(B)FLUORANTHENE	ug/kg	8	7	430		11000		880	Yes	A

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
BENZO(G,H,I)PERYLENE	ug/kg	8	4	370	J	7100		NA	Yes	E
BENZO(K)FLUORANTHENE	ug/kg	5	5	340	J	9200		NA	Yes	E
BENZOIC ACID	ug/kg	5	0	1800	U	18000	U	3.10E+07	No	I
BENZYL ALCOHOL	ug/kg	5	0	350	U	3500	U	2.30E+06	No	I
BENZYL BUTYL PHTHALATE	ug/kg	3	1	1800		1800		1.60E+06	No	D
BIS(2-CHLOROETHOXY)METHANE	ug/kg	8	0	350	U	3500	U	NA	No	G
BIS(2-CHLOROETHYL) ETHER	ug/kg	8	0	350	U	3500	U	580	Yes	H
BIS(2-CHLOROISOPROPYL) ETHER	ug/kg	5	0	350	U	3500	U	310	Yes	H
BIS(2-ETHYLHEXYL)PHTHALATE	ug/kg	8	6	230	J	55000		46000	No	C
BUTYLBENZYLPHTHALATE	ug/kg	5	2	160	J	670		1.60E+06	No	D
CARBAZOLE	ug/kg	3	2	90	J	360	J	3.20E+04	No	C
CHRYSENE	ug/kg	8	8	460		14000		88000	No	C
DI-N-BUTYLPHTHALATE	ug/kg	8	5	260	J	9500		NA	Yes	E
DI-N-OCTYLPHTHALATE	ug/kg	8	1	1200		1200		NA	Yes	E
DIBENZO(A,H)ANTHRACENE	ug/kg	8	5	150	J	2900		88	Yes	A
DIBENZOFURAN	ug/kg	8	5	67	J	900	J	NA	Yes	E
DIETHYL PHTHALATE	ug/kg	8	0	350	U	3500	U	6.30E+06	No	I
DIMETHYL PHTHALATE	ug/kg	8	1	610	J	610	J	NA	Yes	E
FLUORANTHENE	ug/kg	8	8	580		24000		3.10E+05	No	D
FLUORENE	ug/kg	8	3	73	J	1500	J	3.10E+05	No	D
HEXACHLOROBENZENE	ug/kg	8	0	350	U	3500	U	400	No	I
HEXACHLOROBUTADIENE	ug/kg	8	0	350	U	3500	U	8200	No	I
HEXACHLOROCYCLOPENTADIENE	ug/kg	8	0	350	U	3500	U	55000	No	I
HEXACHLOROETHANE	ug/kg	8	0	350	U	3500	U	46000	No	I
INDENO(1,2,3-CD)PYRENE	ug/kg	8	6	360	J	7100		880	Yes	A
ISOPHORONE	ug/kg	8	0	350	U	3500	U	670000	No	I
N-NITROSO-DI-N-PROPYLAMINE	ug/kg	8	0	350	U	3500	U	91	Yes	H
N-NITROSODIPHENYLAMINE	ug/kg	8	0	350	U	3500	U	130000	No	C
NAPHTHALENE	ug/kg	8	6	56	J	2200		NA	Yes	E
NITROBENZENE	ug/kg	8	0	350	U	3500	U	3900	No	I
PENTACHLOROPHENOL	ug/kg	8	0	950	U	18000	U	5300	Yes	H
PHENANTHRENE	ug/kg	8	8	410	J	13000		NA	Yes	E
PHENOL	ug/kg	8	1	330	J	330	J	4.70E+06	No	D
PYRENE	ug/kg	8	8	520		20000		2.30E+05	No	D

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
VOLATILES										
1,1,1-TRICHLOROETHANE	ug/kg	3	0	12	U	16	U	NA	No	G
1,1,2,2-TETRACHLOROETHANE	ug/kg	3	0	12	U	16	U	3200	No	I
1,1,2-TRICHLOROETHANE	ug/kg	3	0	12	U	16	U	11000	No	I
1,1-DICHLOROETHANE	ug/kg	3	0	12	U	16	U	7.80E+05	No	I
1,1-DICHLOROETHENE (1,1-DICHLOROETH	ug/kg	3	0	12	U	16	U	1100	No	I
1,2 -DICHLOROETHANE	ug/kg	3	0	12	U	16	U	7000	No	I
1,2-DICHLOROETHENE (TOTAL)	ug/kg	3	0	12	U	16	U	70000	No	I
1,2-DICHLOROPROPANE	ug/kg	3	0	12	U	16	U	9400	No	I
ACETONE	ug/kg	3	0	12	U	30	U	7.80E+05	No	I
BENZENE	ug/kg	3	0	12	U	16	U	22000	No	I
BROMODICHLOROMETHANE	ug/kg	3	0	12	U	16	U	10000	No	I
BROMOFORM	ug/kg	3	0	12	U	16	U	81000	No	I
BROMOMETHANE	ug/kg	3	0	12	U	16	U	11000	No	I
CARBON DISULFIDE	ug/kg	3	0	12	U	16	U	7.80E+05	No	I
CARBON TETRACHLORIDE	ug/kg	3	0	12	U	16	U	4900	No	I
CHLOROBENZENE	ug/kg	3	0	12	U	16	U	1.60E+05	No	I
CHLOROETHANE	ug/kg	3	0	12	U	16	U	NA	No	G
CHLOROFORM	ug/kg	3	0	12	U	16	U	100000	No	I
CHLOROMETHANE	ug/kg	3	0	12	U	16	U	49000	No	I
CIS-1,3-DICHLOROPROPENE	ug/kg	3	0	12	U	16	U	3500	No	I
DIBROMOCHLOROMETHANE	ug/kg	3	0	12	U	16	U	NA	No	G
ETHYLBENZENE	ug/kg	3	0	12	U	16	U	7.80E+05	No	I
METHYL BUTYL KETONE	ug/kg	3	0	12	U	16	U	NA	No	G
METHYL ETHYL KETONE	ug/kg	3	0	12	U	16	U	4.70E+06	No	I
METHYL ISOBUTYL KETONE	ug/kg	3	0	12	U	16	U	6.30E+05	No	I
METHYLENE CHLORIDE	ug/kg	3	0	20	U	50	U	85000	No	I
STYRENE	ug/kg	3	0	12	U	16	U	1.60E+06	No	I
TETRACHLOROETHENE	ug/kg	3	0	12	U	16	U	7.80E+04	No	I
TOLUENE	ug/kg	3	1	3	J	3	J	1.60E+06	No	I
TRANS-1,3-DICHLOROPROPENE	ug/kg	3	0	12	U	16	U	3500	No	I
TRICHLOROETHENE (TRICHLOROETHYLENE)	ug/kg	3	0	12	U	16	U	58000	No	I
VINYL CHLORIDE	ug/kg	3	0	12	U	16	U	3.40E+02	No	I
XYLENES	ug/kg	3	0	12	U	16	U	1.60E+07	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
DWI-901 SITE SEDIMENT										
DIOXINS										
1,2,3,4,6,7,8 HEPTACHLORODIBENZODIO	ng/kg	2	2	160		260		430	No	C
1,2,3,4,6,7,8 HEPTACHLORODIBENZOFUR	ng/kg	2	2	30		65		430	No	C
1,2,3,4,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	2	0	10	U	10	U	43	No	I
1,2,3,4,7,8 HEXACHLORODIBENZOFURAN	ng/kg	2	2	6.3	J	17		43	No	C
1,2,3,4,7,8,9 HEPTACHLORODIBENZOFUR	ng/kg	2	2	3.9	J	8.5	J	430	No	C
1,2,3,6,7,8 HEXACHLORODIBENZODIOXIN	ng/kg	2	0	10	U	10	U	43	No	C
1,2,3,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	2	2	3.4	J	8.2	J	43	No	C
1,2,3,7,8 PENTACHLORODIBENZODIOXIN	ng/kg	2	0	10	U	10	U	8.6	Yes	H
1,2,3,7,8 PENTACHLORODIBENZOFURAN	ng/kg	2	0	10	U	10	U	86	No	C
1,2,3,7,8,9 HEXACHLORODIBENZODIOXIN	ng/kg	2	0	10	U	10	U	43	No	C
1,2,3,7,8,9 HEXACHLORODIBENZOFURAN	ng/kg	2	0	10	U	10	U	43	No	I
2,3,4,6,7,8 HEXACHLORODIBENZOFURAN	ng/kg	2	1	7.1	J	7.1	J	43	No	C
2,3,4,7,8 PENTACHLORODIBENZOFURAN	ng/kg	2	2	2.7	J	7.8	J	86	No	C
2,3,7,8-TCDD	ng/kg	2	0	2	U	2	U	4.3	No	C
2,3,7,8-TCDF	ng/kg	2	2	4.2		11		43	No	B
OCDD (TOTAL)	ng/kg	2	2	1100		2800		4300	No	B
OCDF (TOTAL)	ng/kg	2	2	66		220		4300	No	C
METALS										
ALUMINUM	mg/kg	9	9	4730		13000		NA	Yes	E
ANTIMONY	mg/kg	9	1	14	J	14	J	3.1	Yes	A
ARSENIC	mg/kg	10	8	5.8		12.5		0.43	Yes	A
BARIUM	mg/kg	10	10	30	B	225	B	550	No	D
BERYLLIUM	mg/kg	9	3	0.74	B	1.1	B	0.075	Yes	A
CADMIUM	mg/kg	10	6	1.9		6.2		39	No	D
CALCIUM	mg/kg	9	9	2680		217000		NA	Yes	E
CHROMIUM	mg/kg	10	10	14.9	J	86		39	Yes	B
COBALT	mg/kg	9	9	6.7		18.2	J	NA	Yes	E
COPPER	mg/kg	10	10	8	B	830		NA	Yes	E
CYANIDE	mg/kg	9	2	0.23	B	0.56	B	160	No	D
IRON	mg/kg	9	9	17000		43000		NA	Yes	E
LEAD	mg/kg	10	10	21.1	J	440		NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
MAGNESIUM	mg/kg	9	9	783	J	15500	J	NA	Yes	E
MANGANESE	mg/kg	9	9	570		12200	J	1100	Yes	B
MERCURY	mg/kg	10	7	0.23		7		2.3	Yes	B
NICKEL	mg/kg	10	10	6.1	B	83		NA	Yes	E
POTASSIUM	mg/kg	9	3	690	J	1100	J	NA	Yes	E
SELENIUM	mg/kg	1	0	0.2	U	0.2	U	39	No	D
SILVER	mg/kg	10	0	1	U	8.4	U	39	No	D
SODIUM	mg/kg	9	2	65.5	B	75.6	B	NA	No	F
THALLIUM	mg/kg	9	0	0.8	UJ	1.1	U	NA	No	G
VANADIUM	mg/kg	9	9	13		25.8		55	No	D
ZINC	mg/kg	10	10	30.5		1900		2300	No	D
PCBs										
AROCLOR-1016	ug/kg	5	0	46	U	51	U	550	No	I
AROCLOR-1221	ug/kg	5	0	94	U	100	U	83	Yes	H
AROCLOR-1232	ug/kg	5	0	46	U	51	U	83	No	I
AROCLOR-1242	ug/kg	5	0	46	U	51	U	83	No	I
AROCLOR-1248	ug/kg	5	0	46	U	51	U	83	No	I
AROCLOR-1254	ug/kg	6	5	300		4000	C	1600	Yes	A
AROCLOR-1260	ug/kg	6	5	168	D	2700	C	83	Yes	A
PESTICIDES										
4,4'-DDD (P,P'-DDD)	ug/kg	5	0	4.6	U	6	U	2700	No	I
4,4'-DDE (P,P'-DDE)	ug/kg	5	0	4.6	U	5.1	U	1900	No	I
4,4'-DDT (P,P'-DDT)	ug/kg	5	0	4.6	U	5.1	U	38	Yes	H
ALDRIN	ug/kg	5	0	2.4	U	2.6	U	NA	No	G
ALPHA-BHC	ug/kg	5	0	2.4	U	2.6	U	NA	No	G
ALPHA-CHLORDANE /2	ug/kg	5	0	2.4	U	3	U	NA	No	G
BETA-BHC	ug/kg	5	0	2.4	U	2.6	U	NA	No	G
CHLORDANE	ug/kg	1	1	167	D	167	D	470	No	D
DELTA-BHC	ug/kg	5	0	2.4	U	2.6	U	NA	Yes	G
DIELDRIN	ug/kg	5	0	4.6	U	30	U	40	Yes	H
ENDOSULFAN I	ug/kg	5	0	2.4	U	2.6	U	47000	No	I
ENDOSULFAN II	ug/kg	5	0	4.6	U	8	U	NA	No	G
ENDOSULFAN SULFATE	ug/kg	5	0	4.6	U	5.1	U	NA	No	G

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
ENDRIN	ug/kg	5	1	14		14		2300	No	I
ENDRIN ALDEHYDE	ug/kg	5	0	4.6	U	5.1	U	NA	No	G
ENDRIN KETONE	ug/kg	5	0	4.6	U	5.1	U	NA	No	G
GAMMA-BHC	ug/kg	5	0	2.4	U	4	U	NA	No	G
GAMMA-CHLORDANE /2	ug/kg	5	1	6	N	6	N	NA	Yes	E
HEPTACHLOR	ug/kg	5	0	2.4	U	2.6	U	140	No	I
HEPTACHLOR EXPOXIDE	ug/kg	5	0	2.4	U	2.6	U	70	No	I
METHOXYCHLOR	ug/kg	5	0	24	U	26	U	39000	No	I
TOXAPHENE	ug/kg	5	0	240	U	260	U	580	Yes	H
RADIONUCLIDES										
BISMUTH-212	pCi/g	5	5	0.28		0.605		1300	No	C
BISMUTH-214	pCi/g	5	5	0.423		0.764		4100	No	C
CESIUM-137	pCi/g	5	5	0.0517		0.245		25	No	C
LEAD-212	pCi/g	5	5	0.504		1.02		44	No	C
LEAD-214	pCi/g	5	5	0.456		0.849		2700	No	C
POTASSIUM-40	pCi/g	5	5	3.9		8.56		63	No	C
PROTACTINIUM-234M	pCi/g	5	5	1.79		17.6		170000	No	C
RADIUM-226	pCi/g	5	5	0.296		2.35		2.7	No	C
RADIUM-228	pCi/g	5	5	0.546		1.06		3.2	No	C
THALLIUM-208	pCi/g	5	5	0.161		0.321		45000	No	C
THORIUM-232	pCi/g	5	5	0.45		0.86	J	24	No	C
THORIUM-234	pCi/g	5	0	0.5	U	0.5	U	41	No	C
URANIUM-234	pCi/g	5	5	0.9		9.8		18	No	C
URANIUM-235	pCi/g	5	1	0.62		0.62		18	No	C
URANIUM-238	pCi/g	5	5	0.93		9.2		18	No	C
SEMIVOLATILES										
(3-AND/OR 4-) METHYLPHENOL	ug/kg	5	1	1700		1700		NA	Yes	E
1,2,4-TRICHLOROBENZENE	ug/kg	5	0	500	U	1400	U	7.80E+04	No	I
1,2-DICHLOROBENZENE	ug/kg	5	0	500	U	1400	U	7.00E+05	No	I
1,3-DICHLOROBENZENE	ug/kg	5	0	500	U	1400	U	NA	No	G
1,4-DICHLOROBENZENE	ug/kg	5	0	500	U	1400	U	27000	No	I
2,2'-CHLOROISOPROPYLETHER	ug/kg	5	0	500	U	1400	U	NA	No	G
2,4,5-TRICHLOROPHENOL	ug/kg	5	0	1200	U	3400	U	7.80E+05	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
2,4,6-TRICHLOROPHENOL	ug/kg	5	0	500	U	1400	U	58000	No	I
2,4-DICHLOROPHENOL	ug/kg	5	0	500	U	1400	U	2.30E+04	No	I
2,4-DIMETHYLPHENOL	ug/kg	5	0	500	U	1400	U	1.60E+05	No	I
2,4-DINITROPHENOL	ug/kg	5	0	1200	U	3400	U	1.60E+04	No	I
2,4-DINITROTOLUENE	ug/kg	5	0	500	U	1400	U	940	Yes	H
2,6-DINITROTOLUENE	ug/kg	5	0	500	U	1400	U	940	Yes	H
2-CHLORONAPHTHALENE	ug/kg	5	0	500	U	1400	U	6.30E+05	No	I
2-CHLOROPHENOL	ug/kg	5	0	500	U	1400	U	3.90E+04	No	I
2-METHYL-4,6-DINITROPHENOL	ug/kg	5	0	1200	U	3400	U	NA	No	G
2-METHYLNAPHTHALENE	ug/kg	5	3	59	J	84	J	NA	No	G
2-METHYLPHENOL	ug/kg	5	0	500	U	1400	U	NA	No	G
2-NITROANILINE	ug/kg	5	0	1200	U	3400	U	15000	No	I
2-NITROPHENOL	ug/kg	5	0	500	U	1400	U	NA	No	G
3,3'-DICHLOROBENZIDINE	ug/kg	5	0	500	U	1400	U	1400	Yes	H
3-NITROANILINE	ug/kg	5	0	1200	U	3400	U	NA	No	G
4-BROMOPHENYL PHENYL ETHER	ug/kg	5	0	500	U	1400	U	NA	No	G
4-CHLORO-3-METHYLPHENOL	ug/kg	5	0	500	U	1400	U	NA	No	G
4-CHLOROANILINE	ug/kg	5	0	500	U	1400	U	3100	No	I
4-CHLOROPHENYL PHENYL ETHER	ug/kg	5	0	500	U	1400	U	NA	No	G
4-NITROANILINE	ug/kg	5	0	1200	U	3400	U	NA	No	G
4-NITROPHENOL	ug/kg	5	0	1200	U	3400	U	NA	No	G
ACENAPHTHENE	ug/kg	5	0	500	U	1400	U	NA	No	G
ACENAPHTHYLENE	ug/kg	5	0	500	U	1400	U	4.70E+05	No	D
ANTHRACENE	ug/kg	5	0	500	U	1400	U	2.30E+06	No	D
BENZO(A)ANTHRACENE	ug/kg	5	3	630		1600		880	Yes	A
BENZO(A)PYRENE	ug/kg	9	5	280	J	1700		88	Yes	A
BENZO(B AND/OR K)FLUORANTHENE	ug/kg	5	5	1200		4600		880	Yes	A
BENZO(G,H,I)PERYLENE	ug/kg	5	0	500	U	1400	U	NA	No	G
BENZYL BUTYL PHTHALATE	ug/kg	5	0	500	U	1400	U	1.60E+06	No	I
BIS(2-CHLOROETHOXY)METHANE	ug/kg	5	0	500	U	1400	U	NA	No	G
BIS(2-CHLOROETHYL) ETHER	ug/kg	5	0	500	U	1400	U	580	No	I
BIS(2-ETHYLHEXYL)PHTHALATE	ug/kg	6	2	6700		19600	D	46000	No	C
CARBAZOLE	ug/kg	5	1	420	J	420	J	3.20E+04	No	C
CHRYSENE	ug/kg	5	4	680		2200		88000	No	C
DI-N-BUTYLPHTHALATE	ug/kg	9	1	52	J	52	J	NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
DI-N-OCTYLPHTHALATE	ug/kg	5	0	500	U	1400	U	NA	Yes	E
DIBENZO(A,H)ANTHRACENE	ug/kg	5	0	500	U	1400	U	88	Yes	H
DIBENZOFURAN	ug/kg	5	0	500	U	1400	U	NA	Yes	E
DIETHYL PHTHALATE	ug/kg	5	0	500	U	1400	U	6.30E+06	No	I
DIMETHYL PHTHALATE	ug/kg	5	0	500	U	1400	U	NA	Yes	E
FLUORANTHENE	ug/kg	5	4	1000		4200		3.10E+05	No	D
FLUORENE	ug/kg	5	1	120	J	120	J	3.10E+05	No	D
HEXACHLOROBENZENE	ug/kg	5	0	500	U	1400	U	400	Yes	H
HEXACHLOROBUTADIENE	ug/kg	5	0	500	U	1400	U	8200	No	I
HEXACHLOROCYCLOPENTADIENE	ug/kg	5	0	500	U	1400	U	55000	No	I
HEXACHLOROETHANE	ug/kg	5	0	500	U	1400	U	46000	No	I
INDENO(1,2,3-CD)PYRENE	ug/kg	5	0	500	U	1400	U	880	Yes	H
ISOPHORONE	ug/kg	5	0	500	U	1400	U	670000	No	I
N-NITROSO-DI-N-PROPYLAMINE	ug/kg	5	0	500	U	1400	U	91	Yes	H
N-NITROSODIPHENYLAMINE	ug/kg	5	0	500	U	1400	U	130000	No	C
NAPHTHALENE	ug/kg	5	2	70	J	170	J	NA	Yes	E
NITROBENZENE	ug/kg	5	0	500	U	1400	U	3900	No	I
PENTACHLOROPHENOL	ug/kg	5	0	1200	U	3400	U	5300	Yes	H
PHENANTHRENE	ug/kg	5	5	450	J	1800		NA	Yes	E
PHENOL	ug/kg	5	1	350	J	350	J	4.70E+06	No	D
PYRENE	ug/kg	5	5	730		2700		2.30E+05	No	D
VOLATILES										
1,1,1-TRICHLOROETHANE	ug/kg	5	0	14	U	16	U	NA	No	G
1,1,2,2-TETRACHLOROETHANE	ug/kg	5	0	14	U	16	U	3200	No	I
1,1,2-TRICHLOROETHANE	ug/kg	5	0	14	U	16	U	11000	No	I
1,1-DICHLOROETHANE	ug/kg	5	0	14	U	16	U	7.80E+05	No	I
1,1-DICHLOROETHENE (1,1-DICHLOROETH	ug/kg	5	0	14	U	16	U	1100	No	I
1,2 -DICHLOROETHANE	ug/kg	5	0	14	U	16	U	7000	No	I
1,2-DICHLOROETHENE (TOTAL)	ug/kg	5	0	14	U	16	U	70000	No	I
1,2-DICHLOROPROPANE	ug/kg	5	0	14	U	16	U	9400	No	I
ACETONE	ug/kg	9	4	18000		49000	E	7.80E+05	No	D
BENZENE	ug/kg	5	0	14	U	16	U	22000	No	I
BROMODICHLOROMETHANE	ug/kg	5	0	14	U	16	U	10000	No	I
BROMOFORM	ug/kg	5	0	14	U	16	U	81000	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee										
analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
BROMOMETHANE	ug/kg	5	0	14	U	16	U	11000	No	I
CARBON DISULFIDE	ug/kg	5	0	14	U	16	U	7.80E+05	No	I
CARBON TETRACHLORIDE	ug/kg	5	0	14	U	16	U	4900	No	I
CHLOROBENZENE	ug/kg	5	0	14	U	16	U	1.60E+05	No	I
CHLOROETHANE	ug/kg	5	0	14	U	16	U	NA	No	G
CHLOROFORM	ug/kg	5	0	14	U	16	U	100000	No	I
CHLOROMETHANE	ug/kg	5	0	14	U	16	U	49000	No	I
CIS-1,3-DICHLOROPROPENE	ug/kg	5	0	14	U	16	U	3500	No	I
DIBROMOCHLOROMETHANE	ug/kg	5	0	14	U	16	U	NA	No	G
ETHYLBENZENE	ug/kg	9	1	470	J	470	J	7.80E+05	No	D
METHYL BUTYL KETONE	ug/kg	5	0	14	U	16	U	NA	No	G
METHYL ETHYL KETONE	ug/kg	5	0	14	U	16	U	4.70E+06	No	I
METHYL ISOBUTYL KETONE	ug/kg	5	0	14	U	16	U	6.30E+05	No	I
METHYLENE CHLORIDE	ug/kg	5	0	30	U	130	U	85000	No	I
STYRENE	ug/kg	5	0	14	U	16	U	1.60E+06	No	I
TETRACHLOROETHENE	ug/kg	5	0	14	U	16	U	7.80E+04	No	I
TOLUENE	ug/kg	5	0	14	U	16	U	1.60E+06	No	I
TRANS-1,3-DICHLOROPROPENE	ug/kg	5	0	14	U	16	U	3500	No	I
TRICHLOROETHENE (TRICHLOROETHYLENE)	ug/kg	5	0	14	U	16	U	58000	No	I
TRICHLOROFLUOROMETHANE	ug/kg	1	0	0.1	U	0.1	U	2.30E+06	No	I
VINYL CHLORIDE	ug/kg	5	0	14	U	16	U	3.40E+02	No	I
XYLENES	ug/kg	9	1	1200	J	1200	J	1.60E+07	No	C
DWI-901 SITE GROUNDWATER										
METALS										
ALUMINUM	ug/L	4	2	4680		88800		NA	Yes	E
ANTIMONY	ug/L	4	1	60.4		60.4		1.5	Yes	B
ARSENIC	ug/L	4	0	4	U	9.8	U	1.1	Yes	H
BARIUM	ug/L	4	4	48		694		260	Yes	B
BERYLLIUM	ug/L	4	1	6.9		6.9		0.02	Yes	A
CADMIUM	ug/L	4	0	2.3	U	6.3	U	1.8	Yes	H
CALCIUM	ug/L	4	4	88000		167000		NA	Yes	E
CHROMIUM	ug/L	4	1	124		124		18	Yes	B
COBALT	ug/L	4	1	67.9		67.9		NA	Yes	E

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
COPPER	ug/L	4	2	69.6		572		NA	Yes	E
CYANIDE	ug/L	2	0	10	U	10	U	0.073	Yes	H
IRON	ug/L	4	2	4320		131000		NA	Yes	E
LEAD	ug/L	4	3	7		597		NA	Yes	E
MAGNESIUM	ug/L	4	4	7400		18900		NA	No	F
MANGANESE	ug/L	4	4	880		9170		18	Yes	B
MERCURY	ug/L	4	3	0.29		61.9		1.1	Yes	B
NICKEL	ug/L	4	2	20.3	B	152		73	Yes	B
POTASSIUM	ug/L	4	2	6380		9800		NA	Yes	E
SELENIUM	ug/L	4	0	4	U	10	U	18	Yes	H
SILVER	ug/L	4	0	6	U	8	U	18	No	I
SODIUM	ug/L	4	4	9160		20500		NA	Yes	E
THALLIUM	ug/L	4	0	3	UJ	40	U	NA	No	G
VANADIUM	ug/L	4	2	9	B	130		26	Yes	B
ZINC	ug/L	4	4	11		1520		1100	Yes	B
PCBs										
AROCLOR-1016	ug/L	2	0	1	U	1	U	0.26	Yes	H
AROCLOR-1221	ug/L	2	0	2	U	2	U	0.011	Yes	H
AROCLOR-1232	ug/L	2	0	1	U	1	U	0.011	Yes	H
AROCLOR-1242	ug/L	2	0	1	U	1	U	0.011	Yes	H
AROCLOR-1248	ug/L	2	0	1	U	1	U	0.011	Yes	H
AROCLOR-1254	ug/L	2	0	1	U	1	U	0.073	Yes	H
AROCLOR-1260	ug/L	2	0	1	U	1	U	0.011	Yes	H
PESTICIDES										
4,4'-DDD (P,P'-DDD)	ug/L	2	0	0.1	U	0.1	U	0.37	No	I
4,4'-DDE (P,P'-DDE)	ug/L	2	0	0.1	U	0.1	U	0.3	No	I
4,4'-DDT (P,P'-DDT)	ug/L	2	0	0.1	U	0.1	U	0.25	No	I
ALDRIN	ug/L	2	0	0.05	U	0.05	U	0.005	Yes	H
ALPHA-BHC	ug/L	2	0	0.05	U	0.05	U	NA	No	G
ALPHA-CHLORDANE /2	ug/L	2	0	0.05	U	0.05	U	NA	No	G
BETA-BHC	ug/L	2	0	0.05	U	0.05	U	NA	No	G
DELTA-BHC	ug/L	2	0	0.05	U	0.05	U	NA	No	G
DIELDRIN	ug/L	2	0	0.1	U	0.1	U	0.0053	Yes	H

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
ENDOSULFAN I	ug/L	2	0	0.05	U	0.05	U	22	No	I
ENDOSULFAN II	ug/L	2	0	0.1	U	0.1	U	NA	No	G
ENDOSULFAN SULFATE	ug/L	2	0	0.1	U	0.1	U	NA	No	G
ENDRIN	ug/L	2	0	0.1	U	0.1	U	1.1	No	I
ENDRIN ALDEHYDE	ug/L	2	0	0.1	U	0.1	U	NA	No	G
ENDRIN KETONE	ug/L	2	0	0.1	U	0.1	U	NA	No	G
GAMMA-BHC	ug/L	2	0	0.05	U	0.05	U	NA	No	G
GAMMA-CHLORDANE /2	ug/L	2	0	0.05	U	0.05	U	NA	No	G
HEPTACHLOR	ug/L	2	0	0.05	U	0.05	U	0.019	Yes	H
HEPTACHLOR EXPOXIDE	ug/L	2	0	0.05	U	0.05	U	NA	No	G
METHOXYCHLOR	ug/L	2	0	0.5	U	0.5	U	18	No	I
TOXAPHENE	ug/L	2	0	5	U	5	U	0.077	Yes	H
RADIONUCLIDES										
THORIUM-232	pCi/L	2	0	0.1	U	0.1	U	1.5	No	C
THORIUM-234	pCi/L	2	0	20	U	20	U	2.5	Yes	H
URANIUM-234	pCi/L	2	2	1.2	J	1.4		1.1	Yes	A
URANIUM-235	pCi/L	2	0	0.1	U	0.1	U	1.1	No	I
URANIUM-238	pCi/L	2	2	1.1		1.1		1.1	Yes	A
SEMIVOLATILES										
(3-AND/OR 4-) METHYLPHENOL	ug/L	2	0	10	U	10	U	NA	No	G
1,2,4-TRICHLOROBENZENE	ug/L	2	0	10	U	10	U	37	No	D
1,2-DICHLOROBENZENE	ug/L	2	0	10	U	10	U	330	No	D
1,3-DICHLOROBENZENE	ug/L	2	0	10	U	10	U	NA	No	I
1,4-DICHLOROBENZENE	ug/L	2	0	10	U	10	U	3.5	Yes	H
2,2'-CHLOROISOPROPYLETHER	ug/L	2	0	10	U	10	U	NA	No	I
2,4,5-TRICHLOROPHENOL	ug/L	2	0	25	U	25	U	370	No	I
2,4,6-TRICHLOROPHENOL	ug/L	2	0	10	U	10	U	7.7	Yes	H
2,4-DICHLOROPHENOL	ug/L	2	0	10	U	10	U	11	No	I
2,4-DIMETHYLPHENOL	ug/L	2	0	10	U	10	U	73	No	I
2,4-DINITROPHENOL	ug/L	2	0	25	U	25	U	7.3	Yes	H
2,4-DINITROTOLUENE	ug/L	2	0	10	U	10	U	0.13	Yes	H
2,6-DINITROTOLUENE	ug/L	2	0	10	U	10	U	0.13	Yes	H
2-CHLORONAPHTHALENE	ug/L	2	0	10	U	10	U	290	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
2-CHLOROPHENOL	ug/L	2	0	10	U	10	U	18	No	I
2-METHYL-4,6-DINITROPHENOL	ug/L	2	0	25	U	25	U	NA	No	G
2-METHYLNAPHTHALENE	ug/L	2	0	10	U	10	U	NA	No	G
2-METHYLPHENOL	ug/L	2	0	10	U	10	U	NA	No	G
2-NITROANILINE	ug/L	2	0	25	U	25	U	53	No	I
2-NITROPHENOL	ug/L	2	0	10	U	10	U	NA	No	G
3,3'-DICHLOROBENZIDINE	ug/L	2	0	10	U	10	U	0.19	Yes	H
3-NITROANILINE	ug/L	2	0	25	U	25	U	NA	No	G
4-BROMOPHENYL PHENYL ETHER	ug/L	2	0	10	U	10	U	NA	No	G
4-CHLORO-3-METHYLPHENOL	ug/L	2	0	10	U	10	U	NA	No	G
4-CHLOROANILINE	ug/L	2	0	10	U	10	U	15	No	I
4-CHLOROPHENYL PHENYL ETHER	ug/L	2	0	10	U	10	U	NA	No	G
4-NITROANILINE	ug/L	2	0	25	U	25	U	NA	No	G
4-NITROPHENOL	ug/L	2	0	25	U	25	U	NA	No	G
ACENAPHTHENE	ug/L	2	0	10	U	10	U	220	No	I
ACENAPHTHYLENE	ug/L	2	0	10	U	10	U	NA	No	G
ANTHRACENE	ug/L	2	0	10	U	10	U	1100	No	I
BENZO(A)ANTHRACENE	ug/L	2	0	10	U	10	U	0.018	Yes	H
BENZO(A)PYRENE	ug/L	2	0	10	U	10	U	0.0012	Yes	H
BENZO(B AND/OR K)FLUORANTHENE	ug/L	2	0	10	U	10	U	0.012	Yes	H
BENZO(G,H,I)PERYLENE	ug/L	2	0	10	U	10	U	NA	No	G
BENZYL BUTYL PHTHALATE	ug/L	2	0	10	U	10	U	730	No	I
BIS(2-CHLOROETHOXY)METHANE	ug/L	2	0	10	U	10	U	NA	No	G
BIS(2-CHLOROETHYL) ETHER	ug/L	2	0	10	U	10	U	0.077	Yes	H
BIS(2-ETHYLHEXYL)PHTHALATE	ug/L	2	0	10	U	10	U	6.1	Yes	A
CARBAZOLE	ug/L	2	0	10	U	10	U	4.3	Yes	H
CHRYSENE	ug/L	2	0	10	U	10	U	1.8	Yes	H
DI-N-BUTYLPHTHALATE	ug/L	2	0	10	U	10	U	NA	No	G
DI-N-OCTYLPHTHALATE	ug/L	2	0	10	U	10	U	NA	No	G
DIBENZO(A,H)ANTHRACENE	ug/L	2	0	10	U	10	U	NA	No	G
DIBENZOFURAN	ug/L	2	0	10	U	10	U	NA	No	G
DIETHYL PHTHALATE	ug/L	2	0	10	U	10	U	2900	No	I
DIMETHYL PHTHALATE	ug/L	2	0	10	U	10	U	NA	No	G
FLUORANTHENE	ug/L	2	0	10	U	10	U	520	No	I
FLUORENE	ug/L	2	0	10	U	10	U	150	No	I

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
HEXACHLOROBENZENE	ug/L	2	0	10	U	10	U	0.053	Yes	H
HEXACHLOROBUTADIENE	ug/L	2	0	10	U	10	U	1.1	Yes	H
HEXACHLOROCYCLOPENTADIENE	ug/L	2	0	10	U	10	U	26	Yes	H
HEXACHLOROETHANE	ug/L	2	0	10	U	10	U	6.1	Yes	H
INDENO(1,2,3-CD)PYRENE	ug/L	2	0	10	U	10	U	0.0078	Yes	H
ISOPHORONE	ug/L	2	0	10	U	10	U	90	No	I
N-NITROSO-DI-N-PROPYLAMINE	ug/L	2	0	10	U	10	U	0.012	Yes	H
N-NITROSODIPHENYLAMINE	ug/L	2	0	10	U	10	U	92	Yes	H
NAPHTHALENE	ug/L	2	0	10	U	10	U	NA	No	G
NITROBENZENE	ug/L	2	0	10	U	10	U	1.8	Yes	H
PENTACHLOROPHENOL	ug/L	2	0	25	U	25	U	0.71	Yes	H
PHENANTHRENE	ug/L	2	0	10	U	10	U	NA	No	G
PHENOL	ug/L	2	0	10	U	10	U	2200	No	I
PYRENE	ug/L	2	0	10	U	10	U	43	No	I
VOLATILES										
1,1,1-TRICHLOROETHANE	ug/L	2	0	10	U	10	U	NA	No	G
1,1,2,2-TETRACHLOROETHANE	ug/L	2	0	10	U	10	U	0.43	Yes	H
1,1,2-TRICHLOROETHANE	ug/L	2	0	10	U	10	U	1.5	Yes	H
1,1-DICHLOROETHANE	ug/L	2	0	10	U	10	U	370	No	I
1,1-DICHLOROETHENE (1,1-DICHLOROETH	ug/L	2	0	10	U	10	U	0.14	Yes	H
1,2 -DICHLOROETHANE	ug/L	2	0	10	U	10	U	0.94	Yes	H
1,2-DICHLOROETHENE (TOTAL)	ug/L	2	0	10	U	10	U	33	No	I
1,2-DICHLOROPROPANE	ug/L	2	0	10	U	10	U	1.3	Yes	H
ACETONE	ug/L	2	0	10	U	10	U	370	No	I
BENZENE	ug/L	2	0	10	U	10	U	2.9	Yes	H
BROMODICHLOROMETHANE	ug/L	2	0	10	U	10	U	1.4	Yes	H
BROMOFORM	ug/L	2	0	10	U	10	U	11	No	I
BROMOMETHANE	ug/L	2	0	10	U	10	U	5.1	Yes	H
CARBON DISULFIDE	ug/L	2	0	10	U	10	U	370	No	I
CARBON TETRACHLORIDE	ug/L	2	0	10	U	10	U	0.66	Yes	H
CHLOROBENZENE	ug/L	2	0	10	U	10	U	73	No	I
CHLOROETHANE	ug/L	2	0	10	U	10	U	NA	No	G
CHLOROFORM	ug/L	2	0	10	U	10	U	14	No	I
CHLOROMETHANE	ug/L	2	0	10	U	10	U	6.6	Yes	H

Table C. 1. Human Health COPC Screening for the DWI 901 Site, Knoxville, Tennessee

analyte	units	samples	hits	min	qual	max	qual	PRG	COPC?	just
CIS-1,3-DICHLOROPROPENE	ug/L	2	0	10	U	10	U	0.47	Yes	H
DIBROMOCHLOROMETHANE	ug/L	2	0	10	U	10	U	1	Yes	H
ETHYLBENZENE	ug/L	2	0	10	U	10	U	370	No	I
METHYL BUTYL KETONE	ug/L	2	0	10	U	10	U	NA	No	G
METHYL ETHYL KETONE	ug/L	2	0	10	U	10	U	2200	No	I
METHYL ISOBUTYL KETONE	ug/L	2	0	10	U	10	U	290	No	I
METHYLENE CHLORIDE	ug/L	2	0	10	U	10	U	11	No	I
STYRENE	ug/L	2	0	10	U	10	U	730	No	I
TETRACHLOROETHENE	ug/L	2	0	10	U	10	U	NA	No	G
TOLUENE	ug/L	2	0	10	U	10	U	730	No	I
TRANS-1,3-DICHLOROPROPENE	ug/L	2	0	10	U	10	U	0.47	Yes	H
TRICHLOROETHENE (TRICHLOROETHYLENE)	ug/L	2	0	10	U	10	U	NA	No	G
VINYL CHLORIDE	ug/L	2	0	10	U	10	U	0.045	Yes	H
XYLENES	ug/L	2	0	10	U	10	U	7300	No	I

Justification	
A	> PRG 10E-06
B	> PRG HQ=0.1
C	< PRG 10E-06
D	< PRG HQ= 0.1
E	No PRG available
F	essential element
G	no detects; no PRG
H	no detects; DL > PRG
I	no detects; DL < PRG

COPC = contaminant of potential concern	min = minimum	U = undetected	
DWI = David Witherspoon, Inc.	NA = not available	J = estimated value	
g = gram	pCi = picocurie		
kg = kilogram	PRG = preliminary remediation goal		
L = liter	just = justification		
max = maximum	qual = qualifier		
mg = milligram	ug = microgram		
ng = nanogram			

Table C.2. COPC mean and RME concentrations for the DWI 901 Site, Knoxville, Tennessee								
Surface soil (DWI-901)	units	hits	samp	mean	RME	min	max	BKG AVG
Antimony	mg/kg	11	23	23.535	39.702	6.6	102	ND
Arsenic	mg/kg	23	23	9.596	12.797	2.7	24	12.7
Barium	mg/kg	23	23	310.117	570.642	28	986	150.3
Beryllium	mg/kg	8	23	0.56	0.696	0.57	1.5	1.5
Cadmium	mg/kg	22	23	16.063	41	1.3	41	2.1
Chromium	mg/kg	23	23	233.661	290.062	9.8	3480	24.3
Lead	mg/kg	23	23	1006.791	2721.826	46.2	6270	166.7
Manganese	mg/kg	23	23	2647.913	4028.382	260	14600	1500
Mercury	mg/kg	22	23	97.064	495.248	0.31	1660	0.77
Zinc	mg/kg	23	23	3939.457	14100.114	95.5	16000	315.4
1,2,3,4,6,7,8-HpCDD	ng/kg	5	5	458.2	1400	35	1400	480
1,2,3,4,6,7,8-HpCDF	ng/kg	4	5	166.6	440	18	440	104
1,2,3,4,7,8-HxCDF	ng/kg	5	5	23.18	39.856	5.4	46	14
1,2,3,7,8,9-HxCDD	ng/kg	1	5	9.6	18	18	18	15
2,3,7,8-TCDF	ng/kg	5	5	34.66	62.354	3.4	71	6.95
OCDD (total)	ng/kg	5	5	2902	9400	200	9400	3600
Aroclor-1242	ug/kg	1	23	10156.804	35234.19	200000	200000	ND
Aroclor-1248	ug/kg	2	23	5970.065	34594.906	3800	100000	ND
Aroclor-1254	ug/kg	22	23	10210.609	27627.47	94	160000	ND
Aroclor-1260	ug/kg	20	23	4119.152	19862.665	120	43000	ND
Pu-239	pCi/g	2	2	3.87	7.54	0.2	7.54	ND
Ra-226	pCi/g	5	5	2.966	5.68	0.84	5.68	3
Th-234	pCi/g	4	11	215.618	962.2	96.5	962.2	ND
U-234	pCi/g	9	11	119.672	445.1	3.8	445.1	2.03
U-238	pCi/g	9	11	170.246	687.3	3.5	687.3	1.84
Benzo(a)anthracene	ug/kg	14	23	2653.217	3370.399	74	44000	ND
Benzo(a)pyrene	ug/kg	18	23	2509.696	3295.817	42	43000	ND
Benzo(b)fluoranthene	ug/kg	22	23	2812.478	4296.755	67	42000	ND
Dibenzo(a,h)anthracene	ug/kg	10	23	726.348	570	61	570	ND
Indeno(1,2,3-cd)pyrene	ug/kg	13	23	1828.043	2129.248	170	28000	ND

Table C.2. COPC mean and RME concentrations for the DWI 901 Site, Knoxville, Tennessee								
Surface Soil (Candora Road Area)	units	hits	samp	mean	RME	min	max	BKG AVG
Antimony	mg/kg	3	8	39.488	162	24	162	ND
Arsenic	mg/kg	8	8	17.288	22.7	6.2	30	12.7
Barium	mg/kg	8	8	384.525	830	52.2	830	150.3
Beryllium	mg/kg	1	8	0.468	0.55	0.55	0.55	1.5
Cadmium	mg/kg	8	8	19.213	28.025	2.3	45	2.1
Chromium	mg/kg	8	8	167.963	464	38.1	464	24.3
Lead	mg/kg	8	8	1978.025	8320	98.2	8320	166.7
Manganese	mg/kg	8	8	1522.875	2735.625	531	2800	1500
Mercury	mg/kg	8	8	107.238	430	16	430	0.77
Zinc	mg/kg	8	8	4906	7167.375	448	10600	315.4
1,2,3,4,6,7,8-HpCDD	ng/kg	1	1	2600		2600	2600	480
1,2,3,4,7,8-HxCDF	ng/kg	1	1	88		88	88	14
1,2,3,6,7,8-HxCDD	ng/kg	1	1	91		91	91	14.5
2,3,7,8-TCDD	ng/kg	1	1	4.6		4.6	4.6	1
2,3,7,8-TCDF	ng/kg	1	1	66		66	66	6.95
OCDD (total)	ng/kg	1	1	16000		16000	16000	3600
Aroclor-1248	ug/kg	1	8	19805	140000	140000	140000	ND
Aroclor-1254	ug/kg	7	8	32287.5	45153.323	1100	52000	ND
Aroclor-1260	ug/kg	6	8	14500	28000	1900	28000	ND
Pb-212	pCi/g	3	3	59.033	149	1	149	1.18
Pa-234	pCi/g	2	2	6999	12380	1618	12380	ND
Ra-226	pCi/g	3	3	629.467	1710	74.4	1710	3
Ra-228	pCi/g	3	3	62.4	154	1.3	154	1.26
Th-232	pCi/g	4	4	27.618	73	0.87	73	0.98
Th-234	pCi/g	5	6	12005.628	55240	0.67	55240	ND
U-234	pCi/g	6	6	21464.832	92530	52.99	92530	2.03
U-238	pCi/g	6	6	23249.99	98530	54.94	98530	1.84
Benzo(a)anthracene	ug/kg	5	8	2205.625	13000	440	13000	ND
Benzo(a)pyrene	ug/kg	6	8	1825.625	9545.847	360	10000	ND
Benzo(b)fluoranthene	ug/kg	7	8	2477.5	9445.621	430	11000	ND
Bis(2-ethylhexyl)phthalate	ug/kg	6	8	11326.875	55000	230	55000	ND
Dibenzo(a,h)anthracene	ug/kg	5	8	636.25	2166.842	150	2900	ND
Indeno(1,2,3-cd)pyrene	ug/kg	6	8	1394.375	5987.42	360	7100	ND

Table C.2. COPC mean and RME concentrations for the DWI 901 Site, Knoxville, Tennessee								
Sediment	units	hits	samp	mean	RME	min	max	BKG AVG
Antimony	mg/kg	1	9	10.317	14	14	14	ND
Arsenic	mg/kg	8	10	6.69	8.53	5.8	12.5	14
Beryllium	mg/kg	3	9	0.766	0.928	0.74	1.1	ND
Chromium	mg/kg	10	10	29.08	46.918	14.9	86	15.75
Manganese	mg/kg	9	9	2585.11	7335.273	570	12200	730
Mercury	mg/kg	7	10	1.756	7	0.23	7	0.33
Aroclor-1254	ug/kg	5	6	1013.917	4000	300	4000	ND
Aroclor-1260	ug/kg	5	6	737.083	2700	168	2700	ND
Benzo(a)anthracene	ug/kg	3	5	843	1600	630	1600	ND
Benzo(a)pyrene	ug/kg	5	9	573.33	1216.891	280	1700	620
Benzo(b)fluoranthene	ug/kg	5	5	2300	4600	1200	4600	1400

Table C.2. COPC mean and RME concentrations for the DWI 901 Site, Knoxville, Tennessee								
Groundwater	units	hits	samp	mean	RME	min	max	BKG AVG
Antimony	ug/L	1	4	31.6	60.4	60.4	60.4	ND
Barium	ug/L	4	4	282.75	694	48	694	240.7
Beryllium	ug/L	1	4	2.85	6.9	6.9	6.9	ND
Chromium	ug/L	1	4	35.3	124	124	124	9.8
Manganese	ug/L	4	4	4007.5	9170	880	9170	2205
Mercury	ug/L	3	4	24.423	59.717	0.29	61.9	ND
Nickel	ug/L	2	4	53.075	152	20.3	152	30.5
Vanadium	ug/L	2	4	37.25	130	9	130	26.5
Zinc	ug/L	4	4	601	1362.252	11	1520	32.5
Uranium-234	pCi/L	2	2	1.3	1.4	1.2	1.4	0.875
Uranium-238	pCi/L	2	2	1.1	1.1	1.1	1.1	0.725

COPC = contaminant of potential concern
DWI = David Witherspoon, Inc.
g = gram
kg = kilogram
L = liter
mg = milligram
ng = nanogram
pCi = picocurie
ug = microgram
min = minimum
max = maximum
RME = reasonable maximum exposure
BKG = background
AVG = average
samp = sample number
Pu plutonium
Ra = radium
Th = thorium
U = uranium

2. TOXICITY ASSESSMENT

This chapter summarizes the effects of ionizing radiation and chemicals on exposed populations. It also discusses methods used to evaluate toxicity.

2.1 RADIATION TOXICITY

The potential health effects associated with exposure to radionuclides at the DWI 901 Site are caused by ionizing alpha, beta, and gamma radiation. The primary effects include an increase in the occurrence of cancer in irradiated individuals and possible genetic effects that may occur in future generations. The risk of serious genetic effects is much lower than the risk of cancer induction (EPA 1989a). Therefore, genetic effects are not the focus of this toxicity assessment, and radiological risks are evaluated only with respect to incremental cancer probabilities according to EPA guidance (EPA 1989a). Nonradiological health effects of uranium are considered, as appropriate, in the chemical toxicity section.

Radiation-induced health effects for humans have been confirmed only at relatively high doses or high dose rates with large populations. Exposure to a high dose of radiation (e.g., a thousand times the average annual background dose rate) during a short period of time (a few hours) produces detrimental effects in all the organs and systems of the body. For low doses, health effects are presumed to occur, but can only be estimated statistically. Risk estimates are strictly applicable to large populations because the appearance of health effects after an exposure is a chance event. For purposes of radiological impact assessment, health effects are measured by cancer incidence in the exposed population. However, risk estimates in the low-dose range are uncertain because of extrapolation from high doses and because of assumptions made on dose-effect relationships and the underlying mechanisms of carcinogenesis. Radiation effects in the exposed population cannot be readily identified because radiogenic cancers are indistinguishable from those caused by other factors. Studies of populations chronically exposed to low-level radiation, such as those residing in regions of elevated natural background, have not shown consistent evidence of an associated increase in the risk of cancer.

Exposure routes can be classified as either external or internal. External exposure occurs when the radioactive material is outside the body. Internal exposure occurs when the radioactive material enters the body by routes such as inhalation or ingestion. Inhaled material can be exhaled, expelled from the lungs to be spit or swallowed and excreted, deposited in the lungs, or absorbed by the blood and relocated to systemic organs where it may be excreted over time.

Some ingested material enters the blood and is either excreted or relocated to other organs and excreted over time. Most insoluble ingested material is not absorbed into the blood but is excreted directly in the feces.

Alpha, beta, and gamma radiations are released during the radioactive decay processes series. Each type of radiation differs in its physical properties and in its ability to induce damage to biological tissue. The Biological Effects of Ionizing Radiation (BEIR) IV report (National Research Council 1988) addresses the risk from radon and alpha radiations. Alpha particles are an internal exposure hazard because they are unable to penetrate the dead skin cell layer of the body to reach living tissue. Within the body, alpha particles are the most effective of the three types of radiation in damaging cells because they have high linear energy transfer, that is, their energy is completely absorbed by tissue within a short distance. High linear energy transfer radiation is more damaging to cells than low linear energy transfer radiation.

The BEIR V report (National Research Council 1990) addresses the risk from low linear energy transfer radiation such as gamma and beta particles. Beta particles are primarily an internal hazard; however, in cases of external skin exposure, energetic beta particles can penetrate living skin cells, representing an external hazard as well. Beta particles deposit less energy to small volumes of tissue than alpha particles and, therefore, induce much less damage than alpha particles. Gamma radiation is primarily an external hazard because it can penetrate tissue and reach internal organs without being taken into the body.

2.2 RADIATION TOXICITY RELATED TO THE DWI 901 SITE

The only exposures at the DWI 901 Site are chronic (long-term) low-level exposures. Although lethal effects in human populations from chronic low-level exposure have never been documented, the effects have been projected from animal experiments (at high doses and dose rates). Studies assessing the difference between acute (short-term) and chronic (long-term) exposures show that, for a given dose, the radiation effects decrease dramatically as the exposure period is extended (National Research Council 1990). Thus, for sites like DWI 901 Site, where all exposures are longer term and lower level, no immediate harmful effects are expected. Rather the statistical impacts of possible increases in cancer or genetic changes are the only credible potential radiation effects (National Research Council 1990). Predictions of the possible induction of such excess cancers or genetic effects are based on animal study data and human data (e.g., Hiroshima and Nagasaki atomic bomb survivors), and assume a linear, no-threshold relationship between effects from acute doses and chronic doses.

The radionuclides that occur at the DWI 901 Site include the various decay series. The toxicity of the various radionuclides is based on:

- the types and energies of radiation they emit;
- the biological importance of the organs/tissues being irradiated;
- the radiological sensitivity of the organs/tissues being irradiated; and
- for internal exposure only, metabolic behavior in the body and biological retention characteristics in the body.

These factors were considered by the International Commission on Radiological Protection (ICRP), which established the concept of committed effective dose equivalent (CEDE) to measure the detriment of exposure to radiation or radioactive materials. The CEDE value is calculated based on the models and criteria established by ICRP (ICRP 1977 and 1978) to allow quantification of this detriment using all of the factors discussed above. Thus, an estimate of risk from exposure to radiation or radioactive material may be made by determining the CEDE and multiplying by a dose-to-risk (e.g., cancer risk) conversion factor. The radiogenic cancer risk factor was estimated by the National Academy of Sciences in BEIR IV (National Research Council 1988) and BEIR V (National Research Council 1990). For detailed discussion of radiation dosimetry and toxicity, refer to publications of the ICRP (1977, 1978), National Research Council (1988, 1990), and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR 1988).

2.3 METHODS OF EVALUATING RADIATION TOXICITY

A risk factor of 6×10^{-7}/mrem (EPA 1989c; National Research Council 1990) can be used to estimate the likelihood of cancer induction from radiation exposure. EPA used this risk factor to develop revisions to the National Emission Standards for Hazardous Air Pollutants for radionuclides under Section 112 of the Clean Air Act (EPA 1989c). It is a lifetime average value and believed to be representative of conditions defined for the exposure scenarios at the DWI 901 Site.

The BEIR V study (National Research Council 1990) also presents a detailed description of current data on the health risks associated with radiation exposure. A mortality risk factor of about 8×10^{-7}/mrem is estimated in the BEIR V report. To compare this mortality risk factor with the risk factor used in this baseline risk assessment for induction of all cancers, whether fatal

or not, the mortality risk factor must be adjusted. On average, the cancer mortality rate is about 60 percent of the cancer induction rate (EPA 1989d). The mortality risk factor (8×10^{-7}/mrem) can be modified to a total cancer induction rate of 1.3×10^{-6}/mrem (8×10^{-7} = 60 percent of 1.3×10^{-6}). BEIR V estimates were derived primarily from data on acute exposures (a single instantaneous exposure), and the BEIR V report suggests that it is appropriate to reduce this risk by applying a dose rate effectiveness factor of two or more in cases of continuous low-level exposure. Thus, the radiation risk factor of 6×10^{-7}/mrem used in this report is consistent with the value recommended in BEIR V.

In addition to using dose-to-risk conversion factors to estimate risk, EPA also has developed guidance for radiological risk assessment consistent with existing guidance for assessing chemical carcinogenic risks (EPA 1989b). Carcinogenic risks are calculated for the radionuclides of potential concern in a manner similar to existing methods for chemical carcinogens by using an age-averaged lifetime excess cancer incidence per unit intake (and per unit external exposure). EPA has developed cancer slope factors per unit intake that are analogous to the slope factors developed for chemical carcinogens. Radiological carcinogenic risk estimated using EPA slope factors and conventional dose conversion factors for the future employee is presented in this appendix.

In this baseline risk assessment, the risk of cancer induction from inhalation of ^{222}Rn decay products has been estimated by converting ^{222}Rn exposure (in working level month) to millirem for CEDE. National Commission on Radiation Protection and Measurements report number 92 (NCRP 1987) indicates that 1 working level month is equal to about 14 rem. Weighting this by the 0.12 lung weighting factor (ICRP 1978) results in a CEDE of roughly 1,000 mrem per working level month.

2.4 CHEMICAL TOXICITY

Toxicity information considered in the assessment of potential carcinogenic risks from chemical exposure includes (1) a weight-of-evidence classification and (2) a slope factor. The weight-of-evidence classification qualitatively describes the likelihood that an agent is a human carcinogenic and is based on the available data from animal and human studies. A chemical may be placed in one of three groups to indicate its potential for carcinogenic effects: Group A, a human carcinogen; Group B1 or B2, a probable human carcinogen; and Group C, a possible human carcinogen. Chemicals that cannot be classified as human carcinogens because of a lack of data are categorized in Group D; and those for which there is evidence of noncarcinogenicity in humans are categorized in Group E.

Two COPCs (arsenic and chromium VI) are classified as known Class A human carcinogens. Toxicological properties of the COPCs, including carcinogenic and noncarcinogenic factors, are summarized in this appendix. The table briefly describes chemical routes of exposure, critical effects, and carcinogenicity of the chemicals.

2.4.1 Methods of Evaluating Chemical Toxicity

Toxicity values used in the risk characterization of COPCs are also presented in this section. The table includes supporting toxicological information along with source identifiers. Toxicity values used in risk calculations include the chronic reference dose for noncarcinogenic risk and the slope factors for carcinogenic risk.

The chronic reference dose is defined as "an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime" (EPA 1989a). If the sum of the ratios of intake to reference dose value (i.e., hazard indices) for all contaminants is less than one, noncarcinogenic toxicity is unlikely. The slope factor is defined as a "plausible upper-bound estimate of the probability of a response (i.e., cancer) per unit intake of a chemical over a lifetime" (EPA 1989a). Slope factors multiplied by the estimated lifetime intake levels yield lifetime cancer risk estimates. Both reference dose and slope factor values are specific to the route of exposure (e.g., either ingestion or inhalation exposure).

2.4.2 Chemicals for Which EPA Toxicity Values Are Available

Oral slope factors are available for 16 of the COPCs. Polycyclic aromatic hydrocarbons (PAHs) assume the oral and inhalation slope factors for benzo(a)pyrene. Inhalation slope factors are available for only six carcinogenic COPCs. Inhalation reference concentrations are available for eight of the noncarcinogenic COPCs.

2.4.3 Chemicals for Which No EPA Toxicity Values Are Available

A number of COPCs do not have reference doses and/or slope factors for determination of potential noncarcinogenic and carcinogenic health effects from oral and inhalation exposure. The possible impacts of the absence of the risk estimation for these contaminants are discussed in Chapter 3.

EPA-derived reference dose values incorporate uncertainty factors to account for data that were used but would not apply to chronic exposures in the most sensitive human subpopulations. In general, the use of these uncertainty factors provides confidence that exposure levels less than

the reference dose values are unlikely to cause toxic effects. However, reference dose values may be much lower than levels that cause toxic effects in sensitive human subpopulations. Table C.3 summarizes toxicity values.

Table C.3. Toxicity values for carcinogenic COPCs at the DWI 901 Site, Knoxville, Tennessee

Chemical	Carcinogenic toxicity data			
	Oral $(mg/kg \cdot day)^{-1}$	Inhalation SF $(mg/kg \cdot day)^{-1}$	WOE	Tumor type
Arsenic	1.5E−01	5.0E+01	A	(Mice) lung tumors
Benzene	2.9E−02	2.9E-02	A	(Humans) leukemia
Beryllium	4.3	8.4	B2	(Rat) gross tumors all sites
Manganese (water)			D	
Mercury			D	
Benzo(a)anthracene	7.3E−01		B2	
Benzo(a)pyrene	7.3E+00		B2	(Mouse) stomach
Benzo(b)fluoranthene	7.3E−01		B2	
Benzo(k)fluoranthene	7.3E−02		B2	(Mice) skin, throat, lungs
Dibenzo(a,h)anthrancene	7.3E+00		B2	(Mice) pulmory adenomas
2,4-Dinitrotoluene	6.83E−01		B2	Epidermoid carcinomas
Indeno(1,2,3-cd)pyrene	7.3E−01		B2	(Rats) skin tumors, liver hepatocellular carcinomas, neoplastic nodules
Aroclor-1254	7.7+00		B2	(Mice) liver
Aroclor-1260	7.7E+00		B2	(Mice) liver
2,3,7,8-TCDD	1.5E+05	1.5E+05	B2	

DWI = David Witherspoon, Incorporated
kg = kilogram
MF = modifying factor
mg = milligram
RfD = reference dose
SF = slope factor
UF = uncertainty factor
WOE = weight of evidence

3. RISK CHARACTERIZATION

This chapter presents risk estimates for reasonable current use and hypothetical future use scenarios for human receptors at the DWI 901 Site. Human receptors include employees, on-site residents, and trespassers wading in Goose Creek. Radiological risks and chemical risks are estimated separately. The overall human health risk and associated uncertainties from exposure to radiological and chemical contaminants are discussed.

For the radiological assessment, risk is defined as the lifetime probability of cancer morbidity and does not include genetic or noncarcinogenic effects. For the chemical assessment, risk is defined as the lifetime probability of cancer incidence for carcinogens and the estimate of exceeding toxic effect thresholds for noncarcinogens.

Cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to carcinogenic contaminants. Results of the cancer risk estimates can be compared to the target risk range of 10^{-6} to 10^{-4}, or 1 in 1 million to 1 in 10,000, which is the goal EPA outlined in the National Contingency Plan (NCP).

EPA does not use a probabilistic approach to estimate the potential for noncarcinogenic health effects (EPA 1989a). Instead, the potential for noncarcinogenic effects is evaluated by comparing the average daily exposure (intake) over a specified time period (exposure duration) with a reference dose derived for similar exposure periods for each chemical (EPA 1989a). This ratio of exposure is called a hazard quotient (HQ). HQs for each potential COC are then summed to obtain a hazard index for the specific pathway. A hazard index greater than one has been defined as the level of concern for potential adverse noncarcinogenic health effects (EPA 1989a).

4. UNCERTAINTY IN THE ASSESSMENT PROCESS

The risks presented in the DWI 901 Site baseline risk assessment are single point estimates of risk rather than probabilistic estimates. Therefore, it is important to specify the uncertainties inherent in the risk assessment in order to place the risk estimates in proper perspective.

A quantitative statistical analysis of uncertainty has not been performed. Instead, key assumptions and site-related variables which contribute most to the uncertainty have been identified. The uncertainty associated with each variable discussed is described as low (i.e., probably will not impact the risk outcome), moderate (i.e., may impact the risk outcome slightly), or high (i.e., is likely to significantly impact the risk estimate).

There are several categories of uncertainties associated with site risk assessments. These include:

- sampling data adequacy,
- selection of potential COCs,
- exposure assessment variables, and
- toxicity values.

Each of these categories is discussed for radiological risk characterization and chemical risk characterization.

4.1 UNCERTAINTY IN RADIOLOGICAL RISK ESTIMATES

4.1.1 Data

Limitations in data relative to locations and substances sampled and to analytical considerations (e.g., laboratory procedures) may affect the contaminants identified for a site. The uncertainty associated with the DWI Site 901 site sampling data is considered moderate to high. Though the sampling plans generally targeted appropriate areas and analytes using historical information and visual observations, the reliance on biased characterization strategies tends to overestimate actual site concentrations. However, given the magnitude of calculated site risks, it is unlikely that more definitive data would cause the risks to fall within the EPA acceptable target risk range.

Site sampling data for evaluation of groundwater and sediment are associated with moderate uncertainty due to the number of samples and the location of sampling stations.

Uncertainty relative to sample analysis and data evaluation is considered low because the data used for this risk assessment were from investigations that implemented site-specific QA programs.

4.1.2 Chemicals of Potential Concern

Uncertainty is inherent in the selection of COPCs for a baseline risk assessment and is associated with a number of factors. The identification of COPCs for a human health evaluation relies on information from site characterization activities and the application of a selection process.

The radionuclides of concern included in this assessment represent the possible extent of on-site contamination adequately. Hence, the uncertainty in selection of radiological COPCs is low.

4.1.3 Exposure Assessment

An exposure assessment is constructed from a number of site-specific considerations, including exposure point concentrations, scenario assumptions and intake parameters, and primary exposure pathways.

4.1.3.1 Exposure point concentrations

Factors that can contribute to uncertainty in exposure point concentrations include data availability and data heterogeneity. The data available for radionuclide concentrations are derived from biased sampling approaches, so heterogeneity in the spatial distribution of contaminants could not be confirmed, especially where the contamination was highly localized (i.e., "hot spots"). The assumption that sample concentrations are representative of sitewide conditions could contribute to uncertainties when estimating appropriate exposure point concentrations. Although the site was segregated into two separate areas, no adjustments to site concentrations have been attempted to compensate for the biased nature of the sample locations. This is likely to overestimate exposures for receptors. Also, the use of the UCL_{95} values reduces the probability of underestimating the risk. The method used to estimate the mean and UCL_{95} depended on the underlying distribution of the data for each analyte. The distributions were assumed to be log normal unless, based on the Shapiro-Wilk statistic, the distribution was significantly different from log normal (at the 0.05 probability level) and not different from normal. The formula used for the mean and UCL_{95} for normal data are unbiased, but uncertainties become larger as sample size becomes smaller. The formula for the mean of log normal distributions (Gilbert 1987) was chosen because it is a minimum variance unbiased estimate of the mean. This bias could cause overestimation of the mean for analytes with log

normal distributions and few samples. This is a conservative error in that risk would tend to be overestimated. However, the uncertainties related to data heterogeneity in soil remain significant and are one of the most important components of total uncertainty in exposure assessment.

The method for addressing nondetects (less than detection limit values) also affects exposure point concentrations. The inclusion of the detection limit as a proxy value for nondetects tends to increase the reported mean concentrations and resultant uncertainty. The detection limits for most analyses were low relative to background or the appropriate soil concentration guidelines. The uncertainty associated with the incorporation of nondetects is considered small.

Direct exposures to gamma radiation was shown to be a major contributor to risk in future scenarios. The dose from radionuclides in site soils was modeled using RESRAD. However, the predicted doses do not match expected doses derived using exposure rate measurements at the site. Since definitive data do not exist for directly measured dose rates, the modelled doses were carried through the risk assessment without modification. Therefore, the effect of this uncertainty is considered high.

In the absence of measurements needed to assess the inhalation pathway at the site, air particulate concentrations and radon and progeny concentrations have been modeled to estimate exposure point concentrations. High uncertainty is associated with the exposures calculated for this pathway, which is significant because inhalation is generally a major contributor to radiological risks associated with the site. Therefore, the effect of this uncertainty on the exposure assessment is considered high.

4.1.3.2 Exposure assumptions

Assumptions used to identify scenarios and intake parameters for the exposure estimates are a source of uncertainty. Site-specific factors were used to select the scenario assumptions such as the extent of exposure (i.e., the exposure time, frequency, and duration) and to identify potential receptors. These assumptions use information on current land use and reasonable projections of future land use that consider the time frame of the assessment. The uncertainty in the scenarios developed for the current conditions is low because the assumptions reflect the actual site conditions.

Future site use is hypothetical but based on reasonable projections for land use within the time frame of this assessment. For example, it is reasonable to project that a commercial property on a main road next to and across the street from other commercial/industrial/residential area could either remain a commercial/industrial property or become a residential property. The

locations and durations associated with exposure to contaminants were considered reasonable for future commercial/residential use. The uncertainty in the selected scenarios is considered low.

The exposure pathways quantified in this baseline risk assessment were determined on the basis of the site conceptual model and related characterization data. The uncertainty associated with selected pathways for this assessment is low because site characterization data support the conceptual model.

Best professional judgment was used to define the variables used to estimate mean and reasonable maximum exposure (RME) exposures for the identified receptors. Intake parameters used in the exposure assessment were derived from data in the literature, including EPA guidelines. Since considerable information is available with respect to reasonable assumptions for intake parameters (e.g., inhalation rates), the related uncertainty is expected to be low. Furthermore, uncertainties associated with selecting values from the typical ranges identified for these parameters are not expected to significantly affect potential exposure estimates.

4.1.4 Toxicity Assessment

Standard dose conversion factors and risk estimates were used to estimate the carcinogenic hazards associated with radioactive contaminants. Health effects associated with radiation exposure have been studied for many years and are well known. The risk estimators used in this assessment are generally accepted by the scientific community as representing reasonable projections of the hazards associated with radiation exposure.

4.1.5 Risk Characterization

Most of the assumptions used in the characterization of risk tend to overestimate potential risks. Therefore, actual risks are most likely to be lower than those presented in this assessment. However, some of the procedures used and uncertainties inherent in the human health assessment process may tend to underestimate potential risks, including the use of standard dose conversion factors based on adult exposures for estimating radiation doses. The radiological dose conversion factors used in this assessment are based on the ICRP reference man. The reference man is an adult male weighing 70 kg (154 lb). ICRP selected such a standardized individual for their dosimetry models because their main concern is worker protection; the majority of radiation workers are adult males. Children are more susceptible to radiation exposure, and such effects are particularly significant for young children. Therefore, use of dose conversion factors derived for adult males may introduce some uncertainty into the risk assessment.

The estimation of health effects associated with radiation doses was based on lifetime-average risk estimators for all routes of exposure. These lifetime-average risk estimators

are appropriate because they reflect the likely conditions of exposure (i.e., any given age group could be exposed to the radiological contaminants). The uncertainty associated with the use of these average risk estimators rather than the multiple age-specific risk estimators to assess radiation toxicity in this baseline risk assessment is, therefore, low.

The limited characterization of airborne contamination could affect risk estimates. No airborne particulate or radon and progeny concentration measurements were made, and the estimated risks associated with airborne exposure could be either overestimated or underestimated as a result. The uncertainty could be expected to significantly affect the results of this assessment because the particulate inhalation pathway is a major contributor to the projected radiation exposure.

4.2 UNCERTAINTY IN CHEMICAL RISK ESTIMATES

4.2.1 Data

Chemical process operations conducted at the DWI 901 Site and Candora Road Area have limited documentation. There is conclusive evidence, either from historical information or from the chemical investigation during the RI, that uniquely associates the organic contaminants with the site.

Uncertainty in site sampling data is considered low because the sampling plans generally targeted appropriate analytes based on historical information, information about similar processes, and guidance. Reasonable certainty also is assumed because of the sample data validation and QA/QC procedures applied to sample analysis and data evaluation.

Site sampling data for evaluation of sediment is associated with low uncertainty due to the location and number of samples. Samples collected for background comparison were not included in this assessment because of the large uncertainties associated with these numbers.

The absence of on-site ambient air sampling for chemicals and radionuclides introduces additional uncertainty into this route of exposure.

4.2.2 Chemicals of Potential Concern

Uncertainty is inherent in the selection of COPCs for the baseline risk assessment. Eliminating contaminants in the COPC screening process can lead to lower estimates of potential health effects than inclusion of all analytes. The only chemicals excluded from the risk

assessment were essential nutrients. The uncertainty associated with the identification of potential COPCs in soil is moderate due to the potential exclusion of chemicals from the risk characterization because of the aggregation of soil data over the two areas.

Contaminants at the DWI 901 Site and in the Candora Road Area are potential sources of contamination to site groundwater. Groundwater data were very limited. Data were obtained from only four wells in one area of the site. The uncertainty associated with the selection of contaminants for groundwater is low because contaminants have been detected in the groundwater.

4.2.3 Exposure Assessment

Factors that can contribute to uncertainty in the exposure assessment include derivation of exposure point concentrations, assumptions for scenario development and intake parameters, and exposure pathways.

4.2.3.1 Exposure point concentrations

Data aggregation introduces moderate uncertainty into the development of exposure point concentrations. Given that assumptions on the distribution of the data are correct, there is a quantifiable degree of uncertainty about the actual spatial distribution of contaminants, that is, whether a site chosen at random would have a contaminant concentration above or below a given value. For example, the concentration in 95 of every 100 samples will, on average, not be greater than the UCL_{95} concentration. Also, because the estimated UCL_{95} concentrations were used to calculate exposure point concentrations, the estimates of risk from COPCs were conservative. Using UCL_{95} concentrations decreases the likelihood of underestimating the risk posed by each COPC, and it increases the likelihood of overestimating the risk. If the data do not fit well with the assumed distribution, the number of COPCs and their exposure concentrations could be overestimated or underestimated depending on how the actual data distribution differs from the assumed data distribution.

4.2.3.2 Exposure assumptions

Values assumed for exposure parameters (e.g., inhalation rate and exposure frequency) used in calculations for intakes were based primarily on EPA guidance (EPA 1990b, 1991b). These assumptions might result in underestimating or overestimating the intakes calculated for specific receptors depending on the accuracy of the assumptions relative to actual site conditions and uses. For example, a sediment ingestion rate of 200 mg/day was used for the RME child

wading in Goose Creek. The sediment ingestion rate is the default value for child soil ingestion. Both of these assumptions are conservative and may overestimate intake, and thus risk, for the wading scenario.

Because of the evolving nature of EPA's policy on quantifying the dermal pathways, there is uncertainty in the parameters (i.e., dermal absorption coefficients, permeability coefficients) necessary to calculate or estimate these pathways. Quantitative evaluation of the dermal pathway from soil was considered. The use of dermal absorption factors may result in an overestimation of risk, but it is not expected to affect the assessment significantly.

Dermal absorption was also assessed for chemicals leached into groundwater and contacted by showering or bathing. Quantitative evaluation of the dermal pathway from groundwater data was considered only for those chemicals for which permeability coefficient values were available (EPA 1992a).

The identification of potential receptors was based on site-specific reasonable current use and hypothetical future land use. Site-specific receptors were identified to the extent possible and exposure parameters were tailored to these receptors to minimize uncertainty in the postulated scenarios and exposure assessment.

4.2.4 Toxicity Assessment

Uncertainty also is inherent in the toxicity values used in characterizing the carcinogenic and noncarcinogenic risks. Such uncertainty is chemical-specific and is incorporated into the toxicity value during its development. For example, an uncertainty factor may be applied for interspecies and intrahuman variability for extrapolation from subchronic to chronic duration of exposure, or for epidemiological data limitations.

A number of identified COPCs are currently under EPA review with the possibility of changed reference doses, slope factors, or carcinogenic weight of evidence. Additional uncertainty in risk estimates is introduced when all COPCs do not have valid toxicity factors for use in quantitative estimates. Inhalation slope factors and reference doses in particular were largely unavailable for the COPCs in the particulate pathway. Inhalation slope factors are not available for several carcinogenic COPCs in soil. In addition, toxicity values could not be obtained for some COPCs, thereby precluding their inclusion in the quantitative risk estimates. The resulting risk estimates do not include the incremental chemical-specific risks from these COPCs and, therefore, may underestimate risk, although the magnitude of this underestimation is not quantifiable. However, some of the metals for which toxicity values are unavailable are

naturally occurring chemicals found throughout the region in concentrations similar to the DWI 901 Site. In addition, a single factor was used to estimate the risk for all PAHs and dioxin/furans, another potentially conservative assumption.

4.2.5 Risk Characterization

Some of the procedures used and uncertainties inherent in the human health assessment process may tend to underestimate potential risk. However, assumptions built into this baseline risk assessment tend to overestimate rather than underestimate potential risks, including conservative assumptions for the exposure scenarios. For example, contamination is assumed to remain constant over time. Actual concentrations may change over time, which would influence the intake and related risk values. Thus, actual risks are likely to be lower than those presented in this assessment.

For COPCs, oral reference doses were available for most of the toxicologically important chemicals, but few inhalation reference doses were available, precluding effective estimation of this pathway contribution to health hazard.

Although lead exposure causes significant toxic effects and lead may also be carcinogenic, toxicity factors are not available because they are under review by EPA. Recent draft guidance from EPA (1992a) suggests a quantitative method for estimating detrimental environmental lead levels using an uptake biokinetic model. This model predicts blood lead levels in the most sensitive populations (children 6 months to 7 years old) exposed to lead in air, dust, drinking water, soil, and paint. The calculated blood levels can then be compared to the adverse effects level of 10 μg/dL. Using the RME exposure point concentration for lead in soil and the nonlinear absorption model, calculated blood levels for children under 6 years of age were all greater than 10 μg/dL. Although this lead model is not applicable to adult employees, it is reasonable to expect exposure would be lower than that of resident children. The RME lead concentration in soil was 2,722 mg/kg, much higher than the interim soil cleanup level of 400 ppm (EPA 1995).

Finally, for this assessment, it was assumed that the toxic and carcinogenic effects of the COPCs are additive. This assumption could result in the underestimation of risks because concurrent exposure to several contaminants might have synergistic toxic effects (i.e., exposure to two of the COPCs concurrently might induce a greater toxic effect than that expected if the separate effects were simply added). Conversely, concurrent exposure to some of the COPCs might also mitigate the toxic effects of exposure to the individual contaminants.

5. PARAMETERS AND ASSUMPTIONS

This chapter contains parameters and assumptions used in the human health risk assessment, risk calculations, risk summary tables, and the results of the biokinetic uptake lead model.

Table C.4. Soil and sediment ingestion, DWI 901 Site, Knoxville, Tennessee

Parameter (unit)	Receptor default values used in intake equation					Reference
	Future employee	Current employee	Resident adult	Resident child	Adolescent trespasser	
Soil/sediment ingestion rate (mg/day)	Avg: 30 RME: 50	30 50	60 100	100 200	100 200	EPA 1991 EPA 1990
Fraction ingested from contaminated source (unitless)	1.0	1.0	1.0	1.0	1.0	EPA 1989
Exposure frequency (days/ year)	Avg: 250 RME: 250	125 125				Best professional judgment, assumes an employee worker 6 months/year
			Avg: 350 RME: 350	350 350		EPA 1989 allows for 2 weeks/year away from residence
					Avg: 7 RME: 45	EPA 1989 EPA 1995
Exposure duration (years)	Avg: 7 RME: 25	4 13				Best professional judgment, assumes an employee will work a portion of time at the DWI 901 Site
			Avg: 9 RME: 24			EPA 1989, national median time, 50th percentile and 90th percentile at one residence
				Avg: 6 RME: 6		Based on age classification
					Avg: 10 RME: 10	EPA 1995 EPA 1995
Body weight (kg)	70	70	70			EPA 1989, combined mean of male and female body weights
				15		EPA 1989, children 1–6 years old, 50th percentile
					45	EPA 1995

Table C.4. (continued)

Parameter (unit)	Receptor default values used in intake equation					Reference
	Future employee	Current employee	Resident adult	Resident child	Adolescent trespasser	
Carcinogen averaging time (days)	25,550	25,550	25,550	25,550	25,550	EPA 1989, equivalent to 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	Avg: 2,555 RME: 9,125	1,460 4,745	3,285 8,760	2,190 2,190	3,650 3,650	EPA 1989, exposure duration × 365 days/year

Equation for ingestion of chemicals in soil and sediment (EPA 1989):

$$Intake\ (mg/kg \cdot day) = \frac{C_s \times IR_s \times CF \times FI \times EF \times ED}{BW \times AT}$$

where

C_s = chemical concentration in soil or sediment (mg/kg)
IR_s = soil ingestion rate (mg soil/day)
CF = conversion factor (10^{-6} kg/mg)
FI = fraction ingested from contaminated source (unitless)
EF = exposure frequency (days/year)
ED = exposure duration (year)
BW = body weight (kg)
AT = averaging time (days)

Equation for ingestion of radionuclides in soil and sediment (Gilbert et al. 1989):

$$D_i = C_{soil,i} \times IR_s \times EF \times DCF_i \times CF_m$$

where

D_i = dose from radionuclide *i* (mrem/year)
$C_{soil,i}$ = soil concentration of radionuclide *i* (pCi/g)
IR_s = soil, sediment ingestion rate (mg/day)
EF = exposure frequency (days/year)
DCF_i = ingestion dose conversion factor for radionuclide *i* (mrem/pCi)
CF_m = conversion factor, 10^{-3} g/mg

Avg = average
EPA = U.S. Environmental Protection Agency
DWI = David Witherspoon, Inc.
g = gram
kg = kilogram
mg = milligram
mrem = millirem
pCi = picocurie
RME = reasonable maximum exposure

Table C.5. Groundwater ingestion, DWI 901 Site, Knoxville, Tennessee

Parameter (unit)	Receptor default values used in intake equation			Reference
	Employee	Resident adult	Resident child	
Groundwater ingestion rate (L/day)	Avg: NA RME: NA	1.4 2.0	0.5 1.0	EPA 1989, 50th and 90th percentile and EPA 1995
Fraction from contaminated source (unitless)	NA	1.0	1.0	EPA 1989
Exposure frequency (days/year)	Avg: NA RME: NA	350 350	Avg: 350 RME: 350	EPA 1989, allows for 2 weeks/year away from residence
Exposure duration (years)	Avg: NA RME: NA	9 30	Avg: 6 RME: 6	EPA 1989, national median time, 50th percentile and 90th percentile at one residence
Body weight (kg)	NA	70	15	EPA 1989
Carcinogen averaging time (days)	NA	25,550	25,550	EPA 1989, equivalent to 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	Avg: NA RME: NA	3,285 10,950	2,190 2,190	EPA 1989, exposure duration × 365 days/year

Equation for ingestion of chemicals in drinking water (EPA 1989):

$$Intake\ (mg/kg \cdot day) = \frac{C_{gw} \times IR_{gw} \times EF \times ED}{BW \times AT}$$

where

C_{gw} = chemical concentration in groundwater (mg/L)
IR_{gw} = water ingestion rate (L/day)
EF = exposure frequency (days/year)
ED = exposure duration (year)
BW = body weight (kg)
AT = averaging time (days)

Table C.5. (continued)

Equation for ingestion of chemicals in drinking water (EPA 1989):

$$D_i = C_{gw,i} \times IR_w \times EF \times DCF_i$$

where

D_i	= dose from radionuclide *i* (mrem/year)
$C_{gw,i}$	= concentration of radionuclide *i* (pCi/L)
IR_w	= water ingestion rate (L/day)
EF	= exposure frequency (days/year)
DCF_i	= ingestion dose conversion factor for radionuclide *i* (mrem/pCi)

Avg = average
DWI = David Witherspoon, Inc.
EPA = U.S. Environmental Protection Agency
gw = groundwater
kg = kilogram
L = liter
mg = milligram
mrem = millirem
NA = not applicable
pCi = picocurie
sw = surface water
RESRAD = Residual Radioactive Material Guidelines
RME = reasonable maximum exposure

Table C.6. Surface water ingestion, DWI 901 Site, Knoxville, Tennessee

Parameter (unit)	Value			Reference
	Resident adult	Resident child	Adolescent	
Surface water contact rate (L/hour)	NA	Avg: 0.025 RME: 0.050	0.005 0.01	EPA 1995
Exposure time (hours/day)	NA	1	1	Pathway specific
Exposure frequency (days/year)	NA	Avg: 7 RME: 45	7 45	EPA 1989 – EPA 1995
Exposure duration (years)	NA	Avg: 6 RME: 6		EPA 1990, based on age classification
			Avg: 10 RME: 10	EPA 1995 EPA 1995
Body weight (kg)	NA	15		EPA 1992, combined mean of male and female body weights adolescent to adult
			45	EPA 1995
Carcinogen averaging time (days)	NA	25,550	25,550	EPA 1991, equivalent to 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	NA	2,190	3,650	EPA 1991, exposure duration × 365 days/year

Equation for ingestion of chemicals in surface water (EPA 1989):

$$Intake\ (mg/kg \cdot day) = \frac{C_{sw} \times CR \times ET \times EF \times ED}{BW \times AT}$$

where

C_{sw} = chemical concentration in water (mg/L)
CR = contact rate (L/hour)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days); for noncarcinogens, AT = ED × 365 days/year; for carcinogens, AT = 70-year lifetime × 365 days/year

Table C.6. (continued)

Equation for ingestion of radionuclides in surface water for RESRAD (Gilbert et al., 1989):

$$D_i = C_{sw,i} \times IR_w \times EF \times DCF_i$$

where

D_i	= dose from radionuclide *i* (mrem/year)
$C_{sw,i}$	= concentration of radionuclide *i* in water (pCi/L)
IR_w	= water ingestion rate (L/event); from L/hour × hour/event
EF	= exposure frequency (events/year)
DCF_i	= ingestion dose conversion factor for radionuclide *i* (mrem/pCi)

Avg = average
DWI = David Witherspoon, Inc.
EPA = U.S. Environmental Protection Agency
kg = kilogram
L = liter
mg = milligram
mrem = millirem
NA = not applicable
pCi = picocurie
RESRAD = Residual Radioactive Materials Guidelines
RME = reasonable maximum exposure

Table C.7. Dermal contact with chemicals in groundwater, DWI 901 Site, Knoxville, Tennessee

Parameter (unit)	Value			Reference
	Employee	Resident adult	Resident child	
Skin surface area for contact (cm^2)	NA	Avg: 20,000 RME: 23,000	7,000 8,000	EPA 1992, based on 50th and 90th percentile
Exposure time (hours/event)	NA	Avg: 0.17 RME: 0.25	0.17 0.25	EPA 1992, based on 50th and 90th percentile
Exposure frequency (days/year)	NA	Avg: 350 RME: 350	Avg: 350 RME: 350	EPA 1991, assumes 2 weeks/year away from residence
Exposure duration (years)	NA	Avg: 9 RME: 30	Avg: 6 RME: 6	EPA 1989, based on 50th and 90th percentile
Body weight (kg)	NA	70	15	EPA 1989, combined mean of male and female body weights
Carcinogen averaging time (days)	NA	25,550	25,550	EPA 1989, equivalent to 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	NA	Avg: 3,285 RME: 10,950	2,190 2,190	EPA 1989, Exposure duration × 365 days/year

Equation for dermal contact with chemicals in water (EPA 1989):

$$Absorbed\ Dose\ (mg/kg \cdot day) = \frac{C_w \times SA \times PC \times ET \times ED \times EF \times CF}{BW \times AT}$$

where

C_w = chemical concentration in groundwater (mg/L)
SA = skin surface area for contact (cm^2)
PC = dermal permeability constant (cm/hour)
ET = exposure time (hours/day)
ED = exposure duration (years)
EF = exposure frequency (day/year)
CF = volumetric conversion factor (L/1,000 cm^3)
BW = body weight (kg)
AT = averaging time (days)

Avg = average
DWI = David Witherspoon, Inc.
cm = centimeter
EPA = U.S. Environmental Protection Agency
kg = kilogram
L = liter
mg = milligram
NA = not applicable
RME = reasonable maximum exposure

Table C.8. Dermal contact with chemicals in soil and sediment, DWI 901 Site, Knoxville, Tennessee

Parameter (unit)	Value					Reference
	Future employee	Current employee	Resident adult	Resident child	Adolescent	
Skin surface area for contact (cm^2)	Avg: 2,000 RME: 5,300	2,000 5,300	5,000 5,800	1,750 2,000	4,300 4,330	EPA 1992, based on 50th percentile
Exposure frequency (events/year)	250	125				EPA 1989, number of days employee works on site per year
			350	350		EPA 1991, assumes 2 weeks/year away from residence
					Avg: 7 RME: 45	EPA 1995
Exposure duration (years)	Avg: 7 RME: 25		9 30	6 6		EPA 1989, based on 50th and 90th percentile
					10 10	EPA 1995 EPA 1995
		4 13				Best professional judgment
Body weight (kg)	70	70	70	15		EPA 1989, combined mean of male and female body weights
Adherence factor (mg/cm^2)	Avg: 0.2 RME: 1.0	Avg: 0.2 RME: 1.0	0.2 1.0	0.2 1.0	0.2 1.0	EPA 1995
Carcinogen averaging time (days)	25,550	25,550	25,550	25,550	25,550	EPA 1989, equivalent to 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	Avg: 2,555 RME: 9,125	1,460 4,745	3,285 10,950	2,190 2,190	3,650 3,650	EPA 1989, exposure duration 365 days/year

Table C.8. (continued)

Equation for dermal contact with chemicals in soil (EPA 1989):

$$Absorbed\ dose\ (mg/kg \cdot day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where

CS	= chemical concentration in soil (mg/kg)
CF	= conversion factor (10^{-6} kg/mg)
SA	= skin surface area for contact (cm^2/event)
AF	= soil to skin adherence factor (mg/cm^2)
ABS	= absorption factor (unitless) (chemical-specific)
EF	= exposure frequency (events/year)
ED	= exposure duration (years)
BW	= body weight (kg)
AT	= averaging time (days)

Avg = average
cm = centimeter
DWI = David Witherspoon, Inc.
EPA = U.S. Environmental Protection Agency
kg = kilogram
mg = milligram
NA = not applicable
RME = reasonable maximum exposure

Table C.9. Inhalation of particulates, DWI 901 Site, Knoxville, Tennessee

Parameter	Value					Reference
	Future employee	Current employee	Resident adult	Resident child	Adolescent	
Inhalation rate of airborne particulates (m^3/day)	Avg: 0.625 RME: 0.833	0.625 0.833	0.625 0.833	0.625 0.833	0.625 0.833	EPA 1990, based on combination inhalation rates for light, moderate, and heavy activity for an 8-hour workday
Fraction from contaminated source (unitless)	1.0	1.0	1.0	1.0	1.0	EPA 1989
Exposure time outdoors (hours/day)	Avg: 1 RME: 0.5		2 4	2 4	2 4	Based on current activity
		Avg: 4 RME: 8				Based on current activity Reference
Exposure frequency (days/year)	Avg: 250 RME:	125 125	350 350	350 350		EPA 1989
					Avg: 7 RME: 45	EPA 1989 and 1995
Exposure duration (years)	Avg: 7 RME: 25		9 30	6 6		EPA 1990, based on age classification
		Avg: 4 RME: 13				Best professional judgment
					avg: 10 RME: 10	EPA 1995 EPA 1995
Body weight (kg)	Adult: 70	70	70	15		EPA 1989
					45	EPA 1995
Carcinogen averaging time (days)	25,550	25,550	25,550	25,550	25,550	EPA 1989, equivalent to a 70-year lifetime exposure at 365 days/year
Noncarcinogen averaging time (days)	Avg: 2,555 RME: 9,125	1,460 4,745	3,285 10,950	2,190 2,190	3,650 3,650	EPA 1989, exposure duration × 365 day/year

Table C.9. (continued)

Parameter	Value					Reference
	Future employee	Current employee	Resident adult	Resident child	Adolescent	
Equation for inhalation (chemicals) (EPA 1989):						

$$Intake\ (mg/kg - day) = \frac{C_{air} \times IR \times ET \times EF \times ED}{BW \times AT}$$

where

C_{air} = contaminant concentration in air (mg/m^3), derived from chemical concentration in soils
IR = inhalation rate (m^3/hour)
ET = exposure time (hours/day)
EF = exposure frequency (days/year)
ED = exposure duration (year)
BW = body weight (kg)
AT = averaging time (days)

$$C_{air} = \frac{C_s}{PEF}$$

where

C_{air} = concentration in air (mg/m^3)
C_s = concentration in soil (mg/kg)
PEF = particulate emission factor (6.8×10^8 m^3/kg) (EPA 1994)

Avg = average
DWI = David Witherspoon, Inc.
EPA = U.S. Environmental Protection Agency
kg = kilogram
m = meter
mg = milligram
RME = reasonable maximum exposure

Table C.10. Risk from soil ingestion for a future adult resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	1.9E-05	5.4E-05	0.048359589	0.135965753	2.5E-06	1.9E-05	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	7.9E-06	1.8E-05	0.026290411	0.05843379	1.0E-06	6.0E-06	1.5E-06	9.0E-06
Barium	3.1E+02	5.7E+02	2.5E-04	7.8E-04	0.003641295	0.011167162	3.3E-05	2.7E-04	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	4.6E-07	9.5E-07	9.20548E-05	0.000190685	5.9E-08	3.3E-07	2.5E-07	1.4E-06
Cadmium	1.6E+01	4.1E+01	1.3E-05	5.6E-05	0.013202466	0.056164384	1.7E-06	1.9E-05	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	1.9E-04	4.0E-04	0.038410027	0.079469041	2.5E-05	1.4E-04	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	8.3E-04	3.7E-03	no toxicity value	no toxicity value	1.1E-04	1.3E-03	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	2.2E-03	5.5E-03	0.043527337	0.11036663	2.8E-04	1.9E-03	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	8.0E-05	6.8E-04	0.265928767	2.261406393	1.0E-05	2.3E-04	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	3.2E-03	1.9E-02	0.010793033	0.064384082	4.2E-04	6.6E-03	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	4.2E-04	2.8E-03	0.140547945	0.941552511	5.4E-05	9.7E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	2.2E-06	4.6E-06	no toxicity value	no toxicity value	2.8E-07	1.6E-06	2.0E-07	1.2E-06
Benzo(a)pyrene	2.5E+00	3.3E+00	2.1E-06	4.5E-06	no toxicity value	no toxicity value	2.7E-07	1.5E-06	1.9E-06	1.1E-05
Benzo(b)fluoranthene	2.8E+00	4.3E+00	2.3E-06	5.9E-06	no toxicity value	no toxicity value	3.0E-07	2.0E-06	2.2E-07	1.5E-06
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	6.0E-07	1.4E-06	1.98999E-05	4.65485E-05	7.7E-08	4.8E-07	5.6E-07	3.5E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	1.5E-06	2.9E-06	5.00834E-06	9.72259E-06	1.9E-07	1.0E-06	1.4E-07	7.3E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	3.8E-12	1.9E-11	no toxicity value	no toxicity value	4.8E-13	6.6E-12	7.3E-08	9.9E-07
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	1.4E-12	6.0E-12	no toxicity value	no toxicity value	1.8E-13	2.1E-12	2.6E-08	3.1E-07
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	1.9E-12	5.5E-12	no toxicity value	no toxicity value	2.4E-13	1.9E-12	3.7E-08	2.8E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	7.9E-13	2.5E-12	no toxicity value	no toxicity value	1.0E-13	8.5E-13	1.5E-08	1.3E-07
2,3,7,8-TCDF	3.5E-06	6.2E-06	2.8E-12	8.5E-12	no toxicity value	no toxicity value	3.7E-13	2.9E-12	5.5E-08	4.4E-07
OCDD	2.9E-06	9.4E-06	2.4E-12	1.3E-11	no toxicity value	no toxicity value	3.1E-13	4.4E-12	4.6E-08	6.6E-07
Aroclor-1242	1.0E+01	35.23419	8.3E-06	4.8E-05	no toxicity value	no toxicity value	1.1E-06	1.7E-05	8.3E-06	1.3E-04
Aroclor-1248	6.0E+00	3.5E+01	4.9E-06	4.7E-05	no toxicity value	no toxicity value	6.3E-07	1.6E-05	4.9E-06	1.3E-04
Aroclor-1254	1.0E+01	2.8E+01	8.4E-06	3.8E-05	0.419614068	1.892292466	1.1E-06	1.3E-05	8.3E-06	1.0E-04
Aroclor-1260	4.1E+00	2.0E+01	3.4E-06	2.7E-05	no toxicity value	no toxicity value	4.4E-07	9.3E-06	3.4E-06	7.2E-05
Hazard Index					1	6				
Total Cancer Risk									3E-05	5E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.11. Risk from inhalation of particulates in soil for a future adult resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (Intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (Intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	5.9E-10	2.7E-09	no toxicity value	no toxicity value	7.6E-11	9.2E-10	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	2.4E-10	8.6E-10	no toxicity value	no toxicity value	3.1E-11	3.0E-10	1.6E-09	1 5E-08
Barium	3.1E+02	5.7E+02	7.8E-09	3.8E-08	5.47E-05	2.69E-04	1.0E-09	1.3E-08	no toxicity value	no toxicity value
Beryllium	5 6E-01	7.0E-01	1.4E-11	4.7E-11	no toxicity value	no toxicity value	1.8E-12	1.6E-11	1.5E-11	1 3E-10
Cadmium	1 6E+01	4.1E+01	4.1E-10	2.8E-09	no toxicity value	no toxicity value	5.2E-11	9.5E-10	3.2E-10	5 8E-09
Chromium (VI)	2 3E+02	2.9E+02	5.9E-09	2.0E-08	no toxicity value	no toxicity value	7.6E-10	6.7E-09	3.1E-08	2 7E-07
Lead	1 0E+03	2.7E+03	2.5E-08	1.8E-07	no toxicity value	no toxicity value	3.3E-09	6.3E-08	no toxicity value	no toxicity value
Manganese	2 6E+03	4.0E+03	6.7E-08	2.7E-07	5.84E-04	2.37E-03	8.6E-09	9.3E-08	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	2.4E-09	3.3E-08	2.86E-05	3.89E-04	3.1E-10	1.1E-08	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	1.3E-08	1.4E-07	no toxicity value	no toxicity value	1.7E-09	4.8E-08	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	9.9E-08	9.5E-07	no toxicity value	no toxicity value	1.3E-08	3.3E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	6.7E-11	2.3E-10	no toxicity value	no toxicity value	8.6E-12	7.8E-11	no toxicity value	no toxicity value
Benzo(a)pyrene	2.5E+00	3.3E+00	6.3E-11	2.2E-10	no toxicity value	no toxicity value	8.1E-12	7.6E-11	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.8E+00	4.3E+00	7.1E-11	2.9E-10	no toxicity value	no toxicity value	9.1E-12	9.9E-11	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	1.8E-11	6.9E-11	no toxicity value	no toxicity value	2.4E-12	2.4E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1 8E+00	2.1E+00	4.6E-11	1.4E-10	no toxicity value	no toxicity value	5.9E-12	4.9E-11	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	1.2E-16	9.4E-16	no toxicity value	no toxicity value	1.5E-17	3.2E-16	2.2E-12	4 8E-11
1,2,3,4,6,7,8-HpCDF	1 7E-06	4.4E-06	4.2E-17	3.0E-16	no toxicity value	no toxicity value	5.4E-18	1.0E-16	8.1E-13	1 5E-11
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	5.8E-17	2.7E-16	no toxicity value	no toxicity value	7.5E-18	9.2E-17	1.1E-12	1 4E-11
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	2.4E-17	1.2E-16	no toxicity value	no toxicity value	3.1E-18	4.2E-17	4.7E-13	6 2E-12
2,3,7,8-TCDF	3.5E-06	6.2E-06	8.7E-17	4.2E-16	no toxicity value	no toxicity value	1.1E-17	1.4E-16	1.7E-12	2 2E-11
OCDD	2.9E-06	9.4E-06	7.3E-17	6.3E-16	no toxicity value	no toxicity value	9.4E-18	2.2E-16	1.4E-12	3 3E-11
Aroclor-1242	1 0E+01	35.23419	2.6E-10	2.4E-09	no toxicity value	no toxicity value	3.3E-11	8.1E-10	no toxicity value	no toxicity value
Aroclor-1248	6.0E+00	3.5E+01	1.5E-10	2 3E-09	no toxicity value	no toxicity value	1.9E-11	8.0E-10	no toxicity value	no toxicity value
Aroclor-1254	1.0E+01	2.8E+01	2.6E-10	1.9E-09	no toxicity value	no toxicity value	3.3E-11	6.4E-10	no toxicity value	no toxicity value
Aroclor-1260	4.1E+00	2.0E+01	1.0E-10	1.3E-09	no toxicity value	no toxicity value	1.3E-11	4.6E-10	no toxicity value	no toxicity value
Hazard Index					0 0007	0.0030				
Total Cancer Risk									3E-08	3E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.12. Risk from dermal contact with chemicals in soil for a future adult resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	3.2E-07	3.2E-06	0.040299658	0.394300685	4.1E-08	1.1E-06	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	1.3E-07	1.0E-06	0.0011	0.0083	1.7E-08	3.5E-07	6.2E-08	1.3E-06
Barium	3.1E+02	5.7E+02	4.2E-06	4.5E-05	0.0009	0.0093	5.5E-07	1.6E-05	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	7.7E-09	5.5E-08	0.0002	0.0011	9.9E-10	1.9E-08	4.2E-07	8.2E-06
Cadmium	1.6E+01	4.1E+01	2.2E-07	3.3E-06	0.0220	0.3258	2.8E-08	1.1E-06	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	3.2E-06	2.3E-05	0.0320	0.2305	4.1E-07	7.9E-06	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	1.4E-05	2.2E-04	no toxicity value	no toxicity value	1.8E-06	7.4E-05	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	3.6E-05	3.2E-04	0.0007	0.0064	4.7E-06	1.1E-04	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	1.3E-06	3.9E-05	0.0633	1.87	1.7E-07	1.3E-05	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	7.0E-06	1.6E-04	0.0028	0.06	9.0E-07	5.6E-05	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	5.4E-05	1.1E-03	0.0009	0.0187	6.9E-06	3.8E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	3.6E-07	2.7E-06	no toxicity value	no toxicity value	4.7E-08	9.2E-07	7.1E-09	2.2E-06
Benzo(a)pyrene	2.5E+00	3.3E+00	3.4E-07	2.6E-06	no toxicity value	no toxicity value	4.4E-08	9.0E-07	6.7E-08	2.2E-05
Benzo(b)fluoranthene	2.8E+00	4.3E+00	3.9E-07	3.4E-06	no toxicity value	no toxicity value	5.0E-08	1.2E-06	7.5E-09	2.8E-06
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	9.9E-08	8.1E-07	no toxicity value	no toxicity value	1.3E-08	2.8E-07	3.0E-07	6.5E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	2.5E-07	1.7E-06	no toxicity value	no toxicity value	3.2E-08	5.8E-07	7.7E-08	1.4E-06
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	1.9E-12	3.3E-11	no toxicity value	no toxicity value	2.4E-13	1.1E-11	7.3E-08	3.4E-06
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	6.8E-13	1.0E-11	no toxicity value	no toxicity value	8.8E-14	3.6E-12	2.6E-08	1.1E-06
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	9.5E-13	9.5E-12	no toxicity value	no toxicity value	1.2E-13	3.3E-12	3.7E-08	9.8E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	3.9E-13	4.3E-12	no toxicity value	no toxicity value	5.1E-14	1.5E-12	1.5E-08	4.4E-07
2,3,7,8-TCDF	3.5E-06	6.2E-06	1.4E-12	1.5E-11	no toxicity value	no toxicity value	1.8E-13	5.1E-12	5.5E-08	1.5E-06
OCDD	2.9E-06	9.4E-06	1.2E-12	2.2E-11	no toxicity value	no toxicity value	1.5E-13	7.7E-12	4.6E-08	2.3E-06
Aroclor-1242	1.0E+01	35.23419	8.3E-06	1.7E-04	no toxicity value	no toxicity value	1.1E-06	5.8E-05	9.2E-06	4.9E-04
Aroclor-1248	6.0E+00	3.5E+01	4.9E-06	1.6E-04	no toxicity value	no toxicity value	6.3E-07	5.7E-05	5.4E-06	4.8E-04
Aroclor-1254	1.0E+01	2.8E+01	8.4E-06	1.3E-04	0.4662	7.3169	1.1E-06	4.5E-05	9.2E-06	3.9E-04
Aroclor-1260	4.1E+00	2.0E+01	3.4E-06	9.5E-05	no toxicity value	no toxicity value	4.4E-07	3.2E-05	3.7E-06	2.8E-04
Hazard Index					0.6	10				
Total Cancer Risk									3E-05	2E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.13. Risk from groundwater ingestion for a future adult resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in groundwater (mg/L) Mean	RME	Intake values (mg/kg-day) Mean	RME	Noncarcinogenic effects Hazard quotient (intake/RfD) Mean	RME	Intake values (mg/kg-day) Mean	RME	Carcinogenic effects Excess lifetime cancer risk (intake x SF) Mean	RME
Antimony	3.2E-02	6.0E-02	6.1E-04	1.7E-03	1.5150685	4.1369863	7.8E-05	5.7E-04	no toxicity value	no toxicity value
Barium	2.8E-01	6.9E-01	5.4E-03	1.9E-02	0.0774658	0.2716243	7.0E-04	6.5E-03	no toxicity value	no toxicity value
Beryllium	2.9E-03	6.9E-03	5.5E-05	1.9E-04	0.0109315	0.0378082	7.0E-06	6.5E-05	3.0E-05	2.8E-04
Chromium (VI)	3.5E-02	1.2E-01	6.8E-04	3.4E-03	0.1353973	0.6794521	8.7E-05	1.2E-03	no toxicity value	no toxicity value
Manganese (water)	4.0E+00	9.0E+00	7.7E-02	2.5E-01	1.5342466	4.9315068	9.9E-03	8.5E-02	no toxicity value	no toxicity value
Mercury	2.4E-02	6.0E-02	4.7E-04	1.6E-03	1.5612877	5.4536073	6.0E-05	5.6E-04	no toxicity value	no toxicity value
Nickel	5.3E-02	1.5E-01	1.0E-03	4.2E-03	0.0508938	0.2082192	1.3E-04	1.4E-03	no toxicity value	no toxicity value
Vanadium	3.7E-02	1.3E-01	7.1E-04	3.6E-03	0.1020548	0.5088063	9.2E-05	1.2E-03	no toxicity value	no toxicity value
Zinc	6.0E-01	1.4E+00	1.2E-02	3.7E-02	0.0384201	0.1244066	1.5E-03	1.3E-02	no toxicity value	no toxicity value
Hazard Index					5	16				
Summed Cancer Risk									3E-05	3E-04

DWI = David Witherspoon, Inc.
kg = kilogram
L = liter
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.14. Risk from dermal contact with groundwater for a future adult resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in groundwater (mg/L)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.2E-02	6.0E-02	1.5E-06	4 8E-06	0.1839726	0.5946918	1.9E-07	1.6E-06	no toxicity value	no toxicity value
Barium	2.8E-01	6.9E-01	1 3E-05	5 5E-05	0.0026876	0.0111560	1.7E-06	1.9E-05	no toxicity value	no toxicity value
Beryllium	2.9E-03	6 9E-03	1 3E-07	5.4E-07	0.0026548	0.0108699	1.7E-08	1.9E-07	7 3E-06	8.0E-05
Chromium (VI)	3 5E-02	1 2E-01	1 6E-06	9 8E-06	0.0164411	0.0976712	2.1E-07	3.3E-06	no toxicity value	no toxicity value
Manganese (water)	4.0E+00	9.0E+00	1 9E-04	7 1E-04	0.0037260	0.0141781	2.4E-05	2.4E-04	no toxicity value	no toxicity value
Mercury	2.4E-02	6.0E-02	1.1E-06	4.7E-06	0.0541671	0.2239874	1.5E-07	1.6E-06	no toxicity value	no toxicity value
Nickel	5.3E-02	1 5E-01	2 5E-06	1 2E-05	0.0004578	0.0022171	3.2E-07	4.1E-06	no toxicity value	no toxicity value
Vanadium	3.7E-02	1 3E-01	1.7E-06	1.0E-05	0.0247847	0.1462818	2.2E-07	3.5E-06	no toxicity value	no toxicity value
Zinc	6.0E-01	1.4E+00	2.8E-05	1.1E-04	0.0004665	0.0017883	3.6E-06	3.7E-05	no toxicity value	no toxicity value
Hazard Index					0.3	1				
Total Cancer Risk									7E-06	8E-05

DWI = David Witherspoon, Inc.
kg = kilogram
L = liter
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.15. Risk from sediment ingestion for a future adult resident while on the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1 0E+01	1 4E+01	8.5E-06	1.9E-05	0.021199315	0.047945205	1.1E-06	6.6E-06	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	5.5E-06	1.2E-05	0.018328767	0.038949772	7.1E-07	4.0E-06	1.1E-06	6.0E-06
Beryllium	7.7E-01	9.3E-01	6.3E-07	1.3E-06	0.000125918	0.000254247	8.1E-08	4.4E-07	3.5E-07	1.9E-06
Chromium (VI)	2.9E+01	4.7E+01	2.4E-05	6.4E-05	0.004780274	0.012854247	3.1E-06	2.2E-05	no toxicity value	no toxicity value
Manganese	2.6E+03	7.3E+03	2.1E-03	1.0E-02	0.042494959	0.200966384	2.7E-04	3.4E-03	no toxicity value	no toxicity value
Mercury	1 8E+00	7.0E+00	1.4E-06	9.6E-06	0.004810959	0.03196347	1.9E-07	3.3E-06	no toxicity value	no toxicity value
Benzo(a)anthracene	8 4E-01	1.6E+00	6.9E-07	2.2E-06	no toxicity value	no toxicity value	8.9E-08	7.5E-07	6.5E-08	5.5E-07
Benzo(a)pyrene	5 7E-01	1 2E+00	4.7E-07	1 7E-06	no toxicity value	no toxicity value	6.1E-08	5.7E-07	4.4E-07	4.2E-06
Benzo(b)fluoranthene	2 3E+00	4.6E+00	1.9E-06	6 3E-06	no toxicity value	no toxicity value	2.4E-07	2.2E-06	1.8E-07	1.6E-06
Aroclor-1254	1.0E+00	4.0E+00	8.3E-07	5.5E-06	0.041667822	0.273972603	1.1E-07	1.9E-06	8.3E-07	1 4E-05
Aroclor-1260	7 4E-01	2 7E+00	6.1E-07	3.7E-06	no toxicity value	no toxicity value	7.8E-08	1.3E-06	6.0E-07	9.8E-06
Hazard Index					0.1	0 6				
Cancer Risk									4E-06	4E-05

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.16. Risk from dermal contact with sediment for an adult wading in Goose Creek while on the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1.0E+01	1.4E+01	1.4E-07	1.1E-06	0.0177	0.1390	1.8E-08	3.8E-07	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	9.2E-08	6.8E-07	0.0007	0.0055	1.2E-08	2.3E-07	4.3E-08	8.5E-07
Beryllium	7.7E-01	9.3E-01	1.0E-08	7.4E-08	0.0002	0.0015	1.3E-09	2.5E-08	5.8E-07	1.1E-05
Chromium (VI)	2.9E+01	4.7E+01	4.0E-06	3.7E-05	0.0040	0.0373	5.1E-07	1.3E-05	no toxicity value	no toxicity value
Manganese	2.6E+03	7.3E+03	3.5E-05	5.8E-04	0.0007	0.0117	4.6E-06	2.0E-04	no toxicity value	no toxicity value
Mercury	1.8E+00	7.0E+00	2.4E-08	5.6E-07	0.0011	0.0265	3.1E-09	1.9E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	8.4E-01	1.6E+00	1.2E-07	1.3E-06	no toxicity value	no toxicity value	1.5E-08	4.4E-07	3.6E-08	1.0E-06
Benzo(a)pyrene	5.7E-01	1.2E+00	7.9E-08	9.7E-07	no toxicity value	no toxicity value	1.0E-08	3.3E-07	2.4E-07	8.0E-06
Benzo(b)fluoranthene	2.3E+00	4.6E+00	3.2E-07	3.7E-06	no toxicity value	no toxicity value	4.1E-08	1.3E-06	9.7E-08	3.0E-06
Aroclor-1254	1.0E+00	4.0E+00	8.3E-07	1.9E-05	0.0463	1.0594	1.1E-07	6.5E-06	9.2E-07	5.6E-05
Aroclor-1260	7.4E-01	2.7E+00	6.1E-07	1.3E-05	no toxicity value	no toxicity value	7.8E-08	4.4E-06	6.7E-07	3.8E-05
Hazard Index					0.07	1				
Total Cancer Risk									3E-06	1E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.17. Risk from soil ingestion for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	1.5E-04	5.1E-04	0.376130137	1.269013699	1.3E-05	4.4E-05	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	6.1E-05	1.6E-04	0.204480974	0.54538204	5.3E-06	1.4E-05	7.9E-06	2.1E-05
Barium	3.1E+02	5.7E+02	2.0E-03	7.3E-03	0.028321187	0.104226849	1.7E-04	6.3E-04	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	3.6E-06	8.9E-06	0.000715982	0.001779726	3.1E-07	7.6E-07	1.3E-06	3.3E-06
Cadmium	1.6E+01	4.1E+01	1.0E-04	5.2E-04	0.102685845	0.524200913	8.8E-06	4.5E-05	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	1.5E-03	3.7E-03	0.298744658	0.74171105	1.3E-04	3.2E-04	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	6.4E-03	3.5E-02	no toxicity value	no toxicity value	5.5E-04	3.0E-03	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	1.7E-02	5.2E-02	0.338545954	1.030088548	1.5E-03	4.4E-03	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	6.2E-04	6.3E-03	2.068334855	21.10645967	5.3E-05	5.4E-04	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	3.3E-03	2.6E-02	1.093150685	8.78782344	2.8E-04	2.3E-03	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	2.5E-02	1.8E-01	0.083945811	0.6009181	2.2E-03	1.5E-02	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	1 7E-05	4.3E-05	no toxicity value	no toxicity value	1.5E-06	3.7E-06	1.1E-06	2.7E-06
Benzo(a)pyrene	2 5E+00	3.3E+00	1.6E-05	4.2E-05	no toxicity value	no toxicity value	1.4E-06	3.6E-06	1.0E-05	2.6E-05
Benzo(b)fluoranthene	2 8E+00	4.3E+00	1.8E-05	5.5E-05	no toxicity value	no toxicity value	1 5E-06	4.7E-06	1.1E-06	3.4E-06
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	4.6E-06	1.3E-05	0.000154777	0.000434453	4.0E-07	1.1E-06	2.9E-06	8.2E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	1.2E-05	2.7E-05	3.89537E-05	9.07442E-05	1.0E-06	2.3E-06	7.3E-07	1.7E-06
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	2.9E-11	1.8E-10	no toxicity value	no toxicity value	2.5E-12	1.5E-11	3.8E-07	2.3E-06
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	1.1E-11	5.6E-11	no toxicity value	no toxicity value	9.1E-13	4.8E-12	1.4E-07	7.2E-07
1,2,3,4,7,8-HxCDF	2 3E-06	4.0E-06	1.5E-11	5.1E-11	no toxicity value	no toxicity value	1.3E-12	4.4E-12	1.9E-07	6.6E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	6.1E-12	2.3E-11	no toxicity value	no toxicity value	5.3E-13	2.0E-12	7.9E-08	3.0E-07
2,3,7,8-TCDF	3.5E-06	6.2E-06	2.2E-11	8.0E-11	no toxicity value	no toxicity value	1.9E-12	6.8E-12	2.8E-07	1.0E-06
OCDD	2.9E-06	9.4E-06	1.9E-11	1.2E-10	no toxicity value	no toxicity value	1.6E-12	1.0E-11	2.4E-07	1.5E-06
Aroclor-1242	1.0E+01	35.23419	6.5E-05	4.5E-04	no toxicity value	no toxicity value	5.6E-06	3.9E-05	4.3E-05	3.0E-04
Aroclor-1248	6.0E+00	3.5E+01	3.8E-05	4.4E-04	no toxicity value	no toxicity value	3.3E-06	3.8E-05	2.5E-05	2.9E-04
Aroclor-1254	1.0E+01	2.8E+01	6.5E-05	3.5E-04	3.263664977	17.66139635	5.6E-06	3.0E-05	4.3E-05	2.3E-04
Aroclor-1260	4.1E+00	2.0E+01	2.6E-05	2.5E-04	no toxicity value	no toxicity value	2.3E-06	2.2E-05	1.7E-05	1.7E-04
Hazard Index					8	52				
Total Cancer Risk									2E-04	1E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.18. Risk from inhalation of particulates in soil for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	2.8E-09	1.2E-08	no toxicity value	no toxicity value	2.4E-10	1.1E-09	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	1.1E-09	4.0E-09	no toxicity value	no toxicity value	9.7E-11	3.4E-10	4.8E-09	1.7E-08
Barium	3.1E+02	5.7E+02	3.6E-08	1.8E-07	2.55E-04	1.25E-03	3.1E-09	1.5E-08	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	6.6E-11	2.2E-10	no toxicity value	no toxicity value	5.6E-12	1.9E-11	4.7E-11	1.6E-10
Cadmium	1.6E+01	4.1E+01	1.9E-09	1.3E-08	no toxicity value	no toxicity value	1.6E-10	1.1E-09	9.9E-10	6.7E-09
Chromium (VI)	2.3E+02	2.9E+02	2.7E-08	9.1E-08	no toxicity value	no toxicity value	2.4E-09	7.8E-09	9.7E-08	3.2E-07
Lead	1.0E+03	2.7E+03	1.2E-07	8.5E-07	no toxicity value	no toxicity value	1.0E-08	7.3E-08	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	3.1E-07	1.3E-06	2.73E-03	1.11E-02	2.7E-08	1.1E-07	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	1.1E-08	1.6E-07	1.33E-04	1.81E-03	9.8E-10	1.3E-08	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	6.0E-08	6.5E-07	no toxicity value	no toxicity value	5.2E-09	5.5E-08	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	4.6E-07	4.4E-06	no toxicity value	no toxicity value	4.0E-08	3.8E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	3.1E-10	1.1E-09	no toxicity value	no toxicity value	2.7E-11	9.1E-11	no toxicity value	no toxicity value
Benzo(a)pyrene	2.5E+00	3.3E+00	3.0E-10	1.0E-09	no toxicity value	no toxicity value	2.5E-11	8.9E-11	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.8E+00	4.3E+00	3.3E-10	1.3E-09	no toxicity value	no toxicity value	2.8E-11	1.2E-10	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	8.5E-11	3.2E-10	no toxicity value	no toxicity value	7.3E-12	2.7E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	2.2E-10	6.7E-10	no toxicity value	no toxicity value	1.8E-11	5.7E-11	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	5.4E-16	4.4E-15	no toxicity value	no toxicity value	4.6E-17	3.8E-16	6.9E-12	5.6E-11
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	2.0E-16	1.4E-15	no toxicity value	no toxicity value	1.7E-17	1.2E-16	2.5E-12	1.8E-11
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	2.7E-16	1.3E-15	no toxicity value	no toxicity value	2.3E-17	1.1E-16	3.5E-12	1.6E-11
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	1.1E-16	5.6E-16	no toxicity value	no toxicity value	9.7E-18	4.8E-17	1.5E-12	7.3E-12
2,3,7,8-TCDF	3.5E-06	6.2E-06	4.1E-16	2.0E-15	no toxicity value	no toxicity value	3.5E-17	1.7E-16	5.2E-12	2.5E-11
OCDD	2.9E-06	9.4E-06	3.4E-16	2.9E-15	no toxicity value	no toxicity value	2.9E-17	2.5E-16	4.4E-12	3.8E-11
Aroclor-1242	1.0E+01	35.23419	1.2E-09	1.1E-08	no toxicity value	no toxicity value	1.0E-10	9.5E-10	no toxicity value	no toxicity value
Aroclor-1248	6.0E+00	3.5E+01	7.0E-10	1.1E-08	no toxicity value	no toxicity value	6.0E-11	9.3E-10	no toxicity value	no toxicity value
Aroclor-1254	1.0E+01	2.8E+01	1.2E-09	8.7E-09	no toxicity value	no toxicity value	1.0E-10	7.4E-10	no toxicity value	no toxicity value
Aroclor-1260	4.1E+00	2.0E+01	4.8E-10	6.2E-09	no toxicity value	no toxicity value	4.2E-11	5.3E-10	no toxicity value	no toxicity value
Hazard Index					0.003	0.01				
Total Cancer Risk									1E-07	3E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.19. Risk from dermal contact with chemicals in soil for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	5.3E-07	5.1E-06	0.065822774	0.634506849	4.5E-08	4.4E-07	no toxicity value	no toxicity value
Arsenic	9.6E+00	1 3E+01	2.1E-07	1.6E-06	0.001745569	0.013302001	1.8E-08	1.4E-07	6.7E-08	5.1E-07
Barium	3.1E+02	5.7E+02	6.9E-06	7.3E-05	0.001416059	0.01488955	5.9E-07	6.3E-06	no toxicity value	no toxicity value
Beryllium	5 6E-01	7 0E-01	1.3E-08	8.9E-08	0.000250594	0.001779726	1.1E-09	7.6E-09	4.6E-07	3.3E-06
Cadmium	1.6E+01	4.1E+01	3.6E-07	5 2E-06	0.035940046	0.524200913	3.1E-08	4.5E-07	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	5.2E-06	3.7E-05	0.052280315	0.370855525	4.5E-07	3.2E-06	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	2.3E-05	3.5E-04	no toxicity value	no toxicity value	1.9E-06	3.0E-05	no toxicity value	no toxicity value
Manganese	2.6E+03	4 0E+03	5.9E-05	5.2E-04	0.0012	0.010300885	5.1E-06	4.4E-05	no toxicity value	no toxicity value
Mercury	9 7E+01	5 0E+02	2.2E-06	6 3E-05	0.103416743	3.015208524	1.9E-07	5.4E-06	no toxicity value	no toxicity value
Uranium	5 1E+02	2.1E+03	1 1E-05	2 6E-04	0.004501209	0.103386158	9.8E-07	2.3E-05	no toxicity value	no toxicity value
Zinc	3 9E+03	1 4E+04	8 8E-05	1.8E-03	0.001469052	0.030045905	7.6E-06	1.5E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3 4E+00	5.9E-07	4.3E-06	no toxicity value	no toxicity value	5.1E-08	3.7E-07	1.2E-07	8.9E-07
Benzo(a)pyrene	2 5E+00	3 3E+00	5.6E-07	4.2E-06	no toxicity value	no toxicity value	4.8E-08	3.6E-07	1.2E-06	8.7E-06
Benzo(b)fluoranthene	2 8E+00	4 3E+00	6.3E-07	5 5E-06	no toxicity value	no toxicity value	5.4E-08	4.7E-07	1.3E-07	1.1E-06
Dibenzo(a,h)anthracene	7.3E-01	1 0E+00	1 6E-07	1 3E-06	no toxicity value	no toxicity value	1.4E-08	1.1E-07	3.3E-07	2.6E-06
Indeno(1,2,3-cd)pyrene	1 8E+00	2.1E+00	4.1E-07	2.7E-06	no toxicity value	no toxicity value	3.5E-08	2.3E-07	8.4E-08	5.6E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	3.1E-12	5.4E-11	no toxicity value	no toxicity value	2.6E-13	4.6E-12	7.9E-08	1.4E-06
1,2,3,4,6,7,8-HpCDF	1 7E-06	4.4E-06	1.1E-12	1 7E-11	no toxicity value	no toxicity value	9.6E-14	1.4E-12	2.9E-08	4.3E-07
1,2,3,4,7,8-HxCDF	2 3E-06	4.0E-06	1.6E-12	1 5E-11	no toxicity value	no toxicity value	1.3E-13	1.3E-12	4 0E-08	3.9E-07
1,2,3,7,8,9-HxCDD	9 6E-07	1.8E-06	6.4E-13	6.9E-12	no toxicity value	no toxicity value	5.5E-14	5.9E-13	1.7E-08	1.8E-07
2,3,7,8-TCDF	3.5E-06	6.2E-06	2.3E-12	2 4E-11	no toxicity value	no toxicity value	2.0E-13	2.0E-12	6.0E-08	6.1E-07
OCDD	2.9E-06	9.4E-06	1.9E-12	3.6E-11	no toxicity value	no toxicity value	1.7E-13	3.1E-12	5.0E-08	9.3E-07
Aroclor-1242	1 0E+01	35.23419	1.4E-05	2.7E-04	no toxicity value	no toxicity value	1.2E-06	2.3E-05	1.0E-05	2.0E-04
Aroclor-1248	6.0E+00	3.5E+01	8.0E-06	2.7E-04	no toxicity value	no toxicity value	6.9E-07	2.3E-05	5.9E-06	1.9E-04
Aroclor-1254	1 0E+01	2 8E+01	1.4E-05	2.1E-04	0.761521828	11.77426423	1.2E-06	1.8E-05	1.0E-05	1 6E-04
Aroclor-1260	4 1E+00	2 0E+01	5.5E-06	1.5E-04	no toxicity value	no toxicity value	4.7E-07	1.3E-05	4 1E-06	1.1E-04
Hazard Index					1	16				
Total Cancer Risk									3E-05	7E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.20. Risk from groundwater for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in groundwater (mg/L)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.2E-02	6.0E-02	1 0E-03	3.9E-03	2.5251142	9.6529680	8.7E-05	3.3E-04	no toxicity value	no toxicity value
Barium	2.8E-01	6.9E-01	9 0E-03	4.4E-02	0.1291096	0.6337900	7.7E-04	3.8E-03	no toxicity value	no toxicity value
Beryllium	2.9E-03	6.9E-03	9.1E-05	4.4E-04	0.0182192	0.0882192	7.8E-06	3.8E-05	3.4E-05	1.6E-04
Chromium (VI)	3.5E-02	1.2E-01	1.1E-03	7.9E-03	0.2256621	1.5853881	9.7E-05	6 8E-04	no toxicity value	no toxicity value
Manganese (water)	4.0E+00	9 0E+00	1.3E-01	5.8E-01	2.5570776	11.5068493	1.1E-02	4.9E-02	no toxicity value	no toxicity value
Mercury	2.4E-02	6.0E-02	7.8E-04	3.8E-03	2.6021461	12.7250837	6.7E-05	3.3E-04	no toxicity value	no toxicity value
Nickel	5.3E-02	1.5E-01	1.7E-03	9 7E-03	0.0848231	0.4858447	1.5E-04	8 3E-04	no toxicity value	no toxicity value
Vanadium	3.7E-02	1.3E-01	1 2E-03	8 3E-03	0.1700913	1.1872146	1.0E-04	7.1E-04	no toxicity value	no toxicity value
Zinc	6.0E-01	1.4E+00	1.9E-02	8.7E-02	0.0640335	0.2902820	1.6E-03	7.5E-03	no toxicity value	no toxicity value
Hazard Index					8	38				
Total Cancer Risk									3E-05	2E-04

DWI = David Witherspoon, Inc.
kg = kilogram
L = liter
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.21. Risk from dermal contact with groundwater for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in groundwater (mg/L)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3 2E-02	6 0E-02	2.4E-06	7.7E-06	0.3004886	0.9652968	2.1E-07	6.6E-07	no toxicity value	no toxicity value
Barium	2.8E-01	6 9E-01	2 2E-05	8.9E-05	0.0043897	0.0181083	1.8E-06	7.6E-06	no toxicity value	no toxicity value
Beryllium	2.9E-03	6 9E-03	2 2E-07	8.8E-07	0.0043362	0.0176438	1.9E-08	7.6E-08	8.0E-06	3.3E-05
Chromium (VI)	3 5E-02	1.2E-01	2.7E-06	1 6E-05	0.0268538	0.1585388	2.3E-07	1.4E-06	no toxicity value	no toxicity value
Manganese (water)	4.0E+00	9.0E+00	3.0E-04	1.2E-03	0.0060858	0.0230137	2.6E-05	9.9E-05	no toxicity value	no toxicity value
Mercury	2.4E-02	6 0E-02	1.9E-06	7.6E-06	0.0884730	0.3635738	1.6E-07	6.5E-07	no toxicity value	no toxicity value
Nickel	5.3E-02	1.5E-01	4 0E-06	1.9E-05	0.0007477	0.0035988	3.5E-07	1.7E-06	no toxicity value	no toxicity value
Vanadium	3.7E-02	1.3E-01	2.8E-06	1.7E-05	0.0404817	0.2374429	2.4E-07	1.4E-06	no toxicity value	no toxicity value
Zinc	6.0E-01	1.4E+00	4.6E-05	1.7E-04	0.0007620	0.0029028	3.9E-06	1.5E-05	no toxicity value	no toxicity value
Hazard Index					0.5	2				
Total Cancer Risk									8E-06	3E-05

DWI = David Witherspoon, Inc.
kg = kilogram
L = liter
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.22. Risk from sediment ingestion for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1.0E+01	1.4E+01	6.6E-05	1.8E-04	0.164883562	0.447488584	5.7E-06	1.5E-05	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	4.3E-05	1.1E-04	0.142557078	0.363531202	3.7E-06	9.3E-06	5.5E-06	1.4E-05
Beryllium	7.7E-01	9.3E-01	4.9E-06	1.2E-05	0.000979361	0.002372968	4.2E-07	1.0E-06	1.8E-06	4.4E-06
Chromium (VI)	2.9E+01	4.7E+01	1.9E-04	6.0E-04	0.037179909	0.119972968	1.6E-05	5.1E-05	no toxicity value	no toxicity value
Manganese	2.6E+03	7.3E+03	1.7E-02	9.4E-02	0.330516347	1.875686247	1.4E-03	8.0E-03	no toxicity value	no toxicity value
Mercury	1.8E+00	7.0E+00	1.1E-05	8.9E-05	0.037418569	0.298325723	9.6E-07	7.7E-06	no toxicity value	no toxicity value
Benzo(a)anthracene	8.4E-01	1.6E+00	5.4E-06	2.0E-05	no toxicity value	no toxicity value	4.6E-07	1.8E-06	3.4E-07	1.3E-06
Benzo(a)pyrene	5.7E-01	1.2E+00	3.7E-06	1.6E-05	no toxicity value	no toxicity value	3.1E-07	1.3E-06	2.3E-06	9.7E-06
Benzo(b)fluoranthene	2.3E+00	4.6E+00	1.5E-05	5.9E-05	no toxicity value	no toxicity value	1.3E-06	5.0E-06	9.2E-07	3.7E-06
Aroclor-1254	1.0E+00	4.0E+00	6.5E-06	5.1E-05	0.324083059	2.557077626	5.6E-07	4.4E-06	4.3E-06	3.4E-05
Aroclor-1260	7.4E-01	2.7E+00	4.7E-06	3.5E-05	no toxicity value	no toxicity value	4.0E-07	3.0E-06	3.1E-06	2.3E-05
Hazard Index					1	6				
Total Cancer Risk									2E-05	9E-05

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.23. Risk from dermal contact with chemicals in sediment for a child resident at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1.0E+01	1.4E+01	2.3E-07	1.8E-06	0.028854623	0.223744292	2.0E-08	1.5E-07	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	1.5E-07	1.1E-06	0.001216951	0.008866615	1.3E-08	9.3E-08	4.7E-08	3.4E-07
Beryllium	7.7E-01	9.3E-01	1.7E-08	1.2E-07	0.000342776	0.002372968	1.5E-09	1.0E-08	6.3E-07	4.4E-06
Chromium (VI)	2.9E+01	4.7E+01	6.5E-07	6.0E-06	0.006506484	0.059986484	5.6E-08	5.1E-07	no toxicity value	no toxicity value
Manganese	2.6E+03	7.3E+03	5.8E-05	9.4E-04	0.001156807	0.018756862	5.0E-06	8.0E-05	no toxicity value	no toxicity value
Mercury	1.8E+00	7.0E+00	3.9E-08	8.9E-07	0.001870928	0.04261796	3.4E-09	7.7E-08	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	4.9E-07	1.7E-05	no toxicity value	no toxicity value	4.2E-08	1.4E-06	1.0E-07	3.4E-06
Benzo(a)pyrene	1.8E+00	9.5E+00	4.1E-07	1.2E-05	no toxicity value	no toxicity value	3.5E-08	1.0E-06	8.4E-07	2.5E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	5.5E-07	1.2E-05	no toxicity value	no toxicity value	4.8E-08	1.0E-06	1.1E-07	2.5E-06
Aroclor-1254	3.2E+01	4.5E+01	4.3E-05	3.5E-04	2.408047945	19.24342533	3.7E-06	3.0E-05	3.2E-05	2.5E-04
Aroclor-1260	1.5E+01	2.8E+01	1.9E-05	2.1E-04	no toxicity value	no toxicity value	1.7E-06	1.8E-05	1.4E-05	1.6E-04
Hazard Index					2	20				
Total Cancer Risk									5E-05	4E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.24. Risk from soil ingestion for an adolescent at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4 0E+01	1.0E-06	2.2E-05	0.002507534	0.054386301	1.4E-07	3.1E-06	no toxicity value	no toxicity value
Arsenic	9.6E+00	1 3E+01	4.1E-07	7.0E-06	0.001363206	0.023373516	5.8E-08	1.0E-06	8.8E-08	1.5E-06
Barium	3 1E+02	5.7E+02	1.3E-05	3.1E-04	0.000188808	0.004466865	1.9E-06	4.5E-05	no toxicity value	no toxicity value
Beryllium	5 6E-01	7.0E-01	2.4E-08	3.8E-07	4.77321E-06	7.6274E-05	3.4E-09	5.4E-08	1.5E-08	2.3E-07
Cadmium	1 6E+01	4 1E+01	6.8E-07	2.2E-05	0.000684572	0.022465753	9.8E-08	3.2E-06	no toxicity value	no toxicity value
Chromium (VI)	2 3E+02	2 9E+02	1.0E-05	1.6E-04	0.001991631	0.031787616	1.4E-06	2.3E-05	no toxicity value	no toxicity value
Lead	1 0E+03	2 7E+03	4.3E-05	1.5E-03	no toxicity value	no toxicity value	6.1E-06	2.1E-04	no toxicity value	no toxicity value
Manganese	2 6E+03	4.0E+03	1.1E-04	2.2E-03	0.002256973	0.044146652	1.6E-05	3.2E-04	no toxicity value	no toxicity value
Mercury	9 7E+01	5.0E+02	4.1E-06	2.7E-04	0.013788899	0.904562557	5.9E-07	3.9E-05	no toxicity value	no toxicity value
Uranium	5 1E+02	2.1E+03	2.2E-05	1.1E-03	0.007287671	0.376621005	3.1E-06	1.6E-04	no toxicity value	no toxicity value
Zinc	3 9E+03	1.4E+04	1.7E-04	7.7E-03	0.000559639	0.025753633	2.4E-05	1 1E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2 7E+00	3.4E+00	1.1E-07	1.8E-06	no toxicity value	no toxicity value	1.6E-08	2.6E-07	1.2E-08	1.9E-07
Benzo(a)pyrene	2.5E+00	3.3E+00	1.1E-07	1.8E-06	no toxicity value	no toxicity value	1.5E-08	2.6E-07	1.1E-07	1.9E-06
Benzo(b)fluoranthene	2.8E+00	4.3E+00	1.2E-07	2.4E-06	no toxicity value	no toxicity value	1.7E-08	3.4E-07	1.2E-08	2.5E-07
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	3.1E-08	5.6E-07	1.03185E-06	1.86194E-05	4.4E-09	8.0E-08	3.2E-08	5.8E-07
Indeno(1,2,3-cd)pyrene	1 8E+00	2.1E+00	7.8E-08	1.2E-06	2.59692E-07	3.88904E-06	1.1E-08	1.7E-07	8.1E-09	1.2E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1 4E-05	2.0E-13	7.7E-12	no toxicity value	no toxicity value	2.8E-14	1.1E-12	4.2E-09	1.6E-07
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	7.1E-14	2.4E-12	no toxicity value	no toxicity value	1.0E-14	3.4E-13	1.5E-09	5.2E-08
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	9.9E-14	2.2E-12	no toxicity value	no toxicity value	1.4E-14	3.1E-13	2.1E-09	4.7E-08
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	4.1E-14	9.9E-13	no toxicity value	no toxicity value	5.8E-15	1.4E-13	8.8E-10	2.1E-08
2,3,7,8-TCDF	3.5E-06	6.2E-06	1.5E-13	3.4E-12	no toxicity value	no toxicity value	2.1E-14	4.9E-13	3.2E-09	7.3E-08
OCDD	2.9E-06	9.4E-06	1.2E-13	5.2E-12	no toxicity value	no toxicity value	1.8E-14	7.4E-13	2.7E-09	1.1E-07
Aroclor-1242	1.0E+01	35.23419	4.3E-07	1.9E-05	no toxicity value	no toxicity value	6.2E-08	2.8E-06	4.8E-07	2.1E-05
Aroclor-1248	6.0E+00	3 5E+01	2.5E-07	1.9E-05	no toxicity value	no toxicity value	3.6E-08	2.7E-06	2.8E-07	2.1E-05
Aroclor-1254	1.0E+01	2 8E+01	4.4E-07	1.5E-05	0.021757767	0.756916986	6.2E-08	2.2E-06	4.8E-07	1.7E-05
Aroclor-1260	4.1E+00	2 0E+01	1.8E-07	1.1E-05	no toxicity value	no toxicity value	2.5E-08	1.6E-06	1.9E-07	1.2E-05
Hazard Index					0.05	2				
Total Cancer Risk									2E-06	8E-05

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.25. Risk from inhalation of particulates in soil for an adolescent at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	1.8E-11	5.3E-10	no toxicity value	no toxicity value	2.6E-12	7.6E-11	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	7.5E-12	1.7E-10	no toxicity value	no toxicity value	1.1E-12	2.5E-11	5.4E-11	1.2E-09
Barium	3.1E+02	5.7E+02	2.4E-10	7.7E-09	1.70E-06	5.37E-05	3.5E-11	1.1E-09	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	4.4E-13	9.4E-12	no toxicity value	no toxicity value	6.3E-14	1.3E-12	5.3E-13	1.1E-11
Cadmium	1.6E+01	4.1E+01	1.3E-11	5.5E-10	no toxicity value	no toxicity value	1.8E-12	7.9E-11	1.1E-11	4.8E-10
Chromium (VI)	2.3E+02	2.9E+02	1.8E-10	3.9E-09	no toxicity value	no toxicity value	2.6E-11	5.6E-10	1.1E-09	2.3E-08
Lead	1 0E+03	2.7E+03	7.9E-10	3.7E-08	no toxicity value	no toxicity value	1.1E-10	5.2E-09	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	2.1E-09	5.4E-08	1.82E-05	4.74E-04	3.0E-10	7.7E-09	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	7.6E-11	6.7E-09	8.88E-07	7.77E-05	1.1E-11	9.5E-10	no toxicity value	no toxicity value
Uranium	5 1E+02	2.1E+03	4.0E-10	2.8E-08	no toxicity value	no toxicity value	5.7E-11	4.0E-09	no toxicity value	no toxicity value
Zinc	3.9E+03	1 4E+04	3.1E-09	1.9E-07	no toxicity value	no toxicity value	4.4E-10	2.7E-08	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3,4E+00	2.1E-12	4.5E-11	no toxicity value	no toxicity value	3.0E-13	6.5E-12	no toxicity value	no toxicity value
Benzo(a)pyrene	2 5E+00	3.3E+00	2.0E-12	4.4E-11	no toxicity value	no toxicity value	2.8E-13	6.3E-12	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.8E+00	4.3E+00	2.2E-12	5.8E-11	no toxicity value	no toxicity value	3.2E-13	8.3E-12	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	5.7E-13	1.4E-11	no toxicity value	no toxicity value	8.1E-14	2.0E-12	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	1.4E-12	2.9E-11	no toxicity value	no toxicity value	2.0E-13	4.1E-12	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	3.6E-18	1.9E-16	no toxicity value	no toxicity value	5.1E-19	2.7E-17	7.7E-14	4.0E-12
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	1.3E-18	5.9E-17	no toxicity value	no toxicity value	1.9E-19	8.5E-18	2.8E-14	1.3E-12
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	1.8E-18	5.4E-17	no toxicity value	no toxicity value	2.6E-19	7.7E-18	3.9E-14	1.1E-12
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	7.5E-19	2.4E-17	no toxicity value	no toxicity value	1.1E-19	3.5E-18	1.6E-14	5.2E-13
2,3,7,8-TCDF	3.5E-06	6.2E-06	2.7E-18	8.4E-17	no toxicity value	no toxicity value	3.9E-19	1.2E-17	5.8E-14	1.8E-12
OCDD	2.9E-06	9.4E-06	2.3E-18	1.3E-16	no toxicity value	no toxicity value	3.3E-19	1.8E-17	4.9E-14	2.7E-12
Aroclor-1242	1.0E+01	35.23419	8.0E-12	4.7E-10	no toxicity value	no toxicity value	1.1E-12	6.8E-11	no toxicity value	no toxicity value
Aroclor-1248	6.0E+00	3.5E+01	4.7E-12	4.7E-10	no toxicity value	no toxicity value	6.7E-13	6.6E-11	no toxicity value	no toxicity value
Aroclor-1254	1.0E+01	2.8E+01	8.0E-12	3.7E-10	no toxicity value	no toxicity value	1.1E-12	5.3E-11	no toxicity value	no toxicity value
Aroclor-1260	4.1E+00	2.0E+01	3.2E-12	2.7E-10	no toxicity value	no toxicity value	4.6E-13	3.8E-11	no toxicity value	no toxicity value
Hazard Index					0.00002	0.0006				
Total Cancer Risk									1E-09	2E-08

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.26. Risk from dermal contact with chemicals in soil for an adolescent at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	8.6E-09	4.7E-07	0.00107824	0.058913961	1.2E-09	6.7E-08	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	3.5E-09	1.5E-07	2.85941E-05	0.001235091	5.0E-10	2.2E-08	1.8E-09	7.9E-08
Barium	3.1E+02	5.7E+02	1.1E-07	6.8E-06	2.31964E-05	0.001382495	1.6E-08	9.7E-07	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	2.1E-10	8.3E-09	4.10496E-06	0.000165248	2.9E-11	1.2E-09	1.3E-08	5.1E-07
Cadmium	1.6E+01	4.1E+01	5.9E-09	4.9E-07	0.000588732	0.048672055	8.4E-10	7.0E-08	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	8.6E-08	3.4E-06	0.000856401	0.034433936	1.2E-08	4.9E-07	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	3.7E-07	3.2E-05	no toxicity value	no toxicity value	5.3E-08	4.6E-06	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	9.7E-07	4.8E-05	1.941E-05	0.000956437	1.4E-07	6.8E-06	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	3.6E-08	5.9E-06	0.001694065	0.279962111	5.1E-09	8.4E-07	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	1.9E-07	2.4E-05	7.37341E-05	0.009599405	2.7E-08	3.5E-06	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	1.4E-06	1.7E-04	2.40645E-05	0.002789762	2.1E-07	2.4E-05	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	9.7E-09	4.0E-07	no toxicity value	no toxicity value	1.4E-09	5.7E-08	3.3E-09	1.4E-07
Benzo(a)pyrene	2.5E+00	3.3E+00	9.2E-09	3.9E-07	no toxicity value	no toxicity value	1.3E-09	5.6E-08	3.2E-08	1.3E-06
Benzo(b)fluoranthene	2.8E+00	4.3E+00	1.0E-08	5.1E-07	no toxicity value	no toxicity value	1.5E-09	7.3E-08	3.5E-09	1.7E-07
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	2.7E-09	1.2E-07	no toxicity value	no toxicity value	3.8E-10	1.7E-08	8.9E-09	4.1E-07
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	6.7E-09	2.5E-07	no toxicity value	no toxicity value	9.6E-10	3.6E-08	2.3E-09	8.7E-08
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	5.0E-14	5.0E-12	no toxicity value	no toxicity value	7.2E-15	7.1E-13	2.2E-09	2.1E-07
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	1.8E-14	1.6E-12	no toxicity value	no toxicity value	2.6E-15	2.2E-13	7.9E-10	6.7E-08
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	2.5E-14	1.4E-12	no toxicity value	no toxicity value	3.6E-15	2.0E-13	1.1E-09	6.1E-08
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	1.1E-14	6.4E-13	no toxicity value	no toxicity value	1.5E-15	9.2E-14	4.5E-10	2.7E-08
2,3,7,8-TCDF	3.5E-06	6.2E-06	3.8E-14	2.2E-12	no toxicity value	no toxicity value	5.4E-15	3.2E-13	1.6E-09	9.5E-08
OCDD	2.9E-06	9.4E-06	3.2E-14	3.3E-12	no toxicity value	no toxicity value	4.6E-15	4.8E-13	1.4E-09	1.4E-07
Aroclor-1242	1.0E+01	35.23419	2.2E-07	2.5E-05	no toxicity value	no toxicity value	3.2E-08	3.6E-06	2.7E-07	3.1E-05
Aroclor-1248	6.0E+00	3.5E+01	1.3E-07	2.5E-05	no toxicity value	no toxicity value	1.9E-08	3.5E-06	1.6E-07	3.0E-05
Aroclor-1254	1.0E+01	2.8E+01	2.2E-07	2.0E-05	0.207907547	1.093240434	3.2E-08	2.8E-06	2.7E-07	2.4E-05
Aroclor-1260	4.1E+00	2.0E+01	9.1E-08	1.4E-05	no toxicity value	no toxicity value	1.3E-08	2.0E-06	1.1E-07	1.7E-05
Hazard Index					0.2	2				
Total Cancer Risk									9E-07	1E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.27. Risk from sediment ingestion for an adolescent wading in Goose Creek while on the DWI Site, Knoxville, Tennessee

Chemical	Exposure point concentration in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1.0E+01	1.4E+01	4.4E-07	7.7E-06	0.001099224	0.019178082	6.3E-08	1.1E-06	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	2.9E-07	4.7E-06	0.000950381	0.015579909	4.1E-08	6.7E-07	6.1E-08	1.0E-06
Beryllium	7.7E-01	9.3E-01	3.3E-08	5.1E-07	6.52907E-06	0.000101699	4.7E-09	7.3E-08	2.0E-08	3.1E-07
Chromium (VI)	2.9E+01	4.7E+01	1.2E-06	2.6E-05	0.000247866	0.005141699	1.8E-07	3.7E-06	no toxicity value	no toxicity value
Manganese	2.6E+03	7.3E+03	1.1E-04	4.0E-03	0.002203442	0.080386553	1.6E-05	5.7E-04	no toxicity value	no toxicity value
Mercury	1.8E+00	7.0E+00	7.5E-08	3.8E-06	0.000249457	0.012785388	1.1E-08	5.5E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	8.4E-01	1.6E+00	3.6E-08	8.8E-07	no toxicity value	no toxicity value	5.1E-09	1.3E-07	3.7E-09	9.1E-08
Benzo(a)pyrene	5.7E-01	1.2E+00	2.4E-08	6.7E-07	no toxicity value	no toxicity value	3.5E-09	9.5E-08	2.5E-08	7.0E-07
Benzo(b)fluoranthene	2.3E+00	4.6E+00	9.8E-08	2.5E-06	no toxicity value	no toxicity value	1.4E-08	3.6E-07	1.0E-08	2.6E-07
Aroclor-1254	1.0E+00	4.0E+00	4.3E-08	2.2E-06	0.002160554	0.109589041	6.2E-09	3.1E-07	4.8E-08	2.4E-06
Aroclor-1260	7.4E-01	2.7E+00	3.1E-08	1.5E-06	no toxicity value	no toxicity value	4.5E-09	2.1E-07	3.5E-08	1.6E-06
Hazard Index					0.01	0.2				
Total Cancer Risk									2E-07	6E-06

DWI = David Witherspoon, Inc
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.28. Risk from dermal contact with sediment for an adolescent wading in Goose Creek while on the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in sediment (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	1 0E+01	1 4E+01	3.8E-09	1.7E-07	0.000472666	0.020774658	5.4E-10	2.4E-08	no toxicity value	no toxicity value
Arsenic	6.7E+00	8.5E+00	2.5E-09	1.0E-07	1.99348E-05	0.000823265	3.5E-10	1.4E-08	1.3E-09	5.3E-08
Beryllium	7.7E-01	9.3E-01	2.8E-10	1.1E-08	5.615E-06	0.00022033	4.0E-11	1.6E-09	1.7E-08	6.8E-07
Chromium (VI)	2 9E+01	4 7E+01	1 1E-08	5.6E-07	0.000106582	0.005569745	1.5E-09	8.0E-08	no toxicity value	no toxicity value
Manganese	2.6E+03	7 3E+03	9.5E-07	8.7E-05	1.89496E-05	0.001741575	1.4E-07	1.2E-05	no toxicity value	no toxicity value
Mercury	1 8E+00	7.0E+00	6.4E-10	8.3E-08	3.06476E-05	0.003957078	9.2E-11	1.2E-08	no toxicity value	no toxicity value
Benzo(a)anthracene	8 4E-01	1 6E+00	3.1E-09	1.9E-07	no toxicity value	no toxicity value	4.4E-10	2.7E-08	1.1E-09	6.5E-08
Benzo(a)pyrene	5.7E-01	1 2E+00	2.1E-09	1.4E-07	no toxicity value	no toxicity value	3.0E-10	2.1E-08	7.2E-09	5.0E-07
Benzo(b)fluoranthene	2 3E+00	4 6E+00	8.4E-09	5.5E-07	no toxicity value	no toxicity value	1.2E-09	7.8E-08	2.9E-09	1.9E-07
Aroclor-1254	1 0E+00	4 0E+00	2.2E-08	2.8E-06	0.001238717	0.158283105	3.2E-09	4.1E-07	2.7E-08	3.5E-06
Aroclor-1260	7.4E-01	2 7E+00	1.6E-08	1.9E-06	no toxicity value	no toxicity value	2.3E-09	2.7E-07	2.0E-08	2.4E-06
Hazard Index					0.002	0.2				
Total Cancer Risk									8E-08	7E-06

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.29. Risk from soil ingestion for a current employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (Intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (Intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	3.5E-06	9.7E-06	0.008635641	0.024279599	2.0E-07	1.8E-06	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	1.4E-06	3.1E-06	0.004694716	0.010434605	8.0E-08	5.8E-07	1.2E-07	8.7E-07
Barium	3.1E+02	5.7E+02	4.6E-05	1 4E-04	0.000650231	0.001994136	2.6E-06	2.6E-05	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	8.2E-08	1.7E-07	1.64384E-05	3.40509E-05	4.7E-09	3.2E-08	2.0E-08	1.4E-07
Cadmium	1.6E+01	4 1E+01	2.4E-06	1.0E-05	0.002357583	0.010029354	1.3E-07	1.9E-06	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	3.4E-05	7.1E-05	0.006858933	0.0141909	2.0E-06	1.3E-05	no toxicity value	no toxicity value
Lead	1 0E+03	2.7E+03	1.5E-04	6.7E-04	no toxicity value	no toxicity value	8.4E-06	1.2E-04	no toxicity value	no toxicity value
Manganese	2 6E+03	4 0E+03	3.9E-04	9.9E-04	0.007772739	0.019708327	2.2E-05	1.8E-04	no toxicity value	no toxicity value
Mercury	9 7E+01	5 0E+02	1.4E-05	1.2E-04	0.04748728	0.40382257	8.1E-07	2.2E-05	no toxicity value	no toxicity value
Uranium	5.1E+02	2 1E+03	7.5E-05	5.0E-04	0.025097847	0.168134377	4.3E-06	9.4E-05	no toxicity value	no toxicity value
Zinc	3.9E+03	1 4E+04	5.8E-04	3 4E-03	0.001927327	0.011497158	3.3E-05	6.4E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	3.9E-07	8 2E-07	no toxicity value	no toxicity value	2.2E-08	1.5E-07	1.6E-08	1.1E-07
Benzo(a)pyrene	2.5E+00	3.3E+00	3.7E-07	8.1E-07	no toxicity value	no toxicity value	2.1E-08	1.5E-07	1.5E-07	1.1E-06
Benzo(b)fluoranthene	2 8E+00	4 3E+00	4.1E-07	1.1E-06	no toxicity value	no toxicity value	2.4E-08	2.0E-07	1.7E-08	1.4E-07
Dibenzo(a,h)anthracene	7.3E-01	1 0E+00	1.1E-07	2.5E-07	3.55356E-06	8.31224E-06	6.1E-09	4.6E-08	4.4E-08	3.4E-07
Indeno(1,2,3-cd)pyrene	1 8E+00	2.1E+00	2.7E-07	5.2E-07	8.94346E-07	1.73618E-06	1.5E-08	9.7E-08	1.1E-08	7.1E-08
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	6.7E-13	3.4E-12	no toxicity value	no toxicity value	3.8E-14	6.4E-13	5.8E-09	9.5E-08
1,2,3,4,6,7,8-HpCDF	1.7E-06	4 4E-06	2.4E-13	1 1E-12	no toxicity value	no toxicity value	1.4E-14	2.0E-13	2.1E-09	3.0E-08
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	3.4E-13	9.7E-13	no toxicity value	no toxicity value	1.9E-14	1.8E-13	2.9E-09	2.7E-08
1,2,3,7,8,9-HxCDD	9.6E-07	1 8E-06	1.4E-13	4.4E-13	no toxicity value	no toxicity value	8.1E-15	8.2E-14	1.2E-09	1.2E-08
2,3,7,8-TCDF	3.5E-06	6 2E-06	5.1E-13	1.5E-12	no toxicity value	no toxicity value	2.9E-14	2 8E-13	4.4E-09	4.2E-08
OCDD	2.9E-06	9.4E-06	4.3E-13	2.3E-12	no toxicity value	no toxicity value	2.4E-14	4.3E-13	1.9E-13	3.3E-12
Aroclor-1242	1.0E+01	35.23419	1.5E-06	8.6E-06	no toxicity value	no toxicity value	8.5E-08	1.6E-06	6.6E-07	1.2E-05
Aroclor-1248	6.0E+00	3 5E+01	8.8E-07	8.5E-06	no toxicity value	no toxicity value	5.0E-08	1.6E-06	3.9E-07	1.2E-05
Aroclor-1254	1.0E+01	2 8E+01	1.5E-06	6.8E-06	0.074931084	0.337909369	8.6E-08	1.3E-06	6.6E-07	9.7E-06
Aroclor-1260	4.1E+00	2.0E+01	6.0E-07	4.9E-06	no toxicity value	no toxicity value	3.5E-08	9.0E-07	2 7E-07	6.9E-06
Hazard Index					0.2	1.0				
Total Cancer Risk									2E-06	4E-05

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.30. Risk from inhalation of particulates in soil for a current employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	4.2E-10	1.9E-09	no toxicity value	no toxicity value	2.4E-11	3.5E-10	no toxicity value	no toxicity value
Arsenic	9 6E+00	1.3E+01	1.7E-10	6.1E-10	no toxicity value	no toxicity value	9.9E-12	1.1E-10	4.9E-10	5.7E-09
Barium	3.1E+02	5.7E+02	5.6E-09	2.7E-08	3.91E-05	1.92E-04	3.2E-10	5.1E-09	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	1.0E-11	3.3E-11	no toxicity value	no toxicity value	5.8E-13	6.2E-12	4.8E-12	5.2E-11
Cadmium	1.6E+01	4.1E+01	2.9E-10	2.0E-09	no toxicity value	no toxicity value	1.7E-11	3.7E-10	1.0E-10	2.2E-09
Chromium (VI)	2 3E+02	2.9E+02	4.2E-09	1.4E-08	no toxicity value	no toxicity value	2.4E-10	2.6E-09	9.9E-09	1.1E-07
Lead	1 0E+03	2.7E+03	1.8E-08	1.3E-07	no toxicity value	no toxicity value	1.0E-09	2.4E-08	no toxicity value	no toxicity value
Manganese	2 6E+03	4.0E+03	4.8E-08	1.9E-07	4.17E-04	1.69E-03	2.7E-09	3.6E-08	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	1.7E-09	2.4E-08	2.04E-05	2.78E-04	1.0E-10	4.4E-09	no toxicity value	no toxicity value
Uranium	5 1E+02	2.1E+03	9.2E-09	9.9E-08	no toxicity value	no toxicity value	5.3E-10	1.8E-08	no toxicity value	no toxicity value
Zinc	3 9E+03	1.4E+04	7.1E-08	6.8E-07	no toxicity value	no toxicity value	4.1E-09	1.3E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2 7E+00	3 4E+00	4.8E-11	1.6E-10	no toxicity value	no toxicity value	2.7E-12	3.0E-11	no toxicity value	no toxicity value
Benzo(a)pyrene	2 5E+00	3.3E+00	4.5E-11	1.6E-10	no toxicity value	no toxicity value	2.6E-12	2.9E-11	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2 8E+00	4.3E+00	5.1E-11	2.1E-10	no toxicity value	no toxicity value	2.9E-12	3.8E-11	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	1.3E-11	4.9E-11	no toxicity value	no toxicity value	7.5E-13	9.1E-12	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1 8E+00	2 1E+00	3.3E-11	1.0E-10	no toxicity value	no toxicity value	1.9E-12	1.9E-11	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	8.3E-17	6.7E-16	no toxicity value	no toxicity value	4.7E-18	1.2E-16	7.1E-13	1.9E-11
1,2,3,4,6,7,8-HpCDF	1.7E-06	4 4E-06	3.0E-17	2.1E-16	no toxicity value	no toxicity value	1.7E-18	3.9E-17	2.6E-13	5.9E-12
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	4.2E-17	1.9E-16	no toxicity value	no toxicity value	2.4E-18	3.6E-17	3.6E-13	5.3E-12
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	1.7E-17	8.6E-17	no toxicity value	no toxicity value	9.9E-19	1.6E-17	1.5E-13	2.4E-12
2,3,7,8-TCDF	3.5E-06	6.2E-06	6.2E-17	3.0E-16	no toxicity value	no toxicity value	3.6E-18	5.6E-17	5 4E-13	8.3E-12
OCDD	2.9E-06	9.4E-06	5.2E-17	4.5E-16	no toxicity value	no toxicity value	3.0E-18	8.4E-17	4.5E-13	1.3E-11
Aroclor-1242	1.0E+01	35.23419	1.8E-10	1.7E-09	no toxicity value	no toxicity value	1.0E-11	3.1E-10	no toxicity value	no toxicity value
Aroclor-1248	6.0E+00	3.5E+01	1.1E-10	1.7E-09	no toxicity value	no toxicity value	6.1E-12	3.1E-10	no toxicity value	no toxicity value
Aroclor-1254	1.0E+01	2.8E+01	1.8E-10	1.3E-09	no toxicity value	no toxicity value	1.1E-11	2.5E-10	no toxicity value	no toxicity value
Aroclor-1260	4.1E+00	2.0E+01	7.4E-11	9.5E-10	no toxicity value	no toxicity value	4.2E-12	1.8E-10	no toxicity value	no toxicity value
Hazard Index					0.0005	0.0022				
Total Cancer Risk									1E-08	1E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.31. Risk from dermal contact with chemicals in soil for a current employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	4.6E-08	1.0E-06	0.005757094	0.128681874	2.6E-09	1.9E-07	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	1.9E-08	3.3E-07	0.000152674	0.002697727	1.1E-09	6.2E-08	3.9E-09	2.3E-07
Barium	3.1E+02	5.7E+02	6.1E-07	1.5E-05	0.000123854	0.003019692	3.5E-08	2.7E-06	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	1.1E-09	1.8E-08	2.19178E-05	0.000360939	6.3E-11	3.4E-08	2.7E-05	1.4E-03
Cadmium	1.6E+01	4.1E+01	3.1E-08	1.1E-06	0.003143444	0.106311155	1.8E-09	2.0E-06	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	4.6E-07	7.5E-06	0.004572622	0.075211771	2.6E-08	1.4E-05	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	2.0E-06	7.1E-05	no toxicity value	no toxicity value	1.1E-07	1.3E-04	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	5.2E-06	1.0E-04	0.000103637	0.002089083	3.0E-07	1.9E-04	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	1.9E-07	1.3E-05	0.009045196	0.611502749	1.1E-08	2.4E-05	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	1.0E-06	5.3E-05	0.000393692	0.020967346	5.7E-08	9.9E-05	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	7.7E-06	3.7E-04	0.000128488	0.006093493	4.4E-07	6.8E-05	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	5.2E-08	8.7E-07	no toxicity value	no toxicity value	3.0E-09	1.6E-07	7.1E-09	3.9E-07
Benzo(a)pyrene	2.5E+00	3.3E+00	4.9E-08	8.5E-07	no toxicity value	no toxicity value	2.8E-09	1.6E-07	6.7E-08	3.8E-06
Benzo(b)fluoranthene	2.8E+00	4.3E+00	5.5E-08	1.1E-06	no toxicity value	no toxicity value	3.1E-09	2.1E-07	7.5E-09	5.0E-07
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	1.4E-08	2.6E-07	no toxicity value	no toxicity value	8.1E-10	4.9E-08	1.9E-08	1.2E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	3.6E-08	5.5E-07	no toxicity value	no toxicity value	2.0E-09	1.0E-07	4.9E-09	2.5E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	2.7E-13	1.1E-11	no toxicity value	no toxicity value	1.5E-14	2.0E-12	4.6E-09	6.1E-07
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	9.8E-14	3.4E-12	no toxicity value	no toxicity value	5.6E-15	6.4E-13	1.7E-09	1.9E-07
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	1.4E-13	3.1E-12	no toxicity value	no toxicity value	7.8E-15	5.8E-13	2.3E-09	1.7E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	5.6E-14	1.4E-12	no toxicity value	no toxicity value	3.2E-15	2.6E-13	9.7E-10	7.8E-08
2,3,7,8-TCDF	3.5E-06	6.2E-06	2.0E-13	4.9E-12	no toxicity value	no toxicity value	1.2E-14	9.0E-13	3.5E-09	2.7E-07
OCDD	2.9E-06	9.4E-06	1.7E-13	7.3E-12	no toxicity value	no toxicity value	9.7E-15	1.4E-12	2.9E-09	4.1E-07
Aroclor-1242	1.0E+01	35.23419	1.2E-06	5.5E-05	no toxicity value	no toxicity value	6.8E-08	1.0E-05	5.8E-07	8.7E-05
Aroclor-1248	6.0E+00	3.5E+01	7.0E-07	5.4E-05	no toxicity value	no toxicity value	4.0E-08	1.0E-05	3.4E-07	8.6E-05
Aroclor-1254	1.0E+01	2.8E+01	1.2E-06	4.3E-05	0.066605408	2.387892873	6.9E-08	8.0E-06	5.9E-07	6.8E-05
Aroclor-1260	4.1E+00	2.0E+01	4.8E-07	3.1E-05	no toxicity value	no toxicity value	2.8E-08	5.7E-06	2.4E-07	4.9E-05
Hazard Index					0.09	3				
Total Cancer Risk									3E-05	2E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.32. Risk from soil ingestion for a future employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	6.9E-06	1.9E-05	0.017271282	0.048559198	6.9E-07	6.9E-06	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	2.8E-06	6.3E-06	0.009389432	0.020869211	2.8E-07	2.2E-06	4.2E-07	3.4E-06
Barium	3.1E+02	5.7E+02	9.1E-05	2.8E-04	0.001300463	0.003988272	9.1E-06	1.0E-04	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	1.6E-07	3.4E-07	3.28767E-05	6.81018E-05	1.6E-08	1.2E-07	7.1E-08	5.2E-07
Cadmium	1.6E+01	4.1E+01	4.7E-06	2.0E-05	0.004715166	0.020058708	4.7E-07	7.2E-06	no toxicity value	no toxicity value
Chromium (VI)	2.3E+02	2.9E+02	6.9E-05	1.4E-04	0.013717867	0.0283818	6.9E-06	5.1E-05	no toxicity value	no toxicity value
Lead	1.0E+03	2.7E+03	3.0E-04	1.3E-03	no toxicity value	no toxicity value	3.0E-05	4.8E-04	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	7.8E-04	2.0E-03	0.015545477	0.039416654	7.8E-05	7.0E-04	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	2.8E-05	2.4E-04	0.09497456	0.80764514	2.8E-06	8.7E-05	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	1.5E-04	1.0E-03	0.050195695	0.336268754	1.5E-05	3.6E-04	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	1.2E-03	6.9E-03	0.003854655	0.022994315	1.2E-04	2.5E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	7.8E-07	1.6E-06	no toxicity value	no toxicity value	7.8E-08	5.9E-07	5.7E-08	4.3E-07
Benzo(a)pyrene	2.5E+00	3.3E+00	7.4E-07	1.6E-06	no toxicity value	no toxicity value	7.4E-08	5.8E-07	5.4E-07	4.2E-06
Benzo(b)fluoranthene	2.8E+00	4.3E+00	8.3E-07	2.1E-06	no toxicity value	no toxicity value	8.3E-08	7.5E-07	6.0E-08	5.5E-07
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	2.1E-07	5.0E-07	7.10712E-06	1.66245E-05	2.1E-08	1.8E-07	1.6E-07	1.3E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	5.4E-07	1.0E-06	1.78869E-06	3.47235E-06	5.4E-08	3.7E-07	3.9E-08	2.7E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	1.3E-12	6.8E-12	no toxicity value	no toxicity value	1.3E-13	2.4E-12	2.0E-08	3.7E-07
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	4.9E-13	2.2E-12	no toxicity value	no toxicity value	4.9E-14	7.7E-13	7.3E-09	1.2E-07
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	6.8E-13	1.9E-12	no toxicity value	no toxicity value	6.8E-14	7.0E-13	1.0E-08	1.0E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	2.8E-13	8.8E-13	no toxicity value	no toxicity value	2.8E-14	3.1E-13	4.2E-09	4.7E-08
2,3,7,8-TCDF	3.5E-06	6.2E-06	1.0E-12	3.1E-12	no toxicity value	no toxicity value	1.0E-13	1.1E-12	1.5E-08	1.6E-07
OCDD	2.9E-06	9.4E-06	8.5E-13	4.6E-12	no toxicity value	no toxicity value	8.5E-14	1.6E-12	1.3E-08	2.5E-07
Aroclor-1242	1.0E+01	35.23419	3.0E-06	1.7E-05	no toxicity value	no toxicity value	3.0E-07	6.2E-06	2.3E-06	4.7E-05
Aroclor-1248	6.0E+00	3.5E+01	1.8E-06	1.7E-05	no toxicity value	no toxicity value	1.8E-07	6.0E-06	1.3E-06	4.7E-05
Aroclor-1254	1.0E+01	2.8E+01	3.0E-06	1.4E-05	0.149862167	0.675818738	3.0E-07	4.8E-06	2.3E-06	3.7E-05
Aroclor-1260	4.1E+00	2.0E+01	1.2E-06	9.7E-06	no toxicity value	no toxicity value	1.2E-07	3.5E-06	9.3E-07	2.7E-05
Hazard Index					0.4	2.0				
Total Cancer Risk									8E-06	2E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.33. Risk from inhalation of particulates in soil for a future employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (Intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (Intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2.4E+01	4.0E+01	8.5E-10	3.8E-09	no toxicity value	no toxicity value	8.5E-11	1.4E-09	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	3.5E-10	1.2E-09	no toxicity value	no toxicity value	3.5E-11	4.4E-10	1.7E-09	2.2E-08
Barium	3.1E+02	5.7E+02	1.1E-08	5.5E-08	7.82E-05	3.84E-04	1.1E-09	2.0E-08	no toxicity value	no toxicity value
Beryllium	5.6E-01	7.0E-01	2.0E-11	6.7E-11	no toxicity value	no toxicity value	2.0E-12	2.4E-11	1.7E-11	2.0E-10
Cadmium	1.6E+01	4.1E+01	5.8E-10	3.9E-09	no toxicity value	no toxicity value	5.8E-11	1.4E-09	3.5E-10	8.6E-09
Chromium (VI)	2.3E+02	2.9E+02	8.4E-09	2.8E-08	no toxicity value	no toxicity value	8.4E-10	1.0E-08	3.5E-08	4.1E-07
Lead	1.0E+03	2.7E+03	3.6E-08	2.6E-07	no toxicity value	no toxicity value	3.6E-09	9.3E-08	no toxicity value	no toxicity value
Manganese	2.6E+03	4.0E+03	9.5E-08	3.9E-07	8.35E-04	3.39E-03	9.5E-09	1.4E-07	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	3.5E-09	4.8E-08	4.08E-05	5.55E-04	3.5E-10	1.7E-08	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	1.8E-08	2.0E-07	no toxicity value	no toxicity value	1.8E-09	7.1E-08	no toxicity value	no toxicity value
Zinc	3.9E+03	1.4E+04	1.4E-07	1.4E-06	no toxicity value	no toxicity value	1.4E-08	4.8E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2.7E+00	3.4E+00	9.6E-11	3.2E-10	no toxicity value	no toxicity value	9.6E-12	1.2E-10	no toxicity value	no toxicity value
Benzo(a)pyrene	2.5E+00	3.3E+00	9.0E-11	3.2E-10	no toxicity value	no toxicity value	9.0E-12	1.1E-10	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.8E+00	4.3E+00	1.0E-10	4.1E-10	no toxicity value	no toxicity value	1.0E-11	1.5E-10	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	2.6E-11	9.8E-11	no toxicity value	no toxicity value	2.6E-12	3.5E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	6.6E-11	2.0E-10	no toxicity value	no toxicity value	6.6E-12	7.3E-11	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	4.6E-06	1.4E-05	1.7E-16	1.3E-15	no toxicity value	no toxicity value	1.7E-17	4.8E-16	2.5E-12	7.2E-11
1,2,3,4,6,7,8-HpCDF	1.7E-06	4.4E-06	6.0E-17	4.2E-16	no toxicity value	no toxicity value	6.0E-18	1.5E-16	9.0E-13	2.3E-11
1,2,3,4,7,8-HxCDF	2.3E-06	4.0E-06	8.4E-17	3.8E-16	no toxicity value	no toxicity value	8.4E-18	1.4E-16	1.3E-12	2.1E-11
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	3.5E-17	1.7E-16	no toxicity value	no toxicity value	3.5E-18	6.2E-17	5.2E-13	9.3E-12
2,3,7,8-TCDF	3.5E-06	6.2E-06	1.2E-16	6.0E-16	no toxicity value	no toxicity value	1.2E-17	2.1E-16	1.9E-12	3.2E-11
OCDD	2.9E-06	9.4E-06	1.0E-16	9.0E-16	no toxicity value	no toxicity value	1.0E-17	3.2E-16	1.6E-12	4.8E-11
Aroclor-1242	1.0E+01	35.23419	3.7E-10	3.4E-09	no toxicity value	no toxicity value	3.7E-11	1.2E-09	no toxicity value	no toxicity value
Aroclor-1248	6.0E+00	3.5E+01	2.2E-10	3.3E-09	no toxicity value	no toxicity value	2.2E-11	1.2E-09	no toxicity value	no toxicity value
Aroclor-1254	1.0E+01	2.8E+01	3.7E-10	2.7E-09	no toxicity value	no toxicity value	3.7E-11	9.5E-10	no toxicity value	no toxicity value
Aroclor-1260	4.1E+00	2.0E+01	1.5E-10	1.9E-09	no toxicity value	no toxicity value	1.5E-11	6.8E-10	no toxicity value	no toxicity value
Hazard Index					0.0010	0.0043				
Total Cancer Risk									4E-08	4E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.34. Risk from dermal contact with chemicals in soil for a future employee at the DWI 901 Site, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	2 4E+01	4.0E+01	9.2E-08	2.1E-06	0.011514188	0.257363748	9.2E-09	7.4E-07	no toxicity value	no toxicity value
Arsenic	9.6E+00	1.3E+01	3.8E-08	6.6E-07	0.000305347	0.005395454	3.8E-09	2.4E-07	1.4E-08	8.7E-07
Barium	3.1E+02	5.7E+02	1.2E-06	3.0E-05	0.000247707	0.006039384	1.2E-07	1.1E-05	no toxicity value	no toxicity value
Beryllium	5 6E-01	7.0E-01	2.2E-09	3.6E-08	4.38356E-05	0.000721879	2.2E-10	1.3E-08	9.4E-08	5.5E-06
Cadmium	1 6E+01	4.1E+01	6.3E-08	2 1E-06	0.006286888	0.212622309	6.3E-09	7.6E-07	no toxicity value	no toxicity value
Chromium (VI)	2 3E+02	2.9E+02	9.1E-07	1.5E-05	0.009145245	0.150423542	9.1E-08	5.4E-06	no toxicity value	no toxicity value
Lead	1 0E+03	2.7E+03	3.9E-06	1.4E-04	no toxicity value	no toxicity value	3.9E-07	5.0E-05	no toxicity value	no toxicity value
Manganese	2 6E+03	4 0E+03	1.0E-05	2.1E-04	0.000207273	0.004178165	1.0E-06	7.5E-05	no toxicity value	no toxicity value
Mercury	9.7E+01	5.0E+02	3.8E-07	2.6E-05	0.018090392	1.223005498	3.8E-08	9.2E-06	no toxicity value	no toxicity value
Uranium	5.1E+02	2.1E+03	2.0E-06	1.1E-04	0.000787383	0.041934692	2.0E-07	3.8E-05	no toxicity value	no toxicity value
Zinc	3 9E+03	1.4E+04	1.5E-05	7.3E-04	0.000256977	0.012186987	1.5E-06	2.6E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2 7E+00	3.4E+00	1.0E-07	1.7E-06	no toxicity value	no toxicity value	1.0E-08	6.2E-07	2.5E-08	1.5E-06
Benzo(a)pyrene	2 5E+00	3.3E+00	9.8E-08	1.7E-06	no toxicity value	no toxicity value	9.8E-09	6.1E-07	2.4E-07	1.5E-05
Benzo(b)fluoranthene	2 8E+00	4.3E+00	1.1E-07	2.2E-06	no toxicity value	no toxicity value	1.1E-08	8.0E-07	2.6E-08	1.9E-06
Dibenzo(a,h)anthracene	7.3E-01	1.0E+00	2.8E-08	5.3E-07	no toxicity value	no toxicity value	2.8E-09	1.9E-07	6.7E-08	4.4E-06
Indeno(1,2,3-cd)pyrene	1.8E+00	2.1E+00	7.2E-08	1.1E-06	no toxicity value	no toxicity value	7.2E-09	3.9E-07	1.7E-08	9 5E-07
1,2,3,4,6,7,8-HpCDD	4.6E-06	1 4E-05	5.4E-13	2.2E-11	no toxicity value	no toxicity value	5.4E-14	7.8E-12	1.6E-08	2.3E-06
1,2,3,4,6,7,8-HpCDF	1.7E-06	4 4E-06	2.0E-13	6.8E-12	no toxicity value	no toxicity value	2.0E-14	2.4E-12	5.9E-09	7.3E-07
1,2,3,4,7,8-HxCDF	2 3E-06	4.0E-06	2.7E-13	6.2E-12	no toxicity value	no toxicity value	2.7E-14	2.2E-12	8.2E-09	6.6E-07
1,2,3,7,8,9-HxCDD	9.6E-07	1.8E-06	1.1E-13	2.8E-12	no toxicity value	no toxicity value	1.1E-14	1.0E-12	3.4E-09	3.0E-07
2,3,7,8-TCDF	3.5E-06	6.2E-06	4.1E-13	9.7E-12	no toxicity value	no toxicity value	4.1E-14	3.5E-12	1.2E-08	1.0E-06
OCDD	2.9E-06	9.4E-06	3.4E-13	1.5E-11	no toxicity value	no toxicity value	3.4E-14	5.2E-12	1.0E-08	1.6E-06
Aroclor-1242	1.0E+01	35.23419	2.4E-06	1.1E-04	no toxicity value	no toxicity value	2.4E-07	3.9E-05	2.0E-06	3.3E-04
Aroclor-1248	6.0E+00	3.5E+01	1.4E-06	1.1E-04	no toxicity value	no toxicity value	1.4E-07	3.8E-05	1.2E-06	3.3E-04
Aroclor-1254	1 0E+01	2.8E+01	2.4E-06	8.6E-05	0.133210815	4.775785747	2.4E-07	3.1E-05	2.1E-06	2.6E-04
Aroclor-1260	4.1E+00	2.0E+01	9.7E-07	6.2E-05	no toxicity value	no toxicity value	9.7E-08	2.2E-05	8.3E-07	1.9E-04
Hazard Index					0.2	7				
Total Cancer Risk									7E-06	1E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.35. Risk from soil ingestion for a future adult resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3 9E+01	1.6E+02	3.2E-05	2.2E-04	0.081139726	0.554794521	4.2E-06	7.6E-05	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	1.4E-05	3.1E-05	0.047364384	0.103652968	1.8E-06	1.1E-05	2.7E-06	1.6E-05
Barium	3.8E+02	8.3E+02	3.2E-04	1.1E-03	0.004514971	0.016242661	4.1E-05	3.9E-04	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	3.8E-08	9.5E-07	7.69315E-06	0.000189315	4.9E-09	3.2E-07	2.1E-08	1.4E-06
Cadmium	1 9E+01	2 8E+01	1.6E-05	3.8E-05	0.015791507	0.038390411	2.0E-06	1.3E-05	no toxicity value	no toxicity value
Chromium (VI)	1 7E+02	4 6E+02	1.4E-04	6.4E-04	0.027610356	0.127123288	1.8E-05	2.2E-04	no toxicity value	no toxicity value
Lead	2 0E+03	8 3E+03	1.6E-03	1.1E-02	no toxicity value	no toxicity value	2.1E-04	3.9E-03	no toxicity value	no toxicity value
Manganese	1 5E+03	2 7E+03	1.3E-03	3.7E-03	0.025033562	0.07494863	1.6E-04	1.3E-03	no toxicity value	no toxicity value
Mercury	1.1E+02	4 3E+02	8.8E-05	5.9E-04	0.29380274	1.96347032	1.1E-05	2.0E-04	no toxicity value	no toxicity value
Uranium	7.0E+04	3 0E+05	5.7E-02	4.1E-01	19.16	135.3210046	7.4E-03	1.4E-01	no toxicity value	no toxicity value
Zinc	4.9E+03	7 2E+03	4.0E-03	9.8E-03	0.013441096	0.032768836	5.2E-04	3.4E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	1.8E-06	1.8E-05	no toxicity value	no toxicity value	2.3E-07	6.1E-06	1.7E-07	4.5E-06
Benzo(a)pyrene	1.8E+00	9 5E+00	1 5E-06	1 3E-05	no toxicity value	no toxicity value	1.9E-07	4.5E-06	1.4E-06	3.3E-05
Benzo(b)fluoranthene	2.5E+00	9 4E+00	2.0E-06	1.3E-05	no toxicity value	no toxicity value	2.6E-07	4.4E-06	1.9E-07	3.2E-06
Bis(2-ethylhexyl)phthalate	1 1E+01	5 5E+01	9.3E-06	7 5E-05	0.000465488	0.003767123	1.2E-06	2.6E-05	1.7E-08	3.6E-07
Dibenzo(a,h)anthracene	6.4E-01	2 2E+00	5.2E-07	3.0E-06	1.74315E-05	9.89426E-05	6.7E-08	1.0E-06	4.9E-07	7.4E-06
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	1.1E-06	8 2E-06	3.82021E-06	2.73398E-05	1.5E-07	2.8E-06	1.1E-07	2.1E-06
Aroclor-1248	2.0E+01	1 4E+02	1.6E-05	1.9E-04	no toxicity value	no toxicity value	2.1E-06	6.6E-05	1.6E-05	5.1E-04
Aroclor-1254	3.2E+01	4.5E+01	2.7E-05	6.2E-05	1.326883562	3.092693356	3.4E-06	2.1E-05	2.6E-05	1.6E-04
Aroclor-1260	1.5E+01	2.8E+01	1.2E-05	3 8E-05	no toxicity value	no toxicity value	1.5E-06	1.3E-05	1.2E-05	1.0E-04
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	2.1E-11	3.6E-11	no toxicity value	no toxicity value	2.7E-12	1.2E-11	4.1E-07	1.8E-06
1,2,3,4,7,8-HxCDF	8 8E-06	8.8E-06	7.2E-12	1.2E-11	no toxicity value	no toxicity value	9.3E-13	4.1E-12	1.4E-07	6.2E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	7.5E-12	1.2E-11	no toxicity value	no toxicity value	9.6E-13	4.3E-12	1.4E-07	6.4E-07
2,3,7,8-TCDD	4.6E-06	4.6E-06	3.8E-12	6.3E-12	no toxicity value	no toxicity value	4.9E-13	2.2E-12	7.3E-08	3 2E-07
2,3,7,8-TCDF	6 6E-06	6 6E-06	5.4E-12	9.0E-12	no toxicity value	no toxicity value	7.0E-13	3.1E-12	1.0E-07	4.6E-07
OCDD	1.6E-05	1.6E-05	1.3E-11	2.2E-11	no toxicity value	no toxicity value	1.7E-12	7.5E-12	2.5E-07	1.1E-06
Hazard Index					21	141				
Total Cancer Risk									6E-05	8E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.36. Risk from inhalation of particulates in soil for a future adult resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	1.0E-09	1.1E-08	no toxicity value	no toxicity value	1.3E-10	3.7E-09	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	4.4E-10	1.5E-09	no toxicity value	no toxicity value	5.6E-11	5.2E-10	2.8E-09	2.6E-08
Barium	3.8E+02	8.3E+02	9.7E-09	5.6E-08	6.79E-05	3.91E-04	1.2E-09	1.9E-08	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	1.2E-12	4.6E-11	no toxicity value	no toxicity value	1.5E-13	1.6E-11	1.3E-12	1.3E-10
Cadmium	1 9E+01	2 8E+01	4.8E-10	1.9E-09	no toxicity value	no toxicity value	6.2E-11	6.5E-10	3.8E-10	3.9E-09
Chromium (VI)	1 7E+02	4.6E+02	4.2E-09	3.1E-08	no toxicity value	no toxicity value	5.4E-10	1.1E-08	2.2E-08	4.4E-07
Lead	2 0E+03	8.3E+03	5.0E-08	5.6E-07	no toxicity value	no toxicity value	6.4E-09	1.9E-07	no toxicity value	no toxicity value
Manganese	1 5E+03	2.7E+03	3.8E-08	1.8E-07	3.36E-04	1.61E-03	4.9E-09	6.3E-08	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	2.7E-09	2.9E-08	3.16E-05	3.37E-04	3.5E-10	9.9E-09	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	1.8E-06	2.0E-05	no toxicity value	no toxicity value	2.3E-07	6.8E-06	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	1.2E-07	4.8E-07	no toxicity value	no toxicity value	1.6E-08	1.7E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2 2E+00	1 3E+01	5.6E-11	8.7E-10	no toxicity value	no toxicity value	7.2E-12	3.0E-10	no toxicity value	no toxicity value
Benzo(a)pyrene	1 8E+00	9.5E+00	4.6E-11	6.4E-10	no toxicity value	no toxicity value	5.9E-12	2.2E-10	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.5E+00	9.4E+00	6.2E-11	6.4E-10	no toxicity value	no toxicity value	8.0E-12	2.2E-10	no toxicity value	no toxicity value
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	2.9E-10	3.7E-09	no toxicity value	no toxicity value	3.7E-11	1.3E-09	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	1.6E-11	1.5E-10	no toxicity value	no toxicity value	2.1E-12	5.0E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	3.5E-11	4.0E-10	no toxicity value	no toxicity value	4.5E-12	1.4E-10	no toxicity value	no toxicity value
Aroclor-1248	2.0E+01	1.4E+02	5.0E-10	9.4E-09	no toxicity value	no toxicity value	6.4E-11	3.2E-09	no toxicity value	no toxicity value
Aroclor-1254	3.2E+01	4.5E+01	8.1E-10	3.0E-09	no toxicity value	no toxicity value	1.0E-10	1.0E-09	no toxicity value	no toxicity value
Aroclor-1260	1.5E+01	2.8E+01	3.7E-10	1.9E-09	no toxicity value	no toxicity value	4.7E-11	6.5E-10	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	2 6E-05	2.6E-05	6.6E-16	1.7E-15	no toxicity value	no toxicity value	8.4E-17	6.0E-16	1.3E-11	9.0E-11
1,2,3,4,7,8-HxCDF	8 8E-06	8.8E-06	2.2E-16	5.9E-16	no toxicity value	no toxicity value	2.9E-17	2.0E-16	4.3E-12	3.0E-11
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	2.3E-16	6.1E-16	no toxicity value	no toxicity value	3.0E-17	2.1E-16	4.4E-12	3.1E-11
2,3,7,8-TCDD	4.6E-06	4.6E-06	1.2E-16	3.1E-16	no toxicity value	no toxicity value	1.5E-17	1.1E-16	2.2E-12	1.6E-11
2,3,7,8-TCDF	6 6E-06	6 6E-06	1.7E-16	4.4E-16	no toxicity value	no toxicity value	2.1E-17	1.5E-16	3.2E-12	2.3E-11
OCDD	1.6E-05	1.6E-05	4.0E-16	1.1E-15	no toxicity value	no toxicity value	5.2E-17	3.7E-16	7.8E-12	5.5E-11
Hazard Index					0.0004	0.002				
Total Cancer Risk									3E-08	5E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.37. Risk from dermal contact with chemicals in soil for an adult resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	5.4E-07	1.3E-05	0.067616438	1.60890411	7.0E-08	4.4E-06	no toxicity value	no toxicity value
Arsenic	1 7E+01	2.3E+01	2 4E-07	1.8E-06	0.0019	0.0147	3.0E-08	6.2E-07	1.1E-07	2.3E-06
Barium	3.8E+02	8.3E+02	5.3E-06	6.6E-05	0.0011	0.0135	6.8E-07	2.3E-05	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	6.4E-10	5.5E-08	0.00001	0.0011	8.2E-11	1.9E-08	3.5E-08	8.1E-06
Cadmium	1.9E+01	2.8E+01	2.6E-07	2.2E-06	0.0263	0.2227	3.4E-08	7.6E-07	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	2.3E-06	3.7E-05	0.0230	0.3687	3.0E-07	1.3E-05	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	2.7E-05	6.6E-04	no toxicity value	no toxicity value	3.5E-06	2.3E-04	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	2.1E-05	2.2E-04	0.0004	0.0043	2.7E-06	7.5E-05	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	1.5E-06	3.4E-05	0.0700	1.63	1.9E-07	1.2E-05	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	9 6E-04	2.4E-02	0.3757	9.23	1.2E-04	8.1E-03	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	6.7E-05	5.7E-04	0.0112	0.0950	8.6E-05	2.0E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	3.0E-07	1.0E-05	no toxicity value	no toxicity value	3.9E-08	3.5E-06	5.9E-09	8.5E-06
Benzo(a)pyrene	1.8E+00	9.5E+00	2 5E-07	7.6E-06	no toxicity value	no toxicity value	3.2E-08	2.6E-06	4.9E-08	6.2E-05
Benzo(b)fluoranthene	2 5E+00	9.4E+00	3.4E-07	7.5E-06	no toxicity value	no toxicity value	4.4E-08	2.6E-06	6.6E-09	6.2E-06
Bis(2-ethylhexyl)phthalate	1 1E+01	5.5E+01	1.6E-06	4.4E-05	0.0004	0.0114	2.0E-07	1.5E-05	9.3E-10	1.1E-06
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	8.7E-08	1.7E-06	no toxicity value	no toxicity value	1.1E-08	5.9E-07	1.7E-08	1.4E-05
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	1.9E-07	4.8E-06	no toxicity value	no toxicity value	2.5E-08	1.6E-06	3.7E-09	3.9E-06
Aroclor-1248	2.0E+01	1.4E+02	1.6E-05	6.7E-04	no toxicity value	no toxicity value	2.1E-06	2.3E-04	1.8E-05	2.0E-03
Aroclor-1254	3.2E+01	4.5E+01	2.7E-05	2.2E-04	1.4743	11.9584	3.4E-06	7.4E-05	2.9E-05	6.3E-04
Aroclor-1260	1 5E+01	2.8E+01	1.2E-05	1.3E-04	no toxicity value	no toxicity value	1.5E-06	4.6E-05	1.3E-05	3.9E-04
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	1.1E-11	6.2E-11	no toxicity value	no toxicity value	1.4E-12	2.1E-11	4.1E-07	6.4E-06
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	3.6E-12	2.1E-11	no toxicity value	no toxicity value	4.6E-13	7.2E-12	1.4E-07	2.2E-06
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	3.7E-12	2.2E-11	no toxicity value	no toxicity value	4.8E-13	7.4E-12	1.4E-07	2.2E-06
2,3,7,8-TCDD	4.6E-06	4.6E-06	1.9E-12	1.1E-11	no toxicity value	no toxicity value	2.4E-13	3.8E-12	7.3E-08	1.1E-06
2,3,7,8-TCDF	6 6E-06	6.6E-06	2.7E-12	1.6E-11	no toxicity value	no toxicity value	3.5E-13	5.4E-12	1.0E-07	1.6E-06
OCDD	1.6E-05	1.6E-05	6.6E-12	3.8E-11	no toxicity value	no toxicity value	8.5E-13	1.3E-11	2.5E-07	3.9E-06
Hazard Index					2	25				
Total Cancer Risk									1E-05	4E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.38. Risk from soil ingestion for a child resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	2.5E-04	2.1E-03	0.631086758	5.178082192	2.2E-05	1.8E-04	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	1.1E-04	2.9E-04	0.36838965	0.967427702	9.5E-06	2.5E-05	1.4E-05	3.7E-05
Barium	3.8E+02	8.3E+02	2.5E-03	1.1E-02	0.035116438	0.151598174	2.1E-04	9.1E-04	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	3.0E-07	8.8E-06	5.98356E-05	0.001766941	2.6E-08	7.6E-07	1.1E-07	3.3E-06
Cadmium	1.9E+01	2.8E+01	1.2E-04	3.6E-04	0.122822831	0.358310502	1.1E-05	3.1E-05	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	1.1E-03	5.9E-03	0.214747215	1.186484018	9.2E-05	5.1E-04	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	1.3E-02	1.1E-01	no toxicity value	no toxicity value	1.1E-03	9.1E-03	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	9.7E-03	3.5E-02	0.194705479	0.699520548	8.3E-04	3.0E-03	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	6.9E-04	5.5E-03	2.28513242	18.32572298	5.9E-05	4.7E-04	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	4.5E-01	3.8E+00	149.0222222	1262.996043	3.8E-02	3.2E-01	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	3.1E-02	9.2E-02	0.104541857	0.305842466	2.7E-03	7.9E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	1.4E-05	1.7E-04	no toxicity value	no toxicity value	1.2E-06	1.4E-05	8.8E-07	1.0E-05
Benzo(a)pyrene	1.8E+00	9.5E+00	1.2E-05	1.2E-04	no toxicity value	no toxicity value	1.0E-06	1.0E-05	7.3E-06	7.6E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	1.6E-05	1.2E-04	no toxicity value	no toxicity value	1.4E-06	1.0E-05	9.9E-07	7.6E-06
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	7.2E-05	7.0E-04	0.003620462	0.035159817	6.2E-06	6.0E-05	8.7E-08	8.4E-07
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	4.1E-06	2.8E-05	0.000135578	0.000923464	3.5E-07	2.4E-06	2.5E-06	1.7E-05
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	8.9E-06	7.7E-05	2.97127E-05	0.000255172	7.6E-07	6.6E-06	5.6E-07	4.8E-06
Aroclor-1248	2.0E+01	1.4E+02	1.3E-04	1.8E-03	no toxicity value	no toxicity value	1.1E-05	1.5E-04	8.4E-05	1.2E-03
Aroclor-1254	3.2E+01	4.5E+01	2.1E-04	5.8E-04	10.32020548	28.86513799	1.8E-05	4.9E-05	1.4E-04	3.8E-04
Aroclor-1260	1.5E+01	2.8E+01	9.3E-05	3.6E-04	no toxicity value	no toxicity value	7.9E-06	3.1E-05	6.1E-05	2.4E-04
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	1.7E-10	3.3E-10	no toxicity value	no toxicity value	1.4E-11	2.8E-11	2.1E-06	4.3E-06
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	5.6E-11	1.1E-10	no toxicity value	no toxicity value	4.8E-12	9.6E-12	7.2E-07	1.4E-06
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	5.8E-11	1.2E-10	no toxicity value	no toxicity value	5.0E-12	1.0E-11	7.5E-07	1.5E-06
2,3,7,8-TCDD	4.6E-06	4.6E-06	2.9E-11	5.9E-11	no toxicity value	no toxicity value	2.5E-12	5.0E-12	3.8E-07	7.6E-07
2,3,7,8-TCDF	6.6E-06	6.6E-06	4.2E-11	8.4E-11	no toxicity value	no toxicity value	3.6E-12	7.2E-12	5.4E-07	1.1E-06
OCDD	1.6E-05	1.6E-05	1.0E-10	2.0E-10	no toxicity value	no toxicity value	8.8E-12	1.8E-11	1.3E-06	2.6E-06
Hazard Index					163	1319				
Total Cancer Risk									3E-04	2E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.39. Risk from inhalation of particulates in soil for a child resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	4.6E-09	5.1E-08	no toxicity value	no toxicity value	4.0E-10	4.4E-09	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	2.0E-09	7.1E-09	no toxicity value	no toxicity value	1.7E-10	6 1E-10	8.7E-09	3.1E-08
Barium	3.8E+02	8.3E+02	4.5E-08	2.6E-07	3.17E-04	1.82E-03	3.9E-09	2.2E-08	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	5.5E-12	2.2E-10	no toxicity value	no toxicity value	4.7E-13	1.9E-11	4.0E-12	1.6E-10
Cadmium	1.9E+01	2.8E+01	2.3E-09	8.8E-09	no toxicity value	no toxicity value	1.9E-10	7.5E-10	1.2E-09	4.6E-09
Chromium (VI)	1.7E+02	4.6E+02	2.0E-08	1.5E-07	no toxicity value	no toxicity value	1.7E-09	1.2E-08	6.9E-08	5.1E-07
Lead	2.0E+03	8.3E+03	2 3E-07	2.6E-06	no toxicity value	no toxicity value	2.0E-08	2.2E-07	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	1.8E-07	8.6E-07	1.57E-03	7.51E-03	1.5E-08	7.4E-08	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	1.3E-08	1.3E-07	1.47E-04	1.57E-03	1.1E-09	1.2E-08	no toxicity value	no toxicity value
Uranium	7 0E+04	3.0E+05	8.2E-06	9.3E-05	no toxicity value	no toxicity value	7.1E-07	8.0E-06	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	5.8E-07	2.3E-06	no toxicity value	no toxicity value	4.9E-08	1.9E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2 2E+00	1.3E+01	2.6E-10	4.1E-09	no toxicity value	no toxicity value	2.2E-11	3.5E-10	no toxicity value	no toxicity value
Benzo(a)pyrene	1 8E+00	9.5E+00	2.1E-10	3.0E-09	no toxicity value	no toxicity value	1.8E-11	2.6E-10	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2 5E+00	9.4E+00	2.9E-10	3.0E-09	no toxicity value	no toxicity value	2.5E-11	2.5E-10	no toxicity value	no toxicity value
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	1.3E-09	1.7E-08	no toxicity value	no toxicity value	1.1E-10	1.5E-09	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	7.5E-11	6.8E-10	no toxicity value	no toxicity value	6.4E-12	5.8E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1 4E+00	6.0E+00	1.6E-10	1.9E-09	no toxicity value	no toxicity value	1.4E-11	1.6E-10	no toxicity value	no toxicity value
Aroclor-1248	2 0E+01	1.4E+02	2.3E-09	4.4E-08	no toxicity value	no toxicity value	2.0E-10	3.8E-09	no toxicity value	no toxicity value
Aroclor-1254	3.2E+01	4.5E+01	3.8E-09	1.4E-08	no toxicity value	no toxicity value	3.3E-10	1.2E-09	no toxicity value	no toxicity value
Aroclor-1260	1.5E+01	2.8E+01	1.7E-09	8.8E-09	no toxicity value	no toxicity value	1.5E-10	7.5E-10	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	3.1E-15	8.2E-15	no toxicity value	no toxicity value	2.6E-16	7.0E-16	3.9E-11	1.0E-10
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	1.0E-15	2.8E-15	no toxicity value	no toxicity value	8.9E-17	2.4E-16	1.3E-11	3 6E-11
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	1.1E-15	2.9E-15	no toxicity value	no toxicity value	9.2E-17	2.4E-16	1.4E-11	3.7E-11
2,3,7,8-TCDD	4.6E-06	4.6E-06	5.4E-16	1.4E-15	no toxicity value	no toxicity value	4.6E-17	1.2E-16	7.0E-12	1.9E-11
2,3,7,8-TCDF	6.6E-06	6.6E-06	7.8E-16	2.1E-15	no toxicity value	no toxicity value	6.7E-17	1 8E-16	1.0E-11	2.7E-11
OCDD	1.6E-05	1.6E-05	1.9E-15	5.0E-15	no toxicity value	no toxicity value	1.6E-16	4.3E-16	2.4E-11	6.5E-11
Hazard Index					0.002	0.01				
Total Cancer Risk									8E-08	5E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.40. Risk from dermal contact with chemicals in soil for a child resident at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	8.8E-07	2.1E-05	0.110440183	2.589041096	7.6E-08	1.8E-06	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	3.9E-07	2.9E-06	0.00314479	0.023595798	3.3E-08	2.5E-07	1.2E-07	9.1E-07
Barium	3.8E+02	8.3E+02	8.6E-06	1.1E-04	0.001755822	0.021656882	7.4E-07	9.1E-06	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	1.0E-09	8.8E-08	0.000209425	0.001766941	9.0E-11	7.6E-09	3.9E-08	3.3E-06
Cadmium	1.9E+01	2.8E+01	4.3E-07	3.6E-06	0.042987991	0.358310502	3.7E-08	3.1E-07	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	3.8E-06	5.9E-05	0.037580763	0.593242009	3.2E-07	5.1E-06	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	4.4E-05	1.1E-03	no toxicity value	no toxicity value	3.8E-06	9.1E-05	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	3.4E-05	3.5E-04	0.000681469	0.006995205	2.9E-06	3.0E-05	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	2.4E-06	5.5E-05	0.11426	2.62	2.1E-07	4.7E-06	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	1.6E-03	3.8E-02	0.61362	14.86	1.3E-04	3.2E-03	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	1.1E-04	9.2E-04	0.001829482	0.015292123	9.4E-06	7.9E-05	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	4.9E-07	1.7E-05	no toxicity value	no toxicity value	4.2E-08	1.4E-06	1.0E-07	3.4E-06
Benzo(a)pyrene	1.8E+00	9.5E+00	4.1E-07	1.2E-05	no toxicity value	no toxicity value	3.5E-08	1.0E-06	8.4E-07	2.5E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	5.5E-07	1.2E-05	no toxicity value	no toxicity value	4.8E-08	1.0E-06	1.1E-07	2.5E-06
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	2.5E-06	7.0E-05	0.000661703	0.018360218	2.2E-07	6.0E-06	1.6E-08	4.4E-07
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	1.4E-07	2.8E-06	no toxicity value	no toxicity value	1.2E-08	2.4E-07	2.9E-07	5.6E-06
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	3.1E-07	7.7E-06	no toxicity value	no toxicity value	2.7E-08	6.6E-07	6.4E-08	1.6E-06
Aroclor-1248	2.0E+01	1.4E+02	2.7E-05	1.1E-03	no toxicity value	no toxicity value	2.3E-06	9.2E-05	1.9E-05	7.9E-04
Aroclor-1254	3.2E+01	4.5E+01	4.3E-05	3.5E-04	2.408047945	19.24342533	3.7E-06	3.0E-05	3.2E-05	2.5E-04
Aroclor-1260	1.5E+01	2.8E+01	1.9E-05	2.1E-04	no toxicity value	no toxicity value	1.7E-06	1.8E-05	1.4E-05	1.6E-04
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	1.7E-11	1.0E-10	no toxicity value	no toxicity value	1.5E-12	8.5E-12	4.5E-07	2.6E-06
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	5.9E-12	3.4E-11	no toxicity value	no toxicity value	5.1E-13	2.9E-12	1.5E-07	8.7E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	6.1E-12	3.5E-11	no toxicity value	no toxicity value	5.2E-13	3.0E-12	1.6E-07	9.0E-07
2,3,7,8-TCDD	4.6E-06	4.6E-06	3.1E-12	1.8E-11	no toxicity value	no toxicity value	2.6E-13	1.5E-12	7.9E-08	4.5E-07
2,3,7,8-TCDF	6.6E-06	6.6E-06	4.4E-12	2.5E-11	no toxicity value	no toxicity value	3.8E-13	2.2E-12	1.1E-07	6.5E-07
OCDD	1.6E-05	1.6E-05	1.1E-11	6.1E-11	no toxicity value	no toxicity value	9.2E-13	5.3E-12	2.8E-07	1.6E-06
Hazard Index					3	40				
Total Cancer Risk									7E-05	1E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.41. Risk from soil ingestion for an adolescent at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	1.7E-06	8.9E-05	0.004207245	0.221917808	2.4E-07	1.3E-05	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	7.4E-07	1.2E-05	0.002455931	0.041461187	1.1E-07	1.8E-06	1.6E-07	2.7E-06
Barium	3.8E+02	8.3E+02	1.6E-05	4.5E-04	0.00023411	0.006497065	2.3E-06	6.5E-05	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	2.0E-09	3.8E-07	3.98904E-07	7.5726E-05	2.8E-10	5.4E-08	1.2E-09	2.3E-07
Cadmium	1.9E+01	2.8E+01	8 2E-07	1.5E-05	0.000818819	0.015356164	1.2E-07	2.2E-06	no toxicity value	no toxicity value
Chromium (VI)	1 7E+02	4.6E+02	7.2E-06	2.5E-04	0.001431648	0.050849315	1.0E-06	3.6E-05	no toxicity value	no toxicity value
Lead	2 0E+03	8.3E+03	8.4E-05	4.6E-03	no toxicity value	no toxicity value	1.2E-05	6.5E-04	no toxicity value	no toxicity value
Manganese	1 5E+03	2.7E+03	6.5E-05	1.5E-03	0.001298037	0.029979452	9.3E-06	2.1E-04	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	4 6E-06	2.4E-04	0.015234216	0.785388128	6.5E-07	3.4E-05	no toxicity value	no toxicity value
Uranium	7 0E+04	3.0E+05	3.0E-03	1.6E-01	0.993481481	54.12840183	4.3E-04	2.3E-02	no toxicity value	no toxicity value
Zinc	4 9E+03	7.2E+03	2.1E-04	3.9E-03	0.000696946	0.013107534	3.0E-05	5.6E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2 2E+00	1 3E+01	9.4E-08	7.1E-06	no toxicity value	no toxicity value	1.3E-08	1.0E-06	9.8E-09	7.4E-07
Benzo(a)pyrene	1.8E+00	9.5E+00	7.8E-08	5.2E-06	no toxicity value	no toxicity value	1.1E-08	7.5E-07	8.1E-08	5.5E-06
Benzo(b)fluoranthene	2 5E+00	9.4E+00	1.1E-07	5.2E-06	no toxicity value	no toxicity value	1.5E-08	7.4E-07	1.1E-08	5.4E-07
Bis(2-ethylhexyl)phthalate	1.1E+01	5 5E+01	4.8E-07	3.0E-05	2.41364E-05	0.001506849	6.9E-08	4.3E-06	9.7E-10	6.0E-08
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	2.7E-08	1.2E-06	9.03856E-07	3.9577E-05	3.9E-09	1.7E-07	2.8E-08	1.2E-06
Indeno(1,2,3-cd)pyrene	1 4E+00	6.0E+00	5.9E-08	3.3E-06	1.98085E-07	1.09359E-05	8.5E-09	4.7E-07	6.2E-09	3.4E-07
Aroclor-1248	2 0E+01	1 4E+02	8.4E-07	7.7E-05	no toxicity value	no toxicity value	1.2E-07	1.1E-05	9.3E-07	8.4E-05
Aroclor-1254	3 2E+01	4.5E+01	1 4E-06	2.5E-05	0.06880137	1.237077342	2.0E-07	3.5E-06	1.5E-06	2.7E-05
Aroclor-1260	1.5E+01	2 8E+01	6.2E-07	1.5E-05	no toxicity value	no toxicity value	8.8E-08	2.2E-06	6.8E-07	1.7E-05
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	1.1E-12	1.4E-11	no toxicity value	no toxicity value	1.6E-13	2.0E-12	2.4E-08	3.1E-07
1,2,3,4,7,8-HxCDF	8 8E-06	8 8E-06	3.8E-13	4.8E-12	no toxicity value	no toxicity value	5.4E-14	6.9E-13	8.0E-09	1.0E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	3.9E-13	5.0E-12	no toxicity value	no toxicity value	5.5E-14	7.1E-13	8.3E-09	1.1E-07
2,3,7,8-TCDD	4.6E-06	4.6E-06	2.0E-13	2.5E-12	no toxicity value	no toxicity value	2.8E-14	3.6E-13	4.2E-09	5.4E-08
2,3,7,8-TCDF	6.6E-06	6 6E-06	2.8E-13	3.6E-12	no toxicity value	no toxicity value	4.0E-14	5.2E-13	6.0E-09	7.7E-08
OCDD	1.6E-05	1.6E-05	6.8E-13	8.8E-12	no toxicity value	no toxicity value	9.7E-14	1.3E-12	1.5E-08	1.9E-07
Hazard Index					1	57				
Total Cancer Risk									3E-06	1E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.42. Risk from inhalation of particulates in soil for an adolescent at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	3.1E-11	2.2E-09	no toxicity value	no toxicity value	4.4E-12	3.1E-10	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	1.4E-11	3.1E-10	no toxicity value	no toxicity value	1.9E-12	4.4E-11	9.7E-11	2.2E-09
Barium	3.8E+02	8.3E+02	3.0E-10	1.1E-08	2.11E-06	7.81E-05	4.3E-11	1.6E-09	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	3.7E-14	9.3E-12	no toxicity value	no toxicity value	5.2E-15	1.3E-12	4.4E-14	1.1E-11
Cadmium	1 9E+01	2.8E+01	1.5E-11	3.8E-10	no toxicity value	no toxicity value	2.2E-12	5.4E-11	1.3E-11	3.3E-10
Chromium (VI)	1 7E+02	4.6E+02	1.3E-10	6.2E-09	no toxicity value	no toxicity value	1.9E-11	8.9E-10	7.7E-10	3.7E-08
Lead	2.0E+03	8.3E+03	1.6E-09	1.1E-07	no toxicity value	no toxicity value	2.2E-10	1.6E-08	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	1.2E-09	3.7E-08	1.05E-05	3.22E-04	1.7E-10	5.3E-09	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	8.4E-11	5.8E-09	9.82E-07	6.75E-05	1.2E-11	8.3E-10	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	5.5E-08	4.0E-06	no toxicity value	no toxicity value	7.8E-09	5.7E-07	no toxicity value	no toxicity value
Zinc	4 9E+03	7.2E+03	3.8E-09	9.7E-08	no toxicity value	no toxicity value	5.5E-10	1.4E-08	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	1 7E-12	1.7E-10	no toxicity value	no toxicity value	2.5E-13	2.5E-11	no toxicity value	no toxicity value
Benzo(a)pyrene	1 8E+00	9 5E+00	1.4E-12	1.3E-10	no toxicity value	no toxicity value	2.0E-13	1.8E-11	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2 5E+00	9.4E+00	1.9E-12	1.3E-10	no toxicity value	no toxicity value	2.8E-13	1.8E-11	no toxicity value	no toxicity value
Bis(2-ethylhexyl)phthalate	1 1E+01	5.5E+01	8.9E-12	7.4E-10	no toxicity value	no toxicity value	1.3E-12	1.1E-10	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	5.0E-13	2.9E-11	no toxicity value	no toxicity value	7.1E-14	4.2E-12	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1 4E+00	6.0E+00	1.1E-12	8.1E-11	no toxicity value	no toxicity value	1.6E-13	1.2E-11	no toxicity value	no toxicity value
Aroclor-1248	2 0E+01	1.4E+02	1.6E-11	1.9E-09	no toxicity value	no toxicity value	2.2E-12	2.7E-10	no toxicity value	no toxicity value
Aroclor-1254	3.2E+01	4.5E+01	2.5E-11	6.1E-10	no toxicity value	no toxicity value	3.6E-12	8 7E-11	no toxicity value	no toxicity value
Aroclor-1260	1 5E+01	2.8E+01	1 1E-11	3.8E-10	no toxicity value	no toxicity value	1.6E-12	5.4E-11	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	2.0E-17	3.5E-16	no toxicity value	no toxicity value	2.9E-18	5.0E-17	4.4E-13	7.5E-12
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	6.9E-18	1.2E-16	no toxicity value	no toxicity value	9.9E-19	1.7E-17	1.5E-13	2.5E-12
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	7.1E-18	1.2E-16	no toxicity value	no toxicity value	1.0E-18	1.7E-17	1.5E-13	2.6E-12
2,3,7,8-TCDD	4.6E-06	4.6E-06	3.6E-18	6.2E-17	no toxicity value	no toxicity value	5.2E-19	8.8E-18	7.7E-14	1.3E-12
2,3,7,8-TCDF	6.6E-06	6.6E-06	5.2E-18	8.9E-17	no toxicity value	no toxicity value	7.4E-19	1.3E-17	1.1E-13	1.9E-12
OCDD	1.6E-05	1.6E-05								
Hazard Index					0.00001	0.0005				
Total Cancer Risk									9E-10	4E-08

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.43. Risk from dermal contact with chemicals in soil for an adolescent at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3 9E+01	1.6E+02	1 4E-08	1.9E-06	0.001809115	0.240392466	2.1E-09	2.7E-07	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	6.3E-09	2.7E-07	5.15147E-05	0.00219087	9.1E-10	3.8E-08	3.3E-09	1.4E-07
Barium	3.8E+02	8.3E+02	1.4E-07	9.9E-06	2.8762E-05	0.002010841	2.0E-08	1.4E-06	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	1.7E-11	8.2E-09	3.43058E-07	0.00016406	2.5E-12	1.2E-09	1.1E-09	5.0E-07
Cadmium	1.9E+01	2.8E+01	7.0E-09	3.3E-07	0.000704184	0.03326913	1.0E-09	4.8E-08	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	6.2E-08	5.5E-06	0.000615609	0.055082521	8.8E-09	7.9E-07	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	7.2E-07	9.9E-05	no toxicity value	no toxicity value	1.0E-07	1.4E-05	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	5.6E-07	3.2E-05	1.11631E-05	0.000649505	8.0E-08	4.6E-06	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	3.9E-08	5.1E-06	0.001871632	0 243077626	5.6E-09	7.3E-07	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	2.6E-05	3.5E-03	0.010051695	1.379637442	3.7E-06	5.0E-04	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	1.8E-06	8.5E-05	2.99687E-05	0.001419874	2.6E-07	1.2E-05	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	8.1E-09	1.5E-06	no toxicity value	no toxicity value	1.2E-09	2.2E-07	2.8E-09	5 3E-07
Benzo(a)pyrene	1.8E+00	9.5E+00	6.7E-09	1.1E-06	no toxicity value	no toxicity value	9.6E-10	1.6E-07	2.3E-08	3.9E-06
Benzo(b)fluoranthene	2.5E+00	9.4E+00	9.1E-09	1.1E-06	no toxicity value	no toxicity value	1.3E-09	1.6E-07	3.1E-09	3.8E-07
Bis(2-ethylhexyl)phthalate	1 1E+01	5.5E+01	4.2E-08	6.5E-06	1.08393E-06	0.000170475	5.9E-09	9.3E-07	4.4E-10	6.9E-08
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	2.3E-09	2.6E-07	no toxicity value	no toxicity value	3.3E-10	3.7E-08	7.8E-09	8.6E-07
Indeno(1,2,3-cd)pyrene	1.4E+00	6 0E+00	5.1E-09	7.1E-07	no toxicity value	no toxicity value	7.3E-10	1.0E-07	1.8E-09	2.4E-07
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	2.9E-13	9.3E-12	no toxicity value	no toxicity value	4.1E-14	1.3E-12	1.2E-08	4.0E-07
1,2,3,4,7,8-HxCDF	8.8E-06	8 8E-06	9.7E-14	3.1E-12	no toxicity value	no toxicity value	1.4E-14	4.5E-13	4.1E-09	1.3E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	1.0E-13	3.2E-12	no toxicity value	no toxicity value	1.4E-14	4.6E-13	4.3E-09	1.4E-07
2,3,7,8-TCDD	4.6E-06	4.6E-06	5.1E-14	1.6E-12	no toxicity value	no toxicity value	7.2E-15	2.3E-13	2.2E-09	7.0E-08
2,3,7,8-TCDF	6.6E-06	6.6E-06	7.3E-14	2.4E-12	no toxicity value	no toxicity value	1.0E-14	3.4E-13	3.1E-09	1.0E-07
OCDD	1.6E-05	1 6E-05	1.8E-13	5.7E-12	no toxicity value	no toxicity value	2.5E-14	8.1E-13	7.5E-09	2.4E-07
Aroclor-1248	2 0E+01	1.4E+02	4.4E-07	1.0E-04	no toxicity value	no toxicity value	6.2E-08	1.4E-05	5.3E-07	1.2E-04
Aroclor-1254	3.2E+01	4 5E+01	7.1E-07	3.2E-05	0.039446119	1.786752042	1.0E-07	4.6E-06	8.7E-07	3.9E-05
Aroclor-1260	1.5E+01	2.8E+01	3.2E-07	2.0E-05	no toxicity value	no toxicity value	4.6E-08	2.8E-06	3.9E-07	2.4E-05
Hazard Index					0.05	4				
Total Cancer Risk									2E-06	2E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.44. Risk from soil ingestion for a current employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point in surface soil (mg/kg) Mean	Exposure point in surface soil (mg/kg) RME	Intake values (mg/kg-day) Mean	Intake values (mg/kg-day) RME	Noncarcinogenic effects: quotient (intake/RfD) Mean	Noncarcinogenic effects: quotient (intake/RfD) RME	Intake values (mg/kg-day) Mean	Intake values (mg/kg-day) RME	Carcinogenic effects: cancer risk (intake x SF) Mean	Carcinogenic effects: cancer risk (intake x SF) RME
Antimony	3.9E+01	1.6E+02	5.8E-06	4.0E-05	0.014489237	0.09907045	3.3E-07	7.4E-06	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	2.5E-06	5.6E-06	0.008457926	0.018509459	1.4E-07	1.0E-06	2.2E-07	1.5E-06
Barium	3.8E+02	8.3E+02	5.6E-05	2.0E-04	0.000806245	0.002900475	3.2E-06	3.8E-05	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	6.9E-09	1.7E-07	1.37378E-06	3.38063E-05	3.9E-10	3.1E-08	1.7E-09	1.3E-07
Cadmium	1.9E+01	2.8E+01	2.8E-06	6.9E-06	0.002819912	0.006855431	1.6E-07	1.3E-06	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	2.5E-05	1.1E-04	0.004930421	0.022700587	1.4E-06	2.1E-05	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	2.9E-04	2.0E-03	no toxicity value	no toxicity value	1.7E-05	3.8E-04	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	2.2E-04	6.7E-04	0.004470279	0.013383684	1.3E-05	1.2E-04	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	1.6E-05	1.1E-04	0.052464775	0.3506197	9.0E-07	2.0E-05	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	1.0E-02	7.2E-02	3.421428571	24.1644651	5.9E-04	1.3E-02	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	7.2E-04	1.8E-03	0.002400196	0.005851578	4.1E-05	3.3E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	3.2E-07	3.2E-06	no toxicity value	no toxicity value	1.8E-08	5.9E-07	1.4E-08	4.3E-07
Benzo(a)pyrene	1.8E+00	9.5E+00	2.7E-07	2.3E-06	no toxicity value	no toxicity value	1.5E-08	4.3E-07	1.1E-07	3.2E-06
Benzo(b)fluoranthene	2.5E+00	9.4E+00	3.6E-07	2.3E-06	no toxicity value	no toxicity value	2.1E-08	4.3E-07	1.5E-08	3.1E-07
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	1.7E-06	1.3E-05	8.31229E-05	0.000672701	9.5E-08	2.5E-06	1.3E-09	3.5E-08
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	9.3E-08	5.3E-07	3.11277E-06	1.76683E-05	5.3E-09	9.8E-08	3.9E-08	7.2E-07
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	2.0E-07	1.5E-06	6.8218E-07	4.88211E-06	1.2E-08	2.7E-07	8.5E-09	2.0E-07
Aroclor-1248	2.0E+01	1.4E+02	2.9E-06	3.4E-05	no toxicity value	no toxicity value	1.7E-07	6.4E-06	1.3E-06	4.9E-05
Aroclor-1254	3.2E+01	4.5E+01	4.7E-06	1.1E-05	0.236943493	0.552266671	2.7E-07	2.1E-06	2.1E-06	1.6E-05
Aroclor-1260	1.5E+01	2.8E+01	2.1E-06	6.8E-06	no toxicity value	no toxicity value	1.2E-07	1.3E-06	9.4E-07	9.8E-06
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	3.8E-12	6.4E-12	no toxicity value	no toxicity value	2.2E-13	1.2E-12	3.3E-08	1.8E-07
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	1.3E-12	2.2E-12	no toxicity value	no toxicity value	7.4E-14	4.0E-13	1.1E-08	6.0E-08
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	1.3E-12	2.2E-12	no toxicity value	no toxicity value	7.6E-14	4.1E-13	1.1E-08	6.2E-08
2,3,7,8-TCDD	4.6E-06	4.6E-06	6.8E-13	1.1E-12	no toxicity value	no toxicity value	3.9E-14	2.1E-13	5.8E-09	3.1E-08
2,3,7,8-TCDF	6.6E-06	6.6E-06	9.7E-13	1.6E-12	no toxicity value	no toxicity value	5.5E-14	3.0E-13	8.3E-09	4.5E-08
OCDD	1.6E-05	1.6E-05	2.3E-12	3.9E-12	no toxicity value	no toxicity value	1.3E-13	7.3E-13	2.0E-08	1.1E-07
Hazard Index					4	25				
Total Cancer Risk									5E-06	8E-05

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.45. Risk from inhalation of particulates in soil for a current employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	7.1E-10	7.8E-09	no toxicity value	no toxicity value	4.1E-11	1.4E-09	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	3.1E-10	1.1E-09	no toxicity value	no toxicity value	1.8E-11	2.0E-10	8.9E-10	1.0E-08
Barium	3.8E+02	8.3E+02	6.9E-09	4.0E-08	4.85E-05	2.79E-04	4.0E-10	7.4E-09	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	8.4E-13	3.3E-11	no toxicity value	no toxicity value	4.8E-14	6.2E-12	4.0E-13	5.2E-11
Cadmium	1.9E+01	2.8E+01	3.5E-10	1.3E-09	no toxicity value	no toxicity value	2.0E-11	2.5E-10	1.2E-10	1.5E-09
Chromium (VI)	1.7E+02	4.6E+02	3.0E-09	2.2E-08	no toxicity value	no toxicity value	1.7E-10	4.1E-09	7.1E-09	1.7E-07
Lead	2.0E+03	8.3E+03	3.6E-08	4.0E-07	no toxicity value	no toxicity value	2.0E-09	7.4E-08	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	2.7E-08	1.3E-07	2.40E-04	1.15E-03	1.6E-09	2.4E-08	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	1.9E-09	2.1E-08	2.25E-05	2.41E-04	1.1E-10	3.8E-09	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	1.3E-06	1.4E-05	no toxicity value	no toxicity value	7.2E-08	2.6E-06	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	8.8E-08	3.4E-07	no toxicity value	no toxicity value	5.0E-09	6.4E-08	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	4.0E-11	6.2E-10	no toxicity value	no toxicity value	2.3E-12	1.2E-10	no toxicity value	no toxicity value
Benzo(a)pyrene	1.8E+00	9.5E+00	3.3E-11	4.6E-10	no toxicity value	no toxicity value	1.9E-12	8.5E-11	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.5E+00	9.4E+00	4.5E-11	4.5E-10	no toxicity value	no toxicity value	2.6E-12	8.4E-11	no toxicity value	no toxicity value
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	2.0E-10	2.6E-09	no toxicity value	no toxicity value	1.2E-11	4.9E-10	no toxicity value	no toxicity value
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	1.1E-11	1.0E-10	no toxicity value	no toxicity value	6.5E-13	1.9E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	2.5E-11	2.9E-10	no toxicity value	no toxicity value	1.4E-12	5.3E-11	no toxicity value	no toxicity value
Aroclor-1248	2.0E+01	1.4E+02	3.6E-10	6.7E-09	no toxicity value	no toxicity value	2.0E-11	1.2E-09	no toxicity value	no toxicity value
Aroclor-1254	3.2E+01	4.5E+01	5.8E-10	2.2E-09	no toxicity value	no toxicity value	3.3E-11	4.0E-10	no toxicity value	no toxicity value
Aroclor-1260	1.5E+01	2.8E+01	2.6E-10	1.3E-09	no toxicity value	no toxicity value	1.5E-11	2.5E-10	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	4.7E-16	1.2E-15	no toxicity value	no toxicity value	2.7E-17	2.3E-16	4.0E-12	3.5E-11
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	1.6E-16	4.2E-16	no toxicity value	no toxicity value	9.1E-18	7.9E-17	1.4E-12	1.2E-11
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	1.6E-16	4.4E-16	no toxicity value	no toxicity value	9.4E-18	8.1E-17	1.4E-12	1.2E-11
2,3,7,8-TCDD	4.6E-06	4.6E-06	8.3E-17	2.2E-16	no toxicity value	no toxicity value	4.7E-18	4.1E-17	7.1E-13	6.2E-12
2,3,7,8-TCDF	6.6E-06	6.6E-06	1.2E-16	3.2E-16	no toxicity value	no toxicity value	6.8E-18	5.9E-17	1.0E-12	8.8E-12
OCDD	1.6E-05	1.6E-05	2.9E-16	7.7E-16	no toxicity value	no toxicity value	1.6E-17	1.4E-16	2.5E-12	2.1E-11
Hazard Index					0.0003	0.002				
Total Cancer Risk									8E-09	2E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.46. Risk from dermal contact with chemicals in soil for a current employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	7.7E-08	4.2E-06	0.009659491	0.525073386	4.4E-09	7.8E-07	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	3.4E-08	5.9E-07	0.000275054	0.004785372	1.9E-09	1.1E-07	7.1E-09	4.0E-07
Barium	3.8E+02	8 3E+02	7.5E-07	2.2E-05	0.00015357	0.004392148	4.3E-08	4.0E-06	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	9.2E-11	1.8E-08	1.8317E-06	0.000358346	5.2E-12	3.3E-09	2.3E-09	1.4E-06
Cadmium	1.9E+01	2.8E+01	3.8E-08	7.3E-07	0.003759883	0.072667564	2.1E-09	1.3E-07	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	3.3E-07	1.2E-05	0.003286947	0.120313112	1.9E-08	2.2E-06	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	3.9E-06	2.2E-04	no toxicity value	no toxicity value	2.2E-07	4.0E-05	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	3.0E-06	7.1E-05	5.96037E-05	0.00141867	1.7E-07	1.3E-05	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	2.1E-07	1.1E-05	0.00999329	0.530938403	1.2E-08	2.1E-06	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	1.4E-04	7.7E-03	0.053669468	3.013450942	7.8E-06	1.4E-03	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	9.6E-06	1.9E-04	0.000160013	0.003101336	5.5E-07	3.5E-05	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	4.3E-08	3 4E-06	no toxicity value	no toxicity value	2.5E-09	6.3E-07	5.9E-09	1.5E-06
Benzo(a)pyrene	1.8E+00	9 5E+00	3.6E-08	2.5E-06	no toxicity value	no toxicity value	2.0E-09	4.6E-07	4.9E-08	1.1E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	4.8E-08	2.4E-06	no toxicity value	no toxicity value	2.8E-09	4.5E-07	6.6E-09	1.1E-06
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	2.2E-07	1.4E-05	5.78749E-05	0.003723565	1.3E-08	2.6E-06	9.3E-10	2 0E-07
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	1.2E-08	5.6E-07	no toxicity value	no toxicity value	7.1E-10	1.0E-07	1.7E-08	2.5E-06
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	2.7E-08	1.6E-06	no toxicity value	no toxicity value	1.6E-09	2.9E-07	3.7E-09	6.9E-07
Aroclor-1248	2.0E+01	1.4E+02	2.3E-06	2.2E-04	no toxicity value	no toxicity value	1.3E-07	4.0E-05	1.1E-06	3.5E-04
Aroclor-1254	3.2E+01	4.5E+01	3.8E-06	7.0E-05	0.210616438	3.902684473	2.2E-07	1.3E-05	1.9E-06	1.1E-04
Aroclor-1260	1 5E+01	2.8E+01	1.7E-06	4.4E-05	no toxicity value	no toxicity value	9.7E-08	8.1E-06	8.3E-07	6.9E-05
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	1.5E-12	2.0E-11	no toxicity value	no toxicity value	8.7E-14	3.8E-12	2.6E-08	1.1E-06
1,2,3,4,7,8-HxCDF	8 8E-06	8.8E-06	5.2E-13	6.8E-12	no toxicity value	no toxicity value	3.0E-14	1.3E-12	8.9E-09	3.8E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	5.3E-13	7.1E-12	no toxicity value	no toxicity value	3.1E-14	1.3E-12	9.2E-09	3.9E-07
2,3,7,8-TCDD	4.6E-06	4 6E-06	2.7E-13	3.6E-12	no toxicity value	no toxicity value	1.5E-14	6.6E-13	4.6E-09	2.0E-07
2,3,7,8-TCDF	6 6E-06	6.6E-06	3.9E-13	5.1E-12	no toxicity value	no toxicity value	2.2E-14	9.5E-13	6.6E-09	2.9E-07
OCDD	1.6E-05	1.6E-05	9.4E-13	1.2E-11	no toxicity value	no toxicity value	5.4E-14	2.3E-12	1.6E-08	6.9E-07
Hazard Index					0.3	8				
Total Cancer Risk									4E-06	5E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.47. Risk from soil ingestion for a future employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	1.2E-05	7.9E-05	0.028978474	0.1981409	1.2E-06	2.8E-05	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	5.1E-06	1.1E-05	0.016915851	0.037018917	5.1E-07	4.0E-06	7.6E-07	5.9E-06
Barium	3.8E+02	8.3E+02	1.1E-04	4.1E-04	0.00161249	0.005800951	1.1E-05	1.5E-04	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	1.4E-08	3.4E-07	2.74755E-06	6.76125E-05	1.4E-09	1.2E-07	5.9E-09	5.2E-07
Cadmium	1.9E+01	2.8E+01	5.6E-06	1.4E-05	0.005639824	0.013710861	5.6E-07	4.9E-06	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	4.9E-05	2.3E-04	0.009860841	0.045401174	4.9E-06	8.1E-05	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	5.8E-04	4.1E-03	no toxicity value	no toxicity value	5.8E-05	1.5E-03	no toxicity value	no toxicity value
Manganese	1.5E+03	2.7E+03	4.5E-04	1.3E-03	0.008940558	0.026767368	4.5E-05	4.8E-04	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	3.1E-05	2.1E-04	0.10492955	0.7012394	3.1E-06	7.5E-05	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	2.1E-02	1.4E-01	6.842857143	48.3289302	2.1E-03	5.2E-02	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	1.4E-03	3.5E-03	0.004800391	0.011703156	1.4E-04	1.3E-03	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	6.5E-07	6.4E-06	no toxicity value	no toxicity value	6.5E-08	2.3E-06	4.7E-08	1.7E-06
Benzo(a)pyrene	1.8E+00	9.5E+00	5.4E-07	4.7E-06	no toxicity value	no toxicity value	5.4E-08	1.7E-06	3.9E-07	1.2E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	7.3E-07	4.6E-06	no toxicity value	no toxicity value	7.3E-08	1.7E-06	5.3E-08	1.2E-06
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	3.3E-06	2.7E-05	0.000166246	0.001345401	3.3E-07	9.6E-06	4.7E-09	1.3E-07
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	1.9E-07	1.1E-06	6.22554E-06	3.53366E-05	1.9E-08	3.8E-07	1.4E-07	2.8E-06
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	4.1E-07	2.9E-06	1.36436E-06	9.76422E-06	4.1E-08	1.0E-06	3.0E-08	7.6E-07
Aroclor-1248	2.0E+01	1.4E+02	5.8E-06	6.8E-05	no toxicity value	no toxicity value	5.8E-07	2.4E-05	4.5E-06	1.9E-04
Aroclor-1254	3.2E+01	4.5E+01	9.5E-06	2.2E-05	0.473886986	1.104533341	9.5E-07	7.9E-06	7.3E-06	6.1E-05
Aroclor-1260	1.5E+01	2.8E+01	4.3E-06	1.4E-05	no toxicity value	no toxicity value	4.3E-07	4.9E-06	3.3E-06	3.8E-05
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	7.6E-12	1.3E-11	no toxicity value	no toxicity value	7.6E-13	4.5E-12	1.1E-07	6.8E-07
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	2.6E-12	4.3E-12	no toxicity value	no toxicity value	2.6E-13	1.5E-12	3.9E-08	2.3E-07
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	2.7E-12	4.5E-12	no toxicity value	no toxicity value	2.7E-13	1.6E-12	4.0E-08	2.4E-07
2,3,7,8-TCDD	4.6E-06	4.6E-06	1.4E-12	2.3E-12	no toxicity value	no toxicity value	1.4E-13	8.0E-13	2.0E-08	1.2E-07
2,3,7,8-TCDF	6.6E-06	6.6E-06	1.9E-12	3.2E-12	no toxicity value	no toxicity value	1.9E-13	1.2E-12	2.9E-08	1.7E-07
OCDD	1.6E-05	1.6E-05	4.7E-12	7.8E-12	no toxicity value	no toxicity value	4.7E-13	2.8E-12	7.0E-08	4.2E-07
Hazard Index					7	50				
Total Cancer Risk									2E-05	3E-04

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.48. Risk from inhalation of particulates in soil for a future employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in suface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (Intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (Intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1 6E+02	1.4E-09	1.6E-08	no toxicity value	no toxicity value	1.4E-10	5.6E-09	no toxicity value	no toxicity value
Arsenic	1.7E+01	2 3E+01	6.2E-10	2.2E-09	no toxicity value	no toxicity value	6.2E-11	7.8E-10	3.1E-09	3.9E-08
Barium	3.8E+02	8.3E+02	1.4E-08	8.0E-08	9.70E-05	5.58E-04	1.4E-09	2.8E-08	no toxicity value	no toxicity value
Beryllium	4.7E-02	6 9E-01	1.7E-12	6.6E-11	no toxicity value	no toxicity value	1.7E-13	2.4E-11	1.4E-12	2 0E-10
Cadmium	1.9E+01	2 8E+01	6.9E-10	2.7E-09	no toxicity value	no toxicity value	6.9E-11	9.6E-10	4.2E-10	5.9E-09
Chromium (VI)	1.7E+02	4.6E+02	6.1E-09	4.5E-08	no toxicity value	no toxicity value	6.1E-10	1.6E-08	2.5E-08	6.5E-07
Lead	2 0E+03	8 3E+03	7.1E-08	8.0E-07	no toxicity value	no toxicity value	7.1E-09	2.9E-07	no toxicity value	no toxicity value
Manganese	1.5E+03	2 7E+03	5.5E-08	2.6E-07	4.80E-04	2.30E-03	5.5E-09	9.4E-08	no toxicity value	no toxicity value
Mercury	1.1E+02	4.3E+02	3.9E-09	4.1E-08	4.51E-05	4.82E-04	3.9E-10	1.5E-08	no toxicity value	no toxicity value
Uranium	7.0E+04	3.0E+05	2.5E-06	2.8E-05	no toxicity value	no toxicity value	2.5E-07	1.0E-05	no toxicity value	no toxicity value
Zinc	4.9E+03	7 2E+03	1.8E-07	6.9E-07	no toxicity value	no toxicity value	1.8E-08	2.5E-07	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	7.9E-11	1.2E-09	no toxicity value	no toxicity value	7.9E-12	4.5E-10	no toxicity value	no toxicity value
Benzo(a)pyrene	1.8E+00	9 5E+00	6.6E-11	9.2E-10	no toxicity value	no toxicity value	6.6E-12	3.3E-10	no toxicity value	no toxicity value
Benzo(b)fluoranthene	2.5E+00	9.4E+00	8.9E-11	9.1E-10	no toxicity value	no toxicity value	8.9E-12	3.2E-10	no toxicity value	no toxicity value
Bis(2-ethylhexyl)phthalate	1.1E+01	5.5E+01	4.1E-10	5.3E-09	no toxicity value	no toxicity value	4.1E-11	1.9E-09	no toxicity value	no toxicity value
Dibenzo(a.h)anthracene	6.4E-01	2 2E+00	2.3E-11	2.1E-10	no toxicity value	no toxicity value	2.3E-12	7.4E-11	no toxicity value	no toxicity value
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	5.0E-11	5.8E-10	no toxicity value	no toxicity value	5.0E-12	2.1E-10	no toxicity value	no toxicity value
Aroclor-1248	2.0E+01	1 4E+02	7.1E-10	1.3E-08	no toxicity value	no toxicity value	7.1E-11	4.8E-09	no toxicity value	no toxicity value
Aroclor-1254	3.2E+01	4 5E+01	1.2E-09	4.3E-09	no toxicity value	no toxicity value	1.2E-10	1.5E-09	no toxicity value	no toxicity value
Aroclor-1260	1.5E+01	2 8E+01	5.2E-10	2.7E-09	no toxicity value	no toxicity value	5.2E-11	9.6E-10	no toxicity value	no toxicity value
1,2,3,4,6,7,8-HpCDD	2.6E-05	2 6E-05	9.4E-16	2.5E-15	no toxicity value	no toxicity value	9.4E-17	8.9E-16	1.4E-11	1.3E-10
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	3.2E-16	8.5E-16	no toxicity value	no toxicity value	3.2E-17	3.0E-16	4.8E-12	4.5E-11
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	3.3E-16	8.7E-16	no toxicity value	no toxicity value	3.3E-17	3.1E-16	4.9E-12	4.7E-11
2,3,7,8-TCDD	4.6E-06	4.6E-06	1.7E-16	4.4E-16	no toxicity value	no toxicity value	1.7E-17	1.6E-16	2.5E-12	2.4E-11
2,3,7,8-TCDF	6.6E-06	6.6E-06	2.4E-16	6.3E-16	no toxicity value	no toxicity value	2.4E-17	2.3E-16	3.6E-12	3.4E-11
OCDD	1.6E-05	1.6E-05	5.8E-16	1.5E-15	no toxicity value	no toxicity value	5.8E-17	5.5E-16	8.6E-12	8.2E-11
Hazard Index					0.00062	0.00334				
Total Cancer Risk									3E-08	7E-07

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.49. Risk from dermal contact with chemicals in soil for a future employee at the Candora Road Area, Knoxville, Tennessee

Chemical	Exposure point concentration in surface soil (mg/kg)		Intake values (mg/kg-day)		Noncarcinogenic effects: Hazard quotient (intake/RfD)		Intake values (mg/kg-day)		Carcinogenic effects: Excess lifetime cancer risk (intake x SF)	
	Mean	RME	Mean	RME	Mean	RME	Mean	RME	Mean	RME
Antimony	3.9E+01	1.6E+02	1.5E-07	8.4E-06	0.019318982	1.050146771	1.5E-08	3.0E-06	no toxicity value	no toxicity value
Arsenic	1.7E+01	2.3E+01	6.8E-08	1.2E-06	0.000550109	0.009570744	6.8E-09	4.2E-07	2.5E-08	1.5E-06
Barium	3.8E+02	8.3E+02	1.5E-06	4.3E-05	0.000307141	0.008784296	1.5E-07	1.5E-05	no toxicity value	no toxicity value
Beryllium	4.7E-02	6.9E-01	1.8E-10	3.6E-08	3.66341E-06	0.000716693	1.8E-11	1.3E-08	7.9E-09	5.5E-06
Cadmium	1.9E+01	2.8E+01	7.5E-08	1.5E-06	0.007519765	0.145335127	7.5E-09	5.2E-07	no toxicity value	no toxicity value
Chromium (VI)	1.7E+02	4.6E+02	6.6E-07	2.4E-05	0.006573894	0.240626223	6.6E-08	8.6E-06	no toxicity value	no toxicity value
Lead	2.0E+03	8.3E+03	7.7E-06	4.3E-04	no toxicity value	no toxicity value	7.7E-07	1.5E-04	no toxicity value	no toxicity value
Manganese	1 5E+03	2.7E+03	6.0E-06	1.4E-04	0.000119207	0.002837341	6.0E-07	5.1E-05	no toxicity value	no toxicity value
Mercury	1 1E+02	4.3E+02	4.2E-07	2.2E-05	0.019986581	1.061876806	4.2E-08	8.0E-06	no toxicity value	no toxicity value
Uranium	7 0E+04	3.0E+05	2.7E-04	1.5E-02	0.107338936	6.026901884	2.7E-05	5.5E-03	no toxicity value	no toxicity value
Zinc	4.9E+03	7.2E+03	1.9E-05	3.7E-04	0.000320026	0.006202672	1.9E-06	1.3E-04	no toxicity value	no toxicity value
Benzo(a)anthracene	2.2E+00	1.3E+01	8.6E-08	6.7E-06	no toxicity value	no toxicity value	8.6E-09	2.4E-06	2.1E-08	5.8E-06
Benzo(a)pyrene	1.8E+00	9.5E+00	7.1E-08	5.0E-06	no toxicity value	no toxicity value	7.1E-09	1.8E-06	1.7E-07	4.2E-05
Benzo(b)fluoranthene	2.5E+00	9.4E+00	9.7E-08	4.9E-06	no toxicity value	no toxicity value	9.7E-09	1.7E-06	2.3E-08	4.2E-06
Bis(2-ethylhexyl)phthalate	1 1E+01	5.5E+01	4.4E-07	2.9E-05	1.1575E-05	0.000744713	4.4E-08	1.0E-05	3.3E-09	7.5E-07
Dibenzo(a,h)anthracene	6.4E-01	2.2E+00	2.5E-08	1.1E-06	no toxicity value	no toxicity value	2.5E-09	4.0E-07	5.9E-08	9.4E-06
Indeno(1,2,3-cd)pyrene	1.4E+00	6.0E+00	5.5E-08	3.1E-06	no toxicity value	no toxicity value	5.5E-09	1.1E-06	1.3E-08	2.7E-06
Aroclor-1248	2 0E+01	1.4E+02	4.7E-06	4.4E-04	no toxicity value	no toxicity value	4.7E-07	1.6E-04	4.0E-06	1.3E-03
Aroclor-1254	3.2E+01	4.5E+01	7.6E-06	1.4E-04	0.421232877	7.805368947	7.6E-07	5.0E-05	6.5E-06	4.3E-04
Aroclor-1260	1.5E+01	2.8E+01	3.4E-06	8.7E-05	no toxicity value	no toxicity value	3.4E-07	3.1E-05	2.9E-06	2.7E-04
1,2,3,4,6,7,8-HpCDD	2.6E-05	2.6E-05	3.1E-12	4.0E-11	no toxicity value	no toxicity value	3.1E-13	1.4E-11	9.2E-08	4.3E-06
1,2,3,4,7,8-HxCDF	8.8E-06	8.8E-06	1.0E-12	1.4E-11	no toxicity value	no toxicity value	1.0E-13	4.9E-12	3.1E-08	1.5E-06
1,2,3,6,7,8-HxCDD	9.1E-06	9.1E-06	1.1E-12	1.4E-11	no toxicity value	no toxicity value	1.1E-13	5.1E-12	3.2E-08	1.5E-06
2,3,7,8-TCDD	4.6E-06	4.6E-06	5.4E-13	7.2E-12	no toxicity value	no toxicity value	5.4E-14	2.6E-12	1.6E-08	7.7E-07
2,3,7,8-TCDF	6.6E-06	6.6E-06	7.7E-13	1.0E-11	no toxicity value	no toxicity value	7.7E-14	3.7E-12	2.3E-08	1.1E-06
OCDD	1.6E-05	1.6E-05	1.9E-12	2.5E-11	no toxicity value	no toxicity value	1.9E-13	8.9E-12	5.6E-08	2.7E-06
Hazard Index					0.6	16				
Total Cancer Risk									1E-05	2E-03

DWI = David Witherspoon, Inc.
kg = kilogram
mg = milligram
RfD = reference dose
RME = reasonable maximum exposure
SF = slope factor

Table C.50. Chemical exposure pathway summaries for the DWI 901 Site, Knoxville, Tennessee

Exposure pathway	Risk		Hazard	
	Mean	RME	Mean	RME
Current employee				
Soil ingestion	2×10^{-6}	4×10^{-5}	0.2	1
Particulate inhalation	1×10^{-8}	1×10^{-7}	0.0005	0.0022
Dermal contact with soil	3×10^{-5}	2×10^{-3}	0.09	3
Combined pathway	**3×10^{-5}**	**2×10^{-3}**	**0.3**	**4**
Future employee				
Soil ingestion	8×10^{-6}	2×10^{-4}	0.4	2
Particulate inhalation	4×10^{-8}	4×10^{-7}	0.001	0.0043
Dermal contact with soil	7×10^{-6}	1×10^{-3}	0.2	7
Combined pathway	**2×10^{-5}**	**1×10^{-3}**	**4**	**9**
Future adult resident				
Groundwater ingestion	3×10^{-5}	3×10^{-4}	5	16
Dermal contact with groundwater	7×10^{-6}	1×10^{-4}	0.3	1.0
Sediment ingestion	4×10^{-6}	4×10^{-5}	0.1	0.6
Dermal contact with sediment	3×10^{-6}	1×10^{-4}	0.07	1
Soil ingestion	3×10^{-5}	5×10^{-4}	1	6
Particulate inhalation	3×10^{-8}	4×10^{-7}	0.0007	0.0030
Dermal contact with soil	3×10^{-5}	2×10^{-3}	0.6	10
Combined pathway	**1×10^{-4}**	**3×10^{-3}**	**7**	**34**
Child resident				
Groundwater ingestion	3×10^{-5}	2×10^{-4}	8	38
Dermal contact with groundwater	8×10^{-6}	3×10^{-5}	0.5	2
Sediment ingestion	2×10^{-5}	9×10^{-5}	1	6
Dermal contact with sediment	5×10^{-5}	4×10^{-4}	2	20
Soil ingestion	2×10^{-4}	1×10^{-3}	8	52
Particulate inhalation	1×10^{-7}	3×10^{-7}	0.003	0.01
Dermal contact with soil	3×10^{-5}	7×10^{-4}	1	16
Combined pathway	**3×10^{-4}**	**2×10^{-3}**	**20**	**126**
Adolescent trespasser				
Sediment ingestion	2×10^{-7}	6×10^{-6}	0.01	0.2
Dermal contact with sediment	8×10^{-8}	7×10^{-6}	0.002	0.2
Soil ingestion	2×10^{-6}	8×10^{-5}	0.05	2
Particulate inhalation	1×10^{-9}	2×10^{-8}	0.00002	0.0006
Dermal contact with soil	9×10^{-7}	1×10^{-4}	0.2	2
Combined pathway	**3×10^{-6}**	**2×10^{-4}**	**0.3**	**4**

DWI = David Witherspoon, Inc.
RME = reasonable maximum exposure

Table C.51. Chemical exposure pathway summaries for the Candora Road Area, Knoxville, Tennessee

Exposure pathway	Risk		Hazard	
	Mean	RME	Mean	RME
Current employee				
Soil ingestion	5×10^{-6}	8×10^{-5}	4	25
Particulate inhalation	8×10^{-9}	2×10^{-7}	0.0003	0.0002
Dermal contact with soil	4×10^{-6}	5×10^{-4}	0.3	8
Combined pathway	**9×10^{-6}**	**6×10^{-4}**	**4**	**33**
Future employee				
Soil ingestion	2×10^{-5}	3×10^{-4}	7	50
Particulate inhalation	3×10^{-8}	7×10^{-7}	0.00062	0.00334
Dermal contact with soil	1×10^{-5}	2×10^{-3}	0.6	16
Combined pathway	**3×10^{-5}**	**2.3×10^{-3}**	**8**	**66**
Adult resident				
Soil ingestion	6×10^{-5}	8×10^{-4}	21	141
Particulate inhalation	3×10^{-8}	5×10^{-7}	0.004	0.002
Dermal contact with soil	1×10^{-5}	4×10^{-4}	2	25
Combined pathway	**7×10^{-5}**	**1×10^{-3}**	**23**	**166**
Child resident				
Soil ingestion	3×10^{-4}	2×10^{-3}	163	1,319
Particulate inhalation	8×10^{-8}	5×10^{-7}	0.002	0.01
Dermal contact with soil	7×10^{-5}	1×10^{-3}	3	40
Combined pathway	**4×10^{-4}**	**3×10^{-3}**	**166**	**1,359**
Adolescent trespasser				
Soil ingestion	3×10^{-6}	1×10^{-4}	1	57
Particulate inhalation	9×10^{-10}	4×10^{-8}	0.00001	0.0005
Dermal contact with soil	2×10^{-6}	2×10^{-4}	0.05	4
Combined pathway	**5×10^{-6}**	**3×10^{-4}**	**1**	**61**

RME = reasonable maximum exposure

Table C.52. Radiological pathway summaries for the DWI 901 Site, Knoxville, Tennessee

Exposure pathway	Risk		
	Mean child	Mean adult	RME
Current employee			
External gamma	NA	1.6E-5	1.7E-4
Particulate inhalation	NA	4.9E-7	1.1E-5
Radon inhalation	NA	7.2E-6	2.4E-7
Soil ingestion	NA	3.4E-8	6.1E-7
Total	NA	2.4E-5	1.9E-4
Future employee			
External gamma	NA	5.3E-5	4.9E-4
Particulate inhalation	NA	3.1E-6	3.4E-5
Radon inhalation	NA	4.6E-5	8.8E-4
Soil ingestion	NA	2.2E-7	4.9E-6
Total	NA	1.0E-4	1.4E-3
Future resident			
External gamma	1.0E-4	1.5E-4	1.8E-3
Particulate inhalation	6.6E-6	1.0E-5	2.2E-4
Radon inhalation	2.4E-4	3.6E-4	3.1E-3
Plant ingestion	2.3E-5	3.5E-5	2.7E-4
Meat ingestion	6.8E-6	1.0E-5	9.5E-5
Milk ingestion	5.3E-6	7.9E-6	8.6E-5
Soil ingestion	2.2E-6	2.0E-6	4.6E-5
Total	3.9E-4	5.8E-4	5.6E-3
Adolescent trespasser			
External gamma	NA	6.5E-7	2.4E-5
Particulate inhalation	NA	1.3E-9	5.3E-7
Radon inhalation	NA	6.0E-11	1.2E-8
Soil ingestion	NA	2.1E-10	1.2E-7
Total	NA	6.5E-7	2.5E-5

DWI = David Witherspoon, Inc.
NA = not applicable
RME = reasonable maximum exposure

Table C.53. Radiological pathway summaries for the Candora Road Area, Knoxville, Tennessee

Exposure pathway	Risk		
	Mean child	Mean adult	RME
Current employee			
External gamma	NA	2.3E-3	2.5E-2
Particulate inhalation	NA	7.2E-5	1.7E-3
Radon inhalation	NA	1.5E-3	2.2E-5
Soil ingestion	NA	4.8E-6	9.8E-5
Total	NA	3.8E-3	2.7E-2
Future employee			
External gamma	NA	7.3E-3	7.0E-2
Particulate inhalation	NA	4.6E-4	5.6E-3
Radon inhalation	NA	9.6E-3	2.6E-1
Soil ingestion	NA	3.1E-5	7.9E-4
Total	NA	1.7E-2	3.4E-1
Future resident			
External gamma	1.4E-2	2.1E-2	2.6E-1
Particulate inhalation	9.7E-4	1.5E-3	3.6E-2
Radon inhalation	5.0E-2	7.6E-2	9.1E-1
Plant ingestion	3.3E-3	5.0E-3	4.6E-2
Meat ingestion	1.2E-4	1.9E-4	1.4E-3
Milk ingestion	1.4E-4	2.1E-4	2.4E-3
Soil ingestion	3.1E-4	2.8E-4	7.3E-3
Total	6.9E-2	1.0E-1	1.3E+0
Adolescent trespasser			
External gamma	NA	8.9E-5	3.5E-3
Particulate inhalation	NA	1.9E-7	8.7E-5
Radon inhalation	NA	3.7E-9	1.1E-6
Soil ingestion	NA	3.0E-8	2.0E-5
Total	NA	8.9E-5	3.6E-3

NA = not applicable
RME = reasonable maximum exposure

6. USE OF THE LEAD MODEL VERSION 0.99D

Lead exposures at the DWI 901 Site were evaluated using the *Integrated Exposure Uptake Biokinetic Model for Lead in Children*. RME and mean exposure point concentrations were used in the model. Multiple simulations were performed and the results are attached.

ATTACHMENT C.1

LEAD MODEL VERSION 0.99D RESULTS

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	1006.8	1006.8
1-2	1006.8	1006.8
2-3	1006.8	1006.8
3-4	1006.8	1006.8
4-5	1006.8	1006.8
5-6	1006.8	1006.8
6-7	1006.8	1006.8

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	11.6	22.23	19.77
1-2:	13.4	33.08	30.17
2-3:	12.6	34.58	31.24
3-4:	12.2	35.65	32.28
4-5:	10.2	29.20	25.65
5-6:	8.7	27.59	23.72
6-7:	7.7	26.96	22.73

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.13	0.31	0.00	0.02
1-2:	2.14	0.74	0.00	0.03
2-3:	2.49	0.80	0.00	0.06
3-4:	2.47	0.84	0.00	0.07
4-5:	2.55	0.93	0.00	0.07
5-6:	2.77	1.01	0.00	0.09
6-7:	3.10	1.04	0.00	0.09

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	2721.8	1006.8
1-2	2721.8	1006.8
2-3	2721.8	1006.8
3-4	2721.8	1006.8
4-5	2721.8	1006.8
5-6	2721.8	1006.8
6-7	2721.8	1006.8

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	16.8	32.85	30.69
1-2:	19.4	48.62	46.09
2-3:	18.4	51.24	48.31
3-4:	18.0	53.48	50.48
4-5:	15.3	44.66	41.40
5-6:	13.2	42.42	38.83
6-7:	11.8	41.47	37.51

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	1.87	0.27	0.00	0.02
1-2:	1.85	0.64	0.00	0.03
2-3:	2.18	0.70	0.00	0.06
3-4:	2.19	0.74	0.00	0.07
4-5:	2.33	0.85	0.00	0.07
5-6:	2.56	0.94	0.00	0.09
6-7:	2.89	0.98	0.00	0.09

AD MODEL Version 0.99d

R CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

IET: DEFAULT

RINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

OIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	2721.8	0.0
1-2	2721.8	0.0
2-3	2721.8	0.0
3-4	2721.8	0.0
4-5	2721.8	0.0
5-6	2721.8	0.0
6-7	2721.8	0.0

Additional Dust Sources: None DEFAULT

AINT Intake: 0.00 ug Pb/day DEFAULT

ATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

ALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	13.2	25.48	23.12
1-2:	15.2	37.87	35.09
2-3:	14.4	39.69	36.48
3-4:	14.0	41.09	37.84
4-5:	11.8	33.84	30.38
5-6:	10.0	32.00	28.22
6-7:	8.9	31.26	27.10

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.05	0.30	0.00	0.02
1-2:	2.04	0.71	0.00	0.03
2-3:	2.39	0.76	0.00	0.06
3-4:	2.38	0.81	0.00	0.07
4-5:	2.48	0.91	0.00	0.07
5-6:	2.70	0.99	0.00	0.09
6-7:	3.04	1.02	0.00	0.09

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	2721.8	2721.8
1-2	2721.8	2721.8
2-3	2721.8	2721.8
3-4	2721.8	2721.8
4-5	2721.8	2721.8
5-6	2721.8	2721.8
6-7	2721.8	2721.8

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	21.8	43.37	41.46
1-2:	25.1	63.80	61.59
2-3:	23.9	67.66	65.07
3-4:	23.5	71.21	68.55
4-5:	20.4	60.63	57.66
5-6:	17.8	58.08	54.76
6-7:	16.0	56.99	53.30

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	1.65	0.24	0.00	0.02
1-2:	1.61	0.56	0.00	0.03
2-3:	1.92	0.61	0.00	0.06
3-4:	1.94	0.66	0.00	0.07
4-5:	2.12	0.78	0.00	0.07
5-6:	2.36	0.86	0.00	0.09
6-7:	2.69	0.91	0.00	0.09

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor..
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	1006.8	0.0
1-2	1006.8	0.0
2-3	1006.8	0.0
3-4	1006.8	0.0
4-5	1006.8	0.0
5-6	1006.8	0.0
6-7	1006.8	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	6.8	12.73	9.97
1-2:	7.7	18.83	15.51
2-3:	7.2	19.58	15.82
3-4:	6.9	19.89	16.15
4-5:	5.8	16.25	12.43
5-6:	4.9	15.46	11.35
6-7:	4.4	15.26	10.79

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.39	0.35	0.00	0.02
1-2:	2.44	0.85	0.00	0.03
2-3:	2.80	0.90	0.00	0.06
3-4:	2.75	0.93	0.00	0.07
4-5:	2.75	1.01	0.00	0.07
5-6:	2.94	1.08	0.00	0.09
6-7:	3.27	1.10	0.00	0.09

APPENDIX D

REMEDIATION TECHNOLOGY DISCUSSION

1. DISCUSSION OF RETAINED TECHNOLOGIES

This chapter presents the process options retained after preliminary screening and an evaluation of each option for effectiveness, implementability, and relative cost. The effectiveness evaluation considers the ability of the process option to treat the applicable contaminated media and to wholly or partially satisfy the remedial action objectives. Implementability considerations include technical and administrative implementability. The evaluation of cost at this stage is qualitative and is used as a comparison between process options within a remedial technology type. Based on these evaluations, one or more representative process options may be retained for each technology type.

1.1 NO ACTION

The no action general response action serves as a baseline for comparison of other alternatives. In this study, the no action alternative does not include monitoring or institutional controls.

For all media, the effectiveness of the no action alternative for PCBs, radionuclides, heavy metals, VOCs, SVOCs, dioxins, and furans is due to natural attenuation. The naturally occurring processes of radioactive decay, hydrolysis, biodegradation, photolysis, sorption, volatilization, and diffusion may eventually reduce certain contaminant concentrations to acceptable levels. COCs in all media present risks that will not be alleviated by the no action alternative. Off-site migration of contaminants is evident. Off-site risk in the sediment and surface water may be present for COCs detected resulting from erosion of site soil and stormwater runoff.

1.2 MONITORING

A monitoring program is a key component of the observational approach, which permits modifications of actions based on observed conditions. Soil, sediment, surface water, and groundwater monitoring, along with vegetation sampling, on and off site during remedial actions would indicate when remaining contamination is reduced to acceptable levels. In addition, airborne contaminants would be monitored during remedial activities. Contamination fixed to debris would be determined by collecting wipe samples. Debris would be segregated based on the types of contamination present. Radiologically contaminated debris would be screened and separated from other debris. Sitewide, postremediation media monitoring would be used to verify

clean closure of the site or to identify additional remediation areas. The monitoring plans would be developed during remedial design to provide information necessary to assess the remediation of the site and any remaining risk.

1.2.1 Effectiveness

A monitoring program is effective for the determination of the performance and applicability of process treatment options to a site. A monitoring program reveals the extent to which soil excavation and groundwater extraction is effective in removing contaminated media from a site. While monitoring is a valuable tool in assessing the applicability and efficiency of a removal action, monitoring alone does not meet remedial action objectives for the site.

1.2.2 Implementability

Standard monitoring programs are readily implementable for soil, sediment, debris, surface water, and groundwater sampling. Caution must be observed during monitoring activities to ensure that data are collected in accordance with recognized procedures and that all QA concerns are addressed.

1.2.3 Cost

The cost of a verification sampling program is minor when compared to the remedial actions that are to be performed to clean up the site. However, a 30-year long-term monitoring program will have a substantial cost.

1.3 INSTITUTIONAL CONTROLS

The types of institutional controls remaining after the initial screening of process options include permit programs, land acquisition, and access restrictions. Permit programs, land acquisition, and access restrictions may be applicable to the site as a whole or to a specific media type, e.g., groundwater usage restrictions or fences to restrict direct contact with contaminated soils. Land use restrictions are placed in the zoning land use plan and would restrict future land uses to those with acceptable risk to human health and the environment. Land acquisition places the area affected by contaminants under governmental ownership and control, thereby limiting future land use and access. Fencing and warning signs would reduce the possibility of direct contact with any contaminated media, while deed restrictions could be used to restrict land use or prevent groundwater use. Depending on the alternative, fencing and warning signs may be temporary or permanent. Temporary access restrictions would be necessary during construction activities. Long-term access restrictions would be necessary if untreated waste is left in place.

If, as a contingency plan, institutional controls are required to limit exposure to contaminated media, the deed would specifically state that the media must not be used until contaminant concentrations have dropped below specified levels.

1.3.1 Effectiveness

Fencing and warning signs are useful means to restrict access to the site and thereby reduce the amount of direct contact with the contaminated media. Land use restrictions and zoning or deed restrictions are effective measures to warn interested parties of any restricted activities or media usages at the site. Eminent domain is not a removal action but is a means of controlling the site by transferring the property ownership to a federal, state, or local entity. This action may still require additional remediation steps.

1.3.2 Implementability

The installation of fences and signs around the site can be easily performed. Maintenance activities required for fencing are minimal. Land use or deed restrictions are attached to the deed and are implementable. The deed is altered to include statements concerning easements and restricted activities at the site. Eminent domain is technically implementable, but it is not a favorable administrative alternative. Eminent domain is not as attractive an option as the other forms of institutional control, because the property must be condemned and the government agency must purchase and take control of the site.

1.3.3 Cost

Institutional controls are an insignificant cost item when compared to the remedial actions that are required at the site. The cost of land purchase could be substantial for the eminent domain process option.

1.4 SOURCE CONTAINMENT

The concept of source containment is based on the immobilization of contaminants by inhibiting the ability of groundwater, surface water, and wind to come in contact with contaminated media. Source containment techniques include capping, vertical barriers, subsurface horizontal barriers, surface water controls, and dust controls. The following subsections analyze the capabilities for each.

1.4.1 Capping

Capping isolates the waste through the construction of an impermeable cover. The capping options considered for implementation at the DWI 901 Site are single and multilayer caps. A single layer consists of compacted clay, soil, bentonite, concrete, or asphalt applied over an area of contamination (AOC) to reduce surface erosion, direct contact with wastes, percolation and migration of surface water, and precipitation, or to provide shielding from direct exposure to radiation. A multilayer cap combines two or more layers. A vegetative and fill layer physically separates the barrier layer from the environment; this separation is important to prevent damage to the barrier layer from the effects of erosion, thermal cycling, frost damage, burrowing animals, and human activity on the cap such as vehicle traffic. A drainage layer beneath the vegetative layer can remove water infiltrating from the surface, thereby reducing the quantity of water that could penetrate the barrier layer. The barrier layer minimizes the infiltration of water into the waste and prevents access to the waste. A multilayer cap offers the same advantages as a single layer cap, with the additional ability to reduce the infiltration of surface water, eliminating or reducing the potential for leaching of contaminants.

1.4.1.1 Effectiveness

Single-layer and multilayer caps are designed to minimize contact between infiltrating rainwater and emplaced contaminants and to minimize direct contact with contaminants. A multilayer cap would be the most effective in minimizing the amount of rainwater that infiltrates the site and would provide more protection against erosion or intrusion. Single-layer caps have limited applications and are generally used as temporary measures for a site-specific problem.

1.4.1.2 Implementability

The use of capping for source containment is a simple and readily implementable remedial technology to contain the source of the contaminants. The primary drawback for capping is the long-term monitoring and maintenance activities. The construction of a cap or cover will require secondary technologies such as surface water controls, leachate treatment, and monitoring. Maintenance and surveillance activities must be performed for each type of cap to prevent intrusion by deep-rooted vegetation and burrowing animals, and erosion or degradation of the cap materials.

1.4.1.3 Cost

The multilayer cap has a higher capital cost than the single-layer cap. Future monitoring activities for the capping option increase the costs for this process option.

1.4.2 Vertical Barriers

Vertical barriers are a primary process option applicable to contaminated groundwater but are useful in conjunction with an impermeable cap. The vertical barrier options retained after the initial screening are slurry walls, diaphragm walls, polyethylene sheeting, grout curtain, rock grouting, and sheet pile walls. Slurry walls are usually constructed with either a cement-bentonite or a soil-bentonite mixture. The basic principle of these walls is to create a low-permeability barrier to restrict lateral groundwater and contaminant flow. Diaphragm walls are barriers composed of reinforced concrete panels that are emplaced by slurry trenching techniques. Polyethylene sheeting is similar to a slurry wall; however, a geomembrane is placed into the excavated trench and backfilled with a slurry to provide a low-permeability wall. Grout curtains are fixed underground barriers formed by injecting either particulate or chemical grout. The most common type of particulate grout is Portland cement. The grout is injected in a regular pattern of holes to prevent groundwater or shallow surface water from infiltrating the contaminated media. Rock grouting is similar to a grout curtain but is used for sealing the void spaces between rocks. Sheet pile walls are constructed by permanently driving webbed sections of sheet piling into the ground. Sections of sheet piling must be joined together before being driven into the ground. Although initially the wall is not watertight, the joints fill with fine and medium-grained soil particles that usually block the flow of groundwater. Sheet piling is limited by the depth of the groundwater level and geology of the soil.

1.4.2.1 Effectiveness

Upgradient barriers prevent groundwater flow into a contaminated area, thus preventing contamination of the groundwater. Downgradient barriers prevent migration of contaminants outside of the contaminated areas. Of all the vertical barriers, the slurry wall has the widest range of compatibilities and the lowest coefficient of permeability. To provide adequate containment, the slurry wall must be "keyed-in" to the bedrock. The effectiveness of the slurry wall process option is reduced dramatically if it is not keyed into the aquitard. Polyethylene sheeting is a slurry wall with a geomembrane liner placed in the trench; the effectiveness of the polyethylene sheeting is similar to the slurry wall with decreased permeability because of the geomembrane. Grout curtains are effective but have higher coefficients of permeability than the slurry wall. Rock grouting would be very beneficial in sealing fissures and cracks in rocks; however, rock grouting is not common and the effectiveness is hot clear. Sheet pilings are effective for applications like temporary dewatering or erosion protection when another barrier intersects the flowing surface water. Diaphragm walls are very effective vertical barriers against groundwater infiltration. Fissures in the bedrock could prevent a good seal between the barrier and the bedrock.

1.4.2.2 Implementability

The vertical barriers described are readily implementable. The drawback for the sheet pilings is rocky soils or soils with vast amounts of buried hardened metallic debris. Deflection or damage to the piles results from driving them into the ground, and they may be rendered ineffective. A limitation of grout curtains is the appearance of gaps in the wall from the inability of the grout to penetrate the media, which could be a problem at the site because of the clay soil. Grout curtains require extensive compatibility testing to verify performance of the grout mix. Rock grouting also requires extensive testing to verify grout mix performance. Diaphragm walls are readily implementable, but the large load bearing capability of this barrier is not required at the site.

1.4.2.3 Cost

Grout curtains and sheet piling costs are several times greater than slurry walls. Diaphragm walls are a specialty item and have a cost many times greater than slurry walls.

1.4.3 Subsurface Horizontal Barriers

These technologies use engineered barriers to control vertical migration of potentially contaminated leachate and prevent groundwater from coming in contact with contaminated subsurface soils and waste. Grout injection involves drilling through the site or using directional drilling to inject grout beneath a waste mass. One technique is to drill a pattern of holes across a site, lower a special jet nozzle, and erode the soil with a high pressure stream of air or water. The subsequent cavity can be filled with grout. For block displacement, grout is injected vertically around the perimeter of the waste. Holes are then drilled through the waste and grout is injected beneath the waste mass. In conjunction with a cap, block displacement can immobilize contaminant flow vertically and horizontally.

1.4.3.1 Effectiveness

No detailed analysis of applications for grout injection as a horizontal barrier or bottom is possible because this technique is in a developmental phase. While technically feasible, the effectiveness of this process option is unproven.

1.4.3.2 Implementability

The developmental nature of the technique does not allow a definitive decision about the technical implementability of grout injection for horizontal barriers.

1.4.3.3 Cost

No detailed analysis of cost data is available for bottom sealing, but trends would suggest that the capital costs would be high and the operation and maintenance (O&M) costs would be minimal. The high costs for this option are associated with the relatively specialized equipment required to inject a grout bottom under a waste mass.

1.4.4 Surface Water Controls

Surface water controls are secondary process options that could be used in conjunction with capping or excavation technologies. These controls would direct surface water runoff and precipitation away from the site. Surface water controls considered for the DWI 901 Site include collection ditches, grading, sedimentation basins, berms/levees, silt curtains, and soil/sediment stabilization. Collection ditches intercept and route surface water away from a contaminated area. Grading consists of reshaping the surface of the contaminated area to reduce run-on, ponding, and infiltration. Sedimentation basins reduce the flow velocity of surface water so that entrained sediment will settle out in the basin under the effects of gravity. Berms and levees are constructed of earthen materials or concrete. These structures confine floodwater to a floodway and protect structures behind the barrier. Silt curtains are temporary fences composed of plastic sheeting that block surface runoff and contain sediment and silt. Soil stabilization is achieved by placing a layer of concrete or riprap over the unstable area. Soil stabilization during construction activities is used to prevent erosion of site soils and transport of these soils off the site by surface water.

1.4.4.1 Effectiveness

Diversion or collection ditches are effective means of diverting surface water away from the site or capturing surface water runoff from the site for collection and treatment. Grading is an effective action that reshapes existing topography and drainage patterns to manage infiltration and runoff, including erosion control. Berms and levees are effective for intercepting storm water runoff and diverting the flow to natural or man-made drainage ways. Soil stabilization is effective for reducing erosion and off-site migration of contaminants. Sedimentation basins are effective at reducing sediment transport in surface water, though additional measures are required to completely eliminate sediment from surface water.

1.4.4.2 Implementability

All of the surface water control process options are readily implementable and are constructed using conventional technologies and equipment. The surface area and depth of the

basin required for holding the runoff needs to be large enough to allow particles to settle and drop to the bottom of the basin. Maintenance activities on surface water controls are required to verify the integrity of the structures and to assure proper operation.

1.4.4.3 Cost

The difference in costs for each of the process options is relatively minor. Surface water control options contribute a small amount to the overall remedial activities.

1.4.5 Dust Controls

Dust controls use vegetation, caps, foams, water, and other chemical sprays to suppress dust emissions resulting from construction activities on site whether intrusive or from the sorting of debris. Dust controls are particularly useful for sites containing surface soil with contaminants above regulatory levels. Dust controls anticipated for use at the DWI 901 Site include revegetation, capping, vapor-suppressing foam, emulsion sprays, and water sprays. Revegetation is used to control airborne particulate, but its primary purpose is to prevent or reduce the effects of erosion. Normally plant species native to the area will be used. Capping of surface soil eliminates the possibility of airborne contamination but also prevents any intrusive work. A vapor-suppressing foam must be sprayed or spread on the site to prevent the escape of vapors or particulate. Wetting of the site surface consists of water or other nonhazardous chemicals sprayed on the contaminated area. Wetting is a temporary solution and must be repeated on a regular basis to minimize airborne particulate emissions resulting from activities on the site.

1.4.5.1 Effectiveness

The control of fugitive emissions from a site can be reduced by revegetation of the excavated areas and is relatively effective, but it is intended as a temporary measure. Capping is an effective means to suppress dust transport. A vapor-suppressing foam is effective at maintaining control of dust or emission transfers, as long as the foam crust remains intact. Simple wetting of the soil will effectively suppress dust emissions from a site on a temporary basis.

1.4.5.2 Implementability

All dust control process options are readily implementable. Planting of replacement vegetation can be performed at the site as a temporary measure. The vegetation must be fertilized and future maintenance will be required. Capping is an option that can be used for a site-specific problem but is readily implementable. A vapor-suppressing foam can be applied for dust suppression by using a sprayer. Reapplication of the foam is required once the chemical

crust is breached by intrusion or growing vegetation. Wetting of the area with water or a chemical dust suppressant can be performed by spray application. The spray foam and wetting process options must be performed on a repetitive basis as the site requires.

1.4.5.3 Cost

The cost for all of the dust control process options is minor when compared to the overall remedial action costs for the site. Vapor-suppressing foam and wetting have moderate O&M costs because reapplication of the suppressant will be required periodically.

1.5 SOURCE REMOVAL

Source removal involves the excavation and removal of contaminated materials, the separation of debris, and the extraction of groundwater. Source removal must be used in conjunction with a treatment and/or disposal technology for final remediation. For source removal of solids such as surface soil, sediment, or debris, excavation or use of heavy machinery is involved. Generally contaminated surface soil and sediment will be sent to a disposal or treatment facility; however, debris similar to that found on the DWI 901 Site requires separation before disposal or treatment operations. Groundwater extraction can be used to remove contaminants from a subsurface soil or control migration of contaminated groundwater plumes.

1.5.1 Excavation/Backfilling

Soil, debris, and sediment excavation are accomplished using ordinary construction equipment to physically remove contaminated media from the site. The excavated solids can be drummed, placed in a truck or rail car, and shipped to an appropriate disposal or treatment facility. Void spaces would then be backfilled with clean material to maintain a consistent grade at the site.

1.5.1.1 Effectiveness

Excavation is applicable and would be effective for the bulk removal of soil, debris, and sediment at the site. Conventional earth moving equipment can be used.

1.5.1.2 Implementability

Excavation activities are easily implemented and equipment is readily available from a large number of local contractors. Care must be observed during excavation activities within the contamination zone because of underground utilities. Excavation activities are implementable for the sediment, but excavation will require a great deal of clearing wooded areas adjacent to the stream bed.

1.5.1.3 Cost

Excavation is a prerequisite for disposal or treatment of soil, debris, and sediments. Costs for excavation activities are quite standard and region-specific because of the number of contractors capable of performing these activities. Excavation costs are substantial, yet low relative to treatment and disposal costs.

1.5.2 Separation

Separation activities at the DWI 901 Site include manual sorting, magnetic sorting, and mechanical sizing of the debris. Manual sorting involves the physical separation of different types of waste material and segregation of items with similar contamination. The manual sorting process will be slow because it is labor intensive. Magnetic separation involves separating ferrous solid waste using a magnet. Magnetic separation can be performed wet or dry, with either low- or high-density magnets. Mechanical sizing includes shredding, crushing, and grinding. These operations involve stressing brittle wastes beyond their elastic limits and breaking point using heavy, slow-moving equipment such as crushers, grinders, and cutting machines. This process option would reduce the size of waste at the DWI 901 Site, which would facilitate handling and treatment. In addition to particle sizing, screens can be used to remove specific particle sizes from the waste stream.

1.5.2.1 Effectiveness

Sorting is effective at minimizing the amount of waste that will require treatment by segregating the different waste types and removing certain debris that may not require treatment. Mechanical sizing is effective and will reduce the large unmanageable pieces of debris to a more appropriate size for treatment/disposal.

1.5.2.2 Implementability

Sorting is a readily implementable action that may be employed at the site. The drawback for this activity is the manual nature of some aspects of the operation and the exposure of the worker to safety and contamination hazards. Mechanical sizing can be achieved by employing crushers, grinders, choppers, and large construction cutting tools. On-site size reduction equipment will require utilities at the site.

1.5.2.3 Cost

The cost of separation manually is low to moderate when compared to the remedial action. Mechanical sizing equipment ranges in costs from low for construction cutting tools to moderate costs for mechanical shredders and grinders.

1.5.3 Extraction

Extraction technologies considered for implementation at DWI 901 Site include extraction wells, vacuum extraction, and pumping from a trench. Extraction wells can be used to extract groundwater and reduce residual aquifer contamination to acceptable levels. This approach is a permanent solution to groundwater contamination, but it may not be feasible if the site geology does not yield adequate amounts of groundwater. Extraction wells can also be used in a less aggressive containment strategy to capture and treat contaminated groundwater before it migrates beyond the boundaries of a plume. Plume containment may require fewer wells and less treatment capacity than extraction and treatment of the entire plume because it minimizes the amount of groundwater extracted. With vacuum extraction, negative pressure is applied to extraction wells to enhance collection of groundwater and soil vapor. Forced air injections are sometimes used to achieve higher removal rates. Generally this technique is used to enhance extraction from low permeability soils. Pumping from an excavated trench involves the hydraulic isolation of a contaminant plume with subsurface drains. The drains, composed of perforated pipe, are placed in a trench and backfilled with a porous media.

1.5.3.1 Effectiveness

Vacuum extraction is an effective means of removing groundwater from a site containing soils with low permeability. Extraction wells are effective for groundwater removal, but a low permeability soil reduces the effectiveness of extraction wells for a site. Interceptor trenches would be applicable if an excavation already exists.

1.5.3.2 Implementability

All of the process options are readily implementable, but they will be limited by the low permeability clay soil and limestone bedrock, which has yielded low groundwater production rates during the RI. Extraction wells may require pneumatic rotary drilling equipment. Extraction wells have some operational problems such as air locks and periodic maintenance.

1.5.3.3 Cost

Extraction wells are the least expensive option for groundwater removal. Each of the other process options increase cost because of the complexity of installation and equipment required.

1.6 DISPOSAL

The disposal general response action is divided into disposal of contaminated and decontaminated materials. Disposal process options are primary process options and will fulfill remedial action objectives. The disposal process options for decontaminated and contaminated materials are described in the following sections.

1.6.1 Disposal of Decontaminated Material

Disposal options for decontaminated media from the site include disposal of soils and sediment on site, disposal of soils and sediment in a sanitary landfill, disposal of large debris by salvage operations, and disposal of treated water in injection wells, surface water bodies, or in a publicly-owned treatment work (POTW). The most desirable form of disposal for treated media is leaving the treated material on site. Soil and sediment treated to negotiated levels of "clean" can be left in place or used as backfill material. Soil, sediment, and debris that is deemed uncontaminated before or after treatment can be disposed of in a sanitary landfill, if materials meet the WAC for the landfill. Large metallic debris located at the site could be salvaged.

Treated water can be disposed by reinjection wells that introduce treated water into an aquifer having high hydraulic conductivity. Another alternative for disposal of treated water is discharge to a nearby surface water body or to a POTW. To discharge to a surface body of water National Pollutant Discharge Elimination System (NPDES) requirements will be observed; to discharge to a POTW discharge limits will be followed. Discharge criteria for a POTW are established based on the capacity and treatment capability of the system.

1.6.1.1 Effectiveness

The on-site disposal option is an effective means of dealing with treated soil from the site. If the contaminant levels in the soil are reduced to acceptable levels and the soil can be replaced at the site, the need for off-site shipping of the soil would be avoided. A sanitary landfill would be effective for the disposal of the treated soil, sediment, and debris from the site.

The salvage option is an appealing option to reduce the amount of large debris (vehicles, I-beams, and dump truck beds) that must be disposed of from the site.

Discharge of the treated groundwater and surface water to a surface water body or to a sanitary sewer would be effective in the disposal of the treated streams, provided discharge criteria is met for each option. The criteria for disposal to a surface water body is an NPDES

permit; for disposal to a sanitary sewer the WAC for that system must be observed. Reinjection of the treated groundwater back into the site would be effective for disposal of treated groundwater.

1.6.1.2 Implementability

The on-site disposal option would be readily implementable, if a treatment process is employed to render the contaminated media to negotiated and accepted standards of clean at the site. On-site disposal of the treated debris would be impractical because it would impede excavation and cleanup operations for the soil. The WAC for a sanitary landfill may be stringent enough to preclude this option because of increased treatment costs.

The salvage option would be easily employed because of the expected desire of salvage dealers to obtain the large pieces of debris. One concern that must be addressed deals with the extent or lack of contamination on the large debris pieces.

The disposal of the treated groundwater or surface water to a sanitary sewer would depend on the amount and the discharge criteria for the system. Discharge to surface water would require negotiations with the state to obtain an NPDES permit.

1.6.1.3 Cost

On-site disposal or sanitary landfill disposal require high ex situ treatment costs to remove all COC, like PCBs, radionuclides, SVOCs, heavy metals, and dioxins.

Salvage costs will include frisking the equipment for contamination and possibly some decontamination activities, but a small amount of these costs may be retrieved from the salvage dealer.

Increased treatment and permitting costs are expected to become a part of the total costs for the sanitary sewer and surface water discharge options.

1.6.2 Disposal of Contaminated Material

The disposition options for contaminated solid media from DWI 901 Site include disposal at Envirocare of Utah and the Environmental Management Waste Management Facility (EMWMF). For contaminated aqueous media, surface water, and groundwater, an off-site water treatment facility would be used for treatment. Pending acceptance of the wastes by these facilities, wastes would be stored before final disposal, if necessary. Long-term storage off site will not be an option considered in this RI/FS. Once principle waste streams and their

constituents have been identified, the appropriate type of disposal facility can be selected. For certain types of material like debris, a pretreatment step may be needed. At the DWI 901 Site, debris is potentially contaminated with fixed and removable radiological contamination and removable PCB contamination.

Soil and sediment can be shipped to Envirocare of Utah for disposal if the media are treated to remove the PCBs. At present, Envirocare handles mixed waste meeting the LDRs of 40 CFR 268. Other restrictions are applied by state regulations. No free liquid is accepted for disposal, and all packaging must meet the regulations established in 49 CFR 173. TSCA material cannot be disposed at Envirocare; therefore, PCB treatment is required.

The EMWMF to be constructed for wastes from the ORR would be a likely destination for the DWI 901 Site waste. The facility should be capable of accepting waste with minimal or no treatment; however, treatment for PCBs would probably be required.

Disposal options for aqueous waste streams are limited to off-site treatment facilities. Generally, POTWs cannot remediate contaminated water, but certain facilities are designed to remediate contaminated water, such as facilities found on ORR. During remediation, a certain amount of storage area may be needed to maintain waste volumes before transportation to the disposal facility.

1.6.2.1 Effectiveness

All disposal options for contaminated waste are equally effective in lowering the risk related to the site. The contaminated media at the site will be removed and shipped off site for possible treatment and ultimate disposal. Risk reduction is not achieved if the contaminated media is stored in situ; therefore, the effectiveness of interim storage is suspect if the media is left in place.

1.6.2.2 Implementability

The implementability of each option depends on the WAC for each disposal location. At present the EMWMF does not exist but is in the planning stage. The EMWMF is being designed with DWI 901 Site waste being considered for disposal. Activities at the site must be correlated with the scheduled opening for the disposal cell. A number of secondary process options, like excavation and sorting, will be required for alternatives employing contaminated media disposal options. Excavation and shipping operations must be used to remove and transport the contaminated media from the site.

1.6.2.3 Cost

The capital costs for disposal of contaminated waste at off-site facilities will be high. Interim storage pending final disposal is a secondary process option and will add to the total costs of the primary disposal process options.

1.7 EX SITU TREATMENT

Ex situ treatment technologies are segregated into three groups: physicochemical, thermal, and biological. Ex situ treatment technologies will require either removing the contaminated media and treating it at an off-site facility or bringing a mobile facility to the site for treatment operations. The following discussion describes the ex situ technologies applicable to the DWI 901 Site.

1.7.1 Physicochemical Treatment

Physicochemical technologies employ both physical and chemical interactions to remove, immobilize, or destroy contaminants in waste. Figure 7.1 lists these treatment technologies. Dechlorination is a technique of treating a waste media that contains chlorinated compounds such as PCBs reactants are added to contaminated soils to modify conditions so that a nucleophilic substitution reaction occurs in which the chlorine atoms of a halogenated contaminant are replaced. This nucleophilic substitution results in less toxic products that typically consist of a substituted aromatic compound and an alkali metal chloride. Solvent extraction uses solvents such as kerosene and triethylamine to selectively dissolve contaminants in soils and sludge. The contaminant-rich solvent phase can be separated from the solids by decantation. Chemical techniques dissolve or suspend contaminants in a wash solution, which is later treated. Soil washing is similar to solvent extraction but, instead of using a solvent to remove contaminants from the soil, a surfactant-based fluid is used. Soil venting techniques capitalize on the volatility of contaminants. Air is pumped into the subsurface, which increases the interaction between the volatile contaminants and air. The resulting contaminant-rich air can be released to the atmosphere or collected and treated if concentrations exceed permissible levels. Stabilization and solidification is a treatment technology designed to reduce contaminant solubility through chemical changes, physically encapsulate nonreactive species, improve handling by forming a solidified waste form, and reduce contaminant losses to transport media such as infiltrating water by decreasing the surface area of the contaminated media. Solidification uses a reagent to transform the semisolid contaminated media into a solid material to improve the handling and physical characteristics of the media. Stabilization also adds a reagent to the contaminated media to transform contaminants to a less toxic form or immobilize them. Stabilization is particularly applicable to hazardous wastes contaminated with heavy metals. Encapsulation (macro) is used

on wastes that are difficult to stabilize or are extremely hazardous. Encapsulation containers are generally used to provide a storage area for the curing of solidified/stabilized waste before disposal. Sedimentation uses the differences in densities of waste material to affect a separation.

Manual cleaning will consist of brushing, scraping, or wiping debris surfaces for bulk removal of soils to reduce contaminant levels. High pressure washing can be used to remove PCB contamination. A high pressure washing system uses a high velocity water stream to remove any removable contamination and also to contain the decontamination water for treatment at an appropriate treatment facility. The debris washing system will clean small debris in a basket immersed in a soak tank with spray nozzles. Treatment water will be treated and recycled for use to minimize the amount of decontamination water from the treatment operations.

Air stripping uses concentration gradient between aqueous and gaseous phases to remove volatile contaminants from an aqueous stream. Activated carbon adsorption transfers contaminants from an aqueous stream to the surface of the activated carbon usually in a column operation. Membrane separation involves applying a vacuum to a semipermeable membrane, which removes contaminants from an aqueous stream by size exclusion. Ion exchange uses a resin to selectively exchange ions with a waste stream. Media filtration removes suspended solids from an aqueous waste stream by forcing the liquid through a porous media such as sand or combination filter. Distillation is used to remove contaminants from an aqueous waste stream that contains contaminants having different degrees of volatility. The aqueous stream is heated until the volatile component vaporizes. The vaporized component is later condensed, resulting in volume reduction of the original stream; however, the condensed waste stream does become concentrated. Electrokinetics uses electro-osmotic flow to induce migration of inorganic contaminants to the cathode for collection and disposal. Neutralization involves the addition of acids or bases to a waste stream. Neutralization is used to raise or lower the acid/base properties of a waste for treatment purposes, or it is used to lower the reactive nature of the waste. Chemical oxidation uses ultraviolet radiation, peroxides, or ozone to destroy organic contaminants in an aqueous stream. Chemical precipitation processes involve the addition of chemical compounds to an aqueous waste stream to separate the inorganic contaminant ions from the waste stream by precipitation as an insoluble product.

1.7.1.1 Effectiveness

Solvent extraction is a process option that is effective in removing PCBs from soil, sediment, and water. The leachable nature of contaminants in the soil, sediment, and on the debris limits the effectiveness of solidification and stabilization processes. The effectiveness of macroencapsulation is also limited by the leachable nature of contaminant in the waste. Solidification processes are effective in immobilizing heavy metals.

Manual cleaning, high pressure water spray, and a debris washing system utilizing water/ surfactant are all effective for removal of surface contamination from debris.

Carbon adsorption is effective for organics (PCBs) removal from water. Membrane separation and ion exchange separations are effective methods for radionuclide removal from water. Neutralization, sedimentation, and filtration are commonly used to support one another in a treatment train. These unit operations are effective in the removal of precipitated and suspended solids from water.

1.7.1.2 Implementability

A grouting facility will be necessary to stabilize and solidify soil, sediment, and debris. Vendor-supplied systems are available for use in solvent extraction and chemical dechlorination. Solvent extraction implementability hinges on the ability of the solvent to be recycled, because the production of large volumes of PCB-contaminated solvent is undesirable. Macroencapsulation increases the volume of the waste media and is impractical for large, nonstandard-sized material.

Manual cleaning, high pressure water spray, and a debris washing system are readily implementable. High pressure water spray will require a high pressure water source and a containment structure to capture the decontamination water.

All of the groundwater treatment options are readily implementable and available from a large number of vendors.

1.7.1.3 Cost

Solvent extraction would be in the medium cost range. High pressure cleaning will be in the medium cost range. Photochemical oxidation costs are high when compared with other water treatment process options. Costs for cleaning the debris are low when compared to treatment operations for soil and groundwater.

1.7.2 Thermal Treatment

Thermal treatment process options retained after a preliminary screening include incineration, low-temperature thermal desorption (LTTD), and vitrification. Thermal treatments use the volatility or thermal properties of contaminants and their associated waste streams.

Incineration involves a rotary kiln furnace to destroy organic contaminants in the presence of adequate oxygen for combustion. The resulting ash of this process may contain heavy metals and toxic products of incomplete combustion and should be disposed of accordingly.

Steam stripping employs superheated steam to volatilize organic contaminants from a waste stream. This technology usually is coupled with an off-gas treatment system.

LTTD involves heating contaminated soil to drive off VOCs. This process is achieved without heating the soil to combustion temperatures. Infrared thermal desorption uses higher heating temperatures by means of infrared heaters to drive off volatile and semivolatile contaminants. This system is usually coupled with an off-gas and condensate treatment system.

Vitrification uses molten glass bath or insertion of electrodes into the waste material to form a glassy residue. This residue immobilizes contaminants and reduces leaching of contaminants. Most, if not all, organic contaminants are destroyed in the heating process. Plasma arc vitrification uses a plasma arc centrifugal treatment furnace to heat solids until they become a molten bath. The molten bath detoxifies the feed material, and the resulting off-gas, which contains organic material, is scrubbed with an off-gas treatment system. The molten feed material along with the solids form a glassy residue that meets the TCLP criteria. The fuel source uses the contaminated material as raw material for an ongoing combustion process. This option is dependent on the Btu content of the contaminated material.

1.7.2.1 Effectiveness

Incineration and vitrification are effective for PCB destruction. Low-temperature thermal treatment is an effective means of separating organics from soils, but care must be taken when dealing with PCB-contaminated waste, because incomplete combustion from burning PCBs will produce dioxins. Concerns regarding incomplete combustion products can be alleviated by inserting an off-gas treatment system at the end of the desorption treatment process.

1.7.2.2 Implementability

All of the thermal processes are implementable but require massive amounts of energy to operate. Vitrification systems are available commercially. Incineration depends on the WAC for the facility.

1.7.2.3 Cost

Thermal treatment costs are high when compared to other treatment technologies.

1.7.3 Biological Treatment

Contaminated soil can be treated biologically to reduce biodegradable pollutant concentrations. Slurry-phase biodegradation consists of treating soils and sludge in a slurry reactor using either naturally occurring microorganisms or bioaugmentation with specialized

inocula. This process can be carried out anaerobically or aerobically in batch or continuous mode. In constructed wetlands, contaminated soil and sediment are used as wetlands substrate. Certain biological processes degrade contaminants, and these processes generally flourish in a wetland environment. In aerobic land treatment, engineered bed reactors carry out biodegradation using naturally occurring microorganisms. This technique can be modified to composting by degrading the contaminated soil in piles or wind rows to which a bulking material has been added. Degradation of soils and sludge can also be carried out anaerobically if aeration is not possible. One technique for degrading sludge and soil with aeration is to transfer the contaminated media to a mechanically aerated lagoon. Depending on the extent of degradation desired, a stabilization pond can be used in a combined aerobic/anaerobic process. Activated sludge can be treated biologically by sequential batch reactors in a timed process. Aerobic treatment can be enhanced by a fixed-film approach. Mass transfer of contaminants from soil to biological media is expedited by using rotational contactors, trickling filters, or an aerobic fluidized bed reactor to optimize contact time. This approach can be carried out aerobically or anaerobically.

1.7.3.1 Effectiveness

All of the process options involving biological treatment are relatively effective for the treatment of organics in soils or water. PCBs are relatively persistent and do not readily degrade. As chlorinated compounds they degrade best in anaerobic conditions by cometabolism. SVOCs degrade best in an aerobic environment. Effectiveness will be determined by how well the process can be controlled to maintain an optimum temperature and pH range. The ability of biological processes to remove contaminants to low levels is hindered somewhat because bugs tend to starve when organic levels fall below a certain threshold.

1.7.3.2 Implementability

All of the biological processes are implementable. Temperature and pH controls must be maintained and are essential for biological treatment operations. Substances like heavy metals that are toxic to biological organisms may require treatment before biological treatment.

1.7.3.3 Cost

Costs for the biological treatment process options are low when compared to thermal treatment options.

1.8 IN SITU TREATMENT

In situ treatment like ex situ treatment is divided into three groups of physicochemical, thermal, and biological process options. In situ treatment differs from ex situ treatment in that waste is treated in place to reduce the volume, mobility, and/or toxicity of contamination. A major advantage of in situ treatment is elimination of the need for excavation of soil and waste, which must be subsequently disposed of. Because of the diversity of contaminants present at the DWI 901 Site, a series of options would be required to implement an in situ treatment scheme at the site. The following section describes the in situ technologies applicable to the DWI 901 Site.

1.8.1 Physicochemical Treatment

Soil vapor extraction uses the volatility of contaminants. Because VOCs are not COC, this process option will be eliminated. Soil flushing uses a flushing fluid to leach waste constituents from contaminated soil. The flushing fluid increases solubilization in the flushing fluid, formation of emulsions, and chemical reactions among the contaminated media. The flushing fluid is applied through shallow injection wells or aboveground sprayers. The flushing fluid infiltrates the contaminated soil and extraction wells collect the fluid for treatment. Stabilization and solidification are treatment technologies designed to reduce contaminant solubility through chemical changes, to physically encapsulate nonreactive species, and to reduce contaminant losses to transport media such as infiltrating water by decreasing the surface area of the contaminated media. Solidification uses a reagent to transform the semisolid contaminated media into a solid material to improve the handling and physical characteristics of the media. Stabilization also adds a reagent to the contaminated media to transform contaminants to a less toxic form or immobilize them. Stabilization is particularly suited for hazardous wastes contaminated with heavy metals.

Chemical oxidation is a destruction process that can be used to treat organic contaminants in aqueous media or to destroy organic liquids. Permeable treatment beds use downgradient trenches backfilled with a material to remove contaminants from the groundwater.

1.8.1.1 Effectiveness

Soil flushing is effective for removing PCBs from soil. Effectiveness of soil flushing depends on the contaminant that is being extracted from the soil, the flushing solvent being used, and the nature of the soil. Solidification and stabilization are effective methods for demobilizing heavy metals. Solidification can be performed in situ, but the consistency and integrity of the solidified mass is questionable, unless extensive performance testing of the solidification agents

with the waste media has been performed. Neutralization is an effective treatment process by which a media's pH is altered to destroy or alter the characteristics of the contaminant.

Chemical oxidation is an effective means of destroying organics in water. Permeable treatment beds are effective for removing organics from groundwater.

1.8.1.2 Implementability

Soil flushing is implementable, but it is limited by the tight clay soils, the shallow bedrock, and the buried debris in the subsurface at the site. The three factors listed previously can short-circuit the collection of the flushing solvent/contaminant stream into the extraction wells. Compatibility testing of the solidification agent and the contaminated media is required.

Neutralization and oxidation systems are implementable. Permeable treatment beds are not readily implemented, requiring excavation and placement of adsorbent materials in the subsurface.

1.8.1.3 Cost

Soil flushing is cost-effective and feasible for in situ treatment to remove PCBs from contaminated soils.

1.8.2 Thermal Treatment

Thermal treatment processes use heat to volatilize contaminants or melt the effected media into a stabilized form. In situ vitrification also uses vertical electrodes inserted into an area of contaminated subsurface soil. A current is passed through the electrodes to heat the soil, which evaporates moisture, melts sediments, and volatilizes and incinerates organics. The material is heated to a molten state and is cooled to form a stable final waste form. The glassy residue immobilizes contaminants and prevents leaching. In situ steam stripping uses high temperature steam injected into subsurface soil to enhance volatilization and extraction of organic contaminants.

1.8.2.1 Effectiveness

In situ vitrification is effective in destroying or stabilizing all types of contaminants in soils. The final waste form obtained by this treatment process normally has a high degree of chemical and physical integrity.

1.8.2.2 Implementability

Thermal treatment technologies require a great deal of energy for operations. The future usage of the site would be affected by the presence of a mass of vitrified glass in the subsurface. Buried metallic debris poses implementability concerns about the melting of a soil and debris mix into a consistent waste form.

1.8.2.3 Cost

The cost to employ the vitrification process option is high.

1.8.3 Biological Treatment

In situ biodegradation involves the injection of nutrients, oxidants, or microbes into the soil to enhance microbial degradation of organic compounds. The nutrients, oxidants, or microbes can also be removed from soil or groundwater if needed to enhance microbial degradation.

1.8.3.1 Effectiveness

In situ biodegradation is an effective process for degrading organics, but the action of the organisms can be retarded or stopped by toxic levels of heavy metals.

1.8.3.2 Implementability

In situ biodegradation is readily implementable but difficult to control and relatively slow by nature.

1.8.3.3 Cost

The cost of in situ biodegradation is relatively low when compared to thermal treatment or physicochemical treatment.

APPENDIX E

ENGINEERING SUPPORT DOCUMENTATION

E.1

VOLUME CALCULATIONS

3SH830-94.07.960528.493

Jacobs ER Team

CALCULATION PACKAGE COVER SHEET

Name of Assembler: Chris Maner CAM

Date: 23 APR 96

Task/Task Designator: Task 094-20 DWI 901 Site RI/ Peter Caswell

Calculation Description: Surface debris on site calculated for volumes, types, and percent based on aerial photos and ground photos.

References:

(1) LMES ground photographs (included)
(2) Aerial photos collected by Jacobs ER Team (included)
(3) Plate "A" site map with debris locations (included)
(4) Tracings, with dimensions and scale of debris areas (included)

Assumptions:

(1) Transfer trailers, temporary outbuildings, and re-useable heavy equipment not included as debris.
(2) Measurements based on assumptions from attached ground photos and listed on individual area calc sheets.
(3) Percent breakdown of each debris area components (e.g. sheet metal, tires, etc.) based solely on ground photos of the debris surface; percentages assumed to remain constant across and into the "pile".
(4) Void space assumptions chosen based on best judgement of debris appearance.
(5) Buildings and debris inside buildings not included in estimates.

Checked By	Date	Approved By	Date
D. Gelb (DG)	4/29/96	J. Wilson	5/28/96

Keywords:

JOR-ENG-1

Rev. 0 (11/94)

Debris Area	Geometric Shape	Geometric Formula	Calculation	Area Bulk Volume (ft^3)	Bulk Volume Reduction; grouping, sorting, and stacking (%)	Adj. Vol. (ft^3)	Adj. Vol. (yd^3)
A	Modified sphere segment and hemisphere	2/3 pi r^3 - 1/3 pi h^2 (3r - h) AND 2/3 pi r^3	(0.67*pi*(7.2^3))-((0.33*pi*(3.2^2)*(3*7.2-3.2)))+(0.67*pi*(5^3))	853.4	0	853.4	31.6
B_1	Rectangular solid	l x w x h	220*35*2.8	21560.0	50	10780.0	399.3
B_2	Rectangular solid and cylinder	l x w x h AND pi r^2 h	(25.8*6*4)+(pi*(2^2)*8)	719.7	25	539.8	20.0
C	Rectangular solid and cylinder	l x w x h AND pi r^2 h	(7*20*6*6)+(12*12*10)+(2*3*15*6)+(7*pi*(0.4^2)*10)+(0.7*0.7*50)	7079.7	40	4247.8	157.3
D	Rectangular solid and cylinder	l x w x h AND pi r^2 h	(15*4*5*4)+(8*pi*(0.9^2)*3)	1261.1	50	630.5	23.4
E	Triangular solids	1/2 (l x w x h)	(0.5*45*12*6)+(0.5*25*10*6)	2370.0	10	2133.0	79.0
F	Cylinders	pi r^2 h	20*(pi*(0.9^2)*3)	152.7	0	152.7	5.7
G	Parabola solid	4/3 x (xyl)	1.3*123*33.6*8	42981.1	0	42981.1	1591.9
H	Rectangular solid	l x w x h	10*6*4	240.0	90	24.0	0.9
I	Rectangular solid and cylinder	l x w x h AND pi r^2 h	(4*4*5)+(pi*(2.5^2)*7)	217.4	40	130.5	4.8
J	None, bldg re-useable	N/A	N/A	0.0	0	0.0	0.0
K	Cylinder, washer, and rectangular solid	pi r^2 h AND pi (r_1^2 - r_2^2) h AND l x w x h	((pi*(2^2))*3)+(pi*((1^2)-(0.5^2))*0.8)+(4*4*5)	1286.4	40	771.8	28.6
L	Rectangular and triangular solid	l x w x h and (l x w x h)/2	(2*(20*6*6))+(2*(8*4*4))+(0.5*(6*6*4))+(20*10*2)	1880.0	0	1880.0	69.6
M	Modified sphere segment	2/3 pi r^3 - 1/3 pi h^2 (3r - h)	(0.67*pi*(13^3))-((0.33*pi*(8^2)*(3*13-8)))	2567.5	0	2567.5	95.1
N	Rectangular solids (3) and cylinder	l x w x h AND pi r^2 h	(5*5*2)+(20*5*1.5)+(3*3*3)+(pi*(1.5^2)*4)	180.3	0	180.3	6.7
O	Rectangular solid and cylinder	l x w x h AND pi r^2 h	((6*(4*4*5))*0.5)+(2*(pi*(2.5^2)*10))	632.7	0	632.7	23.4
P	Rectangular solid and cylinder	l x w x h AND pi r^2 h	((20*3*8)*0.5)+(pi*(2.5^2)*10)	436.4	0	436.4	16.2

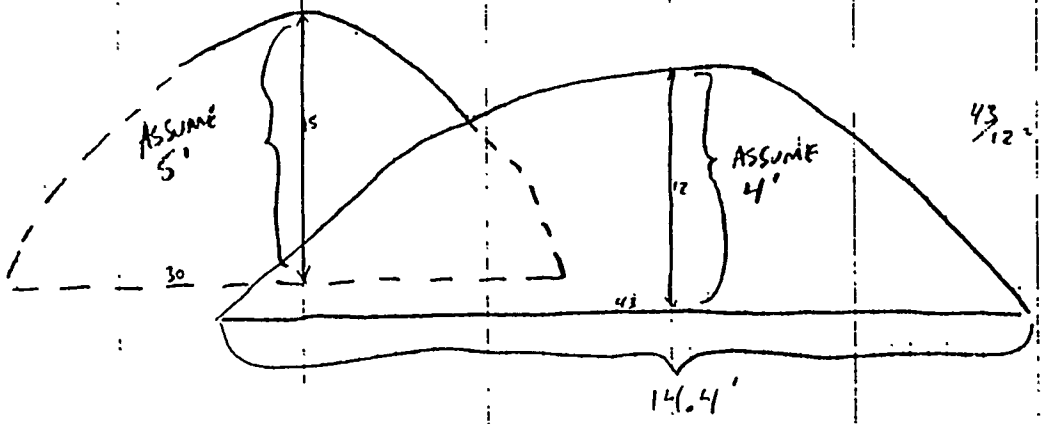
Debris Area	Geometric Shape	Geometric Formula	Calculation	Area Bulk Volume (ft^3)	Bulk Volume Reduction; grouping, sorting, and stacking (%)	Adj. Vol. (ft^3)	Adj. Vol. (yd^3)
Q	Rectangular solid	l x w x h	((4*20*6)*0.6)+(3*3*3)	315.0	0	315.0	11.7
R	Rectangular solids and cylinders	l x w x h AND pi r^2 h	(20*6*6)+(3*(pi*(0.9^2)*3))+(10*(pi*(0.4^2)*10))+(10*6*5)	1108.0	0	1108.0	41.0
S	Modified sphere segment	2/3 pi r^3 - 1/3 pi h^2 (3r - h)	(0.67*pi*(8^3))-((0.33*pi*(4^2)*(3*84)))	745.9	0	745.9	27.6
T	Rectangular solid	l x w x h	(40*10*10)	4000.0	50	2000.0	74.1
U	Hemisphere	2/3 pi r^3	(0.67*pi*(6^3))	454.7	0	454.7	16.8
V	Rectangular solid	l x w x h	(338*44*6)	89232.0	0	89232.0	3304.9
W	Rectangular solid	l x w x h	(15*30*3)	1350.0	30	945.0	35.0
X	Rectangular solid	l x w x h	((3*(4*5*4))*0.5)	120.0	0	120.0	4.4
Y	Rectangular solids	l x w x h	(20*10*1.5)+(20*6*6)+(6*5*13)+(4*8*10)+((4*5*4)*0.5)+(11*4*1)	1814.0	0	1814.0	67.2
Total						165676.1	6136.2

Material Type - percent and volume																																	
Area No.	Area Volume (yd^3)	concrete slabs		spooled wire		temporary bldg.		loose tires		catalytic converters		equipment (refrigerant compressors, fan units)**		electric meters		heavy gauge (iron/steel) metal bins, dumpsters, roll-offs		heavy gauge metal (iron/steel) pipes, rods, rollers		drums		sheet metal		tanks, cylinders		lumber, pallets		plastic		fines (ash, scraped soil, any material < 6"+/-)		thin (wire like) metal	
		%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)	%	(yd^3)
A	31.6	0	0	0	0	0	0	0	0	0	0	0	0	99	31.3	0	0	0	0	0	0	1	0.3	0	0	0	0	0	0	0	0	0	0
B_1	399.3	0	0	0	0	0	0	0	0	0	0	40	159.7	0	0	25	99.8	15	59.9	0	0	10	39.9	0	0	10	39.9	0	0	0	0	0	0
B_2	20.0	0	0	0	0	0	0	0	0	0	0	5	1.0	0	0	50	10.0	10	2.0	0	0	20	4.0	10	2.0	5	1.0	0	0	0	0	0	0
C	157.3	0	0	0	0	0	0	0	0	0	0	15	23.6	0	0	50	78.7	10	15.7	0	0	0	0	0	0	25	39.3	0	0	0	0	0	0
D	23.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	14.0	0	0	40	9.3	0	0	0	0	0	0	0	0	0	0	0	0
E	79.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	79.0	0	0	0	0	0	0
F	5.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	5.7	0	0	0	0	0	0	0	0	0	0	0	0
G	1591.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	79.6	20	318.4	5	79.6	15	238.8	0	0	10	159.2	5	79.6	20	318	20	318
H	0.9	0	0	0	0	0	0	0	0	0	0	95	0.8	0	0	0	0	0	0	0	0	0	0	0	0	5	0.04	0	0	0	0	0	0
I	4.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	1.4	0	0	0	0	0	0	70	3.4	0	0	0	0	0	0	0	0
J	0.0	0	0	0	0	100	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	28.6	0	0	80	22.9	0	0	15	4.3	0	0	0	0	0	0	5	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L	69.6	0	0	0	0	0	0	0	0	0	0	40	27.9	0	0	20	13.9	0	0	0	0	15	10.4	0	0	15	10.4	0	0	10	7	0	0
M	95.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	9.5	0	0	0	0	20	19.0	0	0	15	14.3	0	0	40	38	15	14
N	6.7	0	0	0	0	0	0	10	0.7	0	0	20	1.3	0	0	20	1.3	0	0	0	0	20	1.3	10	0.7	10	0.7	5	0.3	0	0	5	0.3
O	23.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	14.1	0	0	0	0	0	0	40	9.4	0	0	0	0	0	0	0	0
P	16.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	8.1	50	8.1	0	0	0	0	0	0	0	0
Q	11.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	5.8	40	4.7	0	0	10	1.2	0	0	0	0	0	0	0	0	0	0
R	41.0	0	0	0	0	0	0	0	0	0	0	20	8.2	0	0	50	20.5	20	8.2	10	4.1	0	0	0	0	0	0	0	0	0	0	0	0
S	27.6	0	0	0	0	0	0	0	0	100	27.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T	74.1	0	0	0	0	0	0	0	0	0	0	30	22.2	0	0	40	29.6	0	0	0	0	30	22.2	0	0	0	0	0	0	0	0	0	0
U	16.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1.7	0	0	10	1.7	0	0	10	1.7	10	1.7	50	8	10	1.7
V	3304.9	0	0	0	0	0	0	0	0	0	0	10	330.5	0	0	0	0	10	330.5	0	0	20	661.0	0	0	10	330.5	10	330.5	30	991	10	330
W	35.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	28.0	0	0	0	0	0	0	10	3.5	0	0	0	0	10	4
X	4.4	15	0.7	0	0	0	0	0	0	0	0	40	1.8	0	0	25	1.1	20	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	67.2	0	0	0	0	0	0	0	0	0	0	15	10.1	0	0	35	23.5	15	10.1	0	0	25	16.8	0	0	10	6.7	0	0	0	0	0	0
Total (yd^3)	6136.2		0.7		22.9		0.0*		5.0		27.6		587.1		31.3		404.4		780.0		98.7		1024.8		23.6		686.3		412.1		1363.3		668.6
% of Total	100.0		0.01		0.4		0.0		0.1		0.5		9.6		0.5		6.6		12.7		1.6		16.7		0.4		11.2		6.7		22.2		10.9

*Outbuildings are not included in debris estimation; item may require decontamination prior to release.

** Potentially salvageable heavy equipment (welders/compressors, transfer trailers, fork lifts) are not included in estimation; items may require decontamination prior to release.

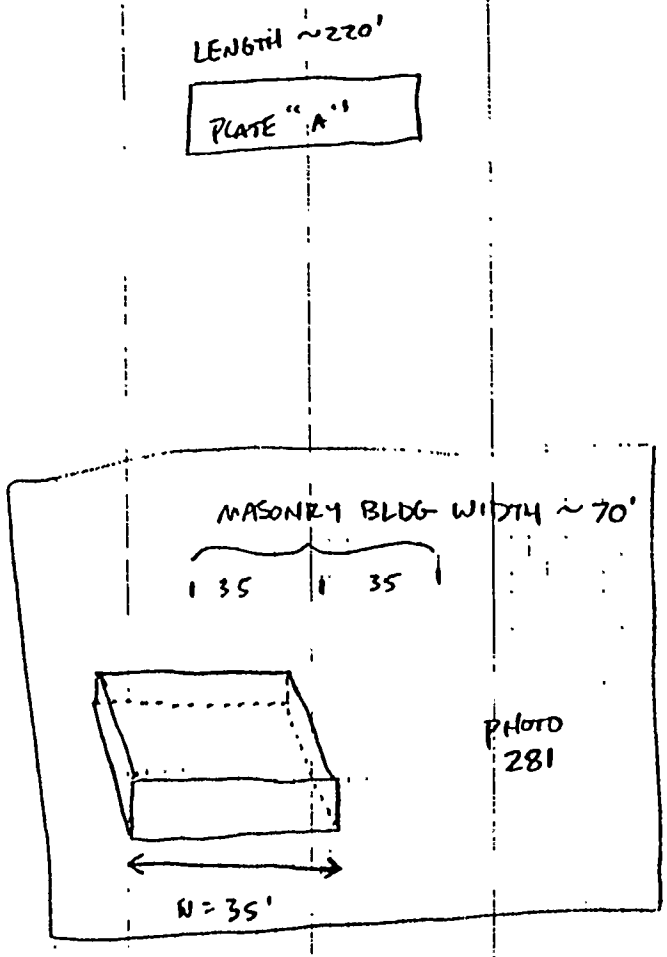
DWI 901 DEBRIS
AREA A
PHOTO 266

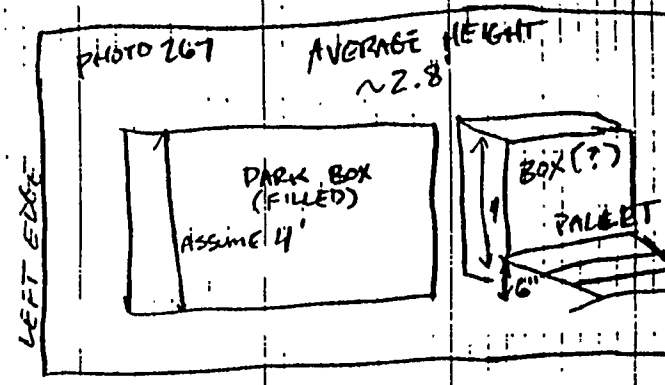


43/12 = 3.6 x WIDER THAN TALL

AREA B,
PHOTOS 267, 309, 273, 281

SHAPE: RECTANGULAR SOLID
L x W x H



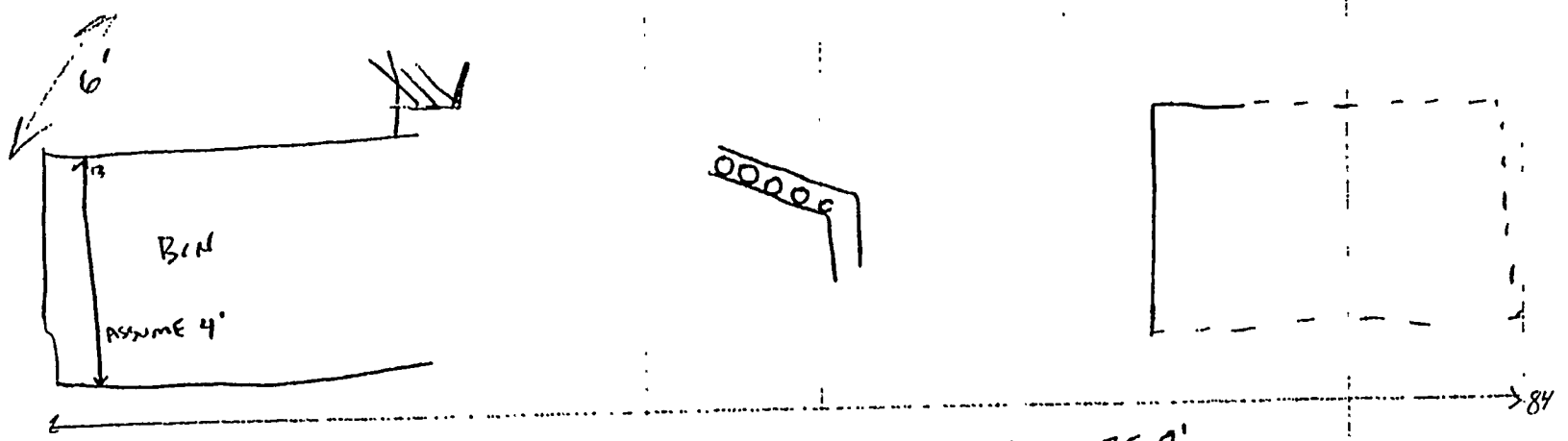


E-9

DWI 901 DEBRIS
AREA B_2
PHOTO 305

CYLINDER NOT SHOWN
ASSUME 4' DIAMETER
8' LONG (ENDS NOT
ACCOUNTED FOR... OPEN
CYLINDER CALC.)

NO PERSPECTIVE ON DEPTH
ASSUME 6'



$\frac{84}{13} = 6.5$ x WIDE AS TALL $\Rightarrow$ L = 25.8'

DWI 901 DEBRIS

AREA C

M. LANDGUTH ARIEAL PHOTO, 335

(7 LARGE "ROLL-OFF" BOXES, STACKS OF PALLETS, 2 MEDIUM BOXES, ~7 PIPES, 1 WOOD "CROSS" COUNTED)

(3 AIR COMPRESSORS/OR WELDERS NOT COUNTED)

(i) $7 \times (20' \times 6' \times 6')$ ASSUMED ALL DIMENSIONS, EMPTY OF CONTENTS

(ii) PALLETS: 6" HIGH (STACKED 20 HIGH) = 10' H

3 ROWS - 3 DEEP; 1 PALLET ASSUMED 4' SQUARE $\Rightarrow$ 12' x 12'

$\hookrightarrow$ 12' x 12' x 10'

(iii) 2 MED BX: $2 \times (3'(h) \times 15'(l) \times 6'(w))$ ASSUMED ALL DIMENSIONS, EMPTY OF ANY CONTENTS

(iv) 7 PIPES: $7 \times (\pi (0.4)^2 10')$ ASSUMED ALL DIMENSIONS

(v) CROSS: 8" SQUARE LUMBER, APPROX 30' LONG PLUS 2 - 10' CROSS MEMBERS

(0.7' x 0.7' x 50')

ASSUME AVERAGE 40% BULK DENSITY

DWI: 901 DEBRIS

AREA D

M. LANDGUTH AERIAL PHOTO

~15 SMALL BINS $15 \times (4'(h) \times 5'(\ell) \times 4'(w)$

~8 55-GAL DRUMS $8 \times (\pi \times (0.9')^2 \times 3'(h))$

DWI 901 DEBRIS

AREA E

MILANDOUTH PHOTO, Z95, & PLATE

$\frac{1}{2}$ (TRIANGULAR SOLID) $l \cdot w \cdot h = V$ $\quad h_{ii} = \frac{h_1 + h_2}{2} = \frac{8+4}{2} \cong 6$ $\quad h_{iii} = 6$

ALL DIMENSIONS ASSUMED

(ii) $(\frac{33}{.5} \times 45' \times 12' \times 6')$

(iii) $(\frac{33}{.5} \times 25' \times 10' \times 6')$

DWI 901 DEBRIS

AREA F

ARIEL PHOTO (M. LANDGRAF), 3/3

$V = \pi r^2 h$

AIR PHOTO DEMONSTRATES APPROX. 20 55-GALLON DRUMS

ASSUME FILLED 100%

$20 \times \left(\pi \cdot (0.9')^2 \cdot 3' \right)$

DWI 901 DEBRIS
AREA G
M. LANGUTH PHOTO "G", 284

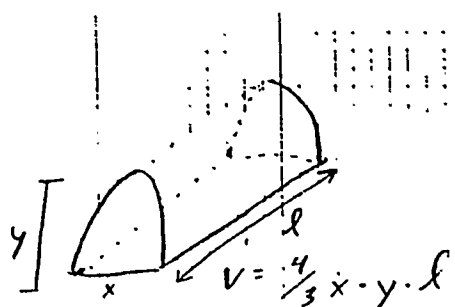
LENGTH

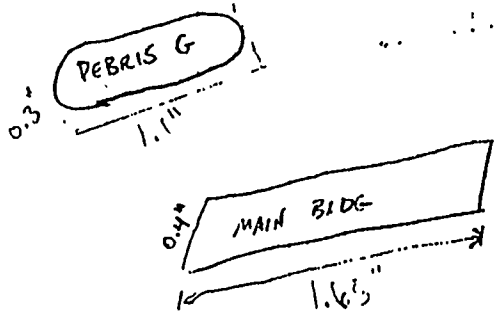
$\frac{1.65''}{185'} = \frac{1.1''}{\ell}$

$1.65\ell = 203.5$

$\ell = \frac{203.5}{1.65}$

$\ell = 123'$





$\frac{1.65''}{185'} = \frac{0.3''}{x}$ WIDTH

$x = 33.6'$

HEIGHT: PHOTO 284
~ 8'

DWI 401 DEBRIS

AREA H

PHOTO 295, 313

ESTIMATE DOES NOT INCLUDE TRANSPORT TRAILERS (SHOULD BE SALVAGED)
ONLY ONE DETECTABLE ITEM REMAINS ... WOOD FRAME BOX, DIMENSIONS ASSUMED

$V = l \times w \times h$

$= 10' \times 6' \times 4'$

DWI 901 DEBRIS

AREA I

PHOTO 339

COMPRISED OF: 1 SMALL METAL BIN, % FILLED UNKNOWN ASSUME 40%; 4'h x 4'w x 5'l
1 CYLINDER APPROX. 5'H x 7'l
(TANK?)

DWI 901 DEBRIS
AREA J
AERIEL PHOTO

NOT CALCULATED, BLDG. APPEARS RE-USEABLE

DWI 901 DEBRIS
AREA K

PHOTO 282

3 BASIC ITEM TYPES

① SPOOLS OF WIRE (~30) $V = \pi r^2 h$

② TIRES (~40, INCL. THOSE IN BIN) $V = \pi(r_1^2 - r_2^2)h$

③ SMALL METAL BIN (1) $V = 4' \times 4' \times 5'$

ASSUME: SPOOLS ARE 4' DIAMETER, 3' high
TIRES ARE 2' DIAMETER, 1' HOLE, 10" WIDE

DWI 901 DEBRIS
AREA L
M. LANDGUTH AIR PHOTO, 282

ESTIMATE INCLUDES: 2 LARGE METAL ROLL OFFS (EMPTY), 2 WHITE STORAGE BOXES ON TRANSFER TRAILERS, FAN UNIT (TRIANGULAR), AND FAN UNIT PLATFORM

DOES NOT INCLUDE: TRANSFER TRAILERS (RE-USEABLE)

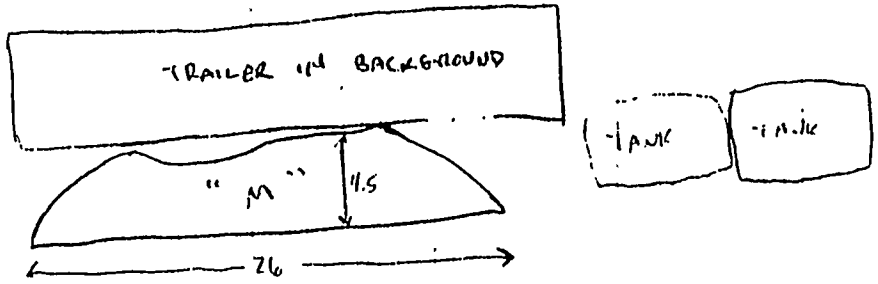
$$\left(0.8\left(2\left(20 \times 6 \times 6\right)\right)\right) + 2\left(8'l \times 4'w \times 4'h\right) + \frac{1}{2}\left(6'w \times 6'h \times 4'w\right) + \left(20'l \times 10'w \times 2'h\right)$$

ASSUME: EMPTY LARGE BOXES CAN HAVE 80% VOLUME REDUCTION THROUGH COMPACTION OR FILLING WITH OTHER MATERIAL; ALL OTHER ITEMS NO BULK REDUCTION

DWI 901 DEBRIS
AREA M
PHOTO 338

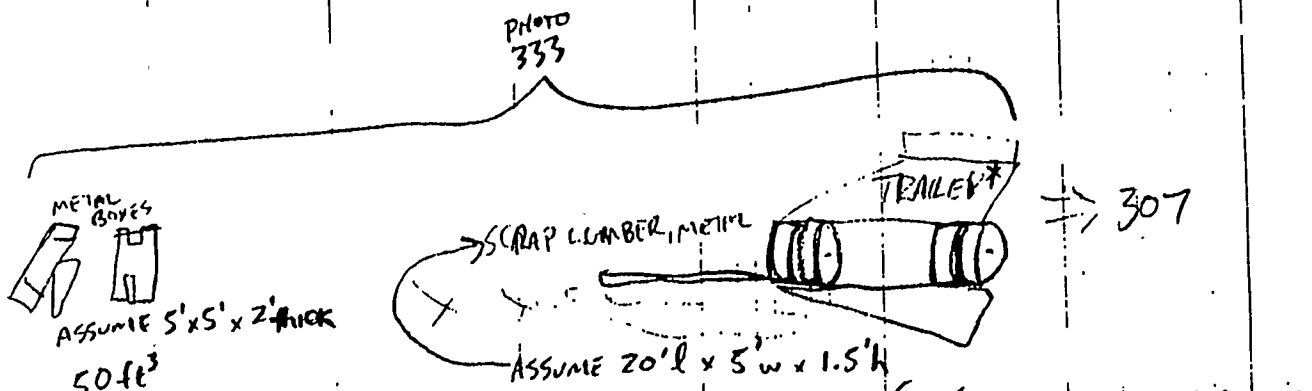
MODIFIED SPHERE SEGMENT

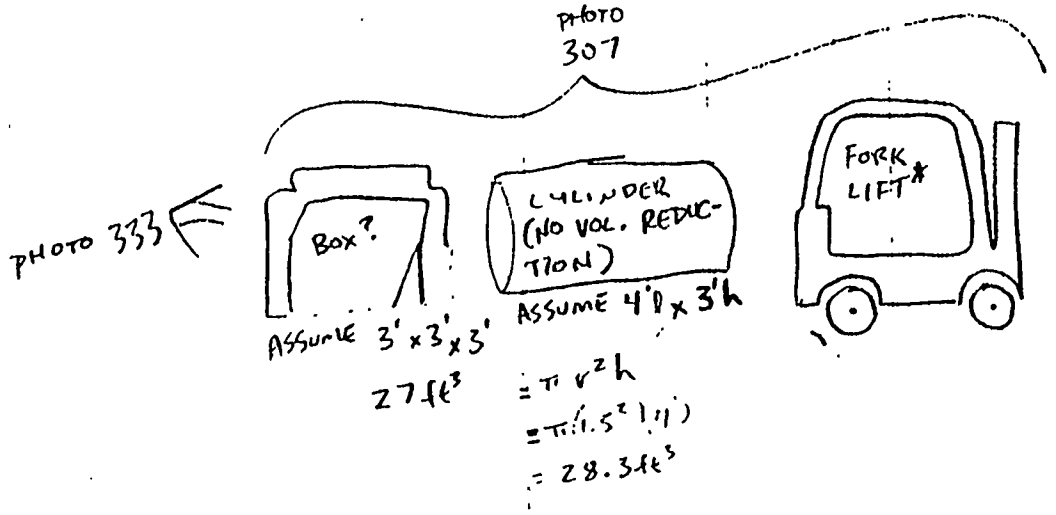
$$V = \tfrac{2}{3}\pi(13^3) - \tfrac{1}{3}\pi(8^2)(3\cdot13 - 8)$$



PILE IS 5.8 x WIDER THAN TALL
ASSUME HEIGHT: 6' MAN COULD NOT STAND UPRIGHT UNDER TRAILER
∴ 5', THUS 29' WIDE MODIFIED HEMISPHERE

DWI 901 DEBRIS
AREA N
PHOTOS 307, 333





* TRAILER, FORKLIFT NOT COUNTED, RE-USEABLE ITEMS

DWI 901 DEBRIS
AREA O
PHOTO 277

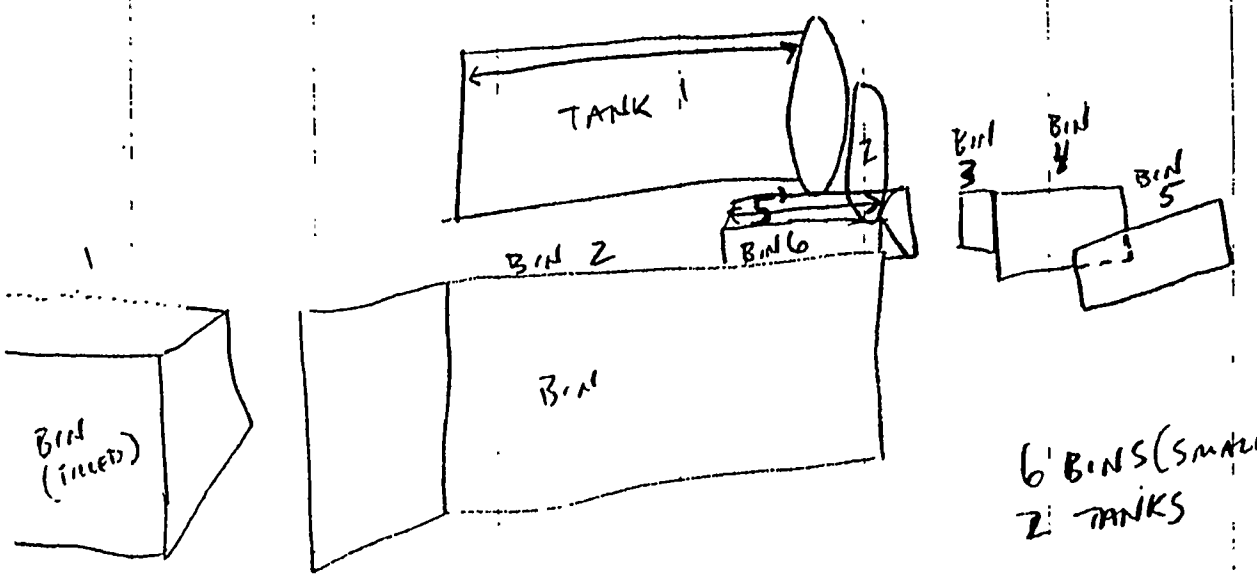
$\therefore 150 = 0.5' \Rightarrow d = 5'$ AND RADIUS = 2.5'

ASSUME: 50% FILLED (AVG.) FOR BINS
0% REDUCTION ON TANKS

$\frac{5'}{10 \text{ SQUARES}} = \frac{x'}{20}$

$10x = 100'$
$x = 10'$

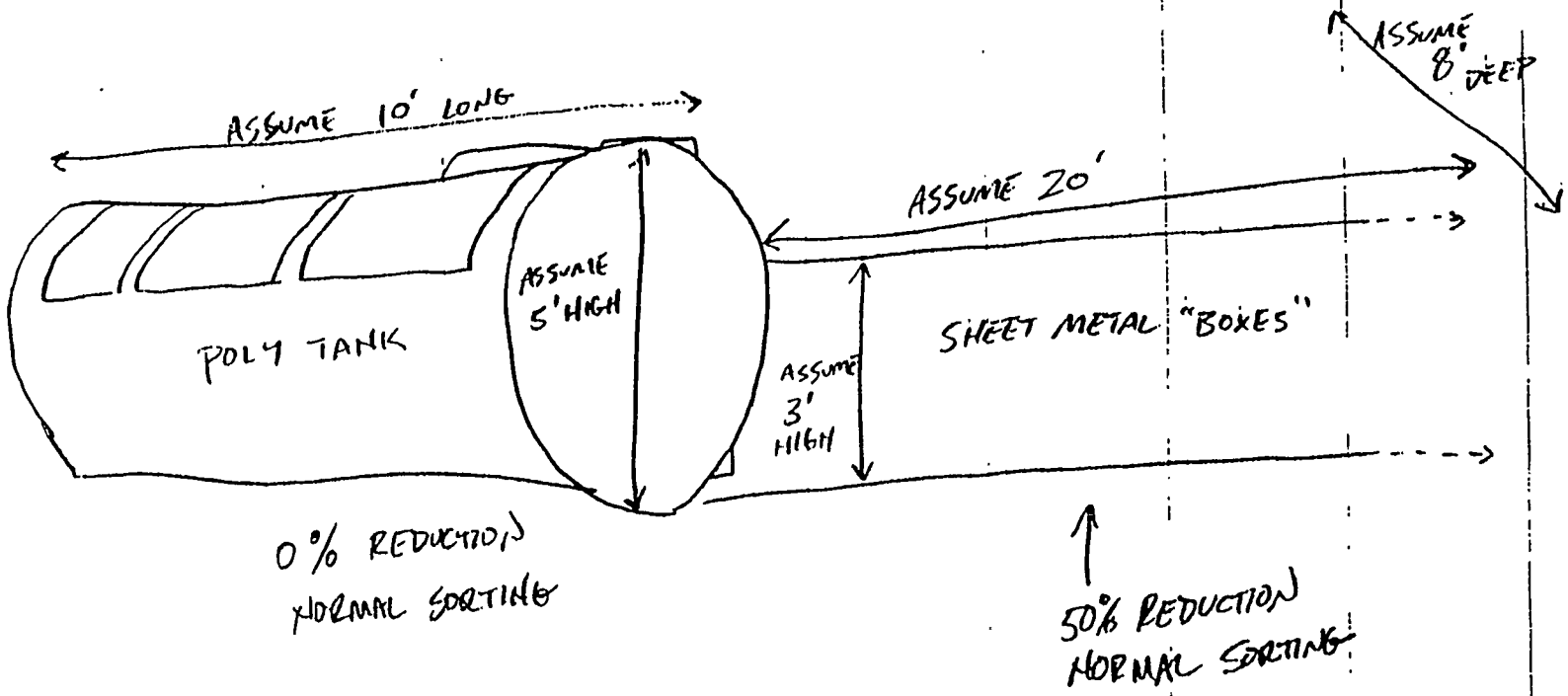
$\pi r^2 h$
$\pi (2.5^2)(10)$



6' BINS (SMALL METAL) 4' x 4' x 5'
2 TANKS
ASSUME AS PREVIOUS ARE

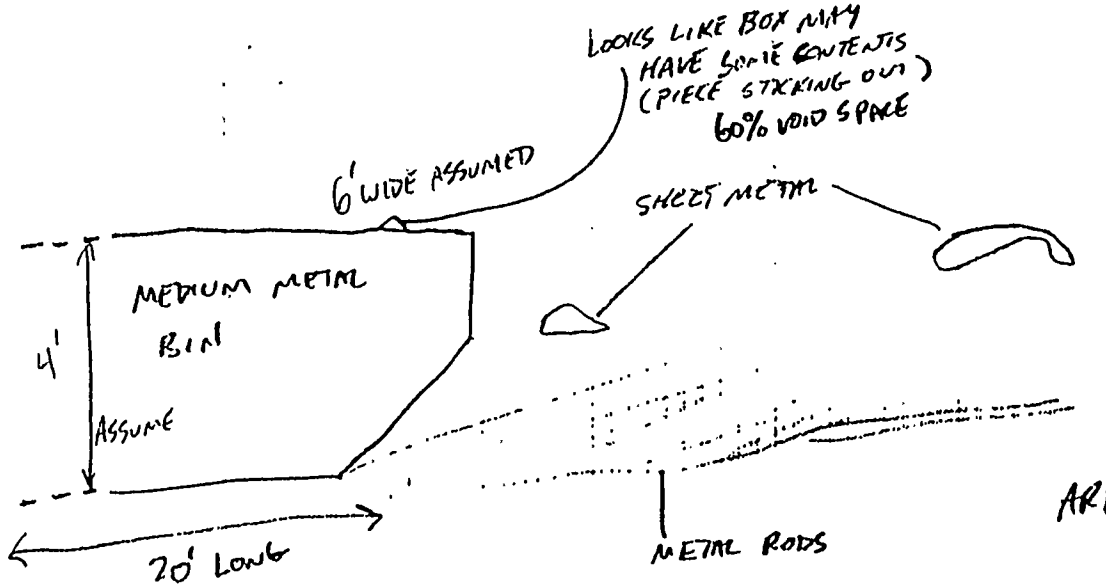
DWI 901 DEBRIS
AREA P
PHOTO 300

$$V = \left(\pi (2.5^{\wedge}2)10\right) + \left((3 \times 8 \times 20) \times .5\right)$$



DWI 901 DEBRIS
AREA Q
PHOTO 283

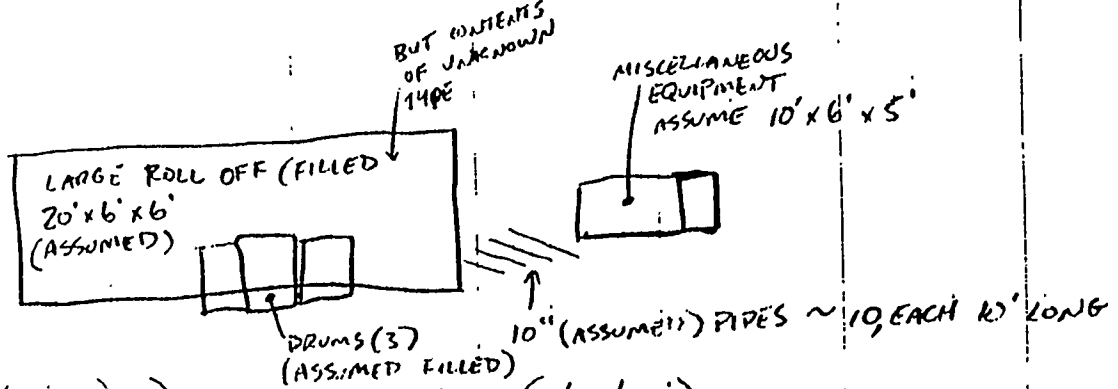
$V = ((4 \times 20 \times 6) \times 0.6) + (3 \times 3 \times 3)$



ARBITRARY: RODS AND OTHER METAL DEBRIS ~ 1 cy

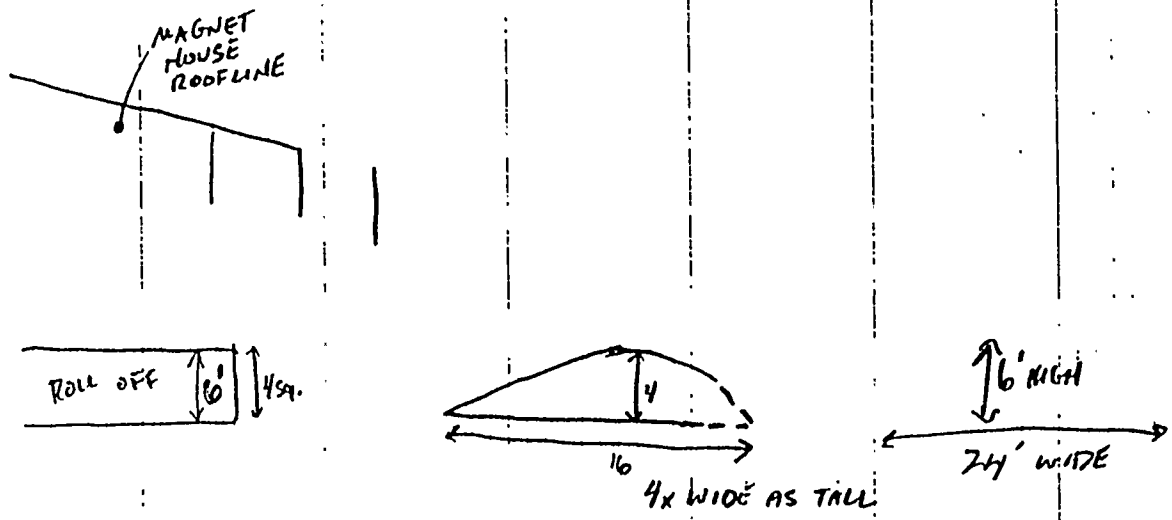
BOX 4' x 20' x 6

DWI 901 DEBRIS
AREA R
PHOTO 314, M. LANDGRITH AIR PHOTO



$$(20'\times6'\times6') + 3(\pi(1'^2)4') + 10\left(\frac{\pi(0.8'^2)10'}{4}\right) + (10'\times6'\times5')$$

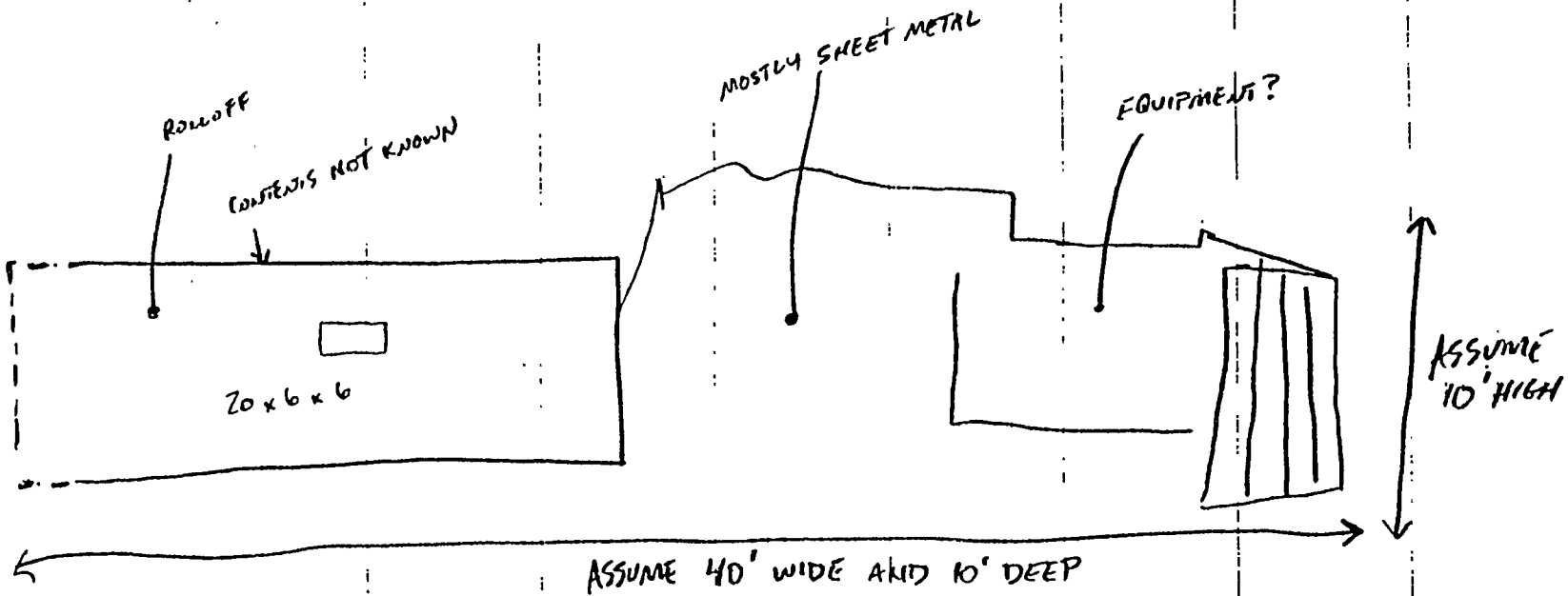
DWI 901 DEBRIS
AREA 5
PHOTO 334



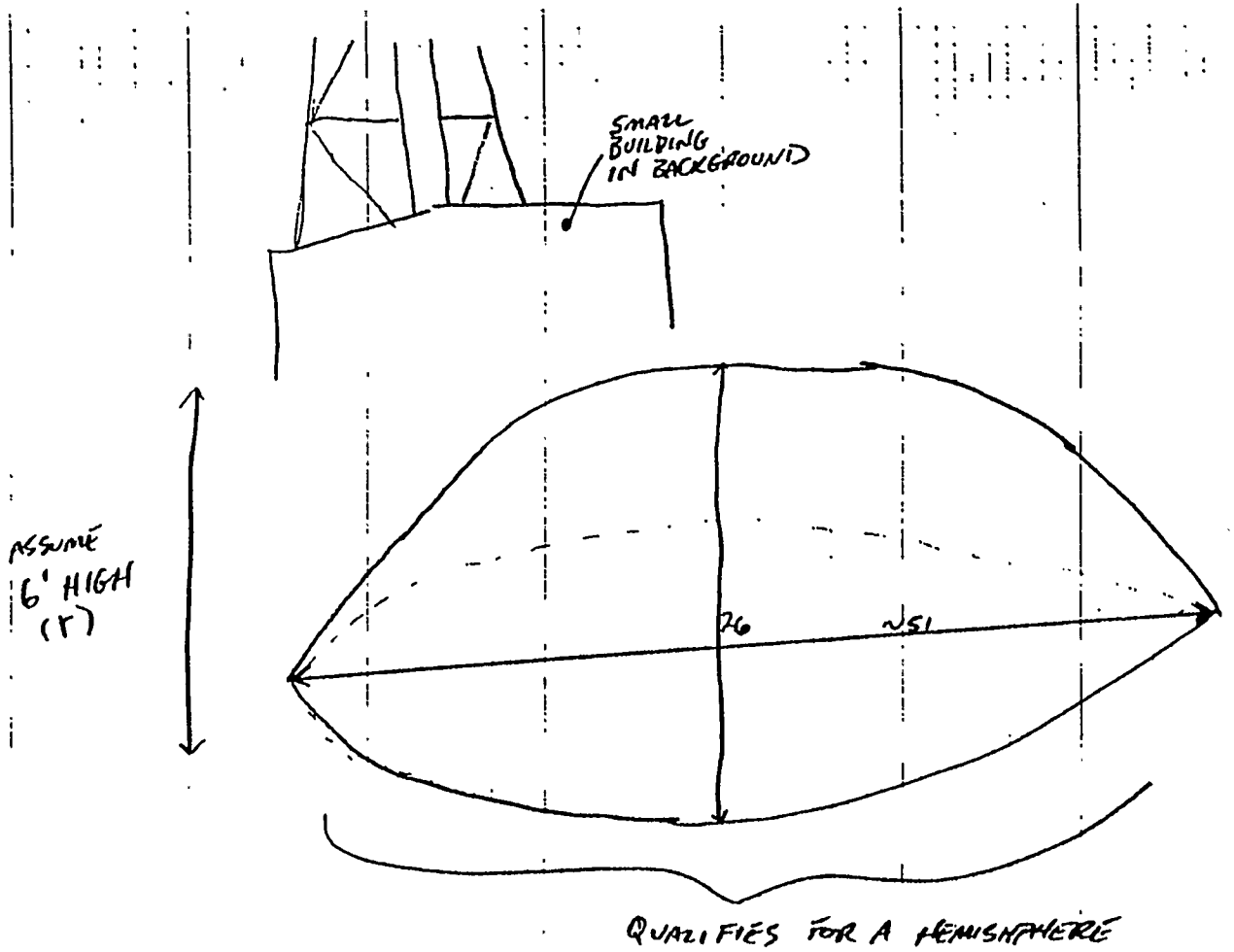
DWI 401 DEBRIS

AREA T

PHOTO 291



DWI 401 DEBRIS
AREA U
PHOTO 323



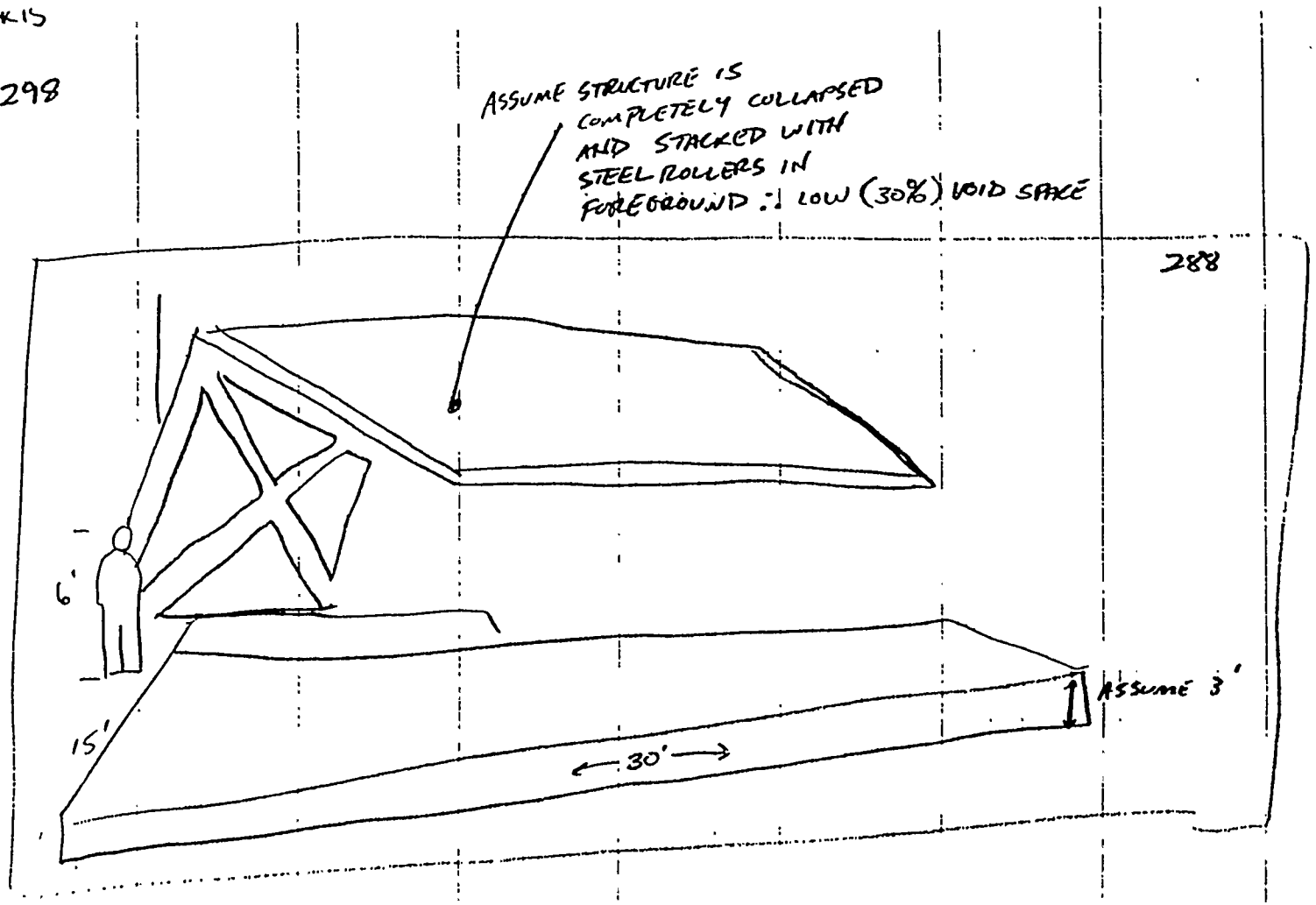
AREA V

PHOTOS: VARIOUS SHOTS FOR COMPOSITION AND RELATIVE POSITION
SIZE MEASURED FROM DEBRIS PLATE A WHICH IS BASED ON RELATIVE POSITIONING

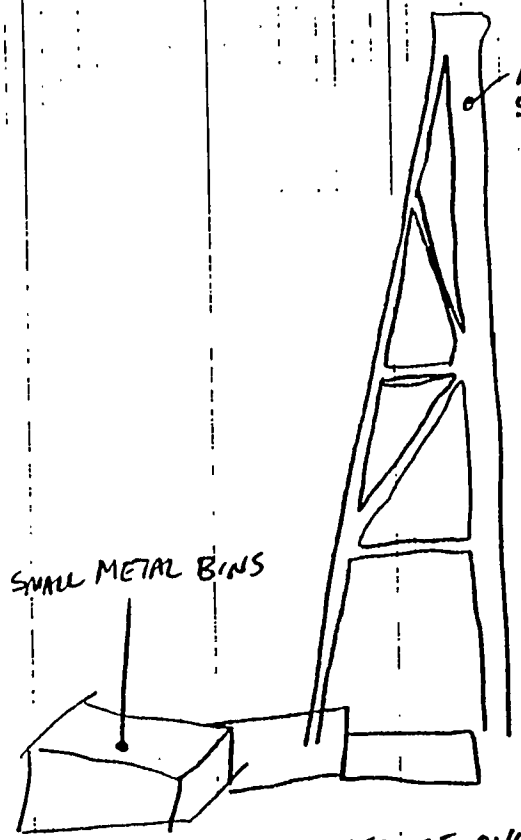
ON 1" = 50' PLATE AREA V IS APPROX 6.75" LONG → 338'
0.5" TO 1.25" WIDE (AVG = .88) → 44'

AND FROM PHOTO 296 IS APPROX 6' HIGH

VWL 701 DEBRIS
AREA W
PHOTOS 288, 298



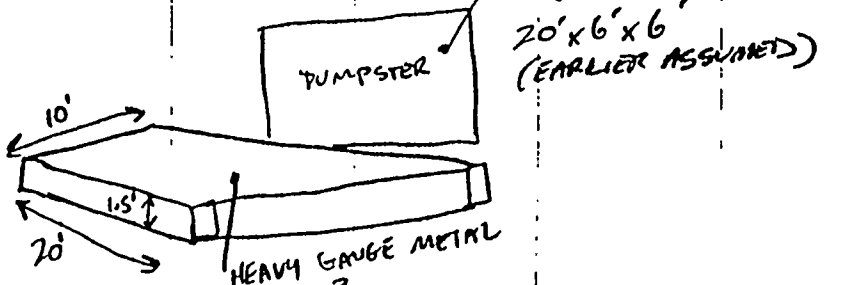
DWI 401 DEBRIS
AREA X
PHOTO 270



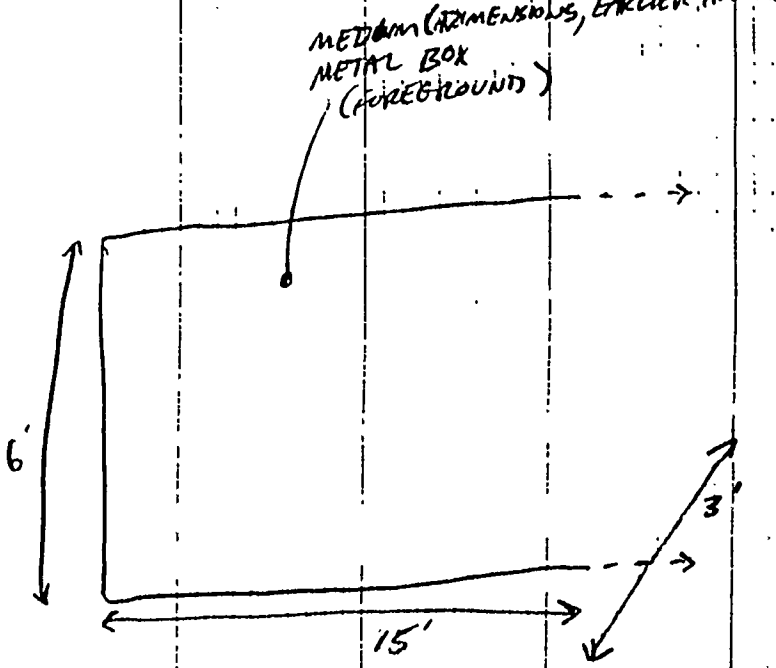
3 VISIBLE, WILL ASSUME ONLY 3 EXIST, CONTENTS UNKNOWN, ASSUME 50% FILLED

$(3(4' \times 5' \times 4') \times 0.5)$

AREA Y (PAGE 10F2)
PHOTOS 269, 340



(20 x 10 x 1.5) + (20x6x6) + (6x15x3) + (pg.2)

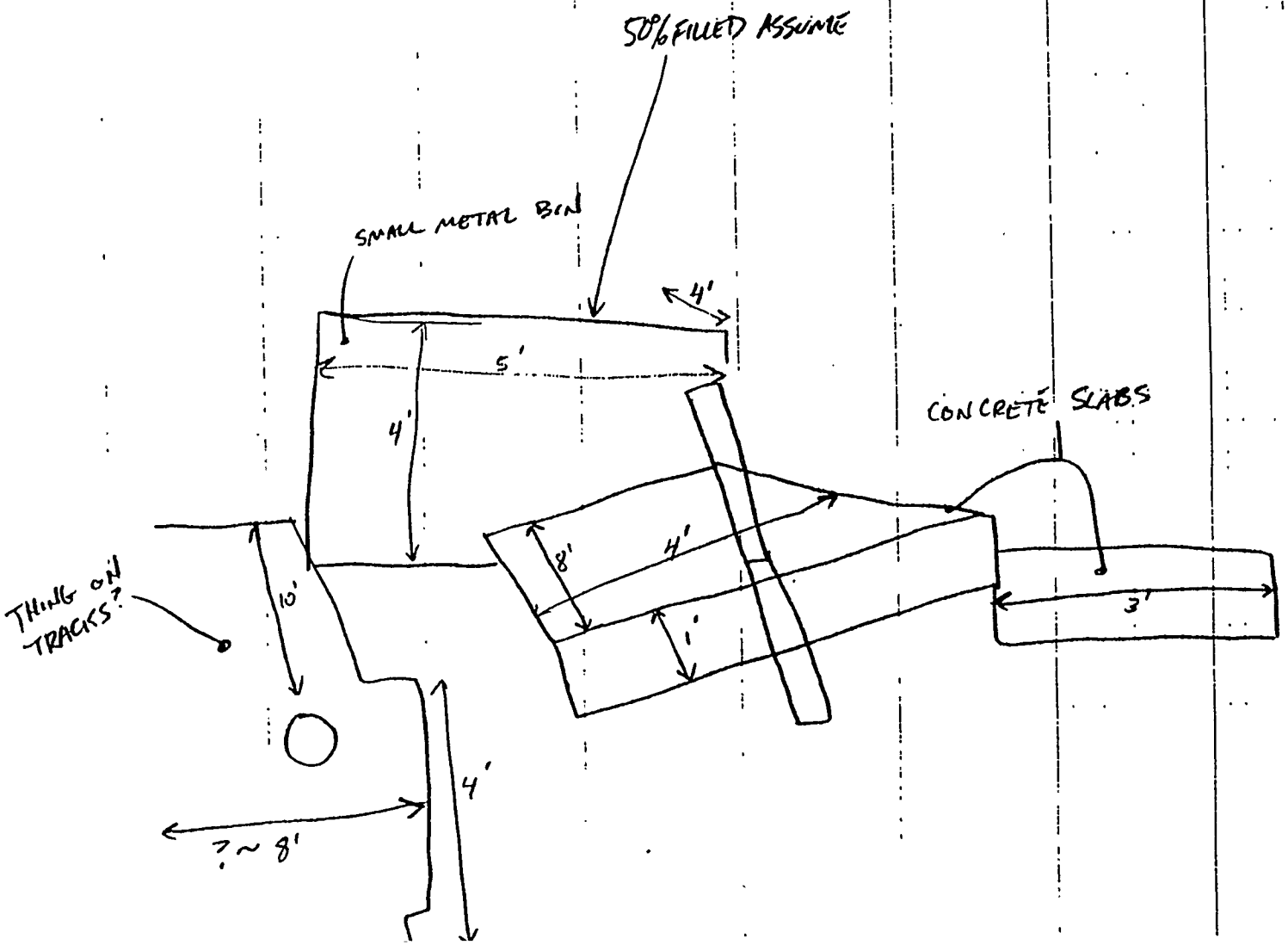


DWI 901 DEBRIS
AREA Y (2 OF 2)
PHOTO 340

$(PSI) + (4 \times 8 \times 10) + ((4 \times 5 \times 4) \times 0.5) + (11 \times 4 \times 1)$

TRACK THING

50% FILLED ASSUME



E.2

CAP CALCULATIONS

3SH830-94.07.960701.088

JACOBS ENGINEERING GROUP INC.
Oak Ridge Operations

CALCULATION PACKAGE COVER SHEET

Name of Assembler: Mitch JERALD

Date: 07/01/96

Task/Task Designator: Mitch JERALD

Calculation Description: CAPPING QUANTITIES FOR THE DAVID WITHERSPOON, INC 901 SITE

References: (~~copies are attached~~)

NONE

Assumptions:

NONE

NOTE: TOPO MAP USED TO COMPUTE AREA AND VOLUMES (SEE ATTACHED)

Checked By	Date	Approved By	Date
[signature]	7/1/96	[signature]	7/16/96

Keywords:

Date: June 20, 1996

To: Karen Burch

From: Mitch Jerald

Subject: David Witherspoon , Inc., 901 Site (Capping Quantities)

Notes:
Capping Area: Approx. 1.5 acres
Soil and Debris Waste Volume: 22,700 cy
Drawing: 1"= 100ft.
Perimeter Berm: Approx. 1200ft. long; 10ft. high; 10ft. wide@ top; 3:1 side slopes

Cap Design:
* Multi-layer cap (components listed from top to bottom; quantities are approximate)

* 6 in. top soil layer = 2,000 cy

* 1ft.-6 in. thick soil cover = 6,150 cy

* 6 oz geotextile (heat bonded to geonet) = 12,300 sy

* 5mm geonet (drainage layer) = 12,300 sy

* 6 oz geotextile (heat bonded to geonet) = 12,000 sy

* 40 mil (VLDPE) synthetic geomembrane liner = 12,000 sy

* 2ft thick clay soil cap (compacted) = 8,200 cy

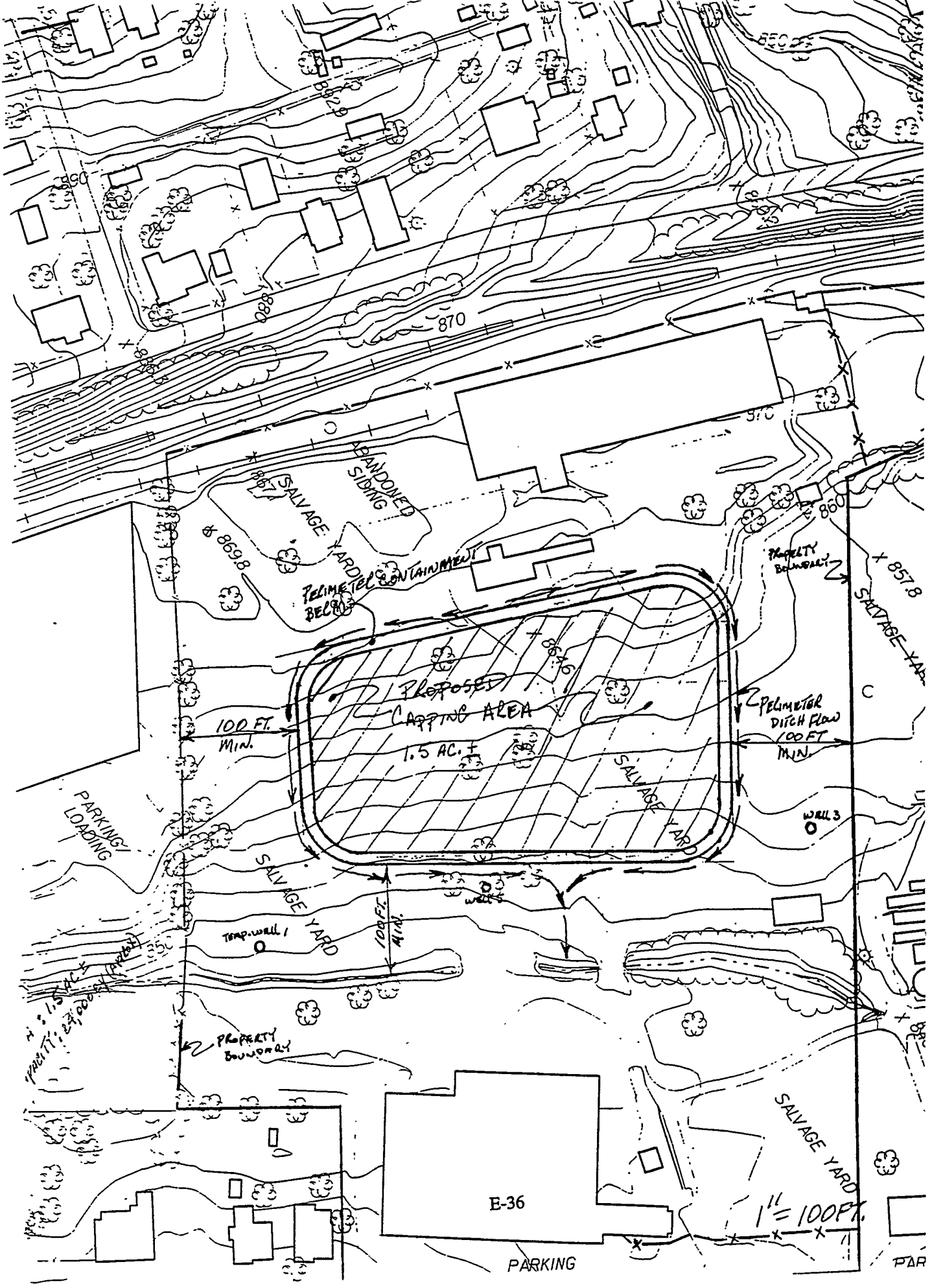
* 4 in. dia. perforated pipe @ anchor trench = 1,200 lin. ft.

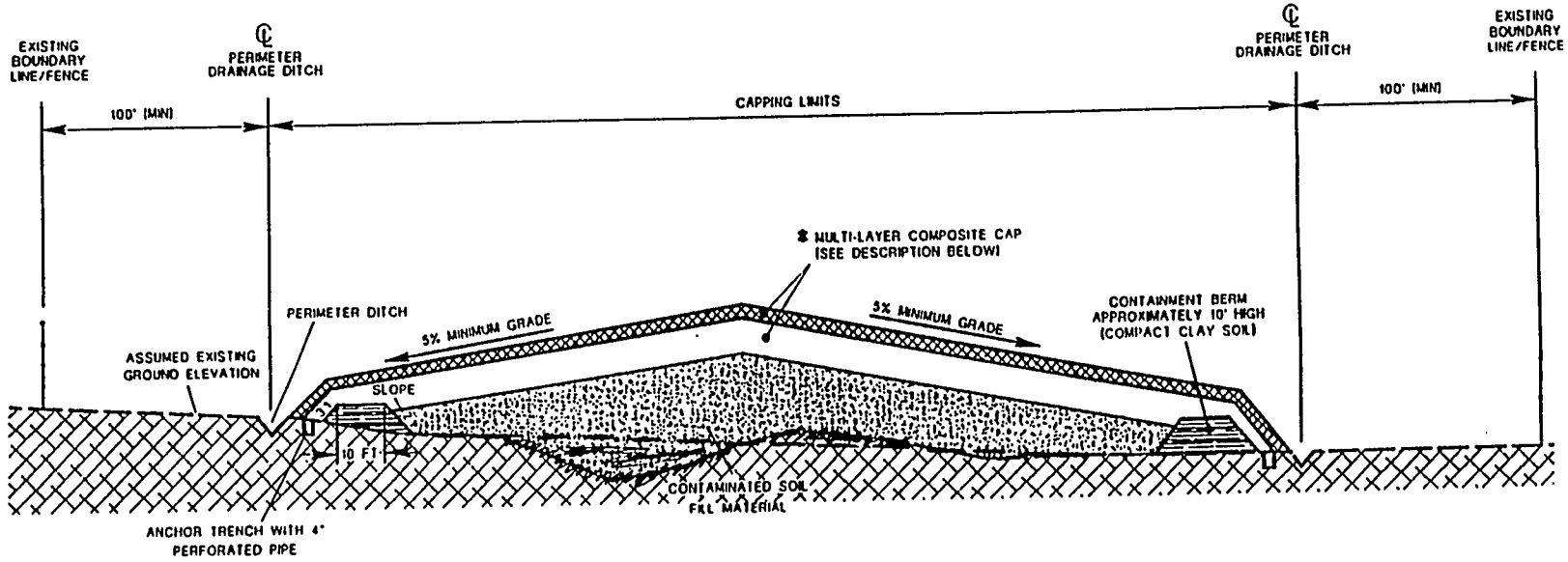
* Anchor trench (2'x 1'x 1,200') excavation = 100 cy

*Anchor trench backfill = 100 cy

* Perimeter ditch excavation = 350 cy

* Perimeter containment berm (clay soil material) = 13,500 cy


870
ABANDONED SIDING
SALVAGE YARD
PERIMETER BERM
PROPERTY BOUNDARY
PROPOSED CAPPING AREA
1.5 AC. ±
100 FT. MIN.
PERIMETER DITCH FLOW
100 FT MIN.
SALVAGE YARD
WELL 3
PARKING/ LOADING
SALVAGE YARD
WELL 5
TEMP. WELL 1
100 FT. MIN.
PROPERTY BOUNDARY
SALVAGE YARD
E-36
PARKING
1" = 100FT.



FROM TOP TO BOTTOM

* MULTI-LAYER COMPOSITE CAP
1) 6" top soil
2) 1'-6" soil cover
3) 6oz geotextile (heat bonded to drainage layer)
4) 5mm geonet (drainage layer)
5) 6oz geotextile (heat bonded to drainage layer)
6) 40 mil Very Low Density Polyethylene Liner (VLDPE) (synthetic geomembrane liner)
7) 2' thick clay soil cap (compacted)

NOT TO SCALE

JE

Fig. ~~2-2~~

Cross Section View - Schematic

DAVID WITHERSPOON, INC., 901 SITE - KNOXVILLE, TENNESSEE

DOE · ~~Atomic City Auto Parts · Oak Ridge, Tennessee~~

DOCUMENT ID	DRAWING ID	DRAWING DATE:
~~0009-50~~ / RI/FS	~~90-13000.DWG~~	~~JUNE 1990-00~~

DRAFT

0044-20 ? ?

APPENDIX F

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

DOE has agreed to undertake remedial activities at the DWI 901 Site as specified under a consent order with the state of Tennessee (Consent Order No. 90-3443, April 4, 1991) and as further directed by an MOU between DOE and the state of Tennessee. Remedial activities at the DWI 901 Site are not subject to the FFA, but are subject to the rules of the Hazardous Substance Site Remedial Action Program directed by the TDEC Division of Superfund. According to the MOU and the consent order, these activities shall be conducted in a manner consistent with the terms and conditions of the FFA, CERCLA, and as approved by the Commissioner.

This section describes the potential applicable or relevant and appropriate requirements (ARARs) under consideration at the DWI 901 Site, including chemical-specific ARARs, radiation protection standards, location-specific ARARs, and action-specific ARARs for each alternative.

Tennessee Rules 1200-1-13 and Section 121 of CERCLA specify that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal, state, and local regulations, whichever is more stringent, that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured.

The site is contaminated with low-level waste (LLW), RCRA characteristic waste, and PCBs. A complete description of the DWI 901 Site and the nature and extent of contamination is found in Chapter 3 of this RI/FS.

Federal construction activities are covered by the OSHA standards in 29 CFR 1926, "Construction Standards," and 29 CFR 1910 "General Industry." DOE also addresses occupational safety in DOE Orders. ARARs apply to those federal and state regulations that are designed to protect the environment. They do not generally apply to occupational safety regulations. EPA requires compliance with the OSHA standards in §300.150 of the NCP, not through the ARARs process. Therefore, neither the regulations promulgated by OSHA nor the DOE Orders related to occupational safety are addressed as ARARs; these regulations will appear in the site-specific HASP for the DWI 901 Site.

Following is a listing of the definitions of terms used throughout this report:

Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA or hazardous substance site [TDEC 1200-1-13-.02(c); 40 CFR 300.5].

Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting law that address problems or situations sufficiently similar to those encountered at the hazardous substance or CERCLA site that their use is well suited to the particular site [TDEC 1200-1-13-.02(aa); 40 CFR 300.5]. They are not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA or hazardous substance site. The requirements must be both relevant and appropriate.

Substantive requirements pertain directly to the actions or conditions at a site, while **administrative requirements** facilitate their implementation. EPA recognizes that certain administrative requirements, such as consultation with state agencies, reporting, etc., are accomplished through the state involvement and public participation requirements of the NCP. These administrative requirements should be observed if they are useful in determining cleanup standards at the site [55 *Federal Register* (FR) 8757].

CERCLA on-site remedial response actions must only comply with the substantive requirements of a regulation and not the administrative requirements to obtain federal, state, or local permits [CERCLA §121(e)]. TDEC Rules do not detail this, but do incorporate 40 CFR 300, the promulgated federal regulations for this statute, by reference.

To ensure that CERCLA response actions proceed as rapidly as possible, EPA has reaffirmed their position that on-site actions need only comply with substantive requirements in the final NCP (55 FR 8756, March 8, 1990). CERCLA defines on-site as the areal extent of contamination and all suitable areas in proximity to the contamination necessary for implementation of the response action (40 CFR 300.5). TDEC defines the CERCLA AOC as the horizontal and vertical extent of contamination in air, soils, sediment, drinking water supply, surface water, groundwater, subsurface strata, or on the land surface occurring or originating at a hazardous substance site [TDEC 1200-1-13.02(c)]..

In the absence of promulgated regulations, there are many criteria, advisories, guidance, values, and proposed standards that are not legally binding but may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs but are to-be-considered (TBC) guidance [40 CFR 300.400(g)(13)].

1.1 CHEMICAL-SPECIFIC ARARS

Chemical-specific requirements define acceptable levels of hazardous substances for remediation planning purposes [TDEC 1200-1-13-.08(3)(a)] and set health or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants (55 FR 8741, March 8, 1990). These requirements generally set protective cleanup levels for the chemicals of concern in the designated media or else indicate a safe level of discharge that may be incorporated when considering a specific remedial activity. COCs identified in environmental media (soil, sediment, groundwater, and surface water) at the DWI 901 Site include metals, PCBs, VOCs, SVOCs, and uranium. No RCRA-listed hazardous waste has been identified at the DWI 901 Site; however, RCRA-characteristic waste is present.

1.1.1 Groundwater

As stated in the NCP (55 FR 8666), EPA's goal for contaminated groundwater is to return groundwater to its beneficial use within a time that is reasonable for the particular circumstances at a CERCLA site. Under the TDEC Underground Injection Control regulations, all groundwater in the state is classified for domestic and industrial water supply, livestock watering and wildlife, and irrigation. CERCLA §121(d)(2)(A) specifies that remedial actions must require a level or standard of control that at least attains Safe Drinking Water Act (SDWA) maximum contaminant level goals (MCLGs) where such goals are relevant and appropriate under the circumstances of the release. In addition, SDWA maximum contaminant levels (MCLs) have been listed in TDEC's final Superfund rule, *Inactive Hazardous Substance Site Remedial Action Program* (Rules of the TDEC, Chap. 1200-1-13-.08, Table 8-1), effective February 19, 1994, as remediation goals for groundwater used or classified as a domestic water supply. Chapter 1200-5-1 of TDEC Rules, as amended in January 1993, lists MCLs for public water systems that are identical to federal MCLs. The NCP requires use of SDWA MCLs as cleanup levels for carcinogens that have a zero value MCLG and any nonzero value MCLG for remedial action compliance for systemic toxicants [40 CFR 300.430(e)(2)]). Table F.1 references MCLs and MCLGs as ARAR for DWI 901 Site groundwater.

National Secondary Drinking Water Standards regulate contaminants that affect the aesthetic qualities related to public acceptance of drinking water (40 CFR 143.3). Tennessee has

Table F.1. Potential chemical-specific ARARs and TBC guidance for remedial actions at the DWI 901 Site, Knoxville, Tennessee

Chemical characteristic(s)	Requirement(s)	Operating condition(s)	Citation(s)
Surface water	AWQC—May not exceed allowable concentrations for specified substances in surface waters. Various concentrations are indicated by designated use(s) for both maximum and continuous exposures	Remedial actions that directly clean up contaminated surface waters—relevant and appropriate	TDEC 1200-4-3-.03
Groundwater	MCLs—May not exceed allowable concentrations for specified substances in groundwater designated as current or potential drinking water	Remedial actions that directly clean up contaminated groundwater—relevant and appropriate	TDEC 1200-5-1 TDEC 1200-1-13-.08 40 CFR 141
	SMCLs—May not exceed allowable concentrations for specified substances as water exits the supply tap	Remedial actions that directly clean up contaminated groundwater—relevant and appropriate	TDEC 1200-5-1.12 40 CFR 143
Soil	Remediation goals for PCB-contaminated soils are set at 1 ppm for residential and 10 ppm for industrial land use; also equates 10 in. of clean soil with one order magnitude of protection	Remedial actions to clean up contaminated soils—TBC	OSWER Directive 9355.4-01, August 1990
	Screening level for lead-contaminated soils for residential land use is 400 ppm	Remedial actions to clean up contaminated soils—TBC	OSWER Directive 9355.4-12, August 1994

ARAR = applicable or relevant and appropriate requirement
AWQC = ambient water quality criteria
CFR = *Code of Federal Regulations*
DWI = David Witherspoon, Inc.
MCL = maximum contaminant level
OSWER = Office of Solid Waste and Emergency Response (EPs)
PCB = polychlorinated biphenyl
SMCL = secondary maximum contaminant level
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

promulgated enforceable secondary maximum contaminant levels in Chapter 1200-5-1.12 of the TDEC Rules. These regulations apply to all community water systems and to those noncommunity water systems "as may be deemed necessary" by TDEC. In that context, they are not legally applicable to cleanup of groundwater, but may be considered as relevant and appropriate where groundwater meets the state classification as a current or potential drinking water source.

Tests indicate the groundwater COCs at the DWI 901 Site may exceed the chemical-specific ARARs referenced in Table F.1. Background levels have not yet been established. The proposed remedial alternatives address groundwater contamination indirectly through cleanup of the sources responsible for potential groundwater contamination. As currently designed, none of the base actions of the alternatives include direct remediation of groundwater. The regulations listed in Table F.1 serve as cleanup criteria for any direct remediation of the groundwater, if such were deemed necessary. They also serve as screening levels to determine the effectiveness of any proposed source control actions which would indirectly effect cleanup of the groundwater.

1.1.2 Surface Water

CERCLA §121(d)(2)(A) specifically states that remedial actions shall at least attain federal ambient water quality criteria (AWQC) established under Clean Water Act (CWA) if they are relevant and appropriate. In determining whether any AWQC are relevant and appropriate, one must consider the "designated or potential use of the surface or groundwater, the environmental media affected, the purposes for which the criteria were developed, and the latest information available" [CERCLA §121(d)(2)(B)].

The purpose of the Tennessee Water Quality Control Act [Tennessee Code Annotated (TCA) 69-3-102(b)] is "to abate existing pollution of the waters of Tennessee, to reclaim polluted waters, to prevent the future pollution of waters and to plan for the future use of the waters . . . ." The Tennessee Water Quality Control Act (TCA 69-3-103(33) defines waters of the state as "any and all water, public or private, on or beneath the surface of the ground, which are (sic) contained within, flow through, or border upon Tennessee or any portion thereof . . . ."

Tennessee has promulgated implementing regulations to fully protect existing uses of all surface waters as established under the Tennessee Water Quality Control Act. Chapter 1200-4-3 of the TDEC Rules lists seven use-designation categories for Tennessee's surface waters. Specific water quality standards are promulgated for each category. Goose Creek is a permanent stream on the DWI 901 Site. Site runoff drains into this creek and then eventually into the Tennessee River. Chapter 1200-4-4 of the TDEC Rules state that "all other streams, named and unnamed,

which have not been specifically noted shall be classified for fish and aquatic life, recreation, irrigation, and livestock watering and wildlife uses." Goose Creek is not specifically classified in Tennessee's regulations, so it would fall under this classification scheme.

Chapter 1200-4-3 of the TDEC Rules lists criteria for protection of recreational uses, which includes AWQC for consumption of aquatic organisms alone. Table F.1 cites TDEC recreational AWQC for the protection of human health for COCs in DWI 901 Site surface water. When the designated use classification requires protection of aquatic life, or when environmental factors rather than human health are being considered at a remedial action site, AWQC for the protection of aquatic life that is more stringent than the AWQC for human health may be relevant and appropriate for CERCLA cleanup. AWQC for the protection of aquatic life are also cited in Table F.1 for COCs in DWI 901 Site surface water.

1.1.3 Soil

There are currently few promulgated federal or state regulations directly addressing cleanup criteria for contaminated soils at hazardous substance or CERCLA sites; however, there are a number of unpromulgated guidance criteria that may be used as TBC guidance.

Regulations found in the TSCA contain storage, disposal, and cleanup requirements for PCB-contaminated materials. These regulations require that any soils that are removed from the site for disposal containing concentrations of PCBs 50 ppm or greater (40 CFR 761.60) be incinerated (40 CFR 761.70) or disposed of in a chemical waste landfill (40 CFR 761.75). No provisions of TSCA may be avoided as a result of any dilution under 40 CFR 761.1(b).

EPA has codified a TSCA PCB spill cleanup policy (40 CFR 761.120 et seq.) that applies to spills occurring after May 4, 1987. It states that cleanup of any historic spills that occurred before that date must be approved by the EPA regional administrator. In the guidance report for remedial actions at Superfund sites containing PCBs, EPA considers this spill policy and clarifies that the TSCA antidilution provisions are only applicable after a remedial response begins, and that they are not appropriate to dilution which has occurred due to the introduction of PCBs into the environment under prior activities at Superfund sites (EPA 1990). The form and concentration of PCB contamination should be evaluated "as found" at the site; once the remedial response begins, the antidilution prohibition applies. The TSCA requirement for disposal previously discussed would then be applicable for the disposal of any media excavated from the DWI 901 Site with concentrations greater than 50 ppm. PRGs are set in the guidance report at 1 ppm for residential land use (a risk of 10^{-5}) and between 10 and 25 ppm for industrial and/or remote areas (a risk of 10^{-4}) (EPA 1990). Alternatives should reduce concentrations to these

levels, or limit exposures. This guidance indicates that a 25-cm (10-in.) cover of clean soil will reduce the risk by approximately one order of magnitude. These values are considered TBC guidance, not ARARs.

EPA has proposed a remediation strategy for PCBs undergoing cleanup under RCRA or CERCLA (59 FR 62788, December 6, 1994; final rule expected December 1996). Under this strategy, PCBs disposed of, placed in a land disposal facility, spilled, or otherwise released into the environment before April 18, 1978, would be presumed to be disposed of in an environmentally safe manner. However, if the EPA regional administrator determines that there is a risk of exposure from such wastes, the burden will be on the site owner or operator to prove that PCB wastes in concentrations of 50 ppm or greater in environmental media do not pose a risk of injury to human health or the environment.

EPA has issued interim soil lead guidance for CERCLA sites and RCRA corrective actions [Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12, August 1994]. This guidance recommends screening levels for lead in soil of 400 ppm for residential land use. Screening levels are defined as levels of contamination above which there may be enough concern to warrant a site-specific study of risks; these screening levels are not meant to be used as cleanup criteria. The interim guidance document provides information on developing site-specific PRGs at CERCLA sites for residential land use. A plan for soil lead cleanup at these types of sites contaminated with multiple sources of lead is also included.

1.1.4 Sediment

EPA has presented an approach to deriving PCB cleanup levels in sediments (EPA 1990). This approach results in "sediment quality criteria" as a function of organic carbon concentrations and is meant to protect wildlife consumers of freshwater benthic species. These values are considered TBC guidance, not ARARs.

1.2 LOCATION-SPECIFIC ARARS

Location-specific requirements "set restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 FR 51437, 55 FR 8741). There is a stream with riparian vegetation on-site and a "wet" area with facultative wetland vegetation (*Equisetum sp.*) present. A wetlands survey will be performed to determine if these areas meet the regulatory definition of wetlands. Sediment removal activities within the floodplain of Goose Creek will trigger TDEC's aquatic resource alteration requirements, as well as CWA or other federal requirements listed in Table F.2. No federally or state-listed threatened or endangered species, critical habitat, archaeologic or historic resources have yet been identified

Table F.2. Potential location-specific ARARs for remedial action at the DWI 901 Site, Knoxville, Tennessee

Location characteristic(s)	Requirement(s)	Operating condition(s)	Citation(s)
Wetlands			
Presence of wetlands as defined in Executive Order 11990 7(c) and TDEC Rules, Chap. 1200-1-7	Whenever possible, actions must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values. New construction in wetland areas should be particularly avoided unless there are no practicable alternatives. Wetlands protection shall be incorporated into planning, regulating, and decision-making processes	Agency action that involves: • acquiring, managing, and disposing of lands and facilities • providing federally undertaken, financed, or assisted construction and improvements—applicable	EO 11990 10 CFR 1022
Presence of jurisdictional wetlands as defined in 40 CFR 230.3(t) and 33 CFR 328.3(b)	Action to avoid degradation or destruction of wetlands must be taken to the extent possible. Discharges for which there is a practicable alternative with less adverse impacts or those which would cause or contribute to significant degradation are prohibited. If adverse impacts are unavoidable, action must be taken to enhance, restore, or create alternative wetlands	Action involving discharge of dredge or fill material into jurisdictional wetlands—applicable	CWA § 404 40 CFR 230

Table F.2. (continued)

Location characteristic(s)	Requirement(s)	Operating condition(s)	Citation(s)
Floodplains			
Within "lowland and relatively flat areas adjoining inland and coastal waters and other flood-prone areas such as offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." [EO 11988 §6(c) and TDEC Rules, Chap. 1200-1-7)]	Action shall be taken to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values of floodplains. The potential effects of actions in floodplains shall be evaluated and consideration of flood hazards and floodplain management ensured. If action is taken in floodplains, alternatives that avoid adverse effects and incompatible development and minimize potential harm shall be considered	Action that involves acquiring, managing, and disposing of lands and facilities; conducting federal activities and programs affecting land use—applicable	EO 11988 (May 24, 1977) 10 CFR 1022
Aquatic resources			
Discharge of dredge or fill material	Must meet the substantive requirements of the COE permitting process; activities are authorized under NWP 38 (*Cleanup of Hazardous and Toxic Waste*) provided that: • Erosion and siltation controls are used and maintained in effective operating condition • No activity substantially disrupts the movement of those species of aquatic life indigenous to the water body	Incidental discharge of dredge or fill material to "waters of the U.S."—relevant or appropriate	CWA §404 33 CFR 330, Appendix A

Table F.2. (continued)

Location characteristic(s)	Requirement(s)	Operating condition(s)	Citation(s)
	• Heavy equipment is placed on mats or other measures are taken to minimize soil disturbance		
Within an area affecting a stream or river	Must comply with the substantive requirements, as set by the state, of the individual aquatic resource alteration permit process, including best management practices and erosion and siltation controls, and be protective of sensitive resources and downstream waters	Action involving aquatic resource alterations in waters of the state, as defined in TCA 69-3-103(33), including alteration of wet-weather conveyances, bank stabilization, debris removal, and sand and gravel dredging—applicable	Aquatic Resource Alteration (TDEC, Chap. 1200-4-7)
Within area affecting streams or rivers–*and*–presence of fish or wildlife resources	The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the FWS and/or appropriate state agency is strongly recommended for on-site actions	Action which results in the control or structural modification of a natural stream or body of water—applicable	Fish and Wildlife Coordination Act (16 USC 661 et seq.)
Cultural resources			
Presence of archaeological resources on public land	Steps must be taken to protect archaeological resources and sites	Action which would impact any inadvertently discovered resource during remedial activities—relevant and appropriate	Archaeological Resources Protection Act (16 USC 470aa-ll) 43 CFR 7.8 and 7.9

Table F.2. (continued)

Location characteristic(s)	Requirement(s)	Operating condition(s)	Citation(s)
Presence of archaeologic or historic resources	The state archaeologist and U.S. Secretary of Interior must be advised of the presence of the data. A survey of affected areas for resources and data must be conducted and steps taken to recover, protect, and preserve data therefrom, or request that DOI do so	Action involving alteration of any previously undisturbed terrain which might cause irreparable loss or destruction of any inadvertently discovered significant scientific, prehistoric, historic, or archaeologic resources—relevant and appropriate	Archaeological and Historic Preservation Act (16 USC 469a-c)
Presence of human remains, funerary objects, sacred objects, or objects of cultural patrimony	If an inadvertent discovery is made in connection with an on-going activity, activity must stop in the area of the discovery and reasonable effort be made to secure and protect the objects discovered.	Objects that are in federal possession or control or which are excavated intentionally or discovered inadvertently on federal lands after November 16, 1990—relevant and appropriate	Native American Graves Protection and Repatriation Act (25 USC 3001-3013) 43 CFR 10.4
	Notification and consultation procedures are required for off-site activities and recommended for on-site activities.		43 CFR 10.3, 10.4
	Disposition of all inadvertently discovered items must be carried out in prescribed procedures		43 CFR 10.6

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
COE = U.S. Army Corps of Engineers
CWA = Clean Water Act
DOI = U.S. Department of Interior
DWI = David Witherspoon, Inc.
EO = Executive Order
FWS = U.S. Fish and Wildlife Service
NWP = Nationwide Permit
TCA = *Tennessee Code Annotated*
TDEC = Tennessee Department of Environment and Conservation
USC = *United States Code*

on the site. Since the site has been extensively disturbed, neither cultural resources or critical habitat are expected to be present, although undisclosed archaeologic resources could potentially be inadvertently unearthed. Consultations with the state regarding the possible presence of listed species and cultural resources is being pursued.

1.2.1 Aquatic Resources

The Fish and Wildlife Coordination Act (FWCA) [16 *United States Code* (USC) 661 et seq.] requires federal agencies to take into consideration the effect of water-related projects upon fish and wildlife resources and to take action to prevent loss or damage to these resources. Remedial actions which may trigger FWCA include the impoundment, diversion, stream relocation, or other control or modification of any body of water. The provisions of FWCA are not applicable to water impoundment projects where the maximum surface area of the impoundment is less than 6 ha (10 acres), or to projects or activities carried out in connection with land management and use programs carried out by federal agencies on federal lands under their jurisdiction [16 USC 662(h)]. However, the provisions may be relevant and appropriate for such activities. Although no implementing regulations have been promulgated for FWCA, EPA allows consideration of nonpromulgated statutes as ARARs if such statutes are directive in intent (55 FR 8746, March 8, 1990).

The proposed sediment removal activity will involve clearing, excavation, access road construction, and bank stabilization, which will result in erosion of soil into Goose Creek. Sediment and silt control devices are planned to minimize such releases into the stream. The stream is a tributary of the Tennessee River, designated as a "water of the united states"; therefore, the CWA requirements regulating discharge of material into waters of the united states may be triggered as relevant and appropriate requirements. Direct discharge of dredge and fill material into waters of the united states is regulated by U.S. Army Corps of Engineers (COE) under §404 of the CWA. The COE Nationwide Permit (NWP) program establishes COE authorization for activities having minimal impact on waters of the united states (33 CFR 330, Appendix A). COE lists general conditions that apply to all NWPs; each NWP may have additional specific requirements. NWP 38 (Cleanup of Hazardous and Toxic Waste) would most likely be triggered for the sediment removal activities within the off-site tributaries. Substantive requirements triggered for this sediment removal activity are listed in Table F.2.

The Division of Water Pollution Control, TDEC, requires Aquatic Resource Alteration Permits for any alteration of waters of the state. TDEC has authorized general permits for aquatic resource alterations that cause minimal individual or cumulative impacts to water quality. General permits are available for alteration of wet weather conveyances, minor road crossings, utility line crossings of streams, bank stabilization, sand and gravel dredging, and debris removal

(TDEC, Chapt. 1200-4-7). However, such activities are permitted only if no portion of the activity is located in any waterway identified as having contaminated sediments. Since the proposed sediment removal activities would take place in a contaminated stream, the activities are not covered by a general permit. An individual permit may be required. TDEC may establish substantive requirements for this action as part of the individual permit process. Pursuant to CERCLA's definition of on-site, however, the surrounding contaminated soil and sediments in a stream contaminated by the source are considered on-site; therefore, the activity is not subject to the administrative requirement to obtain a permit [CERCLA § 121(e)].

1.2.2 Floodplains

Floodplains are defined in 10 CFR 1022 as any lowland adjoining inland and coastal waters with relatively flat areas that has a 1 percent or greater chance of flood in any given year; this definition does not include the floodway proper. Sediment removal activities would take place in, and impact, the floodplain around the creek at the DWI 901 Site. DOE requires that floodplains be protected to the greatest extent practicable (10 CFR 1022). Since the sediment removal activities will impact floodplains, the requirements found in Executive Order (EO) 11988 (*Floodplain Management*, May 24, 1977) and 10 CFR 1022 would be ARARs. Specific requirements are listed in Table F.2.

1.2.3 Wetlands

If actions must be taken in wetlands [as defined in 40 CFR 230.3(t) and 33 CFR 328.3(b)], then impacts must be minimized, ant the wetlands protected to the maximum extent possible (EO 11990, 10 CFR 1022) (see Table F.2). A wetlands assessment shall be conducted to identify any potential impacts and the appropriate mitigation as needed (40 CFR 230).

1.2.4 Cultural Resources

The primary federal law governing the inadvertent discovery of Native American remains and objects is the Native American Graves Protection and Repatriation Act (NAGPRA). This act states that if Native American cultural items are found on federal lands, the items must be reasonably protected from disturbance and that all activity in the discovery area must cease until the site and artifacts are properly evaluated. Notification of the state archaeologist is required. The U.S. Department of the Interior has promulgated implementing regulations for NAGPRA at 43 CFR 10, which establish procedures for federal agencies to carry out the provisions of NAGPRA (60 FR 62134, December 4, 1995). If significant archaeological resources are discovered or inadvertently unearthed while implementing any of the proposed remedial actions,

the provisions of the Archaeological Resources Protection Act of 1979 (16 USC 470aa-ll), 43 CFR Part 7, 43 CFR 10, and the Archaeologic and Historic Preservation Act (16 USC 469 a-c) may be relevant and appropriate.

1.3 ACTION-SPECIFIC ARARS

Performance, design, or other action-specific requirements are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste, or requirements to conduct certain actions to address particular circumstances at a site (53 FR 51437, 55 FR 8741). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs. These ARARs may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

Four alternatives are currently proposed for remediation of the DWI 901 Site: (1) no action, (2) multilayer cap and monitoring, (3) minimal treatment followed by off-site disposal in a permitted cell, and (4) extensive treatment of all COCs and disposal at a sanitary waste facility on ORR.

1.3.1 Alternative 1—No Action

Pursuant to EPA guidance (OSWER Directive 9234.2-01/FS-A, June 1991), ARARs must be met during and following completion of remedial actions. If no action is taken, there are no ARARs.

1.3.2 ARARs Common To All Action Alternatives

Certain on-site construction and/or excavation activities will be necessary to prepare the site for remediation under Alternatives 2–4, including the movement of soils or site grading activities. These alternatives also share other common components such as removal of standing vegetation, removal of debris from the site to allow action on environmental media, excavation and consolidation of contaminated soils and sediments, and disposition/transportation of decontamination fluids and wastes. All of these activities may also require control of fugitive emissions or surface water runoff. ARARs for these shared activities and common alternative components are listed in Table F.3 and discussed in this section. Action-specific ARARs are presented only for the base remedial actions. If process modifications or contingency actions are triggered, action-specific ARARs will need to be identified and addressed in the ROD at that time.

Table F.3. Potential ARARs and TBC guidance common to all alternatives for the DWI 901 Site, Knoxville, Tennessee

Action	Requirement(s)	Prerequisite	Citation(s)
Fugitive emissions	Take reasonable precautions to prevent particulate matter from becoming airborne; no visible emissions are permitted beyond property boundary lines for more than 5 minute/hour or 20 minute/day	Nonpoint source air emissions from environmental restoration activities—applicable	TDEC Rules, Chap. 1200-3-8-.010
Control of radioactive emissions	DOE will carry out all DOE activities to ensure that radiation doses to individuals will be ALARA	Release of radionuclides into the environment—TBC	DOE Order 5400.5(I.4)
	Exposures to members of the public from all radiation sources shall not cause an effective dose equivalent greater than 100 mrem (1 mSv) per year		DOE Order 5400.5(II.1a)
	Exposures to members of the public from all radiation sources released into the atmosphere shall not cause an effective dose equivalent greater than 10 mrem (0.1 mSv) per year	Release of radionuclides into the air from a DOE facility—relevant and appropriate	40 CFR 61.92 TDEC Rules, Chap. 1200-3-11-.08
	Radiological emission measurements must be performed at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of 1 percent of the standard (0.1 mrem/year). All radionuclides which could contribute greater than 10 percent of the standard (1 mrem/year) for the release point shall be measured		40 CFR 61.93 TDEC Rules, Chap. 1200-3-11-.08

Table F.3. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
Control of surface water runoff	Implement good site planning and best management practices to control stormwater discharges, including: • document best management practices in a stormwater control plan or equivalent document • minimal clearing for grading • removal of vegetation cover within 20 days of construction • perform weekly erosion control inspections and maintenance • control measures to detain runoff • discharges must not cause erosion	Control of stormwater discharges associated with construction activities at industrial sites that result in a disturbance of greater than 5 acres of total land area—applicable	40 CFR 122 TDEC Rules, Chap. 1200-4-10-.05
Treatment in a containment building	Owners or operators of containment buildings designed and operated under the requirements of §264.1101 are not subject to the definition of land disposal in RCRA 3004(k) provided certain provisions outlined in §264.1100 are met	Processes involving treatment of RCRA hazardous debris in a containment building as defined in 40 CFR 260.10—applicable	40 CFR 264.1100 TDEC Rules, Chap. 1200-1-11-.06(32)
	Follow design and operating standards listed in this section, which are intended to ensure containment of managed wastes and to prevent exposure to the elements via precipitation, wind, run-on, etc		40 CFR 264.1101(a) TDEC Rules, Chap. 1200-1-11-.06(32)

WBS ..... 2.0.1.02 SITE PREPARATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.1.2 SITE PREPARATION
Discipline ..... O OTHER
B/M Title ..... TRANSP VEG TO Y-12 LF
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.1.3 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	HAUL SITE VEGETATION TO Y-12 LANDFILL						
1 -A	HAUL 190 CY TREES TO Y-12 LANDFILL, REF VEGDISP.XLSY-12IC (INTERMODAL CONTAINERS)	Matl.	1.00	LS	7,689.00	7,689	
		Labor	0		0.00	0	7,(
2 -A	G/C ADMIN OF S/C, 6%	Matl.	1.00	LOT	461.00	461	
		Labor	0		0.00	0	

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	8,150	0	8,
TOTAL	8,150	(hrs. 0) 0	8,

L OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		71,108		99,306	170,414
SALES TAX		6,044			6,044
TOTAL		77,152		99,306	176,458
TOTAL INDIRECT	20.00%	15,430	20.00%	19,861	35,291
TOTAL		92,582	(hrs. 4,340)	119,167	211,749

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
8 -A	DIVERSION DITCHES	Matl.	1,500.00	LF	1.50	2,250	
		Labor	75	OP	25.25	1,894	4,
9 -A	SILT FENCE AND HAY BALES	Matl.	2,400.00	LF	2.50	6,000	
		Labor	984	L	17.65	17,368	23,
	SITE FENCING						
10 -A	INSTALL FENCE AROUND TEMPORARY FACILITIES	Matl.	800.00	LF	5.55	4,440	
		Labor	170	L	17.65	3,001	7,
11 -A	ALLOWANCE FOR MONITORS FOR DETECTION OF AIRBORNE PARTICULATES	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	60	E	25.95	1,557	11,
****	SUBTOTAL ****	Matl.				64,206	
		Labor	3,152			59,408	123,
	SPECIAL REQUIREMENTS						
12 -A	HEALTH & SAFETY OFFICER	Matl.	400.00	HRS	0.00	0	
		Labor	400	X	50.00	20,000	20,
13 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	3,152.00	HRS	1.00	3,152	
		Labor	158	OP	25.25	3,990	7,
14 -A	PPE REQUIREMENTS	Matl.	50.00	DAYS	75.00	3,750	
		Labor	0		0.00	0	3,
15 -A	LABOR FACTOR	Matl.	3,152.00	HRS	0.00	0	
		Labor	630	OP	25.25	15,908	15,

..... 2.0.1.02 SITE PREPARATION
Code ..... 6100 REMEDIAL ACTION
cipant ..... MK51 MK-F OAK RIDGE FPSC
of Estimate . P Planning/Feasibility Estimate
ttribute ..... 2.0.1.2 SITE PREPARATION
pline ..... 0 OTHER
itle ..... SITE PREPARATION
ving Site .... OTHER
-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
ard Value File C:\AES60F\ERFEB96A.val
ate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site 0
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.1.2 0

Expiration Date: 05/23/1997

em	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE PREPARATION						
	EARLY ACTION						
-A	EXCAVATION AND GRADING FOR TEMPORARY FACILITIES	Matl.	2,000.00	SF	0.20	400	
		Labor	40	OP	25.25	1,010	1,410
	SALVAGEABLE DEBRIS REMOVAL AND CLEANING						
-A	REMOVAL OF SALVAGEABLE SURFACE DEBRIS (INCLUDES FRISK AND DECON OF 50%)	Matl.	500.00	TONS	15.00	7,500	
		Labor	1,000	L	17.65	17,650	25,150
-A	EQUIPMENT (FORKLIFT, TRUCK...ETC)	Matl.	300.00	HRS	35.00	10,500	
		Labor	300	OP	25.25	7,575	18,075
	REMOVAL OF STANDING VEGETATION						
-A	CLEAR & GRUB & CHIP BRUSH & STUMPS	Matl.	6.50	ACRES	2,550.00	16,575	
		Labor	273	L	17.65	4,818	21,393
-A	CUT & SIZE MEDIUM TRESS TO 12" DIA	Matl.	3.00	ACRES	1,525.00	4,575	
		Labor	210	L	17.65	3,707	8,282
-A	SPECIAL REQUIREMENTS TO PREVENT TRESS FROM COMING INTO CONTACT WITH CONTAMINATED SOIL	Matl.	3.00	ACRES	500.00	1,500	
		Labor	24	L	17.65	424	1,924
-A	JONSITE TREE LOAD FOR TRANSPORT TO Y-12 LANDFILL: FE LOADER, TM, 3 CY, CAT 950E	Matl.	16.00	HOURS	29.10	466	
		Labor	16	OP	25.25	404	870
	TEMPORARY SURFACE WATER CONTROLS						

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		82,410		131,923	214,3
SALES TAX		7,005			7,0
SUBTOTAL		89,415		131,923	221,3
TOTAL INDIRECT	20.00%	17,883	20.00%	26,385	44,3
TOTAL		107,298	(hrs. 4,426)	158,308	265,6

:em	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
-A	EQUIPMENT MOBILIZATION	Matl. Labor	6.00 48	EACH TD	150.00 18.20	900 874	1,774
**	SUBTOTAL ****	Matl. Labor	441			61,920 10,695	72,615
	GENERAL CONDITIONS						
-A	UTILITIES (ALLOWANCE)	Matl. Labor	21.00 0	MONTHS	200.00 0.00	4,200 0	4,200
-A	SUPERINTENDENT	Matl. Labor	21.00 3,675	MONTHS X	100.00 30.00	2,100 110,250	112,350
-A	SURVEY CREW	Matl. Labor	1.00 120	LOT X	3,000.00 35.00	3,000 4,200	7,200
-A	DOCUMENTS (SAFETY PLAN, QA PLAN, WM PLAN, WORK PLAN...ETC)	Matl. Labor	1.00 0	LOT	10,000.00 0.00	10,000 0	10,000
**	SUBTOTAL ****	Matl. Labor	3,795			19,300 114,450	133,750
	SPECIAL REQUIREMENTS						
-A	HEALTH & SAFETY OFFICER	Matl. Labor	80.00 80	HRS X	0.00 50.00	0 4,000	4,000
-A	TRAINING AND MEDICAL REQUIREMENTS	Matl. Labor	440.00 22	HRS OP	1.00 25.25	440 556	996
-A	PPE REQUIREMENTS	Matl. Labor	10.00 0	DAYS	75.00 0.00	750 0	750
-A	LABOR FACTOR	Matl. Labor	440.00 88	HRS OP	0.00 25.25	0 2,222	2,222

Creation Date 04/24/1996
Revision Number ... 0

Estimating Job Number .. 35H83094

Project Estimator.. DH BOLLING
WBS ..... 2.0.1.01 TEMPORARY FACILITIES/MOBILIZATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.1.1 TEMP. FACILITIES/MOBILIZATION
Discipline ..... O OTHER
B/M Title ..... TEMP. FACILITIES/MOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Project Engineer ..... K. BURCH
Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TEMPORARY FACILITIES/MOBILIZATION						
1 -A	CONSTRUCTION TRAILER (RENTAL)	Matl.	21.00	MONTHS	320.00	6,720	
		Labor	8	TD	18.20	146	6,
2 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	
3 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,
4 -A	SHOWER/CHANGE TRAILER (RENTAL)	Matl.	21.00	MONTHS	550.00	11,550	
		Labor	8	TD	18.20	146	11,
5 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	
6 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7
7 -A	WATER HOOK-UP	Matl.	1.00	LOT	6,500.00	6,500	
		Labor	120	PF	26.20	3,144	9
8 -A	EQUIPMENT DECON PAD	Matl.	500.00	SF	35.00	17,500	
		Labor	50	C	25.80	1,290	18
9 -A	STAGGING AREA (GRAVEL)	Matl.	1,500.00	SF	5.50	8,250	
		Labor	15	OP	25.25	379	8

DETAIL REPORT
Project Number: 35H83094
ALTERNATIVE 2 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 9
2. Participant

Approved by:

_____ _____
Project Estimator Date

_____ _____
Estimating Manager Date

ase Fiscal Year/Quarter: 96/3
TANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
STIMATE FILE: C:\AES60F\DWI\ALT2\ALT-2.Est 10/01/1996
CHEDULE FILE: ALT-2
EPORT FILE: C:\AES60F\DWI\ALT2\ALT2DET.Out 10/01/1996 15:59:59

AES Version 6.0f

TABLE G.4

ALTERNATIVE 2,
DETAILED SUMMARY REPORT

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2033

	Fiscal Year 2031	2032	2033	Total
AE01 ARCHITECT-ENGNR (F-W)	.	.	.	400
C069 CENTRAL ENGINEERING	.	.	.	444
K026 ENVIRONMENTAL MGMT	.	.	.	144
K045 WASTE MANAGEMENT	.	.	.	51
MK51 MK-F OAK RIDGE FPSC	.	.	.	2974
MK53 FP UNIT SUBCONTRACT	.	.	.	10
MK66 MK-F INDIRECTS & FEE	.	.	.	527
MK67 MK-F ADMIN SUPPORT	.	.	.	374
SC01 OFFSITE SUBCONTRACT	2	2	1	60
TS01 TECH SUPPORT CONTRACTOR	.	.	.	179
X027 WASTE MGMT & REM ACTION	.	.	.	4
Sub-Total	2	2	1	5167
Overhead	0	0	0	0
Sub-Total	2	2	1	5167
Contingency	1	1	0	1818
Grand Total	3	3	1	6985

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ıged By: Participant Code
ıl Year Range 2001 - 2033

	Fiscal Year					Sub
	2026	2027	2028	2029	2030	Total
ARCHITECT-ENGNR (F-W)	.	.	.	.	.	0
CENTRAL ENGINEERING	.	.	.	.	.	0
ENVIRONMENTAL MGMT	.	.	.	.	.	0
WASTE MANAGEMENT	.	.	.	.	.	0
MK-F OAK RIDGE FPSC	.	.	.	.	.	0
FP UNIT SUBCONTRACT	.	.	.	.	.	0
MK-F INDIRECTS & FEE	.	.	.	.	.	0
MK-F ADMIN SUPPORT	.	.	.	.	.	0
OFFSITE SUBCONTRACT	2	2	2	2	2	10
TECH SUPPORT CONTRACTOR	.	.	.	.	.	0
WASTE MGMT & REM ACTION	.	.	.	.	.	0
Total	2	2	2	2	2	10
erhead	0	0	0	0	0	0
Total	2	2	2	2	2	10
ntingency	1	1	1	1	1	5
d Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sub
	2021	2022	2023	2024	2025	Tota
AE01 ARCHITECT-ENGNR (F-W)	.	.	.	.	.	
C069 CENTRAL ENGINEERING	.	.	.	.	.	
K026 ENVIRONMENTAL MGMT	.	.	.	.	.	
K045 WASTE MANAGEMENT	.	.	.	.	.	
MK51 MK-F OAK RIDGE FPSC	.	.	.	.	.	
MK53 FP UNIT SUBCONTRACT	.	.	.	.	.	
MK66 MK-F INDIRECTS & FEE	.	.	.	.	.	
MK67 MK-F ADMIN SUPPORT	.	.	.	.	.	
SC01 OFFSITE SUBCONTRACT	2	2	2	2	2	
TS01 TECH SUPPORT CONTRACTOR	.	.	.	.	.	
X027 WASTE MGMT & REM ACTION	.	.	.	.	.	
Sub-Total	2	2	2	2	2	
Overhead	0	0	0	0	0	
Sub-Total	2	2	2	2	2	
Contingency	1	1	1	1	1	
Grand Total	3	3	3	3	3	

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ıged By: Participant Code
ıl Year Range 2001 - 2033

	Fiscal Year					Sub
	2016	2017	2018	2019	2020	Total
ARCHITECT-ENGNR (F-W)	.	.	.	.	.	0
CENTRAL ENGINEERING	.	.	.	.	.	0
ENVIRONMENTAL MGMT	.	.	.	.	.	0
WASTE MANAGEMENT	.	.	.	.	.	0
MK-F OAK RIDGE FPSC	.	.	.	.	.	0
FP UNIT SUBCONTRACT	.	.	.	.	.	0
MK-F INDIRECTS & FEE	.	.	.	.	.	0
MK-F ADMIN SUPPORT	.	.	.	.	.	0
OFFSITE SUBCONTRACT	2	2	2	2	2	10
TECH SUPPORT CONTRACTOR	.	.	.	.	.	0
WASTE MGMT & REM ACTION	.	.	.	.	.	0
Total	2	2	2	2	2	10
erhead	0	0	0	0	0	0
Total	2	2	2	2	2	10
ntingency	1	1	1	1	1	5
ıd Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sub
	2011	2012	2013	2014	2015	Tota
AE01 ARCHITECT-ENGNR (F-W)	.	.	.	.	.	
C069 CENTRAL ENGINEERING	.	.	.	.	.	
K026 ENVIRONMENTAL MGMT	.	.	.	.	.	
K045 WASTE MANAGEMENT	.	.	.	.	.	
MK51 MK-F OAK RIDGE FPSC	.	.	.	.	.	
MK53 FP UNIT SUBCONTRACT	.	.	.	.	.	
MK66 MK-F INDIRECTS & FEE	.	.	.	.	.	
MK67 MK-F ADMIN SUPPORT	.	.	.	.	.	
SC01 OFFSITE SUBCONTRACT	2	2	2	2	2	
TS01 TECH SUPPORT CONTRACTOR	.	.	.	.	.	
X027 WASTE MGMT & REM ACTION	.	.	.	.	.	
Sub-Total	2	2	2	2	2	
Overhead	0	0	0	0	0	
Sub-Total	2	2	2	2	2	
Contingency	1	1	1	1	1	
Grand Total	3	3	3	3	3	

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ged By: Participant Code
l Year Range 2001 - 2033

	Fiscal Year					Sub
	2006	2007	2008	2009	2010	Total
ARCHITECT-ENGNR (F-W)	.	.	.	.	.	0
CENTRAL ENGINEERING	.	.	.	.	.	0
ENVIRONMENTAL MGMT	.	.	.	.	.	0
WASTE MANAGEMENT	.	.	.	.	.	0
MK-F OAK RIDGE FPSC	.	.	.	.	.	0
FP UNIT SUBCONTRACT	.	.	.	.	.	0
MK-F INDIRECTS & FEE	.	.	.	.	.	0
MK-F ADMIN SUPPORT	.	.	.	.	.	0
OFFSITE SUBCONTRACT	2	2	2	2	2	10
TECH SUPPORT CONTRACTOR	.	.	.	.	.	0
WASTE MGMT & REM ACTION	.	.	.	.	.	0
otal	2	2	2	2	2	10
erhead	0	0	0	0	0	0
Total	2	2	2	2	2	10
ntingency	1	1	1	1	1	5
d Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sul
	2001	2002	2003	2004	2005	Tot
AE01 ARCHITECT-ENGNR (F-W)	351	41	8	.	.	
C069 CENTRAL ENGINEERING	103	271	70	.	.	
K026 ENVIRONMENTAL MGMT	27	97	20	.	.	
K045 WASTE MANAGEMENT	22	24	5	.	.	
MK51 MK-F OAK RIDGE FPSC	.	1492	1482	.	.	
MK53 FP UNIT SUBCONTRACT	.	5	5	.	.	
MK66 MK-F INDIRECTS & FEE	.	264	263	.	.	
MK67 MK-F ADMIN SUPPORT	.	214	160	.	.	
SC01 OFFSITE SUBCONTRACT	.	.	1	2	2	
TS01 TECH SUPPORT CONTRACTOR	18	82	79	.	.	
X027 WASTE MGMT & REM ACTION	2	2	.	.	.	
Sub-Total	523	2492	2093	2	2	
Overhead	0	0	0	0	0	
Sub-Total	523	2492	2093	2	2	
Contingency	183	873	733	1	1	
Grand Total	706	3365	2826	3	3	

FISCAL YEAR SUMMARY
Project Number: 35H83094
ALTERNATIVE 2 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. Participant

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

ıse Fiscal Year/Quarter: 96/3
'ANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
STIMATE FILE: C:\AES60F\DWI\ALT2\ALT-2.Est 10/01/1996
:HEDULE FILE: ALT-2
:PORT FILE: C:\AES60F\DWI\ALT2\ALT2FYS.Out 10/01/1996 16:01:28

AES Version 6.0f

TABLE G.3

ALTERNATIVE 2, FISCAL YEAR SUMMARY REPORT BY PARTICIPANT

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2033

	Fiscal Year			
	2031	2032	2033	Total
2.0.1 DIRECT PROJECT COST	.	.	.	2984
2.0.2 INDIRECT PROJECT COST	.	.	.	2124
2.0.3 SURVEILLANCE AND MAINTENANCE	2	2	1	60
Sub-Total	2	2	1	5168
Overhead	0	0	0	0
Sub-Total	2	2	1	5168
Contingency	1	1	0	1818
Grand Total	3	3	1	6986

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ıged By: WBS
ıl Year Range 2001 - 2033

	Fiscal Year					Sub
	2026	2027	2028	2029	2030	Total
DIRECT PROJECT COST	.	.	.	.	.	0
! INDIRECT PROJECT COST	.	.	.	.	.	0
; SURVEILLANCE AND MAINTENANCE	2	2	2	2	2	10
˙otal	2	2	2	2	2	10
ɛrhead	0	0	0	0	0	0
ſotal	2	2	2	2	2	10
ıtingency	1	1	1	1	1	5
ɨ Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sub
	2021	2022	2023	2024	2025	Tota
2.0.1 DIRECT PROJECT COST	.	.	.	.	.	
2.0.2 INDIRECT PROJECT COST	.	.	.	.	.	
2.0.3 SURVEILLANCE AND MAINTENANCE	2	2	2	2	2	
Sub-Total	2	2	2	2	2	
Overhead	0	0	0	0	0	
Sub-Total	2	2	2	2	2	
Contingency	1	1	1	1	1	
Grand Total	3	3	3	3	3	

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ıged By: WBS
ıl Year Range 2001 - 2033

	Fiscal Year					Sub
	2016	2017	2018	2019	2020	Total
I DIRECT PROJECT COST	.	.	.	.	.	0
? INDIRECT PROJECT COST	.	.	.	.	.	0
3 SURVEILLANCE AND MAINTENANCE	2	2	2	2	2	10
Total	2	2	2	2	2	10
erhead	0	0	0	0	0	0
Total	2	2	2	2	2	10
ntingency	1	1	1	1	1	5
d Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sub
	2011	2012	2013	2014	2015	Total
2.0.1 DIRECT PROJECT COST	.	.	.	.	.	
2.0.2 INDIRECT PROJECT COST	.	.	.	.	.	
2.0.3 SURVEILLANCE AND MAINTENANCE	2	2	2	2	2	
Sub-Total	2	2	2	2	2	
Overhead	0	0	0	0	0	
Sub-Total	2	2	2	2	2	
Contingency	1	1	1	1	1	
Grand Total	3	3	3	3	3	

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

ıged By: WBS
ıl Year Range 2001 - 2033

	Fiscal Year					Sub
	2006	2007	2008	2009	2010	Total
1 DIRECT PROJECT COST	.	.	.	.	.	0
2 INDIRECT PROJECT COST	.	.	.	.	.	0
3 SURVEILLANCE AND MAINTENANCE	2	2	2	2	2	10
Total	2	2	2	2	2	10
erhead	0	0	0	0	0	0
Total	2	2	2	2	2	10
ntingency	1	1	1	1	1	5
d Total	3	3	3	3	3	15

ALTERNATIVE 2 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2033

	Fiscal Year					Sul
	2001	2002	2003	2004	2005	Tot
2.0.1 DIRECT PROJECT COST	.	1497	1487	.	.	
2.0.2 INDIRECT PROJECT COST	523	996	605	.	.	
2.0.3 SURVEILLANCE AND MAINTENANCE	.	.	1	2	2	
Sub-Total	523	2493	2093	2	2	
Overhead	0	0	0	0	0	
Sub-Total	523	2493	2093	2	2	
Contingency	183	873	733	1	1	
Grand Total	706	3366	2826	3	3	

FISCAL YEAR SUMMARY
Project Number: 35H83094
ALTERNATIVE 2 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

ase Fiscal Year/Quarter: 96/3
TANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
STIMATE FILE: C:\AES60F\DWI\ALT2\ALT-2.Est 10/01/1996
CHEDULE FILE: ALT-2
EPORT FILE: C:\AES60F\DWI\ALT2\ALT2FYR.Out 10/01/1996 16:00:40

AES Version 6.0f

TABLE G.2

ALTERNATIVE 2, FISCAL YEAR SUMMARY REPORT BY WORK BREAKDOWN STRUCTURE

ALTERNATIVE 2 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	To
SUB - TOTAL	2015	2315	4330	2412	2744	5
OVERHEAD	0	0	0	0	0	
SUB - TOTAL	2015	2315	4330	2412	2744	5
CONTINGENCY	706	810	1516	844	961	1
GRAND TOTAL	2721	3125	5846	3256	3705	6

ALTERNATIVE 2 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

ged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
INDIRECT PROJECT COST						
.2.02 REMEDIAL DESIGN WORK PLAN						
E01 ARCHITECT-ENGNR (F-W)	0	35	35	0	39	39
069 CENTRAL ENGINEERING	0	7	7	0	8	8
S01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
L REMEDIAL DESIGN WORK PLAN	0	46	46	0	52	52
.2.03 REMEDIAL DESIGN REPORT						
E01 ARCHITECT-ENGNR (F-W)	0	261	261	0	301	301
069 CENTRAL ENGINEERING	0	22	22	0	25	25
045 WASTE MANAGEMENT	0	13	13	0	15	15
S01 TECH SUPPORT CONTRACTOR	0	13	13	0	15	15
L REMEDIAL DESIGN REPORT	0	309	309	0	356	356
.2.04 REMEDIAL ACTION WORK PLAN						
E01 ARCHITECT-ENGNR (F-W)	0	3	3	0	4	4
K67 MK-F ADMIN SUPPORT	0	46	46	0	53	53
S01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
L REMEDIAL ACTION WORK PLAN	0	53	53	0	62	62
.2.05 REMEDIAL ACTION INTEGRATION						
069 CENTRAL ENGINEERING	0	29	29	0	34	34
K66 MK-F INDIRECTS & FEE	440	0	440	527	0	527
K67 MK-F ADMIN SUPPORT	4	263	267	5	315	320
S01 TECH SUPPORT CONTRACTOR	80	53	133	96	63	159
AL REMEDIAL ACTION INTEGRATION	524	345	869	628	412	1040
L INDIRECT PROJECT COST	524	1271	1795	628	1494	2122
.3 SURVEILLANCE AND MAINTENANCE						
.0.3.01 SITE MAINTENANCE						
SC01 OFFSITE SUBCONTRACT	42	0	42	50	0	50
AL SITE MAINTENANCE	42	0	42	50	0	50
L SURVEILLANCE AND MAINTENANCE	42	0	42	50	0	50

2

ALTERNATIVE 2 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	To
2.0.1 DIRECT PROJECT COST						
2.0.1.01 TEMPORARY FACILITIES/MOBILIZAT						
MK51 MK-F OAK RIDGE FPSC	107	158	265	128	189	
TOTAL TEMPORARY FACILITIES/MOBILIZAT	107	158	265	128	189	
2.0.1.02 SITE PREPARATION						
MK51 MK-F OAK RIDGE FPSC	93	119	212	111	143	
MK53 FP UNIT SUBCONTRACT	8	0	8	10	0	
TOTAL SITE PREPARATION	101	119	220	121	143	
2.0.1.03 CAP CONSTRUCTION						
MK51 MK-F OAK RIDGE FPSC	1080	755	1835	1292	903	
TOTAL CAP CONSTRUCTION	1080	755	1835	1292	903	
2.0.1.05 DECON/DEMOBILIZATION						
MK51 MK-F OAK RIDGE FPSC	5	11	16	6	13	
TOTAL DECON/DEMOBILIZATION	5	11	16	6	13	
2.0.1.06 SECONDARY WASTE DISPOSAL						
MK51 MK-F OAK RIDGE FPSC	156	1	157	187	2	
TOTAL SECONDARY WASTE DISPOSAL	156	1	157	187	2	
TOTAL DIRECT PROJECT COST	1449	1044	2493	1734	1250	
2.0.2 INDIRECT PROJECT COST						
2.0.2.01 PROJECT MANAGEMENT						
AE01 ARCHITECT-ENGNR (F-W)	0	47	47	0	56	
C069 CENTRAL ENGINEERING	0	319	319	0	377	
K026 ENVIRONMENTAL MGMT	0	122	122	0	144	
K045 WASTE MANAGEMENT	0	30	30	0	35	
TOTAL PROJECT MANAGEMENT	0	518	518	0	612	

SUMMARY REPORT
Project Number: 35H83094
ALTERNATIVE 2 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3
2. WBS - Level 4
3. Participant

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

ase Fiscal Year/Quarter: 96/3
TANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
STIMATE FILE: C:\AES60F\DWI\ALT2\ALT-2.Est 10/01/1996
CHEDULE FILE: ALT-2
EPORT FILE: C:\AES60F\DWI\ALT2\ALT2SUN.Out 10/01/1996 16:03:58

AES Version 6.0f

TABLE G.1

ALTERNATIVE 2,
SUMMARY REPORT

Figure G.1. DWI 901 SITE RI/FS
Alternative 2

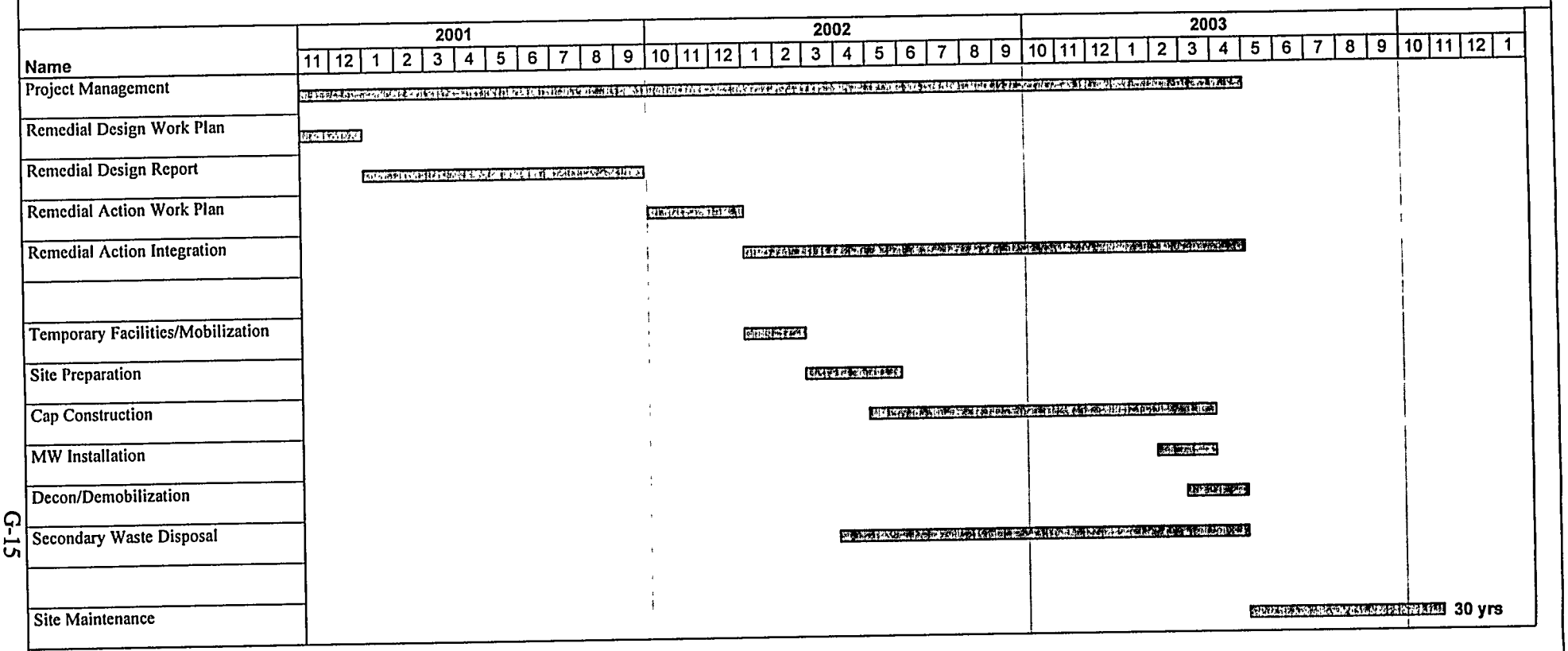


FIGURE G.1

PROJECT SCHEDULE

1.5.2 Detailed Summary Report

A detailed summary of the estimated cost is included at the 3rd level WBS/4th level WBS/participant in Table G.4. All amounts have been rounded to the nearest $1,000.

A summary report by WBS level 3/WBS level 4 with escalated and unescalated cost is shown in Table G.1.

1.5.3 Estimate Reports

A detailed estimate report indicating how cost and labor hours are included at the line item level is included in Table G.5.

1.3.3.4 Decontamination/demobilization

- The decontamination of contractor equipment and facilities is included at an allowance of $3,500 and 384-man hours.

- The contractor will also demobilize his trailers and equipment.

1.3.3.5 Secondary waste disposal

- An allowance of $111,000 is included for characterization, transportation, and treatment of decon water.

- An allowance of $10,000 is included for disposal of contractor PPE.

1.3.3.6 Site maintenance

- Site maintenance includes mowing four times per year, cap repair, and general maintenance activities for 30 years.

1.4 COST SENSITIVITY ANALYSIS

In accordance with the EPA Guidance for conducting RIs and FSs under CERCLA, a cost sensitivity analysis for specific assumptions associated with the project implementation has been preformed. The following assumptions were found to be the cost sensitive.

- Quantity of contaminated material to be consolidated into cap.
- PPE requirements (respirator)
- Project schedule
- Groundwater treatment
- Energy Systems overhead

1.5 ESTIMATE DETAILS

Following is a detailed breakdown of the cost estimate.

1.5.1 FY Reports

A summary of the project estimate by FY and by WBS level 3 is presented in Table G.2. Summary by FY and participant is given in Table G.3. All amounts have been rounded to the nearest $1,000.

1.3.3.3 Cap construction

- The contractor will install temporary sediment control devices while removing sediment from the stream (creek).
- The sediment will not require drying (stream bed will be dry).
- An allowance of $2,500 and 16 hours is included for verification sampling after sediment is removed.
- Only 60 yd^3 of sediment will be required to be removed to lower the risk to acceptable limits.
- Riprap will be installed in the stream bed to replace the removed sediment.
- Contaminated material on site will be consolidated into the cap. This includes gravel, surface soil, mounds and berm, buried anomalies, and subsurface soil (hot spots).
- The quantity of material to be consolidated is estimated to be 22,700 yd^3.
- An allowance of $37,500 and 50-man hours are included for verification sampling after site consolidation is completed.
- The area where contaminated material has been removed shall be backfilled and seeded.
- The backfilled material (top soil) will be taken from a borrow area within 8 km (5 miles) of site.
- The cap shall consist of 2-ft thick clay soil (compacted), 40-mil VLDPE liner, 6-oz geotextile (heat bonded to drainage layer), 5-mm geonet (drainage layer), 6-oz geotextile, 1-ft by 6-in. soil cover, and 6-in. top soil.
- The cap shall be 108,000 ft^2 in area and shall be seeded and straw.
- Dust control shall be required (water truck).

1.3.2 WBS-Specific Assumptions

The following assumptions were developed for each WBS. They represent a step-by-step procedure for conducting remedial activities.

1.3.3 Direct Cost

1.3.3.1 Temporary facilities/mobilization

- The contractor will install/construct on site the construction office trailer; shower/change trailer; decontamination pad; and staging area, including utilities.
- Costs are included for general conditions, including a utilities allowance, full-time superintendent, survey crews, and required documents.
- Equipment mobilization cost is also included in this WBS.

1.3.3.2 Site preparation

- The area to be used for temporary facilities will be graded to remove surface contamination before set-up of temporary facilities.
- Surface debris with salvage value will be cleaned and removed from the site.
- Existing structures will remain as they are.
- The existing trees will be cut and felled onto plastic to prevent contact with contaminated soil and then sized and hauled to a landfill.
- The brush and stumps will be grubbed and chipped then stockpiled for incorporation into cap.
- Temporary surface water controls shall be installed by the contractor (allowed 1,500 lin ft of diversion ditches and 2,400 lin ft of silt fence and hay bales).
- The contractor will install 800 lin ft of chain link fence around the temporary facilities.
- An allowance of $10,000 and 60 electrician hours have been allowed for monitors for detection of airborne particulate.

scope. A 35 percent contingency has been applied to this estimate because of the incompleteness of design at the FS stage and the complexity of the action.

1.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS

In the development of this alternative, various overall site conditions and operating parameters remained unknown. The following assumptions were developed to address these unknowns:

1.3.1 General Assumptions

- Fixed-price subcontractors (FPSCs) will perform all remedial activities, which will include the temporary facilities, site preparation, cap construction, decontamination and demobilization.

- MK-Ferguson will provide overall construction management services, which include administration and management of all fixed-price subcontracts.

- All remedial work on the site will be conducted under Hazardous Waste Operation and Emergency Response (HAZWOPER) requirements.

- The estimate is based on an 8-hour work day and 5-day work week for all remedial activities.

- Level D PPE will be required for all remedial activities. The cost of the Level D PPE is estimated at $75/day.

- A 20 percent productivity factor has been included to account for workers preforming in Level D PPE.

- Training and medical requirements, including yearly updates, have been included for all on-site workers.

- The fixed-price contractor will have one health and safety engineer for the duration of project.

1.2.4.3 Energy Systems and DOE contractors

An off-site subcontract overhead is applied to the total cost of all DOE prime contracts and subcontracts to MK-Ferguson or Energy Systems. This includes MK-Ferguson fixed-price subcontracts. However, the technical support contractor and the remedial design architect and engineers are exempted from this subcontract overhead. This overhead is an apportionment of the cost of plant services, purchasing, facilities maintenance, administration, etc. This project is off site and no overhead is included.

1.2.5 Project Management/Liaison

Project management spans all facets of the project and its administration. Project management includes those activities necessary to support the project such as: project manager and project engineer, project reviews and reporting, project coordination and planning, systems engineering, and scheduling, design and project liaison include those activities necessary to support the Title I and II design activities, such as: architect and engineer design coordination and reviews and architect and engineer estimate reviews. Other costs such as travel, reproduction, and other miscellaneous materials, are also included, These estimates were based on knowledge acquired from similar projects and were adjusted to reflect current environmental and health, and safety requirements as they relate to this project.

1.2.6 Escalation

The estimate has been escalated using the DOE-approved annual rates issued. The estimate is based on FY 1996 third quarter costs and then escalated over the period of activity as determined by the project schedule.

The approved escalation rates are 2.8 percent for FY 1996, 2.8 percent for FY 1997, 2.7 percent for FY 1998, 2.9 percent for FY 1999, 3.0 percent for FY 2000, 3.1 percent for FY 2001, 3.2 percent for FY 2002, and 0.0 percent thereafter.

1.2.7 Contingency

According to DOE Order 4700.1, contingency is defined as the sum of funds included within an estimate to cover materials, labor, conditions, and risk situations, which are an intrinsic part of the presently intended scope of work but are not specifically allowed for elsewhere in the estimate due to uncertainty either as to their existence, nature, likelihood of occurrence, or magnitude of effect.

Contingency cost has been included in this project to cover costs that may result from incomplete design, unforeseen and unpredictable conditions or uncertainties within the defined

The indirect markups for fixed-price construction used in the estimate have been applied according to the guidelines provided by DOE-Oak Ridge Operations (ORO) for use in Oak Ridge, Tennessee. Those markups are:

Overhead (applied to labor and material)	10 percent
Profit (applied to labor and material)	8 percent
Bond (applied to labor and material)	1 percent
General Contractor's markup for work performed by his subcontractors (applied to labor and material)	5 percent
Sales Tax (applied to material)	8.25 percent

For the fixed-price general contractors these markups compound and appear in estimates as totals; indirect 20 percent and tax 8.25 percent. For subcontractors the markups appear as totals; indirect 26 percent and tax 8.25 percent.

MK-Ferguson of Oak Ridge Company (MK-Ferguson) will award, administer, and manage all construction contracts for this project. MK-Ferguson also direct charges certain activities such as health physics, health and safety, subcontract administration, construction superintendent, project controls, QA, etc., as dictated by the needs of the project. These costs are estimated based on the appropriate level of effort necessary for this particular project.

1.2.4 Energy Systems Site Overhead

1.2.4.1 Energy Systems labor

An Energy Systems site overhead is generally applied to all Energy Systems labor. This overhead recovers costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

1.2.4.2 Energy Systems materials

An Energy Systems site overhead is applied to the first $20,000 of any purchased materials. This overhead recovers the costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

identified, and the appropriate wage rates were applied. Material and labor pricing was based on vendor quotes, recent similar job history, and nationally recognized publications such as *R. S. Means Construction Cost Data* and *Richardson's Construction Estimating Standards*. Special equipment and/or special facilities cost were obtained either by vendor contact or data from similar projects.

The basic estimating units used generally reflect a normal standard for construction cost. Many special work situations and job conditions can require additional material and/or labor work hours. These additional cost considerations have been identified and included in the estimate. Some of these additional considerations are: health physics, industrial hygiene, worker productivity, safety requirements, site congestion, worker protection, supporting items, small tools, and cleanup.

1.2.3 Wage Rates

The wage rates for construction labor are those current as of February 1996 for the Oak Ridge area, which are contained in the Automated Estimating System (AES) Standard Value File ERFEB96A.val. These rates are effective for an hour of productive work and are given below:

Code	Craft	Fixed rate
C	Carpenter	$25.80
E	Electrician	$25.95
L	Laborer	$17.65
OP	Operating engineer	$25.25
PF	Pipefitter	$26.20
TD	Truck driver	$18.20

Fixed-price construction labor rates are based on average crew sizes with necessary foremen, general foremen, etc. All fringe benefits, payroll taxes, and workmen's compensation insurance are included.

1.2.3.1 Indirect markups

The indirect markups for construction are taken from the *U.S. Department of Energy Oak Ridge Field Office, Estimating and Cost Control Manual for Construction Projects*.

2.0.2.4 Remedial Action Work Plan
2.0.2.5 Remedial Action Integration

2.0.3 Monitoring & Maintenance
2.0.3.1 Site Maintenance
2.0.3.2 Surface Water Monitoring
2.0.3.3 Groundwater Monitoring

1.1.4 Project Schedule

The project schedule is based on extrapolations from other projects having similar scope and participation. The schedule and appropriate applications of escalation form the basis for obtaining escalated cost and the fiscal year (FY) summary cost information. The assumed schedule for this alternative is shown in Figure G.1.

1.2 BASIS FOR COST ESTIMATE

1.2.1 Engineering Estimate

The engineering cost estimate consists of Titles I, II and III engineering. Titles I and II engineering include all of the design activities required to issue a certified-for-construction (CFC) work package. Title III engineering includes those engineering-related activities necessary to ensure that the remedial activities conform to Titles I and II design drawings and specifications. Computer costs, reproduction costs, travel costs, and material costs are also included in the estimates. Project management has been factored into the estimate to include Title I and II reports; schedule development and maintenance; cost reporting; progress reporting; contract administration; staffing; project review; meetings; and project direction and guidance by the project manager, project engineer, program director, and task engineer/coordinator.

Title I, II, and III engineering costs are estimated based on the appropriate level of effort necessary for this particular project.

1.2.2 Construction Estimate

1.2.2.1 Material and labor pricing

The cost estimate was based on the preliminary bills of materials (BMs) developed for each fixed-price contractor activity as envisioned to accomplish the desired results and assumptions detailed under Section 2.3, "Alternative Specific Assumptions." Each activity was then estimated as to the material and labor costs. Labor crafts that will perform the tasks were

1. COST ESTIMATE—ALTERNATIVE 2

This chapter provides the basis for the cost estimate, summary cost information, assumptions used in developing the estimate, estimate details, and material pricing data used in developing the cost estimate.

1.1 INTRODUCTION

1.1.1 Description of Alternative 2

Alternative 2 includes consolidating the contaminated soil, debris, and sediment and installing a multilayer cap to contain and isolate contaminants. This alternative is designed for a future industrial land use scenario.

1.1.2 Summary Cost Data

Table G.1 summarizes the cost estimate for this alternative. It consists of a project summary report at the third and fourth level Work Breakdown Structure (WBS). All amounts have been rounded to the nearest $1,000. Additional summaries and details of these costs are included in Section 2.5.

1.1.3 Project Summary WBS

DWI—ALTERNATIVE 2

2.0 Project Cost

2.0.1 Direct Project Cost
- 2.0.1.1 Temporary Facilities/Mobilization
- 2.0.1.2 Site Preparation
- 2.0.1.3 Cap Construction
- 2.0.1.4 Monitoring Wells Installation
- 2.0.1.5 Decon/Demobilization
- 2.0.1.6 Secondary Waste Disposal

2.0.2 Indirect Project Cost
- 2.0.2.1 Project Management
- 2.0.2.2 Remedial Design Work Plan
- 2.0.2.3 Remedial Design Report

APPENDIX G

COST ESTIMATE DOCUMENTATION

Yu, C., A. J. Zielen, J. J. Cheng, Y. C. Yuan, L. G. Jones, et al. 1995. *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.61*, ANL/ESD/LD-2.

to a salvage facility or the Y-12 Plant sanitary landfill. The treatment unit would be separately permitted. ARARs for this alternative, in addition to those common to all alternatives, are listed in Table F.4 and discussed below in the following sections.

Once vitrified, any RCRA-contaminated soil would probably no longer meet the definition of a RCRA characteristic waste because its hazardous contaminants would not leach to the environment, and, thus, would not trigger any LDRs or treatment requirements before disposal.

1.3.5.1 RCRA requirements

The standards for RCRA miscellaneous treatment units discussed in Section 1.3.4.2 will be ARAR for the vitrification unit. EPA has indicated in the preamble to its final rule for hazardous debris (57 FR 37234, August 8, 1992) that vitrification would be considered a thermal destruction technology that meets the LDR treatment standards for hazardous debris. Such vitrified waste can then be disposed of in a Subtitle D facility 40 CFR 268.45 (see Sect. 1.3.4.3, "Land disposal restrictions").

1.3.5.2 PCB requirements

The vitrification unit would be subject to the TSCA requirements of 40 CFR 761, Subpart D (see Sect. 1.3.4.4, "PCB requirements"). Approval of the regional administrator is required if an alternate method of disposal is requested. A demonstration must be made that the alternative method achieves the same standard of performance as incinerators or high efficiency boilers [40 CFR 761.60(c)]. The vitrification unit could be considered an alternate method of disposal and would have to meet these requirements and be approved the EPA Regional Administrator."

1.3.5.3 Clean closure

Treated soil/sediment disposed of in a sanitary landfill will need to meet the WAC for that facility in addition to transportation requirements. The clean closure requirements of Section 1.3.4.1 will be relevant and appropriate at the OU after all contaminated materials are removed from the OU.

2. REFERENCES

Environmental Protection Agency (EPA). 1990. *Guidance on Remedial Actions for Superfund Sites with PCB Contamination,* August 1990, OSWER Directive 9355.4-01, EPA Office of Emergency Remedial Response, Washington, DC.

EPA has proposed extensive revisions to the TSCA requirements for management of PCBs (59 FR 62788, December 6, 1994; final rule expected March 1996). The proposed rule adds the term "PCB remediation waste," which, in part, includes all environmental media contaminated with PCBs, including PCBs disposed of before April 18, 1978. Such wastes include, but are not limited to, gravel, sandy soil, clayey soil, loam soil, other soil types, sediments, etc. (40 CFR 761.3).

EPA proposes three alternatives to cleanup and disposal of PCB remediation wastes under TSCA. The first alternative is a self-implementing one with specified procedures and standards proposed at 40 CFR 761.61(a). If these procedures are followed, EPA approval under TSCA would not be necessary. There are several instances where these self-implementing standards do not apply, including site remediation under CERCLA, RCRA corrective action, or any enforcement action. However, it appears that these self-implementing regulations may apply to CERCLA remediation with EPA regional administrator approval, based on a risk analysis of the site. The second alternative retains the current disposal options of incineration, chemical waste landfill, or alternate technologies [40 CFR 761.61(b)].

As the third alternative under the proposed rule, CERCLA or RCRA remediation wastes would be cleaned up under risk-based provisions found at 40 CFR 761.61(c). Treatment levels would be based on a site-specific risk assessment, and would require EPA approval; also requiring approval would be any on-site treatment or redeposition of treated waste or untreated remediation wastes at the site. EPA proposes a TCLP limit of 50 μg/L to determine whether treatment by microencapsulation or vitrification is effective. Wastes shown to leach less than 50 μg/L would be considered appropriate for disposal in a Subtitle D facility [40 CFR 761.61(a)(4)]. If these regulations are finalized before finalizing a ROD for the DWI 901 Site, LTTD would not need to meet PCB destruction standards for incinerators. Rather, LTTD efficacy could be judged based on TCLP results after treatment.

This proposed PCB disposal rule provides TBC guidance for the treatment and disposal of PCBs under this alternative.

1.3.5 Alternative 4—Extensive Treatment and Disposal at Sanitary Facility

Under this alternative, vitrification would be used to destroy organics and immobilize metals and radionuclides in an impermeable glassy solid. The vitrification process would immobilize contaminants, thus preventing any leaching or release of contaminants to the environment. The immobilized waste would be packaged and transported to the Y-12 Plant sanitary landfill provided it met WAC. Contaminated debris would be decontaminated and sent

of human health and the environment. TDEC requirements for miscellaneous treatment units are found at TDEC Rules, Chapter 1200-1-11-.06(19)(b) and are identical to the federal RCRA requirements.

1.3.4.3 Land disposal restrictions

Any RCRA-contaminated soils and/or debris that are restricted from land disposal must be treated to meet the applicable LDRs before land disposal unless such treatment will take place at the receiving facility. Currently, soils contaminated with hazardous waste must be treated to meet the "universal treatment standards" (UTS) for characteristic hazardous waste and all underlying hazardous constituents. EPA has proposed treatment standards for RCRA-contaminated environmental media (61 FR 18780, April 29, 1996). In the interim, EPA has developed guidance for obtaining and complying with a treatability variance for soil that is contaminated with RCRA hazardous wastes for which the UTS have already been set (OSWER Directive 9347.3-06FS, July 1989; 40 CFR 268.44).

The standards for contaminated debris (40 CFR 268.45) require that it be treated before land disposal using extraction, destruction, or immobilization technologies. LTTD is considered by EPA to be a low temperature thermal destruction technology that meets the treatment standards for contaminated debris. Treated debris that no longer contains characteristic hazardous waste is not subject to further Subtitle C regulation and can be disposed of at a Subtitle D facility without further treatment. Hazardous debris that is also contaminated with waste PCBs must comply with the applicable PCB requirements (Sect. 1.3.4.4) and the contaminated debris requirements.

1.3.4.4 PCB requirements

Subpart D of 40 CFR 761 requires that PCBs or PCB items in concentrations of 50 ppm or greater be disposed of in an incinerator operating in compliance with 40 CFR 761.70, in a high efficiency boiler, or in a chemical waste landfill in compliance with 40 CFR 761.75 (40 CFR 761.60). Approval of the regional administrator is required if an alternate method of disposal is requested. A demonstration must be made that the alternative method achieves the same standard of performance as incinerators or high efficiency boilers [40 CFR 761.60(e)]. These requirements would be ARAR for the LTTD process. If LTTD does not meet the 40 CFR 761.70 standards for incinerators and is not approved by the EPA regional administrator as an alternate method of disposal, the proposed EMWMF or alternate disposal facility will need to meet the chemical waste land fill requirements in 40 CFR 761.75 to accept PCB wastes/soil from the DWI 901 Site.

1.3.4 Alternative 3—Minimal Treatment and Disposal at a Proposed EMWMF

In addition to actions common to all alternatives, this alternative includes excavation and off-site disposal of all contaminated soil, debris, and sediment (Table F.4). These contaminated materials would be excavated from the site, staged, processed, treated using LTTD, characterized, and packaged according to WAC, and transported to the proposed EMWMF on the ORR. Processing would include contaminant screening, sorting, and size reduction. Any uncontaminated materials would be sorted and staged separately for disposal at a sanitary landfill. The proposed EMWMF would be permitted to accept TSCA, RCRA, and LLW, so that all of the DWI 901 Site materials could be dispositioned there after being treated to meet LDRs and facility-specific WAC.

1.3.4.1 Clean closure

RCRA has no specific requirements for clean closure of a permitted landfill. Rather, under the general closure requirements of RCRA 40 CFR 264, Subpart G, clean closure requires that the owner or operator control, minimize, or eliminate to the extent necessary to protect human health and the environment postclosure escape of hazardous waste, constituents, leachate, runoff or decomposition products to groundwater, surface water, or the atmosphere (40 CFR 264.111). It also requires removal or decontamination of all waste residues, contaminated system components, contaminated subsoils, and structures and equipment contaminated with waste or leachate, and that they be managed as hazardous waste (40 CFR 264.114). Clean closure requires no postclosure care and assumes unrestricted use of the site. Although the DWI 901 Site was not a permitted landfill, these are relevant and appropriate requirements for the DWI 901 Site clean closure activity.

Since all contaminated media/materials will be removed from the site, no closure requirements under TSCA or the TDEC/NRC LLW regulations will be triggered as ARARs.

1.3.4.2 Miscellaneous treatment unit

Standards for the O&M of miscellaneous units, such as the vitrification unit, are codified in 40 CFR 264.601 and require operation of the unit in a manner that is protective of human health and the environment. The general performance standards require that the owner demonstrate the prevention of releases to groundwater or subsurface media [40 CFR 601(a)], surface water or wetlands [40 CFR 601(b)], or air [40 CFR 601(c)] that could have adverse effects on human health and the environment. In demonstrating compliance with these standards, the operator must consider both waste and media characteristics. These requirements would be satisfied by demonstrating, through the CERCLA process, that the chosen alternative is protective

standards for the public and the environment listed in DOE Order 5400.5 [58 FR 16268, March 25, 1993; a final rule is expected in October 1996]. When final, these standards may then be relevant and appropriate to remedial activities at the DWI 901 Site.

1.3.3.3 PCB waste closure requirements

TSCA regulations, specifically Subpart D (Storage and disposal), do not require PCBs and PCB items landfilled before February 17, 1978, to be removed for disposal. However, if such PCBs are removed from the disposal site, they must be disposed of in accordance with TSCA Subpart D. Although soils/sediments will be incidentally excavated in the process of consolidating and contouring them before capping, the PCB-contaminated soils/sediments will never be removed from the disposal site under this alternative; therefore, the 40 CFR 761 disposal requirements are not ARAR for this alternative.

1.3.3.4 Institutional controls

Institutional controls, including monitoring, will be maintained to limit access and exposure. NCP suggests consideration of one or more alternatives that involve little or no treatment, but provide protection of human health and the environment through the use of institutional controls. Chapter 1200-1-13-.08(3)(a)4.(iv) of TDEC's "Inactive Hazardous Substance Site Remedial Action Program," rule requires that institutional controls be implemented for all areas where containment is a remedial action. Such controls shall include, at a minimum, deed restrictions for sale and use of property and securing the area to prevent human contact with hazardous substances which pose or may pose a threat to human health or safety. In addition, DOE Order 5400.5, Chapter IV, requires administrative (institutional) controls for long-term management in areas containing residual radioactivity. Active controls, which may be considered TBC guidance, include land restrictions, fences, and warning signs.

1.3.3.5 Monitoring

The cap has a design life of 30 years pursuant to RCRA 40 CFR 264.117 and 264.310(b). Groundwater monitoring and use restrictions would begin during remedial action and continue until risk was reduced to acceptable levels and compliance with MCLs is achieved through natural attenuation, which is expected to be within a relatively short period of time. In the preamble to the NCP final rule, EPA allows for reasonable restoration time periods and the use of natural attenuation to achieve groundwater cleanup levels when there are other readily available drinking water sources. It also allows consideration of such factors as location, proximity of population, and likelihood of exposure when determining a reasonable restoration time period (55 FR 8732).

Inadvertent Intrusion," and (5) "Stability of the Disposal Site After Closure," would provide ARARs. Specific requirements of these sections are listed in detail in Table F.4. Chapter 1200-2-11-.16(2) includes requirements for protection of the general public from releases of radioactivity: "Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants or animals must not result in an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other organ of any member of the public. Reasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable."

In addition, certain siting and specific technical requirements listed in TDEC's regulations (Chap. 1200-2-11-.17) may be relevant and appropriate to this action. Since this action does not involve siting a new LLW disposal facility, with the opportunity to select a suitable site, the site suitability and design requirements of Chapter 1200-2-11-.17(1) and (2) may not be relevant and appropriate. The land disposal site closure requirements of Chapter 1200-2-11-17(3) and the institutional requirements of Chapter 1200-2-11-.17(10) would be ARAR, however, depending on whether the LLW is classified as Class A, B, or C pursuant to Chapter 1200-2-11-.17(6). If this alternative is chosen, an LLW classification determination for these wastes would need to be made before the remedial design stage so that the appropriate waste classification-specific closure requirements can be incorporated into the remedial design. Closure requirements are listed in Table F.4. Chapter 1200-2-11-.17(5) and (9) allow the state to approve alternative standards if it finds assurance of compliance with the general performance objectives in Chapter 1200-2-11.16.

Certain DOE Orders may provide TBC guidance for closure of this site. DOE Order 5820.2A, "Radioactive Waste Management," September 9, 1988, requires that inactive disposal facilities be managed in accordance with RCRA and CERCLA and that, during closure and postclosure, residual radioactivity levels shall comply with DOE Order 5400.5 [5820.2A(3)(j)]. DOE Order 5400.5, "Radiation Protection of the Public and the Environment," February 8, 1990, establishes radiation exposure limits for the general public as an EDE of 100 mrem/year from all exposure pathways and all DOE sources of radiation [Chap. II(1)(a)(4)]. The overriding principle of the DOE Order is that all releases of radioactive material shall be ALARA. Cleanup criteria for unrestricted release of contaminated soils can be derived using DOE's RESRAD model (Yu et al. 1995); if RESRAD is used, these derived criteria require field office approval. Residual radioactive material in soil is in excess of background concentrations averaged over an area of 100 m^2. DOE has proposed for codification at 10 CFR 834 the radiation protection

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	Approval of the regional administrator is required if an alternate method of disposal is requested; a demonstration must be made that the alternative method achieves the same standard of performance as incinerators or high efficiency boilers		40 CFR 761.60(e)

ALARA = as low as reasonably achievable
AOC = area of contamination
ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
DWI = David Witherspoon, Inc.
LLW = low-level waste
LTTD = low-temperature thermal desorption
m = meter
mrem = millirem
OSWER = Office of Solid Waste and Emergency Response (EPA)
PCB = polychlorinated biphenyl
ppm = parts per million
RCRA = Resource Conservation and Recovery Act of 1976
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act of 1976

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
Treatment in a miscellaneous unit	Follow design and operating standards that ensure protection of human health and the environment for units in which hazardous waste is treated	Processes involving treatment of RCRA hazardous wastes in a miscellaneous unit as defined in 40 CFR 260.10—relevant and appropriate for Alternatives 3 and 4	40 CFR 264.601 TDEC Rules, Chap. 1200-1-11-.06(27)
	Prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents, specifically preventing adverse effects in		
	• the groundwater or subsurface environment;		40 CFR 264.601(a) TDEC Rules, Chap. 1200-1-11-.06(27)
	• surface water, or wetlands, or the soil surface; and		40 CFR 264.601(b) TDEC Rules, Chap. 1200-1-11-.06(27)
	• the air.		40 CFR 264.601(c) TDEC Rules, Chap. 1200-1-11-.06(27)
Treatment of PCB materials using vitrification or LTTD	PCBs and PCB items in concentrations of 50 ppm or greater must be disposed of in an incinerator operating in compliance with 40 CFR 761.70, in a high efficiency boiler, or in a chemical waste landfill in compliance with 40 CFR 761.75	Treatment/disposal of PCB materials in concentrations of 50 ppm or greater—applicable to Alternatives 3 and 4	40 CFR 761.60

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
Clean closure (e.g., closure with no postclosure care)	Minimize the need for further maintenance; control, minimize, or eliminate to the extent necessary to protect human health and the environment postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to groundwater, surface water, or the atmosphere	Clean closure of a land-based unit containing RCRA hazardous waste (listed or characteristic)—relevant and appropriate for Alternatives 3 and 4	40 CFR 264.111 TDEC Rules, Chap. 1200-1-11-.06(7)
	Remove or decontaminate waste residues, contaminated subsoils, structures, and equipment contaminated with waste and leachate, and manage them as hazardous waste in accordance with 40 CFR 260-268		40 CFR 264.114 TDEC Rules, Chap. 1200-1-11-.06(7)
Release of radioactively contaminated material	Materials that do not exceed the residual surface contamination guidelines, in concert with the ALARA process, may be released to the public without restrictions on use	Release of solid waste with residual surface contamination—relevant and appropriate for Alternatives 3 and 4	DOE Order 5400.5
	Site-specific ALARA analysis of bulk materials with volume radiological contamination required to ensure that waste acceptance criteria for the receiving disposal facility are met		

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
Institutional controls	Controls recommended include restrictions on land use, deed restrictions, well drilling prohibitions, well use advisories, and deed notices	Guidance for the long-term management of contamination left in place—relevant and appropriate for Alternative 2	40 CFR 300.430(e)(3)(ii)
	Controls include, but are not limited to: periodic monitoring, as appropriate; appropriate shielding; physical barriers (i.e., fences and warning signs) to prevent access; inspection and repair of coverings; temporary dikes; drainage courses; appropriate radiological safety measures to ensure protection during activities at the site	Guidance for the interim management of residual radioactive material above guidelines left in inaccessible locations—relevant and appropriate for Alternative 2	DOE Order 5400.5(IV)(6)(c)
	Implement institutional controls for all areas where containment is a remedial action; such controls include, at a minimum, deed restrictions for sale and use of the property and securing the area to prevent human contact with hazardous substances	Containment and long-term management of residual contamination at inactive hazardous waste sites—applicable for Alternative 2	TDEC Rules, Chap. 1200-1-13-.08(3)(a)4.(iv)

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	Maintenance of a buffer zone of land between the disposal unit and disposal boundary and beneath the disposed waste		TDEC Rules, Chap. 1200-2-11-.17(3)(h)
	Closure and stabilization measures in the approved site closure plan must be carried out as each disposal unit is filled and covered		TDEC Rules, Chap. 1200-2-11-.17(3)(i)
	Only wastes containing or contaminated with radioactive materials shall be disposed of at the disposal site		TDEC Rules, Chap. 1200-2-11-.17(3)(k)
	The state may approve alternative standards if it finds assurance of compliance with the general performance objectives in Chapter 1200-2-11-.16		TDEC Rules, Chap. 1200-2-11-.17(5) and (9)
LLW disposal facilities institutional control requirements	An institutional control program is required to physically control access to the disposal site. The program must include environmental monitoring, periodic surveillance, and minor custodial care. Institutional controls may not be relied upon for more than 100 years following transfer of the disposal site to the owner	Closure of a LLW disposal facility with waste left in place—relevant and appropriate for Alternative 2	TDEC Rules, Chap. 1200-2-11-.17(10)

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
LLW disposal facilities closure requirements	Wastes designated as Class C must be disposed of so that the top of the waste is a minimum of 5 m below the top surface of the cover or have intruder barriers that are designed to protect against an inadvertent intrusion for at least 500 years	Closure of a licensed LLW disposal facility—relevant and appropriate for Alternative 2	TDEC Rules, Chap. 1200-2-11-.17(3)(b)
	Wastes must be emplaced in a manner that maintains the package integrity during emplacement and minimizes the void spaces to be filled		TDEC Rules, Chap. 1200-2-11-.17(3)(d)
	Void spaces between waste packages must be filled with earth or other material to reduce future subsidence within the disposal unit		TDEC Rules, Chap. 1200-2-11-.17(3)(e)
	Waste must be placed and covered in a manner that limits the radiation dose rate at the surface of the cover to levels that, at a minimum, will permit the licensee to comply with all provisions of 1200-2-5-.07 at the time the license is transferred pursuant to 1200-2-11-.14		TDEC Rules, Chap. 1200-2-11-.17(3)(f)
	The boundaries and locations of each disposal unit must be accurately located and mapped by means of a land survey		TDEC Rules, Chap. 1200-2-11-.17(3)(g)

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
LLW disposal facilities performance objectives	Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants or animals must not result in an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. Reasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable	Land disposal of LLW—relevant and appropriate for Alternative 2	TDEC Rules, Chap. 1200-2-11-.16(2)
	Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed		TDEC Rules, Chap. 1200-2-11-.16(3)
	The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that surveillance, monitoring, or minor custodial care are required		TDEC Rules, Chap. 1200-2-11-.16(5)

Table F.4. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	Minimum technology requirements of 40 CFR 264.301 for landfills are not required for existing landfills or AOCs	Closure of a CERCLA AOC	OSWER Directive 9347.3-05FS
Postclosure care	Restrict postclosure use of property as necessary to prevent damage to the final cover, liner(s), components of the containment system, or the function of the facility's monitoring system	Final closure of a RCRA hazardous waste facility with some hazardous materials or residues left in place—relevant and appropriate for Alternative 2	40 CFR 264.117(c) TDEC Rules, Chap. 1200-1-11-.06(7)
	Ensure that postclosure care includes: • maintenance of the integrity and effectiveness of the final cover; • maintenance and monitoring of the groundwater monitoring system and compliance with all applicable parts of Subpart F, "Releases from Solid Waste Management Units;" and • prevention of run-on and runoff from damaging the final cover.		40 CFR 264.310(b) TDEC Rules, Chap. 1200-1-11-.06-14(k)
	Postclosure care must begin after completion of closure and continue for 30 years		40 CFR 264.117(a) TDEC Rules, Chap. 1200-1-11-.06(7)

Table F.4. Potential additional action-specific ARARs and TBC guidance for Alternatives 2–4 for the DWI 901 Site, Knoxville, Tennessee

Action	Requirement(s)	Prerequisite	Citation(s)
Closure with waste left in place	When a cover is being placed over waste, design and construct a cover to: • provide long-term minimization of migration of liquids through the capped area, • function with minimum maintenance, • promote drainage and minimize erosion or abrasion of the cover, • accommodate settling and subsidence so that the cover's integrity is maintained, and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.	Final closure of RCRA landfill, tank system, surface impoundment, or waste pile—relevant and appropriate for Alternative 2	40 CFR 264.310(a) TDEC Rules, Chap. 1200-1-11-.06(14)
	Guidelines for levels of residual radioactivity that are acceptable for public use of property without use restrictions; residual radioactivity above such guidelines must be managed in accordance with 5400.5, Chapter II	Guidance for management of residual radioactivity left in place above guidelines—TBC guidance for Alternative 2	DOE Order 5400.5(V)
	Use of and access to residual radioactive material shall be controlled through appropriate administrative and physical controls		DOE Order 5400.5, IV.6d(1)(e)

Any generator who relinquishes control of PCB wastes by transporting them to an off-site disposal facility must comply with the applicable provisions of TSCA (40 CFR 761.207 et seq.). Once wastes generated from a CERCLA response action are transferred off-site (i.e., off the OU), all administrative and substantive portions of all applicable requirements must be met.

1.3.3 Alternative 2—Multilayer Cap and Monitoring

In addition to the actions common to Alternatives 2–4, under this alternative, after removal of surface debris, any remaining contaminated surface mounds, berms, soils, debris, sediment, and vegetation would be incorporated and graded and a multilayer cap would be installed over the site to isolate the contaminants. Under this alternative, RCRA characteristic waste, LLW, and PCB waste would be left in place in the ground, thus triggering, in addition to the ARARs already discussed, closure requirements under RCRA, the TDEC/NRC LLW regulations, and TSCA (see Table F.4).

1.3.3.1 RCRA waste closure requirements

Closure with RCRA waste left in place requires that the unit be capped with a cover designed and constructed to provide long-term minimization of migration of liquids through the capped area, function with minimum maintenance, promote drainage, and minimize erosion of the cover (40 CFR 264.310). These and other closure requirements are listed in Table F.4 under "closure with waste in place." Since movement of any RCRA waste within the OU would be considered "consolidation" within the same AOC, "placement" of RCRA waste does not occur, and the LDRs do not apply.

1.3.3.2 Low-level waste closure requirements

The NRC/TDEC LLW disposal requirements (10 CFR 61/Chap. 1200-2-11) are not legally applicable to this activity because they are NRC/Agreement State regulations for NRC-licensed facilities, and the DWI 901 Site is not an NRC-licensed LLW disposal facility. Historical records indicate that the DWI 901 Site was licensed by the Nuclear Regulatory Commission and the TNDW of Rad Health 1966–1981 to accept low-level uranium contaminated scrap metal. In 1981, the TDRH Commissioners issued on Order and Complaint for license violation. Two hundred drums of mixed waste were transferred onto the site in 1982 and again in 1985 from other Witherspoon sites. However, the site remained in violation throughout the 1980s and has been under investigation from 1989 until involuntary entry into the Tennessee Division of Superfund (TDSF) program in 1993. Parts of the TDEC/NRC LLW regulations may be relevant and appropriate to closure of this site. In particular, certain of the general performance objectives (Chap. 1200-2-11-.16), specifically, Chapter 1200-2-11-.16(2) "Protection of the General Public from Releases of Radioactivity," (3) "Protection of Individuals from

defines on-site as the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action (40 CFR 300.5). Pursuant to this definition, the surrounding off-site soils contaminated by the source could be considered on-site and within the AOC (55 FR 8760, March 8, 1990). Therefore, movement of soils and sediments to and within the OU would not be subject to any administrative requirements or RCRA LDRs until they are treated or removed from the site as in Alternatives 3 and 4. Location-specific ARARs for aquatic resources would be triggered for this in-stream activity (see Sect. 1.2.1 and Table F.2).

1.3.2.8 Dispositioning/transport of decontamination fluids/wastes

Any wastes (e.g, PPE, construction debris, treatment residuals) and decontamination fluids generated during the remedial activities must be characterized using process knowledge or testing [40 CFR 262.11; 40 CFR 268.7; TDEC 1200-1-11-.03(1)(b)] and managed appropriately as either solid waste, hazardous waste, LLW, mixed waste, or PCB waste. Table F.3 lists the general requirements for waste disposal.

Transport of contaminated materials to ORR for treatment and/or disposal is considered off-site transport. CERCLA §121(d)(3) provides that the off-site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions be to a facility that is in compliance with RCRA and applicable state laws. EPA has codified this statutory requirement at 40 CFR 300.440, which establishes the procedures and criteria for determining whether facilities are acceptable for the off-site receipt of waste.

Off-site transfer will be regulated by the RCRA transportation requirements (40 CFR 262 and 40 CFR 263) if the contaminated materials contain RCRA characteristic waste. In addition, DOT regulations for transportation of hazardous materials and TDEC radiation protection standards may apply to transportation of materials containing radioactive materials above certain limits. The DOT regulations list general requirements for shipping and packaging at 49 CFR 172 and 173, and requirements for carriage by public highway or rail at 49 CFR 177 and 174, respectively. Specific loading and unloading requirements for transportation of radioactive materials by public highway are in 49 CFR 177.842.

TDEC requirements for packaging and transportation of radionuclide-containing materials above exempt quantities [as listed in Schedule RHS 8-3, TDEC 1200-2-10-.04(3)] may be applicable for transport of any LLW-containing materials from the DWI 901 Site to an off-site facility for treatment or disposal [TDEC 1200-2-10-.30 et seq.]. In addition, the public protection requirements of DOE Order 5400.5 could be considered TBC guidance.

methods; hydrocarbon contamination by using solvent wipes. Any contaminated soil removed from the debris will be included in the remedial action for the site soils which are contaminated with RCRA characteristic waste, radioactivity, and PCBs at levels greater than 50 ppm.

Scrap metal is excluded from the requirements of RCRA Parts 262-266 and Parts 268, 270, and 124 if it is intended for recycle or reuse [40 CFR 261.6(a)(3)(iii)]. EPA reiterates in the final hazardous debris rule that scrap metal contaminated with a toxicity-characteristic waste is exempt from Subtitle C if recycled or reused (57 FR 37237, August 18, 1992). This exclusion applies to debris if it is salvaged and subsequently recycled. If not recycled, but rather sent to a landfill for disposal, it may be subject to an ARAR. However, RCRA-characteristic hazardous debris that has been treated using physical extraction technologies to a clean surface and that does not then exhibit a characteristic of hazardous waste is no longer considered a hazardous waste and is not be subject to RCRA Subtitle C requirements ([40 CFR 261.3(f)(1); 40 CFR 268.45(c)]. Any debris then sent to a sanitary landfill for disposal will have to meet the WAC of the solid waste facility (40 CFR 258; TDEC 1200-1-7-.01 et seq.).

DOE Order 5400.5 may provide TBC guidance for the surface decontamination of radioactively contaminated debris. Surface contamination guidelines are presented in Figure IV-1 of the DOE Order and are applicable to contaminated equipment (e.g., debris) and any building components that are potentially salvageable or recoverable scrap. If direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination listed in Figure IV-1 ($<$ 1,000 dpm/100 cm^2 for natural uranium, ^{235}U, ^{238}U, and associated decay products, and alpha emitters), it is not necessary to use wiping techniques described in DOE Order 5400.5 to measure removable contamination levels.

1.3.2.6 Removal of standing vegetation

Standing vegetation at the site includes trees and brush that have not yet been characterized for contamination. These materials would be cleared, reduced in volume, and either capped, under Alternative 2, along with the site soils, or tested for contamination and transported to an appropriate landfill under Alternatives 3 and 4. Any vegetation removed off-site to a landfill will have to meet the WAC of the solid waste disposal facility (40 CFR 258; TDEC 1200-1-7-.01 et seq. for sanitary landfills).

1.3.2.7 Potential contaminated sediment and soil excavation and consolidation

Potentially, contamination has migrated out of the OU, particularly along the stream channel. The potential for such contamination and the need to remove it is considered here as a contingency only. In this case, it is assumed that contaminated sediment and soil would be excavated and transported to the site for remedial action along with the site soils. CERCLA

guidance for any radionuclide emissions. The limit is an EDE of 100 mrem/year from all exposure pathways and all DOE sources of radiation. The overriding principle of the DOE Order is that all releases of radioactive material shall be ALARA.

1.3.2.3 Surface water control

Stormwater discharges from activities at industrial sites involving construction operations that result in the disturbance of 2 ha (5 acres) of total land or more require an NPDES general permit (40 CFR 122; Chap. 1200-4-10-.05 of the TDEC Rules), which includes requirements for controlling surface water runoff (see Table F.3). Those requirements would be legally applicable for activities at the DWI 901 Site, which is more than 2 ha (5 acres). As mentioned previously, for CERCLA on-site actions, compliance with only the substantive requirements of the NPDES permitting process is required. In particular, implementation of good site planning and best management practices to control stormwater discharges are required.

1.3.2.4 Construction of a decontamination facility and staging area

Decontamination will be performed, as needed, before removing debris from the site. A decontamination facility and staging area would be constructed to facilitate sampling, decontamination, staging, compaction, and loading of surface debris. If the debris is RCRA characteristic, or has surface contamination, the decontamination facility will be subject to RCRA Subtitle C hazardous debris containment building requirements. In the final debris rule (57 FR 37194, August 18, 1992), EPA established a new treatment unit for treating contaminated debris. A "containment building" has been added to the definitions of 40 CFR 260.10 to provide for storage and treatment of contaminated debris that does not contain free liquids and is not amenable to treatment in tanks or containers (57 FR 979, January 9, 1992). Performance standards for the design and operation of such containment buildings are promulgated under Subpart DD to 40 CFR 264 and 265 for permitted facilities and interim status facilities, respectively. These requirements are listed in detail in Table F.3 and would be applicable to any decontamination facility/staging area if adhered soils a surface contamination removed from the debris are contaminated with RCRA-characteristic waste.

1.3.2.5 Removal of surface debris

Surface debris will be screened for radioactivity and then visually inspected for the presence of other contaminants, looking for adhered soil or hydrocarbons. Uncontaminated debris would be removed from the site and transported to a salvage facility for processing and subsequent recycling or disposal in a solid waste landfill. Soil will be removed by physical

1.3.2.1 Excavation and on-site consolidation

RCRA TCLP tests of the DWI 901 Site soils show them to be contaminated with RCRA-characteristic waste. Characterization tests also show contamination with radioactivity, and PCBs at levels greater than 50 ppm. Soils may be excavated and/or moved within the operable unit (OU) in preparation for characterization, staging, and remediation. Relocation of soil may occur within the same OU [referred to as an AOC under CERCLA]. Since soil remains within the same AOC, no "placement" or land disposal occurs according to RCRA 3004(k), and RCRA disposal requirements are not triggered (55 FR 8760, March 8, 1990). Fugitive dust/radioactive emission requirements, however, may be triggered. Once soil contaminated with PCBs at greater than 50 ppm is identified and removed from the disposal site, it will have to be disposed of in accordance with 40 CFR 761 requirements (Sect. 1.3.4.4). On-site soil that is incidentally excavated in the process of consolidating and contouring is not considered to be removed from the disposal site and would not trigger 40 CFR 761 requirements.

1.3.2.2 Control of fugitive emissions

Airborne pollutants may result from site preparation and remediation activities. The TDEC Division of Air Pollution Control has promulgated regulations governing fugitive dust emissions (TDEC Rules, Chap. 1200-3-8-.010). An operator must take reasonable precautions to prevent particulate matter from becoming airborne. These are listed in Table F.3 and are applicable to remedial activities at the DWI 901 Site.

Subpart H of 40 CFR 61 addresses atmospheric radionuclide emissions from DOE facilities and, while not legally applicable to the DWI 901 Site because it is not a DOE facility, may be relevant and appropriate to any airborne fugitive or point source emissions during remedial activities. The National Emission Standard for Hazardous Air Pollutants (54 FR 51654, December 15, 1989) limits emissions of radionuclides (other than radon) to the ambient air from DOE facilities to amounts that would not cause any member of the public to receive an effective dose equivalent (EDE) of more than 10 mrem/year (40 CFR 61.92). Title 40 CFR 61.93(b)(4)(i) requires radiological emission measurements at all release points that have a potential to discharge radionuclides into the air in quantities that could cause an EDE in excess of 1 percent of the standard (0.1 mrem/year). All radionuclides which could contribute greater than 10 percent of the standard (1 mrem/year) for a release point shall be measured. TDEC has codified these standards verbatim in Chapter 1200-3-11-.08 of the TDEC Rules.

Radiation exposure limits for the general public defined in DOE Order 5400.5, "Radiation Protection of the Public and the Environment," January 7, 1993, may be considered TBC

Table F.3. (continued)

ALARA = as low as reasonably achievable
AOC = area of contamination
ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
DOT = U.S. Department of Transportation
DWI = David Witherspoon, Inc.
EDE = effective dose equivalent
EP = extraction procedure
FR = *Federal Register*
LDR = land disposal restriction
LLW = low-level waste
mrem = millirem
mSv = millisievert
OU = operable unit
PCB = polychlorinated biphenyl
ppm = parts per million
RCRA = Resource Conservation and Recovery Act of 1976
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act of 1976

Table F.3. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	Exemption from TDEC radiation protection regulations for radioactive material in individual quantities, which do not exceed the applicable quantity set forth in Schedule RHS 8-3	Handling of radioactive materials below exempt quantities—applicable	TDEC Rules, Chap. 1200-2-10-.04(3)
	Transporter and receiving facility must be licensed	Delivery of licensable quantities of radioactive material to a disposal facility within the state—applicable	TDEC Rules, Chap. 1200-2-10.32(4)
	Packaging requirements, based on the maximum activity of radioactive material in a package	Packaging of radioactive materials above exempt quantities for public transport—applicable	49 CFR 173.431; 49 CFR 173.433; 49 CFR 173.435; 49 CFR 173.411
	Off-site shipments of mixed waste must be to a facility specifically licensed for both the RCRA component and the radioactive component of the waste	Shipments of LLW—TBC	DOE Order 5820.2A; DOE performance objectives (October 16, 1991)
	Off-site transfer of any hazardous substance, pollutant, or contaminant generated during CERCLA response actions must be to a facility that is in compliance with RCRA and applicable state laws	Off-site transfer of CERCLA wastes—applicable	CERCLA 121(d)(3) 40 CFR 300.440
	Any generated who relinquishes control of PCB wastes by transporting them to an off-site disposal facility must comply with the manifesting provisions of TSCA	Transportation of PCBs—applicable	40 CFR 761.207 et seq.

Table F.3. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	LLW generators must characterize and segregate LLW from uncontaminated waste and otherwise minimize the amount of LLW generated. Subsequent management of LLW must be in accordance with DOE Order 5820.2A. The Commissioner's Order for the Site Treatment Plan and §105 of the Federal Facilities Compliance Act will allow storage of mixed waste until treatment technologies are available	Generators of LLW—TBC	DOE Order 5820.2A(III.3)
	Once PCBs at concentrations of 50 ppm or greater are generated, the PCBs must be handled in accordance with TSCA 40 CFR 761	Generators of PCBs in concentrations greater than 50 ppm—applicable	40 CFR 761
Disposal of scrap metal	Scrap metal contaminated with toxicity characteristic waste is exempt from Subtitle C if recycled or reused	Generation of scrap metal contaminated with RCRA-characteristic waste	40 CFR 261.6(a)(3)(iii); 57 FR 37237 (August 18, 1992)
Disposal of nonhazardous waste	Disposal of nonhazardous waste may be to a permitted landfill if it meets the waste acceptance criteria; a "special waste" permit may be necessary.	Disposal of nonhazardous waste-applicable	40 CFR 258 TDEC Rules, Chap. 1200-1-7-.01 et seq.
Transportation of PCBs, hazardous, low-level, or mixed waste	The waste must meet packaging, labeling, marking, placarding, manifest, and pretransport requirements in accordance with DOT regulations	Transportation of hazardous and radioactive materials above exempt quantities—applicable	49 CFR Parts 172, 173, 175, 178, and 179

Table F.3. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	RCRA characteristic hazardous debris that has been treated using physical extraction technologies to a clean surface and that does not then exhibit a characteristic of hazardous waste is no longer considered a hazardous waste and is not subject to Subtitle C requirements		40 CFR 261.3(f)(1) 40 CFR 268.45(c)
Excavation/transport of adjacent and nearby soils and sediments to the OU for remediation	Land disposal restrictions are not triggered if waste is moved within the AOC	Movement of soils/sediment within the same AOC—applicable	40 CFR 300.5 CERCLA §121(e) 55 FR 8760, March 8, 1990
Characterization/ handling of media/ debris removed from AOC	A person who generates solid waste must determine whether that waste is hazardous using various methods, including application of knowledge of the hazardous characteristics of the waste based on information regarding the materials or processes used. If the media/debris are determined to be hazardous, the media/debris must be handled in accordance with 40 CFR 260-268	Wastes generated during activities potentially contaminated with RCRA-characteristic waste—applicable	40 CFR 262.11 TDEC Rules, Chap. 1200-1-11-.03(1)(b)
	Must treat to meet the LDRs for RCRA characteristic wastes before land disposal	Wastes which failed EP toxicity test or current toxicity tests for hazardous wastes—applicable	40 CFR 268.7
	Where a treatment technology specified in 40 CFR 268 is not appropriate to the waste, the generator may apply for a treatability variance to comply with the LDRs	Hazardous wastes for which the technology specified in 40 CFR 268 is inappropriate—applicable	40 CFR 268.44

Table F.3. (continued)

Action	Requirement(s)	Prerequisite	Citation(s)
	Follow secondary containment requirements listed for management of hazardous wastes containing free liquids or treated with free liquids		40 CFR 264.1101(b) TDEC Rules, Chap. 1200-1-11-.06(32)
	Maintain primary barrier to be free of significant cracks, gaps, corrosion, or other deterioration that could cause release of hazardous substances		40 CFR 264.1101(c)(1) TDEC Rules, Chap. 1200-1-11-.06(32)
	Take measures to prevent the tracking of hazardous waste outside of the unit by personnel or equipment		
	Take measures to control fugitive dust emissions		
	Promptly repair in accordance with prescribed procedures any condition that could lead to the release of a hazardous substance		40 CFR 264.1101(c)(3) TDEC Rules, Chap. 1200-1-11-.06(32)
	At closure, remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures or equipment contaminated with waste and leachate, and manage them as hazardous waste		40 CFR 264.1102(a) TDEC Rules, Chap. 1200-1-11-.06(32)
	If all contaminated subsoils cannot be removed from the structure, close the structure in accordance with the landfill closure and postclosure requirements of 40 CFR 264.310		40 CFR 264.1102(b) TDEC Rules, Chap.1200-1-11-.06(32)

WBS ..... 2.0.1.03 CAP CONSTRUCTION
Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.1.3 CAP CONSTRUCTION
Discipline ..... O OTHER
B/M Title ..... CAP CONSTRUCTION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.4 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SEDIMENT CONSOLIDATION						
1 -A	SEDIMENT CONTROL DEVICES (HAY BALES, SILT FENCE...ETC)	Matl.	1.00	LOT	1,000.00	1,000	
		Labor	40	L	17.65	706	1,706
2 -A	EXCAVATE SEDIMENT	Matl.	60.00	CY	17.60	1,056	
		Labor	24	OP	25.25	606	1,662
3 -A	LOAD, HAUL, AND DUMP TO BE INCLUDED IN CAP	Matl.	60.00	CY	11.00	660	
		Labor	8	OP	25.25	202	862
4 -A	SPOTTERS AND LABORORS	Matl.	1.00	LOT	0.00	0	
		Labor	24	L	17.65	424	424
5 -A	VERIFICATION SAMPLING/ANALYSIS	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	16	L	17.65	282	5,282
6 -A	INSTALL RIPRAP IN STREAM BED	Matl.	60.00	CY	17.35	1,041	
		Labor	15	OP	25.25	379	1,420
7 -A	SPOTTERS AND LABORS	Matl.	1.00	LOT	0.00	0	
		Labor	15	L	17.65	265	265
8 -A	REMOVE SEDIMENT CONTROL DEVICES	Matl.	1.00	LOT	0.00	0	
		Labor	20	L	17.65	353	353
	SITE CONSOLIDATION						
9 -A	CONSOLIDATE SOIL AND DEBRIS	Matl.	22,700.00	CY	0.58	13,166	
		Labor	545	OP	25.25	13,761	26,927
10 -A	COMPACTION (6" LIFTS 3 PASSES)	Matl.	22,700.00	CY	0.32	7,264	
		Labor	159	OP	25.25	4,015	11,279
11 -A	VERIFICATION SAMPLING/ANALYSIS	Matl.	25.00	EACH	1,500.00	37,500	
		Labor	50	L	17.65	883	38,383
12 -A	BACKFILL WITH TOPSOIL (INCLUDES LOADING, HAULING 10 MILES AND	Matl.	6,160.00	CY	11.32	69,731	
		Labor	1,910	OP	25.25	48,228	117,959
			8				

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PLACEMENT W/ COMPACTION)						
13 -A	SEED AND STRAW	Matl.	350.00	MSF	32.70	11,445	
		Labor	105	L	17.65	1,853	13,298
	CAP CONSTRUCTION						
14 -A	PERIMETER CONTAINMENT BERM (INCLUDES LOADING AT BORROW AREA, HAUL 10 MILES, SPREAD AND COMPACTION)	Matl.	13,500.00	CY	11.32	152,820	
		Labor	4,185	OP	25.25	105,671	258,491
15 -A	PERIMETER DITCH EXCAVATION	Matl.	350.00	CY	1.43	501	
		Labor	28	OP	25.25	707	1,208
16 -A	ANCHOR TRENCH BACKFILL	Matl.	100.00	CY	11.32	1,132	
		Labor	31	OP	25.25	783	1,915
17 -A	ANCHOR TRENCH EXCAVATION (2' X 1' X 1200')	Matl.	100.00	CY	1.43	143	
		Labor	8	OP	25.25	202	345
18 -A	4" DIAMETER PERFORATED PIPE @ ANCHOR TRENCH	Matl.	1,200.00	LF	0.60	720	
		Labor	16	L	17.65	282	1,002
19 -A	2' THICK CLAY SOIL CAP (INCLUDES LOADING AT BORROW AREA, HAULING 10 MILES, PLACEMENT AND COMPACTION)	Matl.	8,200.00	CY	11.32	92,824	
		Labor	2,542	OP	25.25	64,186	157,0...
20 -A	40 MIL (VLDPE) SYSNTHE GEOMEMBRANE LINER	Matl.	108,000.00	SF	1.20	129,600	
		Labor	3,240	L	17.65	57,186	186,786
21 -A	5 MM GEONET (DRAINAGE LAYER)	Matl.	110,700.00	SF	0.23	25,461	
		Labor	111	L	17.65	1,959	27,420
22 -A	6 OZ. GEOTEXTILE (HEAT BOND TO GEONET)	Matl.	218,700.00	SF	0.50	109,350	
		Labor	219	L	17.65	3,865	113,215
23 -A	1'-6" THICK SOIL COVER	Matl.	6,150.00	CY	11.32	69,618	
		Labor	1,907	OP	25.25	48,152	117,770
24 -A	6" TOP SOIL	Matl.	2,000.00	CY	11.32	22,640	
		Labor	620	OP	25.25	15,655	38,295
25 -A	SEED AND STRAW	Matl.	108.00	MSF	32.70	3,532	
		Labor	32	L	17.65	565	4,097
****	SUBTOTAL ****	Matl.				756,204	
		Labor	15,870			371,170	1,127,374

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SPECIAL REQUIREMENTS						
26 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	200.00	DAYS	11.65	2,330	
		Labor	1,600	L	17.65	28,240	30,570
27 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	200.00	DAYS	200.00	40,000	
		Labor	0		0.00	0	40,000
28 -A	PPE ALLOWANCE	Matl.	200.00	DAYS	75.00	15,000	
		Labor	1,200	L	17.65	21,180	36,180
29 -A	SPOTTER FOR OPERATORS	Matl.	200.00	DAYS	0.00	0	
		Labor	1,600	L	17.65	28,240	28,240
30 -A	HEALTH AND SAFETY OFFICER	Matl.	200.00	DAYS	0.00	0	
		Labor	1,600	X	50.00	80,000	80,000
31 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	15,870.00	HRS	1.00	15,870	
		Labor	794	OP	25.25	20,049	35,919
32 -A	LABOR FACTOR	Matl.	15,870.00	HRS	0.00	0	
		Labor	3,174	OP	25.25	80,144	80,144

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		829,404		629,023	1,458,427
SALES TAX		70,499			70,499
SUBTOTAL		899,903		629,023	1,528,926
TOTAL INDIRECT	20.00%	179,981	20.00%	125,805	305,786
TOTAL		1,079,884	(hrs. 25,838)	754,828	1,834,712

WBS ..... 2.0.1.05 DECON/DEMOBILIZATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.1.5 DECON/DEMOBILIZATION
Discipline ..... O OTHER
B/M Title ..... DECON/DEMOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.5 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	DECON/DEMOBILIZATION						
1 -A	DECON EQUIPMENT	Matl.	6.00	EACH	250.00	1,500	
		Labor	144	L	17.65	2,542	4,042
2 -A	DECON TEMPORARY FACILITIES	Matl.	1.00	LOT	2,000.00	2,000	
		Labor	240	L	17.65	4,236	6,236
3 -A	DEMOBILIZATION (REMOVAL OF TRAILERS AND EQUIPMENT	Matl.	1.00	LOT	500.00	500	
		Labor	120	TD	18.20	2,184	2,684

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		4,000		8,962	12,962
SALES TAX		340			340
SUBTOTAL		4,340		8,962	13,302
TOTAL INDIRECT	20.00%	868	20.00%	1,792	2,660
TOTAL		5,208	(hrs. 504)	10,754	15,962

WBS ..... 2.0.1.06 SECONDARY WASTE DISPOSAL
Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.1.6 SECONDARY WASTE DISPOSAL
Discipline ..... O OTHER
B/M Title ..... SECONDARY WASTE DISPOSAL
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.6 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SECONDARY WASTE DISPOSAL						
1 -A	DECON WATER ALLOWANCE (ASSUME TREATMENT AT Y-12 WITH TRANSPORTATION INCLUDED)	Matl.	10,000.00	GALS	11.00	110,000	
		Labor	56	TD	18.20	1,019	111,019
2 -A	DISPOSAL OF PPE AND OTHER NONE LIQUID ALLOWANCE	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	8	TD	18.20	146	10,146

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		120,000		1,165	121,165
SALES TAX		10,200			10,200
SUBTOTAL		130,200		1,165	131,365
TOTAL INDIRECT	20.00%	26,040	20.00%	233	26,273
TOTAL		156,240	(hrs.	64) 1,398	157,638

WBS ..... 2.0.2.01 PROJECT MANAGEMENT
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.1 PROJECT MANAGEMENT
Discipline ..... 0 OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site 0
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.4 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	DESIGN MANAGER (1/8 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	600	ER	78.96	47,376	47,376

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	47,376	47,376
TOTAL	0	(hrs. 600) 47,376	47,376

WBS ..... 2.0.2.01 PROJECT MANAGEMENT
Code ..... 9200 PROGRAM MANAGEMENT
ıcipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.2 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	TECHNICAL MANAGER (1/4 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	1,110	A1	60.03	66,633	66,633
2 -A	ESTIMATING & SCHEDULE SUPPORT (1/10 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	450	A1	60.03	27,014	27,014
3 -A	HEALTH & SAFETY COORDINATOR (1/10 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	450	A1	60.03	27,014	27,014
4 -A	FINANCE OFFICER & BUSINESS ANALYST (3/4 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	3,300	A1	60.03	198,099	198,099

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	318,760	318,760
TOTAL	0	(hrs. 5,310) 318,760	318,760

WBS ..... 2.0.2.01 PROJECT MANAGEMENT
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... K026 ENVIRONMENTAL MGMT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	ENVIRONMENTAL PROJECT MANAGER (1/2 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	2,220	A1	54.82	121,700	121,700

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	121,700	121,700
TOTAL	0	(hrs. 2,220) 121,700	121,

WBS ..... 2.0.2.01 PROJECT MANAGEMENT
Code ..... 9200 PROGRAM MANAGEMENT
cipant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.3 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	WASTE MANAGEMENT (1/8 FTE FOR 30 MONTHS)	Matl.	30.00	MONTHS	0.00	0	
		Labor	600	A1	50.00	30,000	30,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	30,000	30,000
TOTAL	0	(hrs. 600) 30,000	30,000

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.02 REMEDIAL DESIGN WORK PLAN
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.5 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	WRITE THE PLAN (1-1/2 FTE FOR 2 MONTHS)	Matl.	2.00	MONTHS	0.00	0	
		Labor	440	ER	78.96	34,742	34,742

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	34,742	34,742
TOTAL	0	(hrs. 440) 34,742	34,7

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.02 REMEDIAL DESIGN WORK PLAN
Code ..... 5100 TITLE I & II ENG
Participant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.7 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	OVERSIGHT AND REVIEW OF PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	120	A1	60.03	7,204	7,204

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	7,204	7,204
TOTAL	0	(hrs. 120) 7,204	7,204

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.02 REMEDIAL DESIGN WORK PLAN
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.6 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	TECHNICAL SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,4

WBS ..... 2.0.2.02 REMEDIAL DESIGN WORK PLAN
Code ..... 5100 TITLE I & II ENG
Participant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.8 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	REVIEW AND SUPPORT TO PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

WBS ..... 2.0.2.03 REMEDIAL DESIGN REPORT
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.9 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REMEDIAL DESIGN (2-1/2 FTE FOR 9 MONTHS)	Matl.	9.00	MONTHS	0.00	0	
		Labor	3,303	ER	78.96	260,805	260,805

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	260,805	260,805
TOTAL	0	(hrs. 3,303) 260,805	260,

WBS ..... 2.0.2.03 REMEDIAL DESIGN REPORT
Code ..... 5100 TITLE I & II ENG
Participant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.10 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	OVERSIGHT AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	360	A1	60.03	21,611	21,611

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	21,611	21,611
TOTAL	0	(hrs. 360) 21,611	21,611

WBS ..... 2.0.2.03 REMEDIAL DESIGN REPORT
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.11 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REVIEW AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	260	A1	50.00	13,000	13,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	13,000	13,000
TOTAL	0	(hrs. 260) 13,000	13,(

WBS ..... 2.0.2.03 REMEDIAL DESIGN REPORT
Code ..... 5100 TITLE I & II ENG
icipant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.12 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	TECHNICAL SUPPORT FOR REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	220	TS	60.89	13,396	13,396

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	13,396	13,396
TOTAL	0	(hrs. 220) 13,396	13,396

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.04 REMEDIAL ACTION WORK PLAN
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.14 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	ER	78.96	3,158	3,158

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	3,158	3,158
TOTAL	0	(hrs. 40) 3,158	3,1

WBS ..... 2.0.2.04 REMEDIAL ACTION WORK PLAN
Code ..... 9470 CONSTRUCTION SUPPORT
icipant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.13 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	PREPARE PLAN (1-1/2 FTE FOR 3 MONTHS)	Matl.	3.00	MONTHS	0.00	0	
		Labor	660	MX	69.00	45,540	45,540

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	45,540	45,540
TOTAL	0	(hrs. 660) 45,540	45,540

WBS ..... 2.0.2.04 REMEDIAL ACTION WORK PLAN
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.16 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	TECHNICAL SUPPORT AND REVIEW	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,4

WBS ..... 2.0.2.04 REMEDIAL ACTION WORK PLAN
Code ..... 9470 CONSTRUCTION SUPPORT
..icipant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.15 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.19 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	GENERAL CONSTRUCTION OVERSIGHT (1/5 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	480	A1	60.03	28,814	28,814

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	28,814	28,814
TOTAL	0	(hrs. 480) 28,814	28,8

WBS ..... 2.0.2.05 REMEDIAL ACTION INTEGRATION
Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... MK66 MK-F INDIRECTS & FEE
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.18 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -C	MK-FERGUSON INDIRECTS AND FEE @ 15.7%	Matl.	2,805.00	K$	157.00	440,385	
		Labor	0		0.00	0	440,385

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL INDIRECT	440,385	0	440,385
TOTAL	440,385	(hrs. 0) 0	440,385

WBS ..... 2.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.17 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	CONSTRUCTION MANAGER (1/4 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	592	MX	69.00	40,848	40,848
2 -A	CONSTRUCTION ENGINEER (1 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	2,352	MC	54.00	127,008	127,008
3 -A	PROJECT CONTROLS (1/5 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	480	MP	54.00	25,920	25,920
4 -A	PROCUREMENT SUPPORT (1 FTE FOR 2 MONTHS)	Matl.	2.00	MONTHS	0.00	0	
		Labor	294	MB	57.00	16,758	16,7[illegible]
5 -A	SAFETY OVERSIGHT (1/5 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	480	MH	55.00	26,400	26,400
6 -A	HP & IH OVERSIGHT (1/5 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	480	MJ	55.00	26,400	26,400
7 -A	VEHICLE USAGE	Matl.	2,560.00	HRS	1.75	4,480	
		Labor	0		0.00	0	4,480

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	4,480	263,334	267,814
TOTAL	4,480	(hrs. 4,678) 263,334	267,814

ALTERNATIVE 2 DWI

WBS ..... 2.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.20 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	TECHNICAL SUPPORT DURING CONSTRUCTION FOR DOE (1/5 FTE FOR 16 MONTHS)	Matl.	16.00	MONTHS	0.00	0	
		Labor	480	TS	60.89	29,227	29,227
2 -A	INDEPENDENT VERIFICATION (ALLOWANCE)	Matl.	16.00	MONTHS	5,000.00	80,000	
		Labor	384	TS	60.89	23,382	103,382

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	80,000	52,609	132,609
TOTAL	80,000	(hrs. 864) 52,609	132,609

WBS ..... 2.0.3.01 SITE MAINTENANCE
Code ..... 7100 SURVEILLANCE & MAINTENANCE
,cipant ..... SC01 OFFSITE SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 2.0.3.1 SITE MAINTENANCE
Discipline ..... O OTHER
B/M Title ..... SITE MAINTENANCE
Receiving Site .... OTHER
Cross-Cut Code .... 01-03-09 RA/S & M/S & M
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT2\ALT-2.Est 10-01-96 3:59p

Building/Area ..... SITE
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DHB
Trace Number ..... O.3.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE MAINTENANCE						
1 -A	MOWING OF SITE 4 TIMES PER YEAR FOR 30 YEARS	Matl.	120.00	EACH	200.00	24,000	
		Labor	2,880	L	0.00	0	24,000
2 -A	REPAIR ERRODED AREAS OF CAP 1 TIME PER YEAR FOR 30 YEARS	Matl.	30.00	EACH	500.00	15,000	
		Labor	720	OP	0.00	0	15,000
3 -A	GENERAL MAINTENANCE FOR SIGNS AND FENCE 1 TIME EVERY 6 YEARS FOR 30 YEARS	Matl.	5.00	EACH	500.00	2,500	
		Labor	120	L	0.00	0	2,500

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	41,500	0	41,500
TOTAL	41,500	(hrs. 3,720) 0	41,500

Total Labor Hours: 59,207

Disciplines
O: OTHER

COST SUMMARY

COST SUMMARY	Material	Labor	Total Cost M + L
Line Item Cost	1,241,052	2,141,348	3,382,400
Total Sales Tax	94,088		94,088
SUBTOTAL	1,335,140	2,141,348	3,476,488
Total Indirect	680,587	174,076	854,663
SUBTOTAL	2,015,727	2,315,424	4,331,151
Overhead	0	0	0
SUBTOTAL	2,015,727	2,315,424	4,331,151
Contingency	705,504	810,398	1,515,902
SUBTOTAL	2,721,231	3,125,822	5,847,053
Market Adjustment			0
TOTAL			5,847,(

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* N I S T  B L C C - D E T A I L E D  L C C  A N A L Y S I S (version 4.20-95)*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

                PART I - INITIAL ASSUMPTIONS AND COST DATA
-------------------------------------------------------------------------------

          Project alternative: DWI ALT2
          Run date: 10-02-1996 17:08:29
          Run type: Federal Analysis--Projects Subject to OMB A-94
          Comment: $1=$1000
          Input data file: DWIALT2.DAT, last modified: 10-02-1996/16:50:54
          LCC output file: DWIALT2.LCC, created: 10-02-1996/16:51:11
          Base Date of Study:  OCT 1996
          Service Date:        OCT 2003
          Study period:        37.00 years (OCT 1996 through SEP 2033)
          Plan/constr. period:  7.00 years (OCT 1996 through SEP 2003)
          Service Period:      30.00 years (OCT 2003 through SEP 2033)
          Discount rate:        7.0%  Real (exclusive of general inflation)
          End-of-year discounting convention


             INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
       (ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)
-------------------------------------------------------------------------------

                        YEAR
                    (Beginning) Cost Phasing    Yearly Cost      Total Cost
                    ----------- ------------    -------------    -------------
                      OCT 2001      10.2%           $706
                      OCT 2002      48.8%         $3,366
                      OCT 2003      41.0%         $2,826
     AT SERVICE DATE: OCT 2004       0.0%             $0
        TOTAL INITIAL CAPITAL ASSET COSTS                            $6,898


* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

                PART II  -  LIFE-CYCLE COST ANALYSIS
            Discount Rate =  7.0% Real (exclusive of general inflation)
-------------------------------------------------------------------------------
  PROJECT ALTERNATIVE: DWI ALT2              RUN DATE: 10-02-1996/17:08:29

                                        PRESENT VALUE     ANNUAL VALUE
                                        (1997 DOLLARS)    (1997 DOLLARS)
                                        --------------    --------------

  CASH REQUIREMENTS AS OF SERVICE DATE:
     DURING CONSTRUCTION                      $4,822              $368
     AT SERVICE DATE                              $0                $0
                                        ------------      ------------
      SUBTOTAL                                $4,822              $368

  OPERATING, MAINTENANCE & REPAIR COSTS:
     NON-ANNUALLY RECURRING COSTS                $23                $2
                                        ------------      ------------
      SUBTOTAL                                   $23                $2

  RESALE VALUE OF ORIG CAPITAL COMPONENTS         $0                $0

  RESALE VALUE OF CAPITAL REPLACEMENTS            $0                $0

  TOTAL LIFE-CYCLE PROJECT COST               $4,845              $369

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

2. COST ESTIMATE—ALTERNATIVE 3

2.1 INTRODUCTION

This chapter provides the basis for the cost estimate, summary cost information, assumptions used in developing the estimate, estimate details and material pricing data used in developing the cost estimate.

2.1.1 Description of Alternative 3

Alternative 3 includes excavation and disposal of all contaminated soil, debris, and sediment. These contaminated materials would be characterized, treated, loaded, and transported to the EMWMF located on the DOE ORR. The EMWMF would be permitted to accept TSCA, RCRA, and LLW, such that all of the DWI materials could be dispositioned there after treatment. This alternative is designed for a future residential land use scenario.

2.1.2 Summary Cost Data

Table G.6 summarizes the cost estimate for this alternative. It consists of a project summary report at the third and fourth level WBS. All amounts have been rounded to the nearest $1,000. Additional summaries and details of these costs are included in Section 3.5.

2.1.3 Project Summary WBS

DWI—ALTERNATIVE 3

3.0 Project Cost

3.0.1 Direct Project Cost
- 3.0.1.1 Temporary Facilities/Mobilization
- 3.0.1.2 Site Preparation
- 3.0.1.3 Excavation/Segregation
- 3.0.1.4 Treatment
- 3.0.1.5 Packaging/Loading/Transporting
- 3.0.1.6 WAC Required Actions
- 3.0.1.7 Monitoring Well Installation
- 3.0.1.8 Decon/Demobilization
- 3.0.1.9 Secondary Waste Disposal

3.0.2 Indirect Project Cost

- 3.0.2.1 Project Management
- 3.0.2.2 Remedial Design Work Plan
- 3.0.2.3 Remedial Design Report
- 3.0.2.4 Remedial Action Work Plan
- 3.0.2.5 Remedial Action Integration

3.0.3 Monitoring & Maintenance

- 3.0.3.1 Site Maintenance
- 3.0.3.2 Surface Water Monitoring
- 3.0.3.3 Groundwater Monitoring

2.1.4 Project Schedule

The project schedule is based on extrapolations from other projects having similar scope and participation. The schedule and appropriate application of escalation form the basis for obtaining escalated cost and the FY summary cost information. The assumed schedule for this alternative is shown in Figure G.2.

2.2 BASIS FOR COST ESTIMATE

2.2.1 Engineering Estimate

The engineering cost estimate consists of Titles I, II and III engineering. Titles I and II engineering includes all of the design activities required to issue a CFC work package. Title III engineering includes those engineering-related activities necessary to ensure that the remedial activities conform to Title I and II design drawings and specifications. Computer costs, reproduction costs, travel costs, and material costs are also included in the estimates. Project management has been factored into the estimate to include Title I and II reports; schedule development and maintenance; cost reporting; progress reporting; contract administration; staffing; project review; meetings; project direction and guidance by the project manager, project engineer, program director, and task engineer/coordinator.

Title I, II, and III engineering costs are estimated based on the appropriate level of effort necessary for this particular project.

2.2.2 Construction Estimate

2.2.2.1 Material and labor pricing

The cost estimate was based on the preliminary BMs developed for each fixed-price contractor activity as envisioned to accomplish the desired results and assumptions as detailed under Section 3.3, "Alternative Specific Assumptions." Each activity was then estimated as to the material cost and labor cost. Labor crafts that will perform the tasks were identified and the appropriate wage rates were applied. Material and labor pricing was based on vendor quotes, recent similar job history, and nationally recognized publications such as *R.S. Means Construction Cost Data* and *Richardson's Construction Estimating Standards*. Special equipment and/or special facilities cost were obtained either by vendor contact or data from similar projects.

The basic estimating units used generally reflect a normal standard for construction cost. Many special work situations and job conditions can cause additional material and/or labor work hours to be required. These additional cost considerations have been identified and included in the estimate. Some of these additional considerations are: health physics, industrial hygiene, worker productivity, safety requirements, site congestion, worker protection, supporting items, small tools, and cleanup.

2.2.2.2 Wage rates

Wage rates for construction labor are those current as of February 1996 for the Oak Ridge area and are as contained in the AES Standard Value File ERFEB96A.val. These rates are effective for an hour of productive work and are given below:

Code	Craft	Fixed rate
C	Carpenter	$25.80
E	Electrician	$25.95
L	Laborer	$17.65
OP	Operating engineer	$25.25
PF	Pipefitter	$26.20
TD	Truck driver	$18.20

Fixed-price construction labor rates are based on average crew sizes with necessary foremen, general foremen, etc. All fringe benefits, payroll taxes, and workmen's compensation insurance are included.

2.2.2.3 Indirect markups

The indirect markups for construction are taken from the *U.S. Department of Energy Oak Ridge Operations Estimating and Cost Control Manual for Construction Projects*.

The indirect markups for fixed-price construction used in the estimate have been applied according to the guidelines provided by ORO for use in Oak Ridge, Tennessee. Those markups are:

Overhead (applied to labor and material)	10 percent
Profit (applied to labor and material)	8 percent
Bond (applied to labor and material)	1 percent
General contractor's markup for work performed by his subcontractors (applied to labor and material)	5 percent
Sales tax (applied to material)	8.25 percent

For the fixed-price general contractor, these markups compound and appear in estimates as totals; indirect 20 percent and tax 8.25 percent. For subcontractors the markups appear as totals; indirect 26 percent and tax 8.25 percent.

MK-Ferguson will award, administer, and manage all construction contracts required for this project. MK-Ferguson also direct charges certain activities such as health physics, health and safety, subcontract administration, construction superintendent, project controls, QA, etc. as dictated by the needs of the project. These costs are estimated based on the appropriate level of effort necessary for this particular project.

2.2.3 Energy Systems Site Overhead

2.2.3.1 Energy Systems labor

An Energy Systems site overhead is generally applied to all Energy Systems labor. This overhead recovers costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

2.2.3.2 Energy Systems materials

An Energy Systems site overhead is applied to the first $20,000 of any purchased materials. This overhead recovers the costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

2.2.3.3 Energy Systems and DOE contractors

An off-site subcontract overhead is applied to the total cost of all DOE prime contracts and subcontracts to MK-Ferguson or Energy Systems. This includes MK-Ferguson fixed-price subcontracts. However, the TS contractor and the remediation design architect and engineering are exempted from this subcontract overhead. This overhead is an apportionment of the cost of plant services, purchasing, facilities maintenance, administration, etc. This project is off site and no overhead is included.

2.2.4 Project Management/Liaison

Project management spans all facets of the project and its administration. Project management includes those activities necessary to support the project such as: project manager and project engineer, project reviews and reporting, project coordination and planning, systems engineering, and scheduling. Design and project liaison includes those activities necessary to support the Title I and II design activities, such as: architect and engineer design coordination and reviews and architect and engineer estimate reviews. Other costs such as travel, reproduction, and other miscellaneous materials, are also included. These estimates were based on knowledge acquired from similar projects and were adjusted to reflect current environmental and health, and safety requirements as they relate to this project.

2.2.5 Escalation

The estimate has been escalated using the DOE-approved annual rates issued. The estimate is based on FY 1996 third quarter costs and then escalated over the period of activity as determined by the project schedule.

The approved escalation rates are 2.8 percent for FY 1996, 2.8 percent for FY 1997, 2.7 percent for FY 1998, 2.9 percent for FY 1999, 3.0 percent for FY 2000, 3.1 percent for FY 2001, 3.2 percent for FY 2002, and 0.0 percent thereafter.

2.2.6 Contingency

According to DOE Order 4700.1, contingency is defined as the sum of funds included within an estimate to cover materials, labor, conditions, and risk situations, which are an intrinsic part of the presently intended scope of work but are not specifically allowed for elsewhere in the estimate due to uncertainty either as to their existence, nature, likelihood of occurrence, or magnitude of effect.

Contingency cost has been included in this project to cover costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties within the defined scope. A 35 percent contingency has been applied to this estimate due to the incompleteness of design at the FS stage and the complexity of the action.

2.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS

In the development of this alternative, various overall site conditions and operating parameters remained unknown. The following assumptions were developed to address these unknowns:

2.3.1 General Assumptions

- FPSCs will perform all remedial activities, which will include the temporary facilities, site preparation, excavation, segregation, treatment, loading, transporting, WAC required actions, decontamination and demobilization.

- MK-Ferguson will provide overall construction management services, which includes administration and management of all fixed price subcontracts.

- All remedial work on the site will be conducted under HAZWOPER requirements.

- The estimate is based on an 8-hour work day and 5-day work week for all remedial activities.

- Level D PPE will be required for 100 percent for the remedial activities. The cost of the Level D PPE is estimated at $75/day.

- A 20 percent productivity factor has been included to account for workers preforming in Level-D PPE.

- Training and medical requirements, including yearly updates, have been included for all on-site workers.

- The fixed-price contractor will have one health and safety engineer for the duration of project.

- The off-site salvage vendor for the recyclable materials will provide the necessary equipment to load and transport salvageable material off site at no cost to the project. No salvage value will be recovered from the off-site vendor.

2.3.2 WBS-Specific Assumptions

The following assumptions were developed for each WBS. They represent a step-by-step procedure for conducting remedial activities.

2.3.3 Direct Cost

2.3.3.1 Temporary facilities/mobilization

- The contractor will install/construct on site the construction office trailer; shower/change trailer; decontamination pad; and staging area, including utilities.

- Costs are included for general conditions, including a utilities allowance, full-time superintendent, survey crews, and required documents.

- Equipment mobilization cost is also included in this WBS.

2.3.3.2 Site preparation

- The area to be used for temporary facilities will be graded to remove surface contamination before set-up of temporary facilities.

- Surface debris with salvage value will be cleaned and removed from the site.

- Existing structures will remain as they are.

- The existing trees will be cut and felled onto plastic to prevent contact with contaminated soil and then sized and hauled to a landfill.

- The brush and stumps will be grubbed and chipped then stockpiled for transporting to EMWMF.

- Temporary surface water controls shall be installed by the contractor (allowed 1,500 lin ft of diversion ditches and 2,400 lin ft of silt fence and hay bales).

- The contractor will and install 800 lin ft of chain link fence around the temporary facilities.

- An allowance of $10,000 and 60 electrician hours have been allowed for monitors for detection of airborne particulate.

2.3.3.3 Excavation/segregation

- Sediment will be staged on site until it is loaded and transported to the EMWMF with the soil.

- An allowance of $2,500 and 16 hours is included for verification sampling after sediment is removed.

- Only 60 yd^3 of sediment will be required to be removed to lower the risk to acceptable limits.

- Riprap will be installed in the stream bed to replace the removed sediment.

- Contaminated material on site will be excavated and segregated for treatment.

- The estimated quantity of soil to be treated and placed into EMWMF is 16,500 yd^3.

- An allowance of $52,500 and 70-man hours is included for verification sampling after the site is excavated.

- The area where contaminated material has been removed shall be backfilled and seeded.

- The backfilled material (top soil) will be taken from a borrow area within 8 km (5 miles) of site.

- Dust control shall be required (water truck).

2.3.3.4 Treatment

- Fifty percent of the debris will require manual washing before being sent to the Y-12 Plant landfill. A line item cost is included for estimated cost at \$75 yd^3 for material and 2 hours/yd^3 for labor.

- Fifty percent of the debris will require automatic washing before being sent to the Y-12 Plant landfill. A line item cost is included for estimated cost based on vendor information at \$655/yd^3.

- The soil will require thermal desorption treatment before being sent to EMWMF. A line item cost is included for estimated cost based on previous projects at \$150/ton.

- All the line item costs for treatment included mobilization/demobilization, studies, and site preparation.

2.3.3.5 Packaging/loading/transporting

- Dump truck beds will be modified for containment of materials while transporting.

- Contaminated materials will be loaded using a front-end loader in a manner as not to contaminate the 12-yd^3 dump truck exterior or tires.

- The dump trucks will not require decontamination between loads.

- Dust control shall be required during loading and unloading activities.

2.3.3.6 WAC-required actions

- Treatment of contaminated material will be required for disposal at EMWMF.
- Only 1 sample shall be characterized for every 10 truck loads.
- No disposal fee is included in this estimate for EMWMF.

2.3.3.7 Decontamination/demobilization

- The decontamination of contractor equipment and facilities is included at an allowance of \$8,500 and 864-man hours.

- The contractor will demobilize his trailers and equipment.

2.3.3.8 Secondary waste disposal

- An allowance of $166,000 is included for characterization, transportation, and treatment of decontamination water.
- An allowance of $10,000 is included for disposal of contractor PPE.

2.3.3.9 Site maintenance

- Site maintenance includes mowing four times per year for 5 years.

2.4 COST SENSITIVITY ANALYSIS

In accordance with the EPA guidance for conducting RIs and FSs under CERCLA, a cost sensitivity analysis for specific assumptions associated with the project implementation has been preformed. The below listed assumptions were found to be the cost sensitivity.

- Quantity of contaminated material to be disposed at EMWMF.
- PPE requirements (respirator)
- Project schedule
- Groundwater treatment
- Energy Systems overhead
- WAC for EMWMF
- Equipment decon requirements
- Disposal Fees

2.5 ESTIMATE DETAILS

Following is a detailed breakdown of the cost estimate.

2.5.1 FY Report

A summary of the project estimate by FY and by WBS level 3 is presented in Table G.7. Summary by FY and participant is given in Table G.8. All amounts have been rounded to the nearest $1,000.

2.5.2 Summary Reports

A summary report by WBS level 3/WBS level 4 with escalated and unescalated cost in shown in Table G.6.

A detailed summary of the estimated cost is included at the 3rd level WBS/4th level WBS/participant in Table G.9. All amounts have been rounded to the nearest $1,000.

2.5.3 Detailed Estimate Report

A detailed estimate report indicating how cost and labor hours are included at the line item level is included in Table G.10.

FIGURE G.2

PROJECT SCHEDULE

Figure G.2. DWI 901 SITE RI/FS
Alternative 3

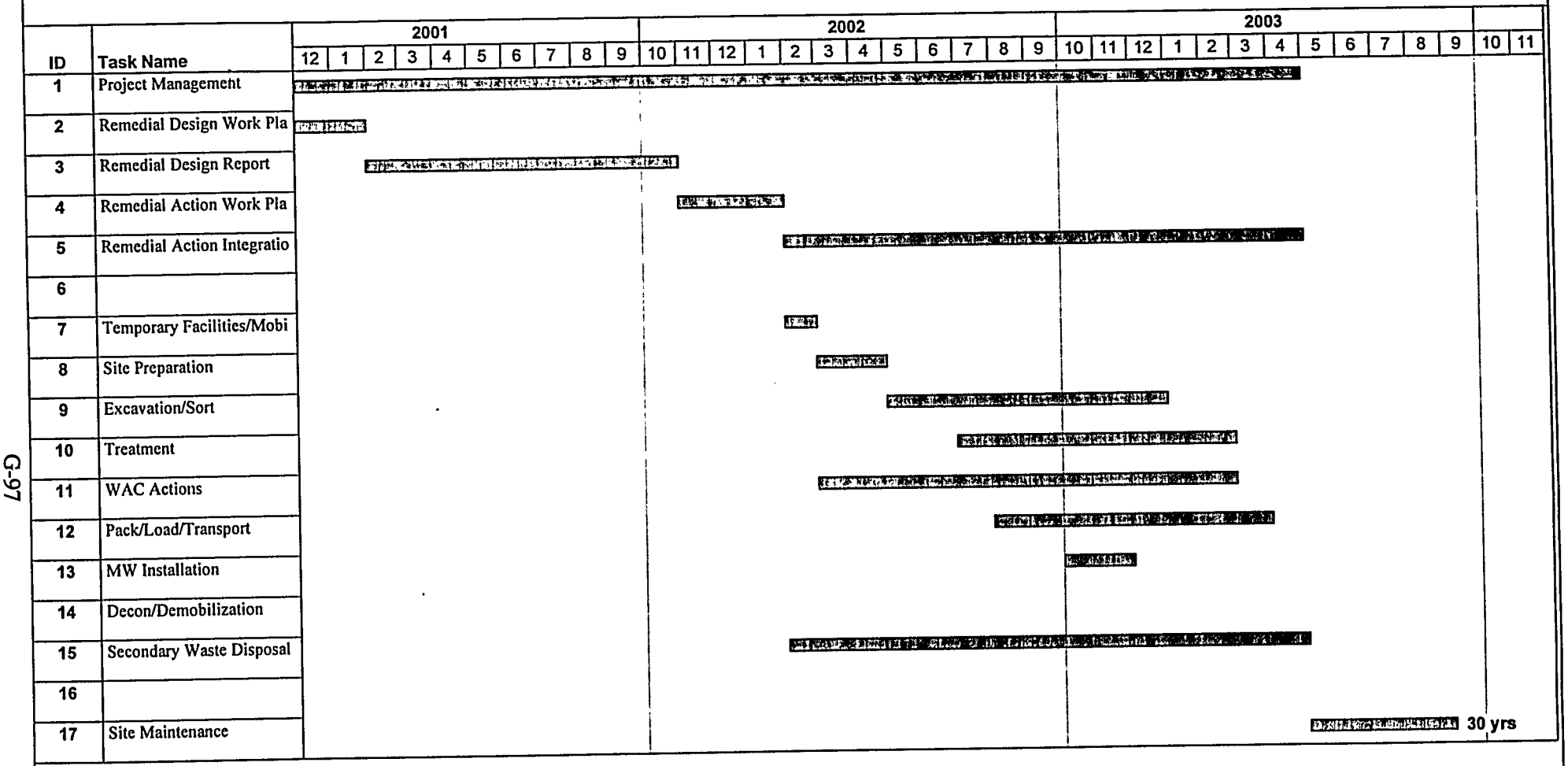


TABLE G.5

ALTERNATIVE 3,
SUMMARY REPORT

SUMMARY REPORT
Project Number: 35H83094
DWI - ALTERNATIVE 3

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3
2. WBS - Level 4
3. Participant

Approved by:

_____ _____
Project Estimator Date

_____ _____
Estimating Manager Date

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT3\ALT-3.Est 10/01/1996
SCHEDULE FILE: ALT-3
REPORT FILE: C:\AES60F\DWI\ALT3\ALT3SUN.Out 10/01/1996 16:09:33

AES Version 6.0f

DWI - ALTERNATIVE 3

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
3.0.1 DIRECT PROJECT COST						
3.0.1.01 TEMPORARY FACILITIES/MOBILIZAT						
MK51 MK-F OAK RIDGE FPSC	131	110	241	157	131	288
TOTAL TEMPORARY FACILITIES/MOBILIZAT	131	110	241	157	131	288
3.0.1.02 SITE PREPARATION						
MK51 MK-F OAK RIDGE FPSC	93	118	211	111	141	252
MK53 FP UNIT SUBCONTRACT	8	0	8	10	0	10
TOTAL SITE PREPARATION	101	118	219	121	141	262
3.0.1.03 EXCAVATION/SEGREGATION						
MK51 MK-F OAK RIDGE FPSC	424	361	785	507	432	939
TOTAL EXCAVATION/SEGREGATION	424	361	785	507	432	939
3.0.1.04 TREATMENT						
MK51 MK-F OAK RIDGE FPSC	6705	129	6834	8028	155	8183
TOTAL TREATMENT	6705	129	6834	8028	155	8
3.0.1.05 PACKAGING/LOADING/TRANSPORTING						
MK51 MK-F OAK RIDGE FPSC	619	244	863	741	292	1033
TOTAL PACKAGING/LOADING/TRANSPORTING	619	244	863	741	292	1033
3.0.1.06 WAC REQUIRED ACTIONS						
MK51 MK-F OAK RIDGE FPSC	381	12	393	456	14	470
TOTAL WAC REQUIRED ACTIONS	381	12	393	456	14	470
3.0.1.08 DECON/DEMOBILIZATION						
MK51 MK-F OAK RIDGE FPSC	12	21	33	14	25	39
TOTAL DECON/DEMOBILIZATION	12	21	33	14	25	39
3.0.1.09 SECONDARY WASTE DISPOSAL						
MK51 MK-F OAK RIDGE FPSC	228	2	230	273	2	275
TOTAL SECONDARY WASTE DISPOSAL	228	2	230	273	2	275
TOTAL DIRECT PROJECT COST	8601	997	9598	10297	1192	11489

DWI - ALTERNATIVE 3

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
3.0.2 INDIRECT COST						
3.0.2.01 PROJECT MANAGEMENT						
AE01 ARCHITECT-ENGNR (F-W)	0	41	41	0	48	48
C069 CENTRAL ENGINEERING	0	287	287	0	339	339
K026 ENVIRONMENTAL MGMT	0	110	110	0	130	130
K045 WASTE MANAGEMENT	0	26	26	0	30	30
TOTAL PROJECT MANAGEMENT	0	464	464	0	547	547
3.0.2.02 REMEDIAL DESIGN WORK PLAN						
AE01 ARCHITECT-ENGNR (F-W)	0	35	35	0	40	40
C069 CENTRAL ENGINEERING	0	7	7	0	8	8
TS01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
X027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
TOTAL REMEDIAL DESIGN WORK PLAN	0	46	46	0	53	53
3.0.2.03 REMEDIAL DESIGN REPORT						
AE01 ARCHITECT-ENGNR (F-W)	0	417	417	0	483	483
C069 CENTRAL ENGINEERING	0	31	31	0	36	36
K045 WASTE MANAGEMENT	0	16	16	0	19	19
TS01 TECH SUPPORT CONTRACTOR	0	16	16	0	18	18
TOTAL REMEDIAL DESIGN REPORT	0	480	480	0	556	556
3.0.2.04 REMEDIAL ACTION WORK PLAN						
AE01 ARCHITECT-ENGNR (F-W)	0	3	3	0	4	4
MK67 MK-F ADMIN SUPPORT	0	46	46	0	53	53
TS01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
X027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
TOTAL REMEDIAL ACTION WORK PLAN	0	53	53	0	62	62
3.0.2.05 REMEDIAL ACTION INTEGRATION						
C069 CENTRAL ENGINEERING	0	23	23	0	28	28
MK66 MK-F INDIRECTS & FEE	1549	0	1549	1854	0	1854
MK67 MK-F ADMIN SUPPORT	4	217	221	5	260	265
TS01 TECH SUPPORT CONTRACTOR	65	43	108	78	51	129
TOTAL REMEDIAL ACTION INTEGRATION	1618	283	1901	1937	339	2276
TOTAL INDIRECT COST	1618	1326	2944	1937	1557	3494

DWI - ALTERNATIVE 3

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
3.0.3 MONITORING/MAINTENANCE						
3.0.3.01 SITE MAINTENANCE						
SC01 OFFSITE SUBCONTRACT	4	0	4	5	0	5
TOTAL SITE MAINTENANCE	4	0	4	5	0	5
TOTAL MONITORING/MAINTENANCE	4	0	4	5	0	5
SUB - TOTAL	10223	2323	12546	12239	2749	14988
OVERHEAD	0	0	0	0	0	0
SUB - TOTAL	10223	2323	12546	12239	2749	14988
CONTINGENCY	3578	813	4391	4284	963	5247
GRAND TOTAL	13801	3136	16937	16523	3712	20235

TABLE G.6

ALTERNATIVE 3, FISCAL YEAR SUMMARY REPORT BY WORK BREAKDOWN STRUCTURE

FISCAL YEAR SUMMARY
Project Number: 35H83094
DWI - ALTERNATIVE 3

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT3\ALT-3.Est 10/01/1996
SCHEDULE FILE: ALT-3
REPORT FILE: C:\AES60F\DWI\ALT3\ALT3FYR.Out 10/01/1996 16:07:35

AES Version 6.0f

DWI - ALTERNATIVE 3

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2008

	Fiscal Year					Sub
	2001	2002	2003	2004	2005	Total
3.0.1 DIRECT PROJECT COST	.	5121	6370	.	.	11491
3.0.2 INDIRECT COST	684	1466	1345	.	.	3495
3.0.3 MONITORING/MAINTENANCE	.	.	.	1	1	2
Sub-Total	684	6587	7715	1	1	14988
Overhead	0	0	0	0	0	0
Sub-Total	684	6587	7715	1	1	14988
Contingency	239	2305	2700	0	0	5244
Grand Total	923	8892	10415	1	1	20232

DWI - ALTERNATIVE 3

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2008

	Fiscal Year 2006	2007	2008	Total
3.0.1 DIRECT PROJECT COST	.	.	.	11491
3.0.2 INDIRECT COST	.	.	.	3495
3.0.3 MONITORING/MAINTENANCE	1	1	1	5
Sub-Total	1	1	1	14991
Overhead	0	0	0	0
Sub-Total	1	1	1	14991
Contingency	0	0	0	5244
Grand Total	1	1	1	20235

TABLE G.7

ALTERNATIVE 3, FISCAL YEAR SUMMARY REPORT BY PARTICIPANT

FISCAL YEAR SUMMARY
Project Number: 35H83094
DWI - ALTERNATIVE 3

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. Participant

Approved by:

_____ _____
Project Estimator Date

_____ _____
Estimating Manager Date

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT3\ALT-3.Est 10/01/1996
SCHEDULE FILE: ALT-3
REPORT FILE: C:\AES60F\DWI\ALT3\ALT3FYS.Out 10/01/1996 16:08:23

AES Version 6.0f

DWI - ALTERNATIVE 3

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2008

	Fiscal Year					Sub
	2001	2002	2003	2004	2005	Total
AE01 ARCHITECT-ENGNR (F-W)	518	48	7	.	.	573
C069 CENTRAL ENGINEERING	98	246	67	.	.	411
K026 ENVIRONMENTAL MGMT	21	89	20	.	.	130
K045 WASTE MANAGEMENT	23	21	5	.	.	49
MK51 MK-F OAK RIDGE FPSC	.	5116	6365	.	.	11481
MK53 FP UNIT SUBCONTRACT	.	4	5	.	.	9
MK66 MK-F INDIRECTS & FEE	.	826	1028	.	.	1854
MK67 MK-F ADMIN SUPPORT	.	171	147	.	.	318
SC01 OFFSITE SUBCONTRACT	.	.	.	1	1	2
TS01 TECH SUPPORT CONTRACTOR	21	61	72	.	.	154
X027 WASTE MGMT & REM ACTION	2	2	.	.	.	4
Sub-Total	683	6584	7716	1	1	14985
Overhead	0	0	0	0	0	0
Sub-Total	683	6584	7716	1	1	14985
Contingency	239	2305	2700	0	0	5244
Grand Total	922	8889	10416	1	1	20229

DWI - ALTERNATIVE 3

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2008

	Fiscal Year 2006	Fiscal Year 2007	Fiscal Year 2008	Total
AE01 ARCHITECT-ENGNR (F-W)	.	.	.	573
C069 CENTRAL ENGINEERING	.	.	.	411
K026 ENVIRONMENTAL MGMT	.	.	.	130
K045 WASTE MANAGEMENT	.	.	.	49
MK51 MK-F OAK RIDGE FPSC	.	.	.	11481
MK53 FP UNIT SUBCONTRACT	.	.	.	9
MK66 MK-F INDIRECTS & FEE	.	.	.	1854
MK67 MK-F ADMIN SUPPORT	.	.	.	318
SC01 OFFSITE SUBCONTRACT	1	1	1	5
TS01 TECH SUPPORT CONTRACTOR	.	.	.	154
X027 WASTE MGMT & REM ACTION	.	.	.	4
Sub-Total	1	1	1	14988
Overhead	0	0	0	0
Sub-Total	1	1	1	14988
Contingency	0	0	0	5244
Grand Total	1	1	1	20232

TABLE G.8

ALTERNATIVE 3, DETAIL REPORT

DETAIL REPORT
Project Number: 35H83094
DWI - ALTERNATIVE 3

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 9
2. Participant

Approved by:

_____ _____
Project Estimator Date

_____ _____
Estimating Manager Date

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT3\ALT-3.Est 10/01/1996
SCHEDULE FILE: ALT-3
REPORT FILE: C:\AES60F\DWI\ALT3\ALT3DET.Out 10/01/1996 16:06:33

AES Version 6.0f

Creation Date 04/24/1996
Revision Number ... 0

Estimating Job Number .. 35H83094

Project Estimator.. DH BOLLING
WBS ..... 3.0.1.01 TEMPORARY FACILITIES/MOBILIZATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.1 TEMP. FACILITIES/MOBILIZATION
Discipline ..... O OTHER
B/M Title ..... TEMP. FACILITIES/MOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Project Engineer ..... K. BURCH
Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TEMPORARY FACILITIES						
1 -A	CONSTRUCTION TRAILER (RENTAL)	Matl.	13.00	MONTHS	320.00	4,160	
		Labor	5	TD	18.20	91	4,251
2 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	532
3 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
4 -A	SHOWER/CHANGE TRAILER (RENTAL)	Matl.	13.00	MONTHS	550.00	7,150	
		Labor	5	TD	18.20	91	7,241
5 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	532
6 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
7 -A	WATER HOOK-UP	Matl.	1.00	LOT	6,500.00	6,500	
		Labor	120	PF	26.20	3,144	9,644
8 -A	EQUIPMENT DECON PAD	Matl.	500.00	SF	35.00	17,500	
		Labor	50	C	25.80	1,290	18,790
9 -A	STAGGING AREA FOR EQUIPMENT (GRAVEL)	Matl.	1,500.00	SF	5.50	8,250	
		Labor	15	OP	25.25	379	8,629
10 -A	STAGGING AREA FOR MATERIAL TO BE TRANSPORTED TO EMWMF.	Matl.	5,000.00	SF	5.50	27,500	
		Labor	50	OP	25.25	1,263	28,763
			1				

tem	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
11 -A	EQUIPMENT MOBILIZATION	Matl.	6.00	EACH	150.00	900	
		Labor	48	TD	18.20	874	1,774
****	SUBTOTAL ****	Matl.				82,460	
		Labor	485			11,848	94,308
	GENERAL CONDITIONS						
12 -A	UTILITIES (ALLOWANCE)	Matl.	13.00	MONTHS	200.00	2,600	
		Labor	0		0.00	0	2,600
13 -A	SUPERINTENDENT	Matl.	13.00	MONTHS	100.00	1,300	
		Labor	2,275	X	30.00	68,250	69,550
14 -A	SURVEY CREW	Matl.	1.00	LOT	3,000.00	3,000	
		Labor	120	X	35.00	4,200	7,200
15 -A	DOCUMENTS (SAFETY PLAN, QA PLAN, WM PLAN, WORK PLAN...ETC)	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	0		0.00	0	10,000
****	SUBTOTAL ****	Matl.				16,900	
		Labor	2,395			72,450	89,350
	SPECIAL REQUIREMENTS						
16 -A	HEALTH & SAFETY OFFICER	Matl.	80.00	HRS	0.00	0	
		Labor	80	X	50.00	4,000	4,000
17 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	491.00	HRS	1.00	491	
		Labor	25	OP	25.25	631	1,122
18 -A	PPE REQUIREMENTS	Matl.	10.00	DAYS	75.00	750	
		Labor	0		0.00	0	750
19 -A	LABOR FACTOR	Matl.	491.00	HRS	0.00	0	
		Labor	98	OP	25.25	2,475	2,475

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		100,601		91,404	192,005
SALES TAX		8,551			8,551
SUBTOTAL		109,152		91,404	200,556
TOTAL INDIRECT	20.00%	21,830	20.00%	18,281	40,111
TOTAL		130,982	(hrs. 3,083)	109,685	240,667

WBS ..... 3.0.1.02 SITE PREPARATION
Code ..... 6100 REMEDIAL ACTION
, .icipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.2 SITE PREPARATION
Discipline ..... O OTHER
B/M Title ..... SITE PREPARATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.2 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE PREPARATION						
	EARLY ACTION						
1 -A	EXCAVATION AND GRADING FOR TEMPORARY FACILITIES	Matl. Labor	7,000.00 140	SF OP	0.20 25.25	1,400 3,535	4,935
	SALVAGEABLE DEBRIS REMOVAL AND CLEANING						
-A	REMOVAL OF SALVAGEABLE SURFACE DEBRIS (INCLUDES FRISK AND DECON OF 50%)	Matl. Labor	500.00 1,000	TONS L	15.00 17.65	7,500 17,650	25,150
3 -A	EQUIPMENT (FOLKLIFT, TRUCK...ETC)	Matl. Labor	300.00 300	HRS OP	35.00 25.25	10,500 7,575	18,075
	REMOVAL OF STANDING VEGETATION						
4 -A	CLEAR & GRUB & CHIP BRUSH & STUMPS (WILL INCLUDE IN MATERIAL GOING TO EMWMF)	Matl. Labor	6.50 273	ACRES L	2,550.00 17.65	16,575 4,818	21,393
5 -A	CUT & HAUL TO LANDFILL MEDIUM TREES TO 12" DIA	Matl. Labor	3.00 210	ACRES L	1,525.00 17.65	4,575 3,707	8,282
6 -A	SPECIAL REQUIREMENTS TO PREVENT CONTAMINATION WHEN TREES ARE CUT TO PREVENT CONTACT WITH SOIL	Matl. Labor	3.00 24	ACRES L	500.00 17.65	1,500 424	1,924
7 -A	JOBSITE TREE LOAD FOR TRANSPORT TO Y-12 LANDFILL: FE LOADER, TM, 3 CY, CAT 950E	Matl. Labor	16.00 16	HOURS OP	29.10 25.25	466 404	870

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TEMPORARY SURFACE WATER CONTROLS						
8 -A	DIVERISION DITCHES	Matl.	1,500.00	LF	1.50	2,250	
		Labor	75	OP	25.25	1,894	4,144
9 -A	SILT FENCE AND HAY BALES	Matl.	2,400.00	LF	2.50	6,000	
		Labor	984	L	17.65	17,368	23,368
	SITE FENCING						
10 -A	INSTALL FENCE AROUND TEMPORARY FACILITIES	Matl.	800.00	LF	5.55	4,440	
		Labor	170	L	17.65	3,001	7,441
11 -A	ALLOWANCE FOR MONITORS FOR DETECTION OF AIRBORNE PARTICULATES	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	60	E	25.95	1,557	11,557
****	SUBTOTAL ****	Matl.				65,206	
		Labor	3,252			61,933	127,139
	SPECIAL REQUIREMENTS						
12 -A	HEALTH & SAFETY OFFICER	Matl.	320.00	HRS	0.00	0	
		Labor	320	X	50.00	16,000	16,000
13 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	3,252.00	HRS	1.00	3,252	
		Labor	163	OP	25.25	4,116	7,368
14 -A	PPE REQUIREMENTS	Matl.	40.00	DAYS	75.00	3,000	
		Labor	0		0.00	0	3,000
15 -A	LABOR FACTOR	Matl.	3,252.00	HRS	0.00	0	
		Labor	650	OP	25.25	16,413	16,413

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		71,458		98,462	169,920
SALES TAX		6,074			6,074
SUBTOTAL		77,532		98,462	175,994
TOTAL INDIRECT	20.00%	15,506	20.00%	19,692	35,198
TOTAL		93,038	(hrs. 4,385)	118,154	211,192

WBS ..... 3.0.1.02 SITE PREPARATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.2 SITE PREPARATION
Discipline ..... O OTHER
B/M Title ..... TRANSP VEG TO Y-12 LF
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... 0.1.3 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	HAUL SITE VEGETATION TO Y-12 LANDFILL						
1 -A	HAUL 190 CY TREES TO Y-12 LANDFILL, REF VEGDISP.XLSY-12IC (INTERMODAL CONTAINERS)	Matl. Labor	1.00 0	LS	7,689.00 0.00	7,689 0	7,689
2 -A	G/C ADMIN OF S/C, 6%	Matl. Labor	1.00 0	LOT	461.00 0.00	461 0	461

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	8,150	0	8,150
TOTAL	8,150	(hrs. 0) 0	8,150

WBS ..... 3.0.1.03 EXCAVATION/SEGREGATION
Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.3 EXCAVATION/SEGREGATION
Discipline ..... O OTHER
B/M Title ..... EXCAVATION/SEGREGATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.1.4 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SEDIMENT EXCAVATION						
1 -A	SEDIMENT CONTROL DEVICES (HAY BALES, SILT FENCE...ETC)	Matl.	1.00	LOT	1,000.00	1,000	
		Labor	40	L	17.65	706	1,706
2 -A	EXCAVATE SEDIMENT	Matl.	60.00	CY	17.60	1,056	
		Labor	24	OP	25.25	606	1,662
3 -A	LOAD, HAUL, AND DUMP ON SITE TO ALLOW TO DRY AND WILL BE INCLUDED IN SOIL GOING TO EMWMF.	Matl.	60.00	CY	11.00	660	
		Labor	8	OP	25.25	202	862
-A	SPOTTERS AND LABORERS	Matl.	1.00	LOT	0.00	0	
		Labor	24	L	17.65	424	424
5 -A	VERIFICATION SAMPLING/ANALYSIS	Matl.	1.00	LOT	2,500.00	2,500	
		Labor	16	L	17.65	282	2,782
6 -A	INSTALL RIP-RAP IN STREAM BED	Matl.	60.00	CY	17.35	1,041	
		Labor	15	OP	25.25	379	1,420
7 -A	SPOTTERS AND LABORERS	Matl.	1.00	LOT	0.00	0	
		Labor	15	L	17.65	265	265
8 -A	REMOVE SEDIMENT CONTROL DEVICES	Matl.	1.00	LOT	0.00	0	
		Labor	20	L	17.65	353	353
9 -A	GRADE AND SEED CLEARED AREA	Matl.	1.00	LOT	200.00	200	
		Labor	24	L	17.65	424	624
	SITE EXCAVATION/SEGREGATION						
10 -A	EXCAVATE SURFACE SOIL, SEDIMENT AND DEBRIS	Matl.	22,600.00	CY	1.25	28,250	
		Labor	994	OP	25.25	25,099	53,349
11 -A	SEGREGATE DEBRIS	Matl.	6,100.00	CY	0.25	1,525	
		Labor	610	OP	25.25	15,403	16,928

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
12 -A	VERIFICATION SAMPLING/ANALYSIS	Matl.	35.00	EACH	1,500.00	52,500	
		Labor	70	L	17.65	1,236	53,736
13 -A	BACKFILL WITH TOPSOIL (INCLUDES LOADING, HAULING 10 MILES, AND PLACEMENT W/ COMPACTION)	Matl.	16,500.00	CY	11.32	186,780	
		Labor	5,115	OP	25.25	129,154	315,934
14 -A	SEED AND STRAW	Matl.	435.60	MSF	32.70	14,244	
		Labor	131	L	17.65	2,312	16,556
****	SUBTOTAL ****	Matl.				289,756	
		Labor	7,106			176,845	466,601
	SPECIAL REQUIREMENTS						
15 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	100.00	DAYS	11.65	1,165	
		Labor	800	L	17.65	14,120	15,285
16 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	100.00	DAYS	200.00	20,000	
		Labor	0		0.00	0	20,000
17 -A	PPE ALLOWANCE	Matl.	100.00	DAYS	75.00	7,500	
		Labor	600	L	17.65	10,590	18,0[illegible]
18 -A	SPOTTER FOR OPERATORS	Matl.	100.00	DAYS	0.00	0	
		Labor	800	L	17.65	14,120	14,120
19 -A	HEALTH AND SAFETY OFFICER	Matl.	100.00	DAYS	0.00	0	
		Labor	800	X	50.00	40,000	40,000
20 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	7,106.00	HRS	1.00	7,106	
		Labor	355	OP	25.25	8,964	16,070
21 -A	LABOR FACTOR	Matl.	7,106.00	HRS	0.00	0	
		Labor	1,421	OP	25.25	35,880	35,880

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		325,527		300,519	626,046
SALES TAX		27,670			27,670
SUBTOTAL		353,197		300,519	653,716
TOTAL INDIRECT	20.00%	70,639	20.00%	60,104	130,743
TOTAL		423,836	(hrs. 11,882)	360,623	784,459

WBS ..... 3.0.1.04 TREATMENT
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.4 TREATMENT
Discipline ..... O OTHER
B/M Title ..... TREATMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.5 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TREATMENT						
1 -A	MANUAL DEBRIS WASHING (INCLUDES MOBILIZATION/DEMOBILIZATION, HANDLING, SITE PREPERATION...ETC.)	Matl.	3,050.00	CY	75.00	228,750	
		Labor	6,100	L	17.65	107,665	336,415
2 -C	AUTOMATIC DEBRIS WASHING (INCLUDES MOBILIZATION/DEMOBILIZATION, STUDIES, SITE PREPERATION...ETC.)	Matl.	3,050.00	CY	655.00	1,997,750	
		Labor	0		0.00	0	1,997,750
3 -C	THERMAL DESORPTION SOIL TREATMENT (INCLUDES MOBILIZATION/DEMOBILIZATION, SITE PREPREATION...ETC.)	Matl.	22,275.00	TONS	150.00	3,341,250	
		Labor	0		0.00	0	3,341,2

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		5,567,750		107,665	5,675,415
SALES TAX		19,444			19,444
SUBTOTAL		5,587,194		107,665	5,694,859
TOTAL INDIRECT	20.00%	1,117,439	20.00%	21,533	1,138,972
TOTAL		6,704,633	(hrs. 6,100)	129,198	6,833,831

WBS ..... 3.0.1.05 PACKAGING/LOADING/TRANSPORTING
Code ..... 6100 REMEDIAL ACTION
cipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.5 PACKAGING/LOADING/TRANSPORTING
Discipline ..... O OTHER
B/M Title ..... PACKAGING/LOADING/TRANSPORTING
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.6 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PACKAGING/LOADING/TRANSPORTING						
1 -A	MODIFICATION OF TRUCK BED FOR CONTAINMENT OF MATERIALS WHILE ON THE ROAD	Matl.	20.00	EACH	2,000.00	40,000	
		Labor	0		0.00	0	40,000
	LOAD AND HAUL (12 CY DUMP TRUCK 60 MILE ROUND TRIP)						
2 -A	LOAD DEBRIS AFTER DECON	Matl.	6,100.00	CY	0.60	3,660	
		Labor	92	OP	25.25	2,323	5,983
-A	HAUL DEBRIS TO Y-12 LANDFILL	Matl.	6,100.00	CY	26.80	163,480	
		Labor	3,050	TD	18.20	55,510	218,990
4 -A	LOAD SURFACE SOIL AND SEDIMENT	Matl.	16,500.00	CY	0.32	5,280	
		Labor	149	OP	25.25	3,762	9,042
5 -A	HAUL SURFACE SOIL AND SEDIMENT TO EMWMF	Matl.	16,500.00	CY	13.40	221,100	
		Labor	4,125	TD	18.20	75,075	296,175
****	SUBTOTAL ****	Matl.				433,520	
		Labor	7,416			136,670	570,190
	SPECIAL REQUIREMENTS						
6 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	120.00	DAYS	11.65	1,398	
		Labor	960	L	17.65	16,944	18,342
7 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	120.00	DAYS	200.00	24,000	
		Labor	0		0.00	0	24,000
8 -A	SPOTTER FOR OPERATORS	Matl.	120.00	DAYS	0.00	0	
		Labor	960	L	17.65	16,944	16,944
9 -A	PPE ALLOWANCE	Matl.	120.00	DAYS	75.00	9,000	
		Labor	0		0.00	0	9,000

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
10 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	7,416.00	HRS	1.00	7,416	
		Labor	371	L	17.65	6,548	13,964
11 -A	LABOR FACTOR	Matl.	7,416.00	HRS	0.00	0	
		Labor	1,483	L	17.65	26,175	26,175

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		475,334		203,281	678,615
SALES TAX		40,403			40,403
SUBTOTAL		515,737		203,281	719,018
TOTAL INDIRECT	20.00%	103,147	20.00%	40,656	143,803
TOTAL		618,884	(hrs. 11,190)	243,937	862,821

WBS ..... 3.0.1.06 WAC REQUIRED ACTIONS
Code ..... 6100 REMEDIAL ACTION
.icipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.6 WAC REQUIRED ACTIONS
Discipline ..... O OTHER
B/M Title ..... WAC REQUIRED ACTIONS
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.7 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	WAC REQUIRED ACTION						
1 -A	SAMPLING OF TRUCK LOAD (1 SAMPLE FOR EVERY 10 TRUCK LOADS)	Matl.	165.00	EACH	1,500.00	247,500	
		Labor	330	L	17.65	5,825	253,325
2 -A	DISPOSAL FEE AT EMWMF	Matl.	16,500.00	CY	0.00	0	
		Labor	0		0.00	0	0
****	SUBTOTAL ****	Matl.				247,500	
		Labor	330			5,825	253,325
	SPECIAL REQUIREMENTS						
3 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	210.00	DAYS	200.00	42,000	
		Labor	0		0.00	0	42,000
4 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	3,311.00	HRS	1.00	3,311	
		Labor	166	OP	25.25	4,192	7,503

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		292,811		10,017	302,828
SALES TAX		24,889			24,889
SUBTOTAL		317,700		10,017	327,717
TOTAL INDIRECT	20.00%	63,540	20.00%	2,003	65,543
TOTAL		381,240	(hrs. 496)	12,020	393,260

WBS ..... 3.0.1.08 DECON/DEMOBILIZATION
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.8 DECON/DEMOBILIZATION
Discipline ..... O OTHER
B/M Title ..... DECON/DEMOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.8 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	DECON/DEMOBILIZATION						
1 -A	DECON EQUIPMENT	Matl.	26.00	EACH	250.00	6,500	
		Labor	624	L	17.65	11,014	17,514
2 -A	DECON TEMPORARY FACILITIES	Matl.	1.00	LOT	2,000.00	2,000	
		Labor	240	L	17.65	4,236	6,236
3 -A	DEMOBILIZATION (REMOVAL OF TRAILERS AND EQUIPMENT)	Matl.	1.00	LOT	500.00	500	
		Labor	120	TD	18.20	2,184	2,684

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		9,000		17,434	26,434
SALES TAX		765			765
SUBTOTAL		9,765		17,434	27,199
TOTAL INDIRECT	20.00%	1,953	20.00%	3,487	5,440
TOTAL		11,718	(hrs. 984)	20,921	32,639

WBS ..... 3.0.1.09 SECONDARY WASTE DISPOSAL
r ` Code ..... 6100 REMEDIAL ACTION
cipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.1.9 SECONDARY WASTE DISPOSAL
Discipline ..... O OTHER
B/M Title ..... SECONDARY WASTE DISPOSAL
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.9 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SECONDARY WASTE DISPOSAL						
1 -A	DECON WATER ALLOWANCE (ASSUME TREATMENT AT Y-12 WITH TRANPORTATION INCLUDED)	Matl.	15,000.00	GALS	11.00	165,000	
		Labor	83	TD	18.20	1,511	166,511
2 -A	DISPOSAL OF PPE AND OTHER NONE LIQUID ALLOWANCE	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	8	TD	18.20	146	10,146

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		175,000		1,657	176,657
SALES TAX		14,875			14,875
SUBTOTAL		189,875		1,657	191,532
TOTAL INDIRECT	20.00%	37,975	20.00%	331	38,306
TOTAL		227,850	(hrs. 91)	1,988	229,838

WBS ..... 3.0.2.01 PROJECT MANAGEMENT
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.4 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	DESIGN MANAGER (1/8 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	513	ER	78.96	40,506	40,506

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	40,506	40,506
TOTAL	0	(hrs. 513) 40,506	40,5

WBS ..... 3.0.2.01 PROJECT MANAGEMENT
r Code ..... 9200 PROGRAM MANAGEMENT
cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.2 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	TECHNICAL MANAGER (1/4 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	999	A1	60.03	59,970	59,970
2 -A	ESTIMATING & SCHEDULE SUPPORT (1/10 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	405	A1	60.03	24,312	24,312
3 -A	HEALTH & SAFETY COORDINATOR (1/10 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	405	A1	60.03	24,312	24,312
4 -A	FINANCE OFFICER & BUSINESS ANALYST (3/4 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	2,970	A1	60.03	178,289	178,289

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	286,883	286,883
TOTAL	0	(hrs. 4,779) 286,883	286,883

WBS ..... 3.0.2.01 PROJECT MANAGEMENT
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... K026 ENVIRONMENTAL MGMT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	ENVIRONMENTAL PROJECT MANAGER (1/2 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	1,998	A1	54.82	109,530	109,530

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	109,530	109,530
TOTAL	0	(hrs. 1,998) 109,530	109,5

WBS ..... 3.0.2.01 PROJECT MANAGEMENT
r Code ..... 9200 PROGRAM MANAGEMENT
cipant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.3 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	WASTE MANAGEMENT (1/8 FTE FOR 27 MONTHS)	Matl.	27.00	MONTHS	0.00	0	
		Labor	513	A1	50.00	25,650	25,650

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	25,650	25,650
TOTAL	0	(hrs. 513) 25,650	25,650

WBS ..... 3.0.2.02 REMEDIAL DESIGN WORK PLAN
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.5 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	WRITE THE PLAN (1-1/2 FTE FOR 2 MONTHS)	Matl.	2.00	MONTHS	0.00	0	
		Labor	440	ER	78.96	34,742	34,742

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	34,742	34,742
TOTAL	0	(hrs. 440) 34,742	34,7

WBS ..... 3.0.2.02 REMEDIAL DESIGN WORK PLAN
Code ..... 5100 TITLE I & II ENG
.cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.7 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	OVERSIGHT AND REVIEW OF PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	120	A1	60.03	7,204	7,204

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	7,204	7,204
TOTAL	0	(hrs. 120) 7,204	7,204

WBS ..... 3.0.2.02 REMEDIAL DESIGN WORK PLAN
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.6 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	TECHNICAL SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,4

WBS ..... 3.0.2.02 REMEDIAL DESIGN WORK PLAN
Code ..... 5100 TITLE I & II ENG
,cipant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.8 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	REVIEW AND SUPPORT TO PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

WBS ..... 3.0.2.03 REMEDIAL DESIGN REPORT
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.9 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REMEDIAL DESIGN (4 FTE FOR 9 MONTHS)	Matl.	9.00	MONTHS	0.00	0	
		Labor	5,283	ER	78.96	417,146	417,146

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	417,146	417,146
TOTAL	0	(hrs. 5,283) 417,146	417,

WBS ..... 3.0.2.03 REMEDIAL DESIGN REPORT
r Code ..... 5100 TITLE I & II ENG
cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.10 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	OVERSIGHT AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	520	A1	60.03	31,216	31,216

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	31,216	31,216
TOTAL	0	(hrs. 520) 31,216	31,216

WBS ..... 3.0.2.03 REMEDIAL DESIGN REPORT
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.11 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REVIEW AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	320	A1	50.00	16,000	16,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	16,000	16,000
TOTAL	0	(hrs. 320) 16,000	16,0

WBS ..... 3.0.2.03 REMEDIAL DESIGN REPORT
r Code ..... 5100 TITLE I & II ENG
cipant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.12 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	TECHNICAL SUPPORT FOR REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	260	TS	60.89	15,831	15,831

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	15,831	15,831
TOTAL	0	(hrs. 260) 15,831	15,831

WBS ..... 3.0.2.04 REMEDIAL ACTION WORK PLAN
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.14 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	ER	78.96	3,158	3,158

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	3,158	3,158
TOTAL	0	(hrs. 40) 3,158	3,158

WBS ..... 3.0.2.04 REMEDIAL ACTION WORK PLAN
Code ..... 9470 CONSTRUCTION SUPPORT
cipant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.13 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	PREPARE PLAN (1-1/2 FTE FOR 4 MONTHS)	Matl.	3.00	MONTHS	0.00	0	
		Labor	660	MX	69.00	45,540	45,540

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	45,540	45,540
TOTAL	0	(hrs. 660) 45,540	45,540

WBS ..... 3.0.2.04 REMEDIAL ACTION WORK PLAN
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.16 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	TECHNICAL SUPPORT AND REVIEW	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,

WBS ..... 3.0.2.04 REMEDIAL ACTION WORK PLAN
Code ..... 9470 CONSTRUCTION SUPPORT
cipant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.15 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPOT	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

WBS ..... 3.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.19 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	GENERAL CONSTRUCTION OVERSIGHT (1/5 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	390	A1	60.03	23,412	23,412

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	23,412	23,412
TOTAL	0	(hrs. 390) 23,412	23,4

WBS ..... 3.0.2.05 REMEDIAL ACTION INTEGRATION
Code ..... 9470 CONSTRUCTION SUPPORT
,cipant ..... MK66 MK-F INDIRECTS & FEE
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.18 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -C	MK-FERGUSON INDIRECTS AND FEE @ 15.7%	Matl.	9,865.00	K$	157.00	1,548,805	
		Labor	0		0.00	0	1,548,805

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL INDIRECT	1,548,805	0	1,548,805
TOTAL	1,548,805	(hrs. 0) 0	1,548,805

WBS ..... 3.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.17 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	CONSTRUCTION MANAGER (1/4 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	481	MX	69.00	33,189	33,189
2 -A	CONSTRUCTION ENGINEER (1 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	1,911	MC	54.00	103,194	103,194
3 -A	PROJECT CONTROLS (1/5 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	390	MP	54.00	21,060	21,060
4 -A	PROCUREMENT SUPPORT (1 FTE FOR 2 MONTHS)	Matl.	2.00	MONTHS	0.00	0	
		Labor	294	MB	57.00	16,758	16,758
5 -A	SAFETY OVERSIGHT (1/5 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	390	MH	55.00	21,450	21,450
6 -A	HP & IH OVERSIGHT (1/5 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	390	MJ	55.00	21,450	21,450
7 -A	VEHICLE USAGE	Matl.	2,200.00	HRS	1.75	3,850	
		Labor	0		0.00	0	3,850

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	3,850	217,101	220,951
TOTAL	3,850	(hrs. 3,856) 217,101	220,951

WBS ..... 3.0.2.05 REMEDIAL ACTION INTEGRATION
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.20 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	TECHNICAL SUPPORT DURING CONSTRUCTION FOR DOE (1/5 FTE FOR 13 MONTHS)	Matl.	13.00	MONTHS	0.00	0	
		Labor	390	TS	60.89	23,747	23,747
2 -A	INDEPENDENT VERIFICATION (ALLOWANCE)	Matl.	13.00	MONTHS	5,000.00	65,000	
		Labor	312	TS	60.89	18,998	83,998

BILL OF MATERIAL SUMMARY	Material	Labor		Total Cost M + L
TOTAL DIRECT	65,000		42,745	107,7
TOTAL	65,000	(hrs. 702)	42,745	107,745

WBS ..... 3.0.3.01 SITE MAINTENANCE
r Code ..... 7100 SURVEILLANCE & MAINTENANCE
. cipant ..... SC01 OFFSITE SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 3.0.3.1 SITE MAINTENANCE
Discipline ..... O OTHER
B/M Title ..... SITE MAINTENANCE
Receiving Site .... OTHER
Cross-Cut Code .... 01-03-09 RA/S & M/S & M
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT3\ALT-3.Est 10-01-96 4:05p

Building/Area ..... SITE
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLLING
Quantity Take-Off By ... DHB
Trace Number ..... O.3.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE MAINTENANCE						
1 -A	MOWING OF SITE 4 TIMES PER YEAR FOR 5 YEARS	Matl.	20.00	EACH	200.00	4,000	
		Labor	480	L	0.00	0	4,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	4,000	0	4,000
TOTAL	4,000	(hrs. 480) 0	4,000

Total Labor Hours: 59,245

Disciplines
O: OTHER

COST SUMMARY

COST SUMMARY	Material	Labor	Total Cost M + L
Line Item Cost	7,098,481	2,156,023	9,254,504
Total Sales Tax	142,671		142,671
SUBTOTAL	7,241,152	2,156,023	9,397,175
Total Indirect	2,980,834	166,087	3,146,921
SUBTOTAL	10,221,986	2,322,110	12,544,096
Overhead	0	0	0
SUBTOTAL	10,221,986	2,322,110	12,544,096
Contingency	3,577,695	812,739	4,390,434
SUBTOTAL	13,799,681	3,134,849	16,934,530
Market Adjustment			0
TOTAL			16,934,5[illegible]

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*N I S T  B L C C - D E T A I L E D  L C C  A N A L Y S I S (version 4.20-95)*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

                PART I - INITIAL ASSUMPTIONS AND COST DATA
-- ------------------------------------------------------------------------

          Project alternative: DWI ALT3
          Run date: 10-02-1996 17:08:36
          Run type: Federal Analysis--Projects Subject to OMB A-94
          Comment: $1=$1000
          Input data file: DWIALT3.DAT, last modified: 10-02-1996/17:01:52
          LCC output file: DWIALT3.LCC, created: 10-02-1996/17:01:55
          Base Date of Study:  OCT 1996
          Service Date:        OCT 2003
          Study period:        12.00 years (OCT 1996 through SEP 2008)
          Plan/constr. period:  7.00 years (OCT 1996 through SEP 2003)
          Service Period:       5.00 years (OCT 2003 through SEP 2008)
          Discount rate:        7.0%  Real (exclusive of general inflation)
          End-of-year discounting convention


              INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
        (ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)
------------------------------------------------------------------------------

                        YEAR
                    (Beginning) Cost Phasing    Yearly Cost      Total Cost
                    ----------- ------------    -------------    -------------
                      OCT 2001       4.6%           $922
                      OCT 2002      44.0%         $8,893
                      OCT 2003      51.5%        $10,414
      AT SERVICE DATE: OCT 2004       0.0%            $0
        TOTAL INITIAL CAPITAL ASSET COSTS                            $20,230


* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

                PART II  -  LIFE-CYCLE COST ANALYSIS
            Discount Rate =  7.0% Real (exclusive of general inflation)
------------------------------------------------------------------------------
  PROJECT ALTERNATIVE: DWI ALT3                RUN DATE: 10-02-1996/17:08:36

                                          PRESENT VALUE     ANNUAL VALUE
                                          (1997 DOLLARS)    (1997 DOLLARS)
                                          --------------    --------------

  CASH REQUIREMENTS AS OF SERVICE DATE:
     DURING CONSTRUCTION                       $13,984           $1,761
     AT SERVICE DATE                               $0               $0
                                            ------------      ------------
      SUBTOTAL                                 $13,984           $1,761

  OPERATING, MAINTENANCE & REPAIR COSTS:
     NON-ANNUALLY RECURRING COSTS                  $3               $0
                                            ------------      ------------
      SUBTOTAL                                     $3               $0

  RESALE VALUE OF ORIG CAPITAL COMPONENTS          $0               $0

  RESALE VALUE OF CAPITAL REPLACEMENTS             $0               $0

  TOTAL LIFE-CYCLE PROJECT COST                $13,987           $1,761

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

3. COST ESTIMATE—ALTERNATIVE 4

3.1 INTRODUCTION

This chapter provides the basis for the cost estimate, summary cost information, assumptions used in developing the estimate, estimate details and material pricing data used in developing the cost estimate.

3.1.1 Description of Alternative 4

Alternative 4 includes excavation and treatment of debris, soil, and sediment. Manual and automated cleaning processes would remove surface contamination from the debris. Decontaminated debris would be transported to a metal salvage facility for recycling or a sanitary landfill for disposal, depending on the material. Soil (excavated 12-in. deep) and sediment and some debris would be staged and shipped to an off-site vitrification plan. The vitrified waste would then be transported to a sanitary landfill for disposal.

Future contamination of surface water and groundwater would cease upon removal of the contaminated materials, thereby reducing the risks to off-site receptors. This alternative is designed for a future residential land use scenario.

3.1.2 Summary Cost Data

Table G.11 summarizes the cost estimate for this alternative. It consists of a project summary report at the third and fourth level WBS. All amounts have been rounded to the nearest $1,000. Additional summaries and details of these costs are included in Section 4.5.

3.1.3 Project Summary WBS

DWI—ALTERNATIVE 4

4.0 Project Cost

4.0.1 Direct Project Cost
- 4.0.1.1 Temporary Facilities/Mobilization
- 4.0.1.2 Site Preparation
- 4.0.1.3 Excavation/Segregation
- 4.0.1.4 Treatment Debris Washing
- 4.0.1.5 Treatment Vitrification
- 4.0.1.6 Loading/Transporting PRE/POST Vitrified Material

4.0.1.7 Loading/Transporting Washed Debris
4.0.1.8 WAC Required Actions/Disposal
4.0.1.9 Monitoring Wells Installation
4.0.1.10 Decon/Demobilization
4.0.1.11 Secondary Waste Disposal

4.0.2 Indirect Project Cost
4.0.2.1 Project Management
4.0.2.2 Remedial Design Work Plan
4.0.2.3 Remedial Design Report
4.0.2.4 Remedial Action Work Plan
4.0.2.5 Remedial Action Integration

4.0.3 Monitoring & Maintenance
4.0.3.1 Site Maintenance
4.0.3.2 Surface Water Monitoring
4.0.3.3 Groundwater Monitoring

3.1.4 Project Schedule

The project schedule is based on extrapolations from other projects having similar scope and participation. The schedule and appropriate application of escalation form the basis for obtaining escalated cost and the FY summary cost information. The assumed schedule for this alternative is shown in Figure G.3.

3.2 BASIS FOR COST ESTIMATE

3.2.1 Engineering Estimate

The engineering cost estimate consists of Titles I, II and III engineering. Titles I and II engineering includes all of the design activities required to issue a CFC work package. Title III engineering includes those engineering-related activities necessary to ensure that the remedial activities conform to Title I and II design drawings and specifications. Computer costs, reproduction costs, travel costs, and material costs are also included in the estimates. Project management has been factored into the estimate to include Title I and II reports; schedule development and maintenance; cost reporting; progress reporting; contract administration; staffing; project review; meetings; project direction and guidance by the project manager, project engineer, program director, and task engineer/coordinator.

Title I, II, and III engineering costs are estimated based on the appropriate level of effort necessary for this particular project.

3.2.2 Construction Estimate

3.2.2.1 Material and labor pricing

The cost estimate was based on the preliminary BMs developed for each fixed price contractor activity as envisioned to accomplish the desired results and assumptions as detailed under Section 3.3, "Alternative Specific Assumptions." Each activity was then estimated as to the material cost and labor cost. Labor crafts that will perform the tasks were identified and the appropriate wage rates were applied. Material and labor pricing was based on vendor quotes, recent similar job history, and nationally recognized publications such as *R.S. Means Construction Cost Data* and *Richardson's Construction Estimating Standards*. Special equipment and/or special facilities cost were obtained either by vendor contact or data from similar projects.

The basic estimating units used generally reflect a normal standard for construction cost. Many special work situations and job conditions can cause additional material and/or labor work hours to be required. These additional cost considerations have been identified and included in the estimate. Some of these additional considerations are: health physics, industrial hygiene, worker productivity, safety requirements, site congestion, worker protection, supporting items, small tools, and cleanup.

3.2.2.2 Wage rates

Wage rates for construction labor are those current as of February 1996 for the Oak Ridge area and are as contained in the AES Standard Value File ERFEB96A.val. These rates are effective for an hour of productive work and are given below:

Code	Craft	Fixed rate
C	Carpenter	$25.80
E	Electrician	$25.95
L	Laborer	$17.65
OP	Operating engineer	$25.25
PF	Pipefitter	$26.20
TD	Truck driver	$18.20

Fixed-price construction labor rates are based on average crew sizes with necessary foremen, general foremen, etc. All fringe benefits, payroll taxes, and workmen's compensation insurance are included.

3.2.2.3 Indirect markups

The indirect markups for construction are taken from the *U.S. Department of Energy Oak Ridge Field Office, Estimating and Cost Control Manual for Construction Projects*.

The indirect markups for fixed price construction used in the estimate have been applied according to the guidelines provided by ORO for use in Oak Ridge, Tennessee. Those markups are:

Overhead (applied to labor and material)	10 percent
Profit (applied to labor and material)	8 percent
Bond (applied to labor and material)	1 percent
General Contractor's markup for work performed by his subcontractors (applied to labor and material)	5 percent
Sales Tax (applied to material)	8.25 percent

For the fixed-price general contractor, these markups compound and appear in estimates as totals; indirect 20 percent and tax 8.25 percent. For subcontractors the markups appear as totals; indirect 26 percent and tax 8.25 percent.

MK-Ferguson will award, administer, and manage all construction contracts required for this project. MK-Ferguson also direct charges certain activities such as health physics, health and safety, subcontract administration, construction superintendent, project controls, QA, etc. as dictated by the needs of the project. These costs are estimated based on the appropriate level of effort necessary for this particular project.

3.2.3 Energy Systems Site Overhead

3.2.3.1 Energy Systems labor

An Energy Systems site overhead is generally applied to all Energy Systems labor. This overhead recovers costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

3.2.3.2 Energy Systems materials

An Energy Systems site overhead is applied to the first $20,000 of any purchased materials. This overhead recovers the costs associated with administration, facilities maintenance, plant services, corporate and central services, and general expenses. This project is off site and no overhead is included.

3.2.3.3 Energy Systems and DOE contractors

An off-site subcontract overhead is applied to the total cost of all DOE prime contracts and subcontracts to MK-Ferguson or Energy Systems. This includes MK-Ferguson fixed-price subcontracts. However, the TS contractor and the remedial design architect and engineer are exempted from this subcontract overhead. This overhead is an apportionment of the cost of plant services, purchasing, facilities maintenance, administration, etc. This project is off site and no overhead is included.

3.2.4 Project Management/Liaison

Project management spans all facets of the project and its administration. Project management includes those activities necessary to support the project such as: project manager and project engineer, project reviews and reporting, project coordination and planning, systems engineering, and scheduling, Design and project liaison includes those activities necessary to support the Title I and II design activities, such as: architect and engineer design coordination and reviews and architect and engineer estimate reviews. Other costs, such as travel, reproduction, and other miscellaneous materials, are also included. These estimates were based on knowledge acquired from similar projects and were adjusted to reflect current environmental and health, and safety requirements as they relate to this project.

3.2.5 Escalation

The estimate has been escalated using the DOE-approved annual rates issued. The estimate is based on FY 1996 third quarter costs and then escalated over the period of activity as determined by the project schedule.

The approved escalation rates are 2.8 percent for FY 1996, 2.8 percent for FY 1997, 2.7 percent for FY 1998, 2.9 percent for FY 1999, 3.0 percent for FY 2000, 3.1 percent for FY 2001, 3.2 percent for FY 2002, and 0.0 percent thereafter.

3.2.6 Contingency

According to DOE Order 4700.1, contingency is defined as the sum of funds included within an estimate to cover materials, labor, conditions, and risk situations, which are an intrinsic part of the presently intended scope of work but are not specifically allowed for elsewhere in the estimate due to uncertainty either as to their existence, nature, likelihood of occurrence, or magnitude of effect.

Contingency cost has been included in this project to cover costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties within the defined scope. A 35 percent contingency has been applied to this estimate due to the incompleteness of design at the FS stage and the complexity of the action.

3.3 ALTERNATIVE-SPECIFIC ASSUMPTIONS

In the development of this alternative, various overall site conditions and operating parameters remained unknown. The following assumptions were developed to address these unknowns:

3.3.1 General Assumptions

- FPSCs will perform all remedial activities, which will include the temporary facilities, site preparation, excavation, segregation, treatment, loading, transporting, WAC required actions, decontamination and demobilization.

- MK-Ferguson will provide overall construction management services, which includes administration and management of all fixed price subcontracts.

- All remedial work on the site will be conducted under HAZWOPER requirements.

- The estimate is based on an 8-hour work day and 5-day work week for all remedial activities.

- Level D PPE will be required for 100 percent for the remedial activities. The cost of the Level D PPE is estimated at $75/day.

- A 20 percent productivity factor has been included to account for workers preforming in Level-D PPE.

- Training and medical requirements, including yearly updates, have been included for all on-site workers.

- The fixed price contractor will have one health and safety engineer for the duration of project.

- The off-site salvage vendor for the recyclable materials will provide the necessary equipment to load and transport salvageable material off site at no cost to the project. No salvage value will be recovered from the off-site vendor.

3.3.2 WBS-Specific Assumptions

The following assumptions were developed for each WBS. They represent a step-by-step procedure for conducting remedial activities.

3.3.3 Direct Cost

3.3.3.1 Temporary facilities/mobilization

- The contractor will install/construct on site the construction office trailer; shower/change trailer; decontamination pad; and staging area including utilities.

- Costs are included for general conditions, including a utilities allowance for the office trailer, full-time superintendent, survey crews, required documents, and equipment mobilization.

- The decontamination pad for equipment will also serve as manual debris washing pad.

- A 10,000 ft^2 gravel area with concrete pads will be prepared for the automated debris decontamination equipment.

- Electric power and water will be connected for the operation of automated debris decontamination equipment.

3.3.3.2 Site preparation

- The area to be used for temporary facilities will be graded to remove surface contamination before set-up of temporary facilities.

- Large surface debris (i.e., nonoperable equipment and truck beds) with salvage value will be cleaned and removed from site.

- Existing structures will remain as they are.

- The existing trees will be cut and felled onto plastic to prevent contact with contaminated soil and then sized and hauled to a landfill.

- Standing brush will also be harvested in a manner to prevent contact with contaminated site soils. The uncontaminated brush will be bundled to facilitate handling and transportation off site for disposal in a sanitary landfill.

- After loading trees and brush into intermodal containers, the intermodal container transporting vendor will haul the treated material to the Y-12 Plant landfill. The transportation vendor price includes container rental, truck driver hours, and mobilization/demobilization.

- Temporary surface water controls shall be installed by the contractor (allowed 1,500 lin ft of diversion ditches and 2,400 lin ft of silt fence and hay bales).

- The contractor will furnish and install 800 lin ft of chain link fence around the temporary facilities.

- An allowance of $10,000 and 60 electrician hours have been allowed for monitors for detection of airborne particulate.

3.3.3.3 Excavation/segregation

- Sediment will be staged on site for incorporation with the soil for off-site treatment.

- An allowance of $2,500 and 16 hours is included for verification sampling after sediment is removed.

- Only 60 yd^3 of sediment will be required to be removed to lower the risk to acceptable limits.

- Riprap will be installed in the stream bed to replace the removed sediment.

- The on-site soil will be excavated to an average 12-in. depth for the entire site. Large clumps of soil adhered to debris during excavation will be physically removed from the debris and left in place for excavation and remedial action with other contaminated soil from the site.

- Surface and excavated debris will be handled during the excavation operation and staged for either manual or automatic decontamination.

- The volume of material to be vitrified will be 16,133 yd^3 of soil and sediment and 1,364 yd^3 of fine debris.

- The volume of debris to be decontaminated (automatic) will be 3,228 yd^3 of metal, 1,098 yd^3 of nonmetal, and 48 yd^3 of stumps with roots, for a total of 4,374 yd^3.

- The volume of debris to be decontaminated (manual) will be 381 yd^3 of metal.

- An allowance of $52,500 and 70-man hours is included for verification sampling after site is excavated.

- The area where contaminated material has been removed shall be backfilled and seeded.

- The backfilled material (top soil) will be taken from a borrow area within 8 km (5 miles) of site.

- Dust control shall be required (water truck).

3.3.3.4 Automated debris washing

- Automated debris treatment (cleaning process) for surface/subsurface debris will accommodate debris from 1-in.-diameter up to 7 × 7 × 14 ft.

- Phase 1 will involve the vendor performing an on-site treatability study, including bench/pilot scale operations. A temporary facility will be erected for the study.

- Phase 2 will involve the vendor mobilizing his own treatment trailers and equipment.

- Phase 3 will involve full operations, represented by a vendor supplied weekly rate, including job site personnel, home office administration, and technical support. The debris are to be washed and dried by the vendor.

- Phase 4 will involve demobilization, including decontamination of equipment and neutralizing of the process water.

- Manual debris treatment will be performed on the larger debris that may be too cumbersome for the automated system. After screening for rad and visual inspection of the estimated 17,000 ft^2 of surface area will be decontaminated by wiping, scraping, brushing, or possibly sand blasting. Hydrocarbons will be removed by using solvent wipes.

3.3.3.5 Vitrification

- The vitrification plant will be located at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky, which is currently under construction. Vortec Corporation is under contract by DOE to design, construct, and operate the plant that will process, at 36 tons per day, LLW, PCB-contaminated, and mixed waste contaminated soils.

- An allowance of $500,000 is included in the estimate, per Vortec's quote, to modify the process to incorporate an oxygen enrichment feature, which will double the processing of as-received wet soil feed through-put to 72-tons/day.

- Vitrification of the Paducah waste stream is estimated to take 2 years, starting in October 1997. It is assumed that the DWI 901 Site waste stream will have access to the Paducah facility beginning in FY 2002.

- Full operations are represented by a vendor-supplied unit price/ton based on vendor historical costs.

3.3.3.6 Loading/transporting of pre/postvitrified material

- Intermodal containers will be used to haul sediment, soil, and debris from the DWI 901 Site to the Paducah plant and, after vitrification, from Paducah to the Y-12 Plant landfill in Oak Ridge. The transportation vendor price includes container rental, liners, truck driver hours, and mobilization/demobilization.

3.3.3.7 Loading/transporting of decontaminated debris

- After loading material into intermodal containers, the intermodal container transporting vendor will haul the treated material from the DWI 901 Site to the Y-12 Plant landfill. The transportation vendor price includes container rental, truck driver hours, and mobilization/demobilization.

3.3.3.8 WAC-required actions/disposal

- Sampling hours and analysis cost for containers going to the Y-12 Plant landfill and to salvage were estimated to be two sampling hours and $1,500 analysis cost per container.

3.3.3.9 Decontamination/demobilization

- An allowance has been included for decontamination of equipment, temporary facilities, and demobilization of trailers and equipment.

3.3.3.10 Secondary waste disposal

- Secondary liquid waste from subcontractor and vendor treatment activities (i.e., spent treatment solution, ion exchange resin, and carbon filter media solution) is estimated to be 12,500 gal and will be shipped to the Y-12 Plant Evaporator Treatment Facility.

- Secondary solid waste from vendor treatment activities (i.e., filter cartridges and PPE will be containerized and shipped to Envirocare.

- An allowance of $10,000 is included for disposal of subcontractor PPE.

3.3.3.11 Site maintenance

- Site maintenance includes mowing four times per year for 5 years.

3.4 COST SENSITIVITY ANALYSIS

In accordance with the EPA guidance for conducting RIs and FSs under CERCLA, a cost sensitivity analysis for specific assumptions associated with the project implementation has been preformed. The below listed assumptions were found to be the cost sensitivity.

- Quantity of contaminated material to be disposed at EMWMF.
- PPE requirements (respirator)
- Project schedule
- Groundwater treatment
- Groundwater and surface water monitoring
- Energy Systems overhead
- Equipment decon requirements

3.5 ESTIMATE DETAILS

Following is a detailed breakdown of the cost estimate.

3.5.1 FY Reports

A summary of the project estimate by FY and by WBS level 3 is presented in Table G.12. Summary by FY and participant is given in Table G.13. All amounts have been rounded to the nearest $1,000.

3.5.2 Summary Reports

A summary report by WBS level 3/WBS level 4 with escalated and unescalated cost is shown in Table G.11.

A detailed summary of the estimated cost is included at the 3rd level WBS/4th level WBS/participant in Table G.14. All amounts have been rounded to the nearest $1,000.

3.5.3 Detailed Estimate Report

A detailed estimate report indicating how cost and labor hours are included at the line item level is included in Table G.15.

FIGURE G.3

PROJECT SCHEDULE

Figure G.3. DWI 901 SITE RI/FS
Alternative 4

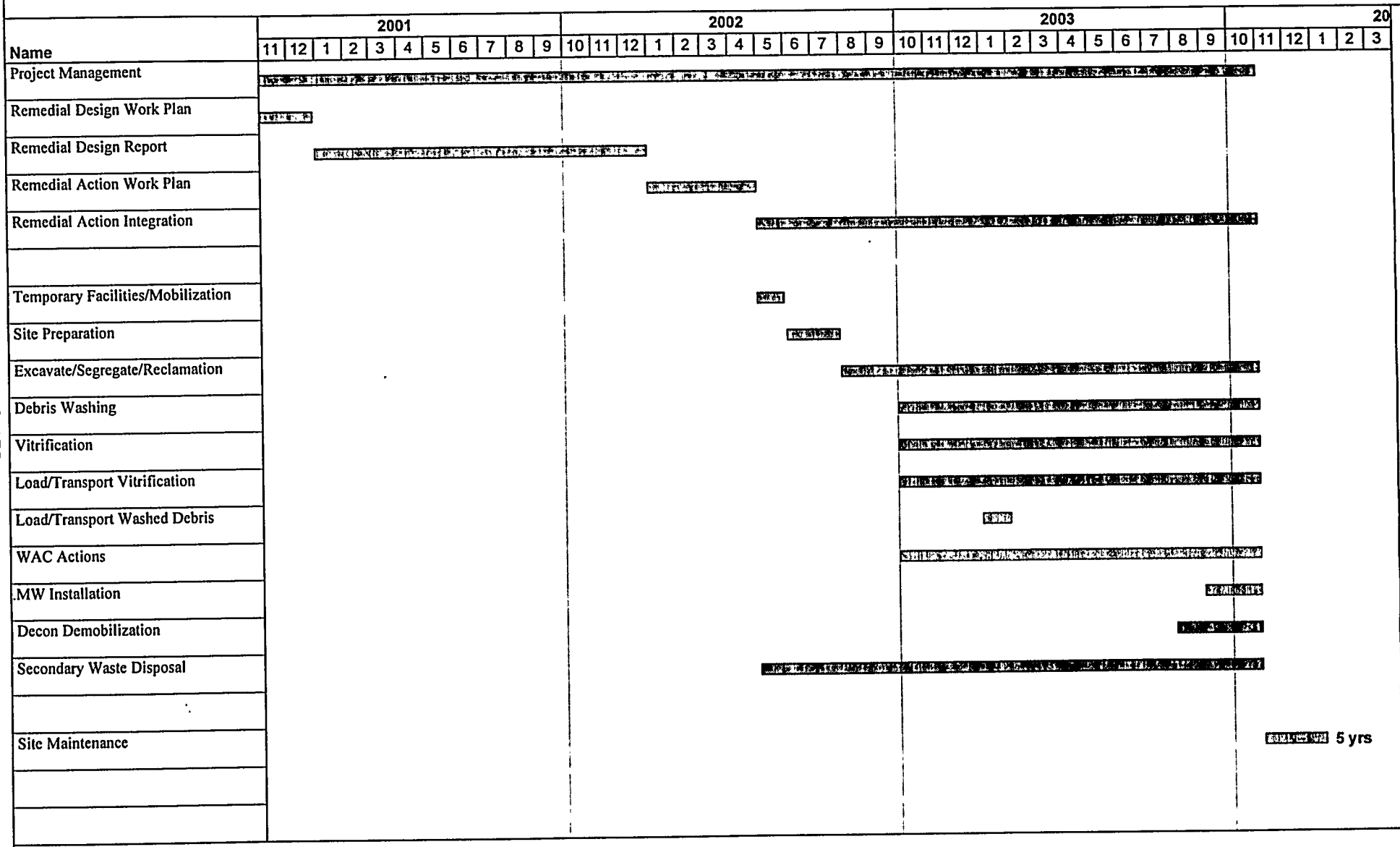


TABLE G.9

ALTERNATIVE 4,
SUMMARY REPORT

SUMMARY REPORT
Project Number: 35H83094
ALTERVATIVE 4 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3
2. WBS - Level 4
3. Participant

Approved by:

_____ _____
Project Estimator Date

_____ _____
Estimating Manager Date

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT4\ALT-4.Est 10/01/1996
SCHEDULE FILE: ALT-4
REPORT FILE: C:\AES60F\DWI\ALT4\ALT4SUN.Out 10/01/1996 16:13:46

AES Version 6.0f

ALTERVATIVE 4 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
4.0.1 Direct Project Cost						
4.0.1.01 Temporary Facilities/Mobilizat						
MK51 MK-F OAK RIDGE FPSC	147	165	312	175	196	371
TOTAL Temporary Facilities/Mobilizat	147	165	312	175	196	371
4.0.1.02 Site Preparation						
MK51 MK-F OAK RIDGE FPSC	88	154	242	106	185	291
MK53 FP UNIT SUBCONTRACT	51	0	51	62	0	62
TOTAL Site Preparation	139	154	293	168	185	353
4.0.1.03 Excavation/Segregation						
MK51 MK-F OAK RIDGE FPSC	303	471	774	363	564	927
TOTAL Excavation/Segregation	303	471	774	363	564	927
4.0.1.04 Treatment Debris wash						
MK51 MK-F OAK RIDGE FPSC	219	25	244	263	30	293
MK53 FP UNIT SUBCONTRACT	3853	0	3853	4619	0	
TOTAL Treatment Debris wash	4072	25	4097	4882	30	4912
4.0.1.05 Treatment Vitrif						
MK53 FP UNIT SUBCONTRACT	6181	0	6181	7411	0	7411
TOTAL Treatment Vitrif	6181	0	6181	7411	0	7411
4.0.1.06 Loading/Transporting Vitrif						
MK53 FP UNIT SUBCONTRACT	1283	0	1283	1539	0	1539
TOTAL Loading/Transporting Vitrif	1283	0	1283	1539	0	1539
4.0.1.07 Loading/Transporting Debris						
MK51 MK-F OAK RIDGE FPSC	5	3	8	6	3	9
MK53 FP UNIT SUBCONTRACT	17	0	17	20	0	20
TOTAL Loading/Transporting Debris	22	3	25	26	3	29

ALTERVATIVE 4 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
4.0.1 Direct Project Cost						
4.0.1.08 WAC Required Actions/Disposal						
MK51 MK-F OAK RIDGE FPSC	2514	55	2569	3013	65	3078
TOTAL WAC Required Actions/Disposal	2514	55	2569	3013	65	3078
4.0.1.10 Decon/Demobilization						
MK51 MK-F OAK RIDGE FPSC	7	15	22	9	18	27
TOTAL Decon/Demobilization	7	15	22	9	18	27
4.0.1.11 Secondary Waste Disposal						
MK51 MK-F OAK RIDGE FPSC	400	3	403	480	4	484
TOTAL Secondary Waste Disposal	400	3	403	480	4	484
TOTAL Direct Project Cost	15068	891	15959	18066	1065	19131
? Indirect Project Cost						
.0.2.01 Project Management						
AE01 ARCHITECT-ENGNR (F-W)	0	105	105	0	124	124
C069 CENTRAL ENGINEERING	0	542	542	0	640	640
K026 ENVIRONMENTAL MGMT	0	146	146	0	172	172
K045 WASTE MANAGEMENT	0	67	67	0	79	79
TOTAL Project Management	0	860	860	0	1015	1015
4.0.2.02 Remedial Design Work Plan						
AE01 ARCHITECT-ENGNR (F-W)	0	35	35	0	39	39
C069 CENTRAL ENGINEERING	0	7	7	0	8	8
TS01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
X027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
TOTAL Remedial Design Work Plan	0	46	46	0	52	52
4.0.2.03 Remedial Design Report						
AE01 ARCHITECT-ENGNR (F-W)	0	695	695	0	805	805
C069 CENTRAL ENGINEERING	0	19	19	0	22	22

ALTERVATIVE 4 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
4.0.2 Indirect Project Cost						
4.0.2.03 Remedial Design Report						
K045 WASTE MANAGEMENT	0	13	13	0	15	15
TS01 TECH SUPPORT CONTRACTOR	0	13	13	0	16	16
TOTAL Remedial Design Report	0	740	740	0	858	858
4.0.2.04 Remedial Action Work Plan						
AE01 ARCHITECT-ENGNR (F-W)	0	3	3	0	4	4
MK67 MK-F ADMIN SUPPORT	0	61	61	0	72	72
TS01 TECH SUPPORT CONTRACTOR	0	2	2	0	3	3
X027 WASTE MGMT & REM ACTION	0	2	2	0	2	2
TOTAL Remedial Action Work Plan	0	68	68	0	81	81
4.0.2.05 Remedial Action Integration						
C069 CENTRAL ENGINEERING	0	32	32	0	39	39
MK66 MK-F INDIRECTS & FEE	2563	0	2563	3070	0	3070
MK67 MK-F ADMIN SUPPORT	5	294	299	5	352	357
TS01 TECH SUPPORT CONTRACTOR	90	59	149	108	71	179
TOTAL Remedial Action Integration	2658	385	3043	3183	462	[illegible]
TOTAL Indirect Project Cost	2658	2099	4757	3183	2468	5651
4.0.3 Monitoring/Maintenance						
4.0.3.01 Surveillance & Maintenance						
SC01 OFFSITE SUBCONTRACT	4	0	4	5	0	5
TOTAL Surveillance & Maintenance	4	0	4	5	0	5
TOTAL Monitoring/Maintenance	4	0	4	5	0	5
SUB - TOTAL	17730	2990	20720	21254	3533	24787
OVERHEAD	0	0	0	0	0	0
SUB - TOTAL	17730	2990	20720	21254	3533	24787

ALTERVATIVE 4 DWI

SUMMARY REPORT
$1 = $1000

10/01/1996

Arranged By: WBS / WBS / Participant Code

	Unescalated			Escalated		
	Material $	Labor $	Total $	Material $	Labor $	Total $
CONTINGENCY	6206	1047	7253	7439	1237	8676
GRAND TOTAL	23936	4037	27973	28693	4770	33463

TABLE G.10

ALTERNATIVE 4, FISCAL YEAR SUMMARY REPORT BY WORK BREAKDOWN STRUCTURE

FISCAL YEAR SUMMARY
Project Number: 35H83094
ALTERVATIVE 4 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 3

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT4\ALT-4.Est 10/01/1996
SCHEDULE FILE: ALT-4
REPORT FILE: C:\AES60F\DWI\ALT4\ALT4FYR.Out 10/01/1996 16:12:10

AES Version 6.0f

ALTERVATIVE 4 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2009

	Fiscal Year					Sub
	2001	2002	2003	2004	2005	Total
4.0.1 Direct Project Cost	.	791	18151	188	.	19130
4.0.2 Indirect Project Cost	993	1651	2765	242	.	5651
4.0.3 Monitoring/Maintenance	.	.	.	1	1	2
Sub-Total	993	2442	20916	431	1	24783
Overhead	0	0	0	0	0	0
Sub-Total	993	2442	20916	431	1	24783
Contingency	348	855	7320	151	0	8674
Grand Total	1341	3297	28236	582	1	33457

ALTERVATIVE 4 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: WBS
Fiscal Year Range 2001 - 2009

	Fiscal Year				
	2006	2007	2008	2009	Total
4.0.1 Direct Project Cost	.	.	.	.	19130
4.0.2 Indirect Project Cost	.	.	.	.	5651
4.0.3 Monitoring/Maintenance	1	1	1	.	5
Sub-Total	1	1	1	0	24786
Overhead	0	0	0	0	0
Sub-Total	1	1	1	0	24786
Contingency	0	0	0	0	8674
Grand Total	1	1	1	0	33460

TABLE G.11

ALTERNATIVE 4, FISCAL YEAR SUMMARY REPORT BY PARTICIPANT

FISCAL YEAR SUMMARY
Project Number: 35H83094
ALTERVATIVE 4 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. Participant

Approved by:

Project Estimator _____ Date _____

Estimating Manager _____ Date _____

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT4\ALT-4.Est 10/01/1996
SCHEDULE FILE: ALT-4
REPORT FILE: C:\AES60F\DWI\ALT4\ALT4FYS.Out 10/01/1996 16:12:39

AES Version 6.0f

ALTERVATIVE 4 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2009

	Fiscal Year					Sub
	2001	2002	2003	2004	2005	Total
AE01 ARCHITECT-ENGNR (F-W)	676	251	42	4	.	973
C069 CENTRAL ENGINEERING	215	231	242	21	.	709
K026 ENVIRONMENTAL MGMT	51	58	58	5	.	172
K045 WASTE MANAGEMENT	35	30	27	2	.	94
MK51 MK-F OAK RIDGE FPSC	.	729	4699	51	.	5479
MK53 FP UNIT SUBCONTRACT	.	62	13452	137	.	13651
MK66 MK-F INDIRECTS & FEE	.	852	2039	179	.	3070
MK67 MK-F ADMIN SUPPORT	.	171	238	21	.	430
SC01 OFFSITE SUBCONTRACT	.	.	.	1	1	2
TS01 TECH SUPPORT CONTRACTOR	14	56	119	10	.	199
X027 WASTE MGMT & REM ACTION	2	2	.	.	.	4
Sub-Total	993	2442	20916	431	1	24783
Overhead	0	0	0	0	0	0
Sub-Total	993	2442	20916	431	1	24783
Contingency	348	855	7320	151	0	8674
Grand Total	1341	3297	28236	582	1	33457

ALTERVATIVE 4 DWI

FISCAL YEAR SUMMARY
$1 = $1000

10/01/1996

Arranged By: Participant Code
Fiscal Year Range 2001 - 2009

	Fiscal Year 2006	2007	2008	2009	Total
AE01 ARCHITECT-ENGNR (F-W)	.	.	.	.	973
C069 CENTRAL ENGINEERING	.	.	.	.	709
K026 ENVIRONMENTAL MGMT	.	.	.	.	172
K045 WASTE MANAGEMENT	.	.	.	.	94
MK51 MK-F OAK RIDGE FPSC	.	.	.	.	5479
MK53 FP UNIT SUBCONTRACT	.	.	.	.	13651
MK66 MK-F INDIRECTS & FEE	.	.	.	.	3070
MK67 MK-F ADMIN SUPPORT	.	.	.	.	430
SC01 OFFSITE SUBCONTRACT	1	1	1	.	5
TS01 TECH SUPPORT CONTRACTOR	.	.	.	.	199
X027 WASTE MGMT & REM ACTION	.	.	.	.	4
Sub-Total	1	1	1	0	24786
Overhead	0	0	0	0	0
Sub-Total	1	1	1	0	24786
Contingency	0	0	0	0	8674
Grand Total	1	1	1	0	33460

TABLE G.12

ALTERNATIVE 4, DETAIL REPORT

DETAIL REPORT
Project Number: 35H83094
ALTERVATIVE 4 DWI

Project ESO Number.....NA
Revision Number.....0
Last Update.....10/01/1996

Sort Order
1. WBS - Level 9
2. Participant

Approved by:

Project Estimator	Date
Estimating Manager	Date

Base Fiscal Year/Quarter: 96/3
STANDARD VALUE: C:\AES60F\ERFEB96A.val EXPIRES: 05/23/1997
ESTIMATE FILE: C:\AES60F\DWI\ALT4\ALT-4.Est 10/01/1996
SCHEDULE FILE: ALT-4
REPORT FILE: C:\AES60F\DWI\ALT4\ALT4DET.Out 10/01/1996 16:11:36

AES Version 6.0f

ALTERVATIVE 4 DWI

Creation Date 05/07/1996
Revision Number ... 0

Estimating Job Number .. 35H83094

Project Estimator.. DH BOLL/JH KLEW
WBS ..... 4.0.1.01 Temporary Facilities/Mobilization
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.1 Temporary Facilities/Mobiliz
Discipline ..... O OTHER
B/M Title ..... TEMP FACILITIES ALT 4 SPECIFIC
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Project Engineer ..... K. BURCH
Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number 0.1.2 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	AREA FOR MANUAL AND AUTOMATED DEBRIS WASHING, AND TREATMENT PLAND FOR ON-SITE VITRIFICATION						
	PREPARE MANUAL DEBRIS WASHING AREA (FIGURE DECON AREA AND UTILITIES HOOK-UP ALREADY IN PLACE FROM EQUIPMENT DECON PAD SET-UP)						
	PREPARE AUTOMATED DEBRIS WASHING AREA *JOBSITE OFFICE*						
1 -A	VENDOR TRAILER (INCLUDES RENTAL FOR 18 MONTHS)	Matl. Labor	1.00 8	EACH TD	2,800.00 18.20	2,800 146	2,946
2 -A	SET-UP LABOR	Matl. Labor	1.00 16	LOT L	250.00 17.65	250 282	532
3 -A	ELECTRICAL HOOK-UP	Matl. Labor	1.00 80	LOT E	5,000.00 25.95	5,000 2,076	7,076
4 -A	WATER HOOK-UP	Matl. Labor	1.00 120	LOT PF	6,500.00 26.20	6,500 3,144	9,644
	INSTALL STRUCTURAL SLAB						
5 -A	6" BASE COURSE, 10,000 SF, M56	Matl. Labor	1,112.00 11	SY OP	4.71 25.25	5,238 278	5,516
6 -A	VAPOR BARRIER, M189	Matl. Labor	100.00 22 1	SQ L	2.40 17.65	240 388	628

.em	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
7 -A	EDGE FORMS FOR 3 EA 5'X8' PADS AND 1 EA 35'X15' PAD, M97 (ADDED 20% ON LABOR SINCE UNDER 10,000 SF)	Matl.	200.00	LF	0.31	62	
		Labor	12	F	21.30	256	318
8 -A	REINFORCING, 4X4-W4XW4 WWF MESH, M105 (ADDED 20% ON LABOR SINCE UNDER 10,000 SF)	Matl.	8.00	CSF	26.50	212	
		Labor	6	F	21.30	128	340
9 -A	EXTRA REINFORCING FOR 3 EA SMALL PADS	Matl.	1.00	LS	100.00	100	
		Labor	8	F	21.30	170	270
10 -A	8" S.O.G., TROWEL FINISH, M109 (ADDED 20% ON LABOR SINCE UNDER 10,000 SF)	Matl.	200.00	SF	1.46	292	
		Labor	6	F	21.30	128	420
11 -A	4" S.O.G., TROWEL FINISH, M109 (ADDED 20% ON LABOR SINCE UNDER 10,000 SF)	Matl.	600.00	SF	0.76	456	
		Labor	16	F	21.30	341	797
12 -A	CURING, M110 (ADDED 20% ON LABOR SINCE UNDER 10,000 SF)	Matl.	50.00	CSF	2.80	140	
		Labor	17	F	21.30	362	502
13 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LS	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
-A	WATER HOOK-UP	Matl.	1.00	LS	6,500.00	6,500	
		Labor	120	PF	26.20	3,144	9,644
****	SUBTOTAL ****	Matl.				32,790	
		Labor	522			12,919	45,709
	SPECIAL REQUIREMENTS						
15 -A	PPE ALLOWANCE	Matl.	10.00	DAYS	75.00	750	
		Labor	60	L	17.65	1,059	1,809
16 -A	HEALTH AND SAFETY OFFICER	Matl.	10.00	DAYS	0.00	0	
		Labor	80	X	50.00	4,000	4,000
17 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	522.00	HRS	1.00	522	
		Labor	26	OP	25.25	657	1,179
18 -A	LABOR FACTOR	Matl.	522.00	HRS	0.00	0	
		Labor	104	OP	25.25	2,626	2,626

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		34,062		21,261	55,323
SALES TAX		2,895			2,895
SUBTOTAL		36,957		21,261	58,218
TOTAL INDIRECT	20.00%	7,391	20.00%	4,252	11,643
TOTAL		44,348	(hrs. 792)	25,513	69,861

WBS ..... 4.0.1.01 Temporary Facilities/Mobilization
Code ..... 6100 REMEDIAL ACTION
...icipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.1 TEMP. FACILITIES/MOBILIZATION
Discipline ..... O OTHER
B/M Title ..... TEMP FACILITIES/MOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TEMPORARY FACILITIES/MOBILIZATION						
1 -A	CONSTRUCTION TRAILER (RENTAL)	Matl.	18.00	MONTHS	320.00	5,760	
		Labor	7	TD	18.20	127	5,887
2 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	532
3 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
4 -A	SHOWER/CHANGE TRAILER (RENTAL)	Matl.	18.00	MONTHS	550.00	9,900	
		Labor	7	TD	18.20	127	10,027
5 -A	SET-UP LABOR	Matl.	1.00	LOT	250.00	250	
		Labor	16	L	17.65	282	532
6 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
7 -A	WATER HOOK-UP	Matl.	1.00	LOT	6,500.00	6,500	
		Labor	120	PF	26.20	3,144	9,644
8 -A	EQUIPMENT DECON PAD	Matl.	500.00	SF	35.00	17,500	
		Labor	50	C	25.80	1,290	18,790
9 -A	STAGGING AREA (GRAVEL)	Matl.	1,500.00	SF	5.50	8,250	
		Labor	15	OP	25.25	379	8,629
10 -A	EQUIPMENT MOBILIZATION	Matl.	6.00	EACH	150.00	900	
		Labor	48	TD	18.20	874	1,774

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
****	SUBTOTAL ****	Matl.				59,310	
		Labor	439			10,657	69,967
	GENERAL CONDITIONS						
11 -A	UTILITIES (ALLOWANCE)	Matl.	18.00	MONTHS	200.00	3,600	
		Labor	0		0.00	0	3,600
12 -A	SUPERINTENDENT	Matl.	18.00	MONTHS	100.00	1,800	
		Labor	3,150	X	30.00	94,500	96,300
13 -A	SURVEY CREW	Matl.	1.00	LOT	3,000.00	3,000	
		Labor	120	X	35.00	4,200	7,200
14 -A	DOCUMENTS (SAFETY PLAN, QA PLAN, WM PLAN, WORK PLAN...ETC)	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	0		0.00	0	10,000
****	SUBTOTAL ****	Matl.				18,400	
		Labor	3,270			98,700	117,100
	SPECIAL REQUIREMENTS						
15 -A	PPE REQUIREMENTS	Matl.	10.00	DAYS	75.00	750	
		Labor	0		0.00	0	750
16 -A	HEALTH & SAFETY OFFICER	Matl.	10.00	DAYS	0.00	0	
		Labor	80	X	50.00	4,000	4,000
17 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	440.00	HRS	1.00	440	
		Labor	22	OP	25.25	556	996
18 -A	LABOR FACTOR	Matl.	440.00	HRS	0.00	0	
		Labor	88	OP	25.25	2,222	2,222

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		78,900		116,135	195,035
SALES TAX		6,707			6,707
SUBTOTAL		85,607		116,135	201,742
TOTAL INDIRECT	20.00%	17,121	20.00%	23,227	40,348
TOTAL		102,728	(hrs. 3,899)	139,362	242,090

WBS ..... 4.0.1.02 Site Preparation
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.2 SITE PREPARATION
Discipline ..... O OTHER
B/M Title ..... SITE PREPARATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.1.3 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE PREPARATION						
	EARLY ACTION						
1 -A	EXCAVATION AND GRADING FOR TEMPORARY FACILITIES	Matl. Labor	2,000.00 40	SF OP	0.20 25.25	400 1,010	1,410
	SALAVAGEABLE DEBRIS REMOVAL AND CLEANING						
2 -A	REMOVAL OF SALAVAGEABLE SURFACE BEBRIS (INCLUDES FRISK AND DECON OF 50%)	Matl. Labor	500.00 1,000	TONS L	15.00 17.65	7,500 17,650	25,150
3 -A	EQUIPMENT (FORKLIFT, TRUCK...ETC)	Matl. Labor	300.00 300	HRS OP	35.00 25.25	10,500 7,575	18,075
	REMOVAL OF STANDING VEGETATION						
4 -A	FELL & CUT-TO-SIZE MEDIUM TREES TO 12" DIA	Matl. Labor	3.00 210	ACRES L	1,525.00 17.65	4,575 3,707	8,282
5 -A	CLEAR BRUSH WITH BRUSH SAW, CLOSE TO GROUND LEVEL, STAGE FOR BUNDLING	Matl. Labor	6.50 208	ACRES L	241.00 17.65	1,567 3,671	5,238
6 -A	BUNDLE BRUSH AND STOCKPILE FOR LOADING INTO TRUCKS, FIGURE 3-MAN CREW	Matl. Labor	3,565.00 891	CY L	0.00 17.65	0 15,726	15,726
7 -A	JOBSITE TREE/BRUSH LOAD FOR TRANSPORT TO Y-12 LANDFILL: FE LOADER, TM, 3 CY, CAT 950E	Matl. Labor	263.00 263	HOURS OP	29.10 25.25	7,653 6,641	14,294
8 -A	SPECIAL REQUIREMENTS TO PREVENT TREES AND BRUSH FROM COMING INTO CONTACT	Matl. Labor	9.50 76	ACRES L	500.00 17.65	4,750 1,341	6,091

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	WITH CONTAMINATED SOIL						
	TEMPORARY SURFACE WATER CONTROLS						
9 -A	DIVERISION DITCHES	Matl.	1,500.00	LF	1.50	2,250	
		Labor	75	OP	25.25	1,894	4,144
10 -A	SILT FENCE AND HAY BALES	Matl.	2,400.00	LF	2.50	6,000	
		Labor	984	L	17.65	17,368	23,368
	SITE FENCING						
11 -A	INSTALL FENCE AROUND TEMPORARY FACILITIES	Matl.	800.00	LF	5.55	4,440	
		Labor	170	L	17.65	3,001	7,441
12 -A	ALLOWANCE FOR MONITORS FOR DETECTION OF AIRBORNE PARTICULATES	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	60	E	25.95	1,557	11,557
***	SUBTOTAL ****	Matl.				59,635	
		Labor	4,277			81,141	140,776
	SPECIAL REQUIREMENTS						
13 -A	PPE REQUIREMENTS	Matl.	54.00	DAYS	75.00	4,050	
		Labor	0		0.00	0	4,050
14 -A	HEALTH & SAFETY OFFICER	Matl.	54.00	DAYS	0.00	0	
		Labor	432	X	50.00	21,600	21,600
15 -A	TRAINING AND MECICAL REQUIREMENTS	Matl.	4,122.00	HRS	1.00	4,122	
		Labor	206	OP	25.25	5,202	9,324
16 -A	LABOR FACTOR	Matl.	4,122.00	HRS	0.00	0	
		Labor	824	OP	25.25	20,806	20,806

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		67,807		128,749	196,556
SALES TAX		5,764			5,764
SUBTOTAL		73,571		128,749	202,320
TOTAL INDIRECT	20.00%	14,714	20.00%	25,750	40,464
TOTAL		88,285	(hrs. 5,739)	154,499	242,784

WBS ..... 4.0.1.02 Site Preparation
Code ..... 6100 REMEDIAL ACTION
cipant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.2 Site Preparation
Discipline ..... O OTHER
B/M Title ..... TRANSP VEG TO Y-12 LF
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.4 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	HAUL SITE VEGETATION TO Y-12 LANDFILL						
1 -A	HAUL 3565 CY TREES/BRUSH TO Y-12 LANDFILL, REF VEGDISP.XLSY-12IC (INTERMODAL CONTAINERS)	Matl.	1.00	LS	48,573.00	48,573	
		Labor	0		0.00	0	48,573
2 -A	G/C ADMIN OF S/C, 6%	Matl.	1.00	LOT	2,914.00	2,914	
		Labor	0		0.00	0	2,914

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	51,487	0	51,487
TOTAL	51,487	(hrs. 0) 0	51,487

WBS ..... 4.0.1.03 Excavation/Segregation
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.3 Reclamation
Discipline ..... O OTHER
B/M Title ..... SITE RECLAMATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.7 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
1 -A	BACKFILL SITE WITH TOPSOIL (INCLUDES LOADING, HAULING 10 MILES AND PLACEMENT W/ COMPACTION)	Matl.	6,160.00	CY	11.32	69,731	
		Labor	1,910	OP	25.25	48,228	117,959
2 -A	SEED AND STRAW	Matl.	350.00	MSF	32.70	11,445	
		Labor	105	L	17.65	1,853	13,298
****	SUBTOTAL ****	Matl.				81,176	
		Labor	2,015			50,081	131,257
	SPECIAL REQUIREMENTS (ACTUAL WORK DAYS)						
3 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	15.00	DAYS	11.65	175	
		Labor	120	L	17.65	2,118	2,293
4 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	15.00	DAYS	200.00	3,000	
		Labor	0		0.00	0	3,000
5 -A	PPE ALLOWANCE	Matl.	15.00	DAYS	75.00	1,125	
		Labor	90	L	17.65	1,589	2,714
6 -A	SPOTTER FOR OPERATORS	Matl.	15.00	DAYS	0.00	0	
		Labor	120	L	17.65	2,118	2,118
7 -A	HEALTH AND SAFETY OFFICER	Matl.	15.00	DAYS	0.00	0	
		Labor	120	X	50.00	6,000	6,000
8 -A	TRAINING AND MECICAL REQUIREMENTS	Matl.	2,015.00	HRS	1.00	2,015	
		Labor	101	OP	25.25	2,550	4,565
9 -A	LABOR FACTOR	Matl.	2,015.00	HRS	0.00	0	
		Labor	403	OP	25.25	10,176	10,176

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		87,491		74,632	162,123
SALES TAX		7,437			7,437
SUBTOTAL		94,928		74,632	169,560
TOTAL INDIRECT	20.00%	18,986	20.00%	14,926	33,912
TOTAL		113,914	(hrs. 2,969)	89,558	203,472

WBS ..... 4.0.1.03 Excavation/Segregation
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.3 Segregation
Discipline ..... O OTHER
B/M Title ..... SEGREGATE FOR DEBRIS TREATMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number 0.1.6 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	ON-SITE LOAD/HAUL DEBRIS TO TREATMENT						
	TOTAL VOL TO CONVEY FROM STAGED AREA AND LOAD INTO SEPARATION /SCREEN /TREATMENT PROCESS, 4707 CY						
1 -A	BOBCAT FE LOADER #753, 10 CF BUCKET, OPERATED BY VENDOR PERSONNEL	Matl. Labor	15.00 0	MO	1,375.00 0.00	20,625 0	20,625
	SEPARATE/ MANUALLY SORT						
2 -A	SHEET METAL, WIRE	Matl. Labor	1,700.00 850	CY L	0.00 17.65	0 15,003	15,003
3 -A	HEAVY GAUGE METAL; PIPES, RODS, ROLLERS	Matl. Labor	770.00 385	CY L	0.00 17.65	0 6,795	6,795
4 -A	EQUIPMENT; ELECTRIC METERS, COMPRESSORS, FAN UNITS, CATALYTIC CONVERTERS	Matl. Labor	636.00 318	CY L	0.00 17.65	0 5,613	5,613
5 -A	DRUMS, TANKS, CYLINDERS	Matl. Labor	122.00 61	CY L	0.00 17.65	0 1,077	1,077
6 -A	CONCRETE	Matl. Labor	1.00 1	CY L	0.00 17.65	0 18	18
7 -A	TIRES	Matl. Labor	5.00 3	CY L	0.00 17.65	0 53	53
8 -A	LUMBER, PALLETS	Matl. Labor	680.00 340	CY L	0.00 17.65	0 6,001	6,001
9 -A	VEGETATION, IE. STUMPS, ROOTS	Matl. Labor	48.00 24	CY L	0.00 17.65	0 424	424
****	SUBTOTAL ****	Matl. Labor	1,982			20,625 34,984	55,[illegible]

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SPECIAL REQUIREMENTS						
10 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	60.00	DAYS	11.65	699	
		Labor	480	L	17.65	8,472	9,171
11 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	60.00	DAYS	200.00	12,000	
		Labor	0		0.00	0	12,000
12 -A	PPE ALLOWANCE	Matl.	60.00	DAYS	75.00	4,500	
		Labor	360	L	17.65	6,354	10,854
13 -A	SPOTTER FOR OPERATORS	Matl.	60.00	DAYS	0.00	0	
		Labor	480	L	17.65	8,472	8,472
14 -A	HEALTH AND SAFETY OFFICER	Matl.	60.00	DAYS	0.00	0	
		Labor	480	X	50.00	24,000	24,000
15 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	1,982.00	HRS	1.00	1,982	
		Labor	99	OP	25.25	2,500	4,482
16 -A	LABOR FACTOR	Matl.	1,982.00	HRS	0.00	0	
		Labor	396	OP	25.25	9,999	9,999

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		39,806		94,781	134,587
SALES TAX		3,384			3,384
SUBTOTAL		43,190		94,781	137,971
TOTAL INDIRECT	20.00%	8,638	20.00%	18,956	27,594
TOTAL		51,828	(hrs. 4,277)	113,737	165,565

WBS ..... 4.0.1.03 Excavation/Segregation
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.3 CONTAM MAT EXCAVATION
Discipline ..... O OTHER
B/M Title ..... CONTAM MAT EXCAVATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.5 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SEDIMENT CONSOLIDATION						
1 -A	SEDIMENT CONTROL DEVICES (HAY BALES, SILT FENCE...ECT)	Matl.	1.00	LOT	1,000.00	1,000	
		Labor	40	L	17.65	706	1,706
2 -A	EXCAVATE SEDIMENT	Matl.	60.00	CY	17.60	1,056	
		Labor	24	OP	25.25	606	1,662
3 -A	LOAD, HAUL AND DUMP TO BE INCLUDED WITH VITRIFICATION TRT	Matl.	60.00	CY	11.00	660	
		Labor	8	OP	25.25	202	862
4 -A	SPOTTERS AND LABORS	Matl.	1.00	LOT	0.00	0	
		Labor	24	L	17.65	424	42[illegible]
5 -A	VERFICATION SAMPLING/ANALYSIS	Matl.	1.00	LOT	5,000.00	5,000	
		Labor	16	L	17.65	282	5,282
6 -A	INSTALL RIPRAP IN STREAM BED	Matl.	60.00	CY	17.35	1,041	
		Labor	15	OP	25.25	379	1,420
7 -A	SPOTTERS AND LABORS	Matl.	1.00	LOT	0.00	0	
		Labor	15	L	17.65	265	265
8 -A	REMOVE SEDIMENT CONTROL DEVICES	Matl.	1.00	LOT	0.00	0	
		Labor	20	L	17.65	353	353
	SITE CONSOLIDATION						
9 -A	STAGE SOIL AND DEBRIS FOR VITRIFCATION	Matl.	17,497.00	CY	0.58	10,148	
		Labor	420	OP	25.25	10,605	20,753
10 -A	VERIFICATION SAMPLING/ANALYSIS	Matl.	25.00	EACH	1,500.00	37,500	
		Labor	50	L	17.65	883	38,383
****	SUBTOTAL ****	Matl.				56,405	
		Labor	632			14,705	71,110

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SPECIAL REQUIREMENTS (ACTUAL WORK DAYS)						
11 -A	DUST CONTROL (WATER TRUCK AND LABOR)	Matl.	80.00	DAYS	11.65	932	
		Labor	640	L	17.65	11,296	12,228
12 -A	EQUIPMENT RENTAL ALLOWANCE	Matl.	80.00	DAYS	200.00	16,000	
		Labor	0		0.00	0	16,000
13 -A	PPE ALLOWANCE	Matl.	80.00	DAYS	75.00	6,000	
		Labor	480	L	17.65	8,472	14,472
14 -A	SPOTTER FOR OPERATORS	Matl.	80.00	DAYS	0.00	0	
		Labor	640	L	17.65	11,296	11,296
15 -A	HEALTH AND SAFETY OFFICER	Matl.	80.00	DAYS	0.00	0	
		Labor	640	X	50.00	32,000	32,000
16 -A	TRAINING AND MEDICAL REQUIREMENTS	Matl.	632.00	HRS	1.00	632	
		Labor	32	OP	25.25	808	1,440
17 -A	LABOR FACTOR	Matl.	632.00	HRS	0.00	0	
		Labor	126	OP	25.25	3,182	3,182
	OTHER						
18 -A	FROM STOCK PILE, LOAD INTERMODAL CONTAINERS TO SHIP TO PGDP VITRIF PLANT, 13 MO = NEEDS TO LOAD 39 CY/DAY, FIGURE FORD 345C W/ .75 CY BUCKET	Matl.	2,252.00	HOURS	6.79	15,291	
		Labor	2,252	OP	25.25	56,863	72,154
	SPECIAL REQUIREMENTS (ACTUAL WORK DAYS)						
19 -A	DUST CONTROL (WATER TRUCK AND LABOR) 13 MO = 286 DAYS - 156 FROM OTHER B/MS	Matl.	130.00	DAYS	1.50	195	
		Labor	1,040	L	17.65	18,356	18,551
20 -A	PPE ALLOWANCE	Matl.	130.00	DAYS	75.00	9,750	
		Labor	780	L	17.65	13,767	23,517
21 -A	HEALTH AND SAFETY OFFICER	Matl.	130.00	DAYS	0.00	0	
		Labor	1,040	X	50.00	52,000	52,000

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		105,205		222,745	327,950
SALES TAX		8,942			8,942
SUBTOTAL		114,147		222,745	336,892
TOTAL INDIRECT	20.00%	22,829	20.00%	44,549	67,378
TOTAL		136,976	(hrs. 8,302)	267,294	404,270

WBS ..... 4.0.1.04 Treatment Debris wash
Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
cipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.4 Treatment
Discipline ..... O OTHER
B/M Title ..... TREAT, M DEBRIS WASH, S/C
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.11 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	MANUAL DEBRIS TREATMENT						
	ESTIMATES PER HISTORICAL DATA FROM ALPHA-4 D&D FS						
	PRE-CLEANING						
1 -A	METAL SURFACES, REF: DWIALT4\ESTWKSHT.XLS	Matl.	17,100.00	SF	0.01	171	
		Labor	342	L	17.65	6,036	6,207
	TREATMENT						
2 -A	METAL SURFACES	Matl.	17,100.00	SF	0.02	342	
		Labor	342	L	17.65	6,036	6,378

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		513		12,072	12,585
SALES TAX		44			44
SUBTOTAL		557		12,072	12,629
TOTAL INDIRECT	20.00%	111	20.00%	2,414	2,525
TOTAL		668	(hrs. 684)	14,486	15,154

WBS ..... 4.0.1.04 Treatment Debris wash
Cost Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.4 Treatment
Discipline ..... O OTHER
B/M Title ..... TREAT, DEBRIS WASH, OTHER S/C
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number 0.1.12 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	OTHER S/C COSTS TO SUPPORT MANUAL AND AUTOMATIC DEBRIS WASHING PROCESS NOTE: SINCE LOADING IS BASED ON TREATMENT PRODUCTIVITY, USE EQUIPMENT BELOW, OPERATED BY VENDOR						
1 -A	ALLOWANCE FOR 5 TON FORKLIFT AND 10-TON CRANE (OPER BY VENDOR PERSONNEL	Matl. Labor	13.00 0	MO	8,000.00 0.00	104,000 0	104,000
2 -A	DIESEL FUEL FOR BOILER	Matl. Labor	7,000.00 0	GAL	1.20 0.00	8,400 0	8,400

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		112,400		0	112,400
SALES TAX		9,554			9,554
SUBTOTAL		121,954		0	121,954
TOTAL INDIRECT	20.00%	24,391	20.00%	0	24,391
TOTAL		146,345	(hrs. 0)	0	146,345

WBS ..... 4.0.1.04 Treatment Debris wash
Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
.cipant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.4 Treatment
Discipline ..... O OTHER
B/M Title ..... T/S, A DEBRIS WASH, OTHER S/C
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.9 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TREATABILITY STUDY SUPPORT						
1 -A	PROVIDE 20'X20' ENCLOSED BUILDING FOR TREATABILITY STUDY, PER MK-F HISTORICAL COST	Matl.	400.00	SF	35.00	14,000	
		Labor	120	C	25.80	3,096	17,096
2 -A	ELECTRICAL HOOK-UP	Matl.	1.00	LS	5,000.00	5,000	
		Labor	80	E	25.95	2,076	7,076
3 -A	WATER HOOK-UP	Matl.	1.00	LS	6,500.00	6,500	
		Labor	120	PF	26.20	3,144	9,644
	SAMPLES (HRS) AND ANALYSIS COST , 5 EA BATCHES/MATERIAL						
4 -A	BRICK	Matl.	5.00	BATCH	1,500.00	7,500	
		Labor	10	L	17.65	177	7,677
5 -A	CONCRETE	Matl.	5.00	BATCH	1,500.00	7,500	
		Labor	10	L	17.65	177	7,677
6 -A	WOOD	Matl.	5.00	BATCH	1,500.00	7,500	
		Labor	10	L	17.65	177	7,677
7 -A	METALS	Matl.	5.00	BATCH	1,500.00	7,500	
		Labor	10	L	17.65	177	7,677

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		55,500		9,024	64,524
SALES TAX		4,718			4,718
SUBTOTAL		60,218		9,024	69,242
TOTAL INDIRECT	20.00%	12,044	20.00%	1,805	13,849
TOTAL		72,262	(hrs. 360)	10,829	83,091

WBS ..... 4.0.1.04 Treatment Debris wash
Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
/cipant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.4 Treatment
Discipline ..... O OTHER
B/M Title ..... T/S, A DEBRIS WASH, VENDOR
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.8 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	TREATABILITY STUDY (PHASE 1)						
	INITIAL PLANNING						
	PREPARE HASP/QAPP FOR TREATABILITY STUDY PERFORM BENCH/PILOT SCALE TREATABILITY STUDY ON SITE LABOR, TRAVEL/PER DIEM, ASUPPLIES AND EQUIPMENT						
1 -A	TOTAL VENDOR COST FOR ABOVE	Matl. Labor	1.00 0	LS	200,000.00 0.00	200,000 0	200,000
-A	G/C ADMIN OF S/C, 6%	Matl. Labor	1.00 0	LOT	12,000.00 0.00	12,000 0	12,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	212,000	0	212,000
TOTAL	212,000	(hrs. 0) 0	212,000

WBS ..... 4.0.1.04 Treatment Debris wash
Cost Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
Participant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.4 Treatment
Discipline ..... O OTHER
B/M Title ..... TREAT, A DEBRIS WASH, VENDOR
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.10 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	AUTOMATED DEBRIS TREATMENT						
	VENDOR MOB, INCLUDING:						
1 -A	TRANSPORT THREE TRAILERS TO SITE, ERECT /SETUP EQUIPMENT, PERSONNEL (5 EA) TRAVEL TO SITE (PHASE 2)	Matl. Labor	1.00 0	LS	75,000.00 0.00	75,000 0	75,000
	VENDOR WEEKLY OPERATIONS, INCLUDING:						
2 -A	5 JOBSITE PERSONNEL, TRAVEL, PER DIEM, HOME OFFICE ADMIN/TECH SUPPORT (PHASE 3)	Matl. Labor	66.00 0	WEEKS	50,000.00 0.00	3,300,000 0	3,300,000
	VENDOR DEMOB INCLUDING:						
3 -A	DECON/DISASSEMBLE EQUIPMENT, NEUTRALIZE PROCESS WATER, TRAVEL/PER DIEM (PHASE 4)	Matl. Labor	1.00 0	LS	60,000.00 0.00	60,000 0	60,000
****	SUBTOTAL ****	Matl. Labor	0			3,435,000 0	3,435,000
	**DEBRIS TO BE WASHED/DRYED BY VENDOR)						
	DEBRIS FROM SURFACE MOUNDS AND BERMS BRICK 200 CY						

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	CONCRETE 200CY						
	ASPHALT 200CY						
	OTHER DEBRIS						
	SHEET METAL (IE. SHEET METAL SCRAP, DRUMS, AND AUTOMOBILE FUEL TANKS) 1036CY						
	HEAVY METAL, > 12 GA THICK 89CY						
	TIRES 806CY						
	LUMBER (IE. MANUFACTURED WOOD PRODUCTS) 688CY						
	VEGETATION (IE. STUMPS, ROOTS) 264CY						
	PLASTIC (IE. VINYL SIDING/PARTS) 24CY						
	COAL SPOILS (IE. COAL, SLAG, SHALE AND/OR SLATE) 1157CY						
	SOFT DEBRIS (IE. PAPER, FOAM RUBBER, AND CLOTH) 83CY						
	DEMOLISHED BUILDINGS/STRUCTURES, CUT INTO TREATABLE PIECES 74CY						
	BURIED DEBRIS (IE. SUBSURFACE METAL DEBRIS) 1577CY						
	ABOVE ITEMS CONVERTED TO TONS (12,607)						
	PRICE/TON PER VENDOR QUOTE, IT CORP, IS:						
	$3,435,000 FROM ABOVE						
	$200,000 FROM T/S						
	$3,635,000 /10,929 TONS = $333/TON						
****	SUBTOTAL ****	Matl. Labor	 0			0 0	 0
4 -A	G/C ADMIN OF S/C, 6%	Matl. Labor	1.00 0	LOT	206,100.00 0.00	206,100 0	206,100

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	3,641,100	0	3,641,100
TOTAL	3,641,100	(hrs. 0) 0	3,641,100

WBS ..... 4.0.1.05 Treatment Vitrif
C[illegible] Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
[illegible]cipant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.5 Treatment
Discipline ..... O OTHER
B/M Title ..... TREAT, VITRIF, VENDOR
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... J Klewicki
Trace Number ..... O.1.13 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	VITRIFICATION TREATMENT SOIL ACCUMULATED FROM EXCAVATION OF STREAM SEDIMENT 60 CY SOIL ACCUMULATED FROM EXCAVATION OF SOIL 16,073 CY SOIL ACCUMULATED FROM EXCAVATION OF FINE DEBRIS 1364 CY TOTAL = 17,597 CY						
1 -A	ABOVE ITEMS CONVERTED TO TONS PRICE/TON PER VENDOR QUOTE, VORTEC CORP	Matl. Labor	24,659.00 0	TONS	212.15 0.00	5,231,407 0	5,231,407
2 -A	ADDITIONAL COST FOR INCORPORATION OF OXYGEN ENRICHMENT CAPABILITY	Matl. Labor	1.00 0	LS	500,000.00 0.00	500,000 0	500,000
3 -A	ALLOWANCE FOR ADDITIONAL MATERIAL HANDLING AT PADUCAH VITRIFICATION PLANT FOR INTERMODAL CONTAINERS	Matl. Labor	1.00 0	LS	100,000.00 0.00	100,000 0	100,000
4 -A	G/C ADMIN OF S/C, 6%	Matl. Labor	1.00 0	LOT	349,884.00 0.00	349,884 0	349,884

BILL OF MATERIAL SUMMARY	Material	Labor		Total Cost M + L
TOTAL DIRECT	6,181,291		0	6,181,291
TOTAL	6,181,291	(hrs. 0)	0	6,181,291

WBS ..... 4.0.1.06 Loading/Transporting Vitrif
Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
,cipant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.6 Transporting
Discipline ..... O OTHER
B/M Title ..... TRANSP PRE/POST VITRIF SOIL
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.14 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	HAUL PRE/POST VITRIFIED SOIL						
1 -A	HAUL 14,337 CY OF CONTAMINATED SOIL/DEBRIS FROM DWI SITE TO PGDP VITRIFICATION PLANT (VORTEC) REF VITRIVOR.XLSDWI TO PGDP IC	Matl. Labor	1.00 0	LS	491,972.00 0.00	491,972 0	491,972
2 -A	HAUL 13,156 CY OF VITRIFIED SOIL/DEBRIS FROM PGDP VITRIFICATION PLANT (VORTEC) TO OF Y-12 LF/DWI REF VITRIVOR.XLSDWI TO PGDP IC	Matl. Labor	1.00 0	LS	497,889.00 0.00	497,889 0	497,889
3 -A	SPECIAL TRAILERS FOR HAULING UP TO 45 TONS PER LOAD	Matl. Labor	4.00 0	EA	55,200.00 0.00	220,800 0	220,800
4 -A	G/C ADMIN OF S/C, 6%	Matl. Labor	1.00 0	LOT	72,640.00 0.00	72,640 0	72,640

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	1,283,301	0	1,283,301
TOTAL	1,283,301	(hrs. 0) 0	1,283,301

WBS ..... 4.0.1.07 Loading/Transporting Debris
Cost Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.7 Loading/Packaging
Discipline ..... O OTHER
B/M Title ..... LOAD TRT DEBRIS IN CONTAINERS
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.15 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	NON-RECYCLABLE (NON-METAL) DEBRIS, LOAD FOR HAULING TO Y-12 LANDFILL TOTAL: 1146 CY						
1 -A	ALLOWANCE FOR FE LOADER, FIGURE OPERATOR 1/2 TIME	Matl.	1.00	MO	4,000.00	4,000	
		Labor	87	OP	25.25	2,197	6,197

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		4,000		2,197	6,197
SALES TAX		340			340
SUBTOTAL		4,340		2,197	6,537
TOTAL INDIRECT	20.00%	868	20.00%	439	1,307
TOTAL		5,208	(hrs. 87)	2,636	7,844

WBS ..... 4.0.1.07 Loading/Transporting Debris
Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
,cipant ..... MK53 FP UNIT SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.7 Transporting
Discipline ..... O OTHER
B/M Title ..... TRANSP TRT DEBRIS TO Y-12 LF
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.16 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	NON-RECYCLABLE (NON-METAL) DEBRIS, HAUL TO Y-12 SANITARY LANDFILL						
1 -A	HAUL 1146 CY OF NON-SALVAGEABLE DEBRIS FROM AUTO DEBRIS WASH TREATMENT, REF DWTRNDSP.XLSY-12IC (INTERMODAL CONTAINERS)	Matl.	1.00	LS	15,676.00	15,676	
		Labor	0		0.00	0	15,676
2 -A	G/C ADMIN OF S/C, 6%	Matl.	1.00	LOT	941.00	941	
		Labor	0		0.00	0	941

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	16,617	0	16,617
TOTAL	16,617	(hrs. 0) 0	16,617

WBS ..... 4.0.1.08 WAC Required Actions/Disposal
Cost Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.8 WAC REQUIRED ACTIONS
Discipline ..... O OTHER
B/M Title ..... WAC REQUIRED ACTIONS
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.17 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	WAC REQUIRED ACTION						
	SAMPLING (HOURS) AND ANALYSIS COST FOR CONTAINERS GOING TO Y-12 LANDFILL						
1 -A	VITRIFIED MATERIAL	Matl.	710.00	EA	1,500.00	1,065,000	
		Labor	1,420	L	17.65	25,063	1,090,063
2 -A	NON-METAL TREATED DEBRIS	Matl.	59.00	EA	1,500.00	88,500	
		Labor	118	L	17.65	2,083	90,583
3 -A	SAMPLING (HOURS) AND ANALYSIS COST FOR CONTAINERS GOING TO SALVAGE (BY OTHERS)	Matl.	518.00	EA	1,500.00	777,000	
		Labor	1,036	L	17.65	18,285	795,285
	FIGURE SAME SIZE AS ABOVE CONTAINERS						
	10355 TONS/20 TONS PER CONTAINER = 518 CONTAINERS						
****	SUBTOTAL ****	Matl.				1,930,500	
		Labor	2,574			45,431	1,975,931

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		1,930,500		45,431	1,975,931
SALES TAX		164,093			164,093
SUBTOTAL		2,094,593		45,431	2,140,024
TOTAL INDIRECT	20.00%	418,919	20.00%	9,086	428,005
TOTAL		2,513,512	(hrs. 2,574)	54,517	2,568,029

ALTERVATIVE 4 DWI

WBS ..... 4.0.1.10 Decon/Demobilization
Cost Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.10 DECON/DEMOBILIZATION
Discipline ..... O OTHER
B/M Title ..... DECON/DEMOBILIZATION, ALT 4
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.19 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	DEMOBILIZATION, ALT 4 SPECIFIC						
	DEMO AUTOMATED DEBRIS WASHING AREA						
1 -A	EXCAVATE 6" BASE COURSE, 10,000 SF	Matl.	185.00	CY	1.00	185	
		Labor	7	OP	25.25	177	362
2 -A	DEMO 8" S.O.G., REINFORCED	Matl.	23.00	SY	10.00	230	
		Labor	23	ZZ	24.00	552	782
3 -A	DEMO 4" S.O.G., REINFORCED	Matl.	67.00	SY	5.00	335	
		Labor	34	ZZ	24.00	816	1,151

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		750		1,545	2,295
SALES TAX		64			64
SUBTOTAL		814		1,545	2,359
TOTAL INDIRECT	20.00%	163	20.00%	309	472
TOTAL		977	(hrs. 64)	1,854	2,831

WBS ..... 4.0.1.10 Decon/Demobilization
Code ..... 6100 REMEDIAL ACTION
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.10 DECON/DEMOBILIZATION
Discipline ..... O OTHER
B/M Title ..... DECON/DEMOBILIZATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.1.18 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	DECON/DEMOBILIZATION						
1 -A	DECON EQUIPMENT	Matl.	10.00	EACH	250.00	2,500	
		Labor	240	L	17.65	4,236	6,736
2 -A	DECON TEMPORARY FACILITIES	Matl.	1.00	LOT	2,000.00	2,000	
		Labor	240	L	17.65	4,236	6,236
3 -A	DEMOBILIZATION (REMOVAL OF TRAILERS AND EQUIPMENT **DECON/DEMOBILIZATION**	Matl.	1.00	LOT	500.00	500	
		Labor	120	TD	18.20	2,184	2,684

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		5,000		10,656	15,656
SALES TAX		425			425
SUBTOTAL		5,425		10,656	16,081
TOTAL INDIRECT	20.00%	1,085	20.00%	2,131	3,216
TOTAL		6,510	(hrs. 600)	12,787	19,297

WBS ..... 4.0.1.11 Secondary Waste Disposal
Cost Code ..... 9300 TREATMENT, STORAGE & DISPOSAL
Participant ..... MK51 MK-F OAK RIDGE FPSC
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.1.11 Secondary Waste Disposal
Discipline ..... O OTHER
B/M Title ..... SECONDARY WASTE DISPOSAL
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-06 RA/CERCLA PJT/ACT/CONSTR
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area .....
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH Boll/J Klew
Quantity Take-Off By ... DH Bolling
Trace Number ..... O.1.20 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SECONDARY WASTE STREAM FROM AUTO DEBRIS WASH TREATABILITY STUDY AND FULL SCALE TREATMENT						
	LIQUID						
	FROM TREATMENT PROCESSES						
	SPENT TREATMENT SOLUTION, 10,000 GAL TOTAL, SAY 50 GAL/DRUM 200 DRUMS						
	ION EXCHANGE RESIN SOLUTION, 250 LBS/DRUM 30 DRUMS						
	CARBON FILTER MEDIA SOLUTION (SLUDGE), 400 LBS/DRUM 20 DRUMS						
1 -A	TRANSPORT AND DISP TO Y-12 EVAP TREAT FAC	Matl. Labor	12,500.00 70	GAL TD	11.00 18.20	137,500 1,274	138,774
	SOLID						
	FROM TREATMENT PROCESSES, ALLOWANCE FOR DISPOSAL (USE ENVIROCARE DISPOSAL COST FOR MIXED WASTE)						
2 -A	FILTER CARTRIDGES, SAY 3 EA 55 GAL DRUMS = 21 CF	Matl. Labor	21.00 0	CF	44.00 0.00	924 0	924
3 -A	PPE, SAY 120 EA 55 GAL DRUMS = 840 CF	Matl. Labor	840.00 0	CF	44.00 0.00	36,960 0	36,960
4 -A	TRANSPORTATION OF ABOVE TO ENVIROCARE	Matl. Labor	3.00 0	TRUCKS	4,000.00 0.00	12,000 0	12,000
	SECONDARY WASTE STREAM FROM S/C ACTIVITIES						
5 -A	DECON WATER ALLOWANCE FROM EQUIP DECON (ASSUME TREATMENT AT Y-12 WITH TRANPORTATION INCLUDED)	Matl. Labor	10,000.00 56	GALS TD	11.00 18.20	110,000 1,019	111,019

.em	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
6 -A	DISPOSAL OF PPE AND OTHER NONE LIQUID ALLOWANCE	Matl.	1.00	LOT	10,000.00	10,000	
		Labor	8	TD	18.20	146	10,146

BILL OF MATERIAL SUMMARY	Material		Labor		Total Cost M + L
TOTAL DIRECT		307,384		2,439	309,823
SALES TAX		26,128			26,128
SUBTOTAL		333,512		2,439	335,951
TOTAL INDIRECT	20.00%	66,702	20.00%	488	67,190
TOTAL		400,214	(hrs. 134)	2,927	403,141

ALTERVATIVE 4 DWI

WBS ..... 4.0.2.01 Project Management
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.4 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	DESIGN MANAGER (1/4 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	1,332	ER	78.96	105,175	105,175

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	105,175	105,175
TOTAL	0	(hrs. 1,332) 105,175	105,'

WBS ..... 4.0.2.01 Project Management
Code ..... 9200 PROGRAM MANAGEMENT
cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.2 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	TECHNICAL MANAGER (1/2 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	2,664	A1	60.03	159,920	159,920
2 -A	ESTIMATING & SCHEDULE SUPPORT (1/10 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	540	A1	60.03	32,416	32,416
3 -A	HEALTH & SAFETY COORDINATOR (1/10 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	540	A1	60.03	32,416	32,416
4 -A	FINANCE OFFICER & BUSINESS ANALYST (1 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	5,292	A1	60.03	317,679	317,679

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	542,431	542,431
TOTAL	0	(hrs. 9,036) 542,431	542,431

WBS ..... 4.0.2.01 Project Management
Cost Code ..... 9200 PROGRAM MANAGEMENT
Participant ..... K026 ENVIRONMENTAL MGMT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.1 PROJECT MANAGEMENT
Discipline ..... O OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.1 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	ENVIRONMENTAL PROJECT MANAGER (1/2 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	2,664	A1	54.82	146,040	146,040

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	146,040	146,040
TOTAL	0	(hrs. 2,664) 146,040	146,0

WBS ..... 4.0.2.01 Project Management
Code ..... 9200 PROGRAM MANAGEMENT
cipant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.1 PROJECT MANAGEMENT
Discipline ..... 0 OTHER
B/M Title ..... PROJECT MANAGEMENT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-01 RA/CERCLA PJT/MANAGEMENT
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site 0
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.3 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	PROJECT MANAGEMENT						
1 -A	WASTE MANAGEMENT (1/4 FTE)	Matl.	36.00	MONTHS	0.00	0	
		Labor	1,332	A1	50.00	66,600	66,600

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	66,600	66,600
TOTAL	0	(hrs. 1,332) 66,600	66,600

ALTERVATIVE 4 DWI

WBS ..... 4.0.2.02 Remedial Design Work Plan
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.5 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	WRITE THE PLAN (1-1/2 FTE FOR 2 MONTHS)	Matl.	2.00	MONTHS	0.00	0	
		Labor	440	ER	78.96	34,742	34,742

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	34,742	34,742
TOTAL	0	(hrs. 440) 34,742	34,7

WBS ..... 4.0.2.02 Remedial Design Work Plan
Code ..... 5100 TITLE I & II ENG
cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.7 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	OVERSIGHT AND REVIEW OF PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	120	A1	60.03	7,204	7,204

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	7,204	7,204
TOTAL	0	(hrs. 120) 7,204	7,204

ALTERVATIVE 4 DWI

WBS ..... 4.0.2.02 Remedial Design Work Plan
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.6 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	TECHNICAL SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,

WBS ..... 4.0.2.02 Remedial Design Work Plan
Code ..... 5100 TITLE I & II ENG
Participant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.2 REMEDIAL DESIGN WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.8 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN WORK PLAN						
1 -A	REVIEW AND SUPPORT TO PLAN	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

WBS ..... 4.0.2.03 Remedial Design Report
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.9 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REMEDIAL DESIGN, CIVIL (2 FTE)	Matl.	12.00	MONTHS	0.00	0	
		Labor	4,404	ER	78.96	347,740	347,740
2 -A	REMEDIAL DESIGN, TREATMENT (2 FTE)	Matl.	12.00	MONTHS	0.00	0	
		Labor	4,404	ER	78.96	347,740	347,740

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	695,480	695,480
TOTAL	0	(hrs. 8,808) 695,480	695,480

WBS ..... 4.0.2.03 Remedial Design Report
r Code ..... 5100 TITLE I & II ENG
. cipant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.10 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	OVERSIGHT AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	320	A1	60.03	19,210	19,210

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	19,210	19,210
TOTAL	0	(hrs. 320) 19,210	19,210

WBS ..... 4.0.2.03 Remedial Design Report
Cost Code ..... 5100 TITLE I & II ENG
Participant ..... K045 WASTE MANAGEMENT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.11 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	REVIEW AND SUPPORT TO REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	260	A1	50.00	13,000	13,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	13,000	13,000
TOTAL	0	(hrs. 260) 13,000	13,

WBS ..... 4.0.2.03 Remedial Design Report
r Code ..... 5100 TITLE I & II ENG
cipant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.3 REMEDIAL DESIGN REPORT
Discipline ..... O OTHER
B/M Title ..... REMEDIAL DESIGN REPORT
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.12 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL DESIGN REPORT						
1 -A	TECHNICAL SUPPORT FOR REMEDIAL DESIGN	Matl.	1.00	LOT	0.00	0	
		Labor	220	TS	60.89	13,396	13,396

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	13,396	13,396
TOTAL	0	(hrs. 220) 13,396	13,396

WBS ..... 4.0.2.04 Remedial Action Work Plan
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... AE01 ARCHITECT-ENGNR (F-W)
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.14 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPORT	Matl.	1.00	LOT	0.00	0	
		Labor	40	ER	78.96	3,158	3,158

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	3,158	3,158
TOTAL	0	(hrs. 40) 3,158	3,

WBS ..... 4.0.2.04 Remedial Action Work Plan
Code ..... 9470 CONSTRUCTION SUPPORT
.cipant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.13 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	PREPARE PLAN (2 FTE)	Matl.	4.00	MONTHS	0.00	0	
		Labor	880	MX	69.00	60,720	60,720

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	60,720	60,720
TOTAL	0	(hrs. 880) 60,720	60,720

WBS ..... 4.0.2.04 Remedial Action Work Plan
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.16 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	TECHNICAL SUPPORT AND REVIEW	Matl.	1.00	LOT	0.00	0	
		Labor	40	TS	60.89	2,436	2,436

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,436	2,436
TOTAL	0	(hrs. 40) 2,436	2,4

WBS ..... 4.0.2.04 Remedial Action Work Plan
Code ..... 9470 CONSTRUCTION SUPPORT
cipant ..... X027 WASTE MGMT & REM ACTION
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.4 REMEDIAL ACTION WORK PLAN
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION WORK PLAN
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.15 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION WORK PLAN						
1 -A	REVIEW AND SUPPOT	Matl.	1.00	LOT	0.00	0	
		Labor	40	A1	50.59	2,024	2,024

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	2,024	2,024
TOTAL	0	(hrs. 40) 2,024	2,024

WBS ..... 4.0.2.05 Remedial Action Integration
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... C069 CENTRAL ENGINEERING
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number 0.2.19 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	GENERAL CONSTRUCTION OVERSIGHT (1/5 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	540	A1	60.03	32,416	32,416

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	0	32,416	32,416
TOTAL	0	(hrs. 540) 32,416	32,

WBS ..... 4.0.2.05 Remedial Action Integration
Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... MK66 MK-F INDIRECTS & FEE
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.18 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -C	MK-FERGUSON INDIRECTS AND FEE ON MK51 (FPSC) @ 15.7%	Matl.	4,578.00	K$	157.00	718,746	
		Labor	0		0.00	0	718,746
2 -C	MK-FERGUSON INDIRECTS AND FEE ON MK53 (FPSC) @ 15.7%	Matl.	11,386.00	K$	157.00	1,787,602	
		Labor	0		0.00	0	1,787,602
3 -C	MK-FERGUSON INDIRECTS AND FEE ON MK67 @ 15.7%	Matl.	360.00	K$	157.00	56,520	
		Labor	0		0.00	0	56,520

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL INDIRECT	2,562,868	0	2,562,868
TOTAL	2,562,868	(hrs. 0) 0	2,562,868

WBS ..... 4.0.2.05 Remedial Action Integration
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... MK67 MK-F ADMIN SUPPORT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... MK-F S/C OH
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... 0.2.17 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	CONSTRUCTION MANAGER (1/4 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	666	MX	69.00	45,954	45,954
2 -A	CONSTRUCTION ENGINEER (1 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	2,646	MC	54.00	142,884	142,884
3 -A	PROJECT CONTROLS (1/5 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	540	MP	54.00	29,160	29,160
4 -A	PROCUREMENT SUPPORT (1 FTE)	Matl.	2.00	MONTHS	0.00	0	
		Labor	294	MB	57.00	16,758	16,758
5 -A	SAFETY OVERSIGHT (1/5 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	540	MH	55.00	29,700	29,700
6 -A	HP & IH OVERSIGH (1/5 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	540	MJ	55.00	29,700	29,700
****	SUBTOTAL ****	Matl.				0	
		Labor	5,226			294,156	294,156
7 -A	VEHICLE USAGE	Matl.	2,613.00	HRS	1.75	4,573	
		Labor	0		0.00	0	4,573

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	4,573	294,156	298,729
TOTAL	4,573	(hrs. 5,226) 294,156	298,729

WBS ..... 4.0.2.05 Remedial Action Integration
Cost Code ..... 9470 CONSTRUCTION SUPPORT
Participant ..... TS01 TECH SUPPORT CONTRACTOR
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.2.5 REMEDIAL ACTION INTEGRATION
Discipline ..... O OTHER
B/M Title ..... REMEDIAL ACTION INTEGRATION
Receiving Site .... OTHER
Cross-Cut Code .... 01-06-04 RA/CERCLA PJT/DESIGN
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... NA
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DH BOLLING
Trace Number ..... O.2.20 O

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	REMEDIAL ACTION INTEGRATION						
1 -A	TECHNICAL SUPPORT DURING CONSTRUCTION FOR DOE (1/5 FTE)	Matl.	18.00	MONTHS	0.00	0	
		Labor	540	TS	60.89	32,881	32,881
2 -A	INDEPENDENT VERIFICATION (ALLOWANCE)	Matl.	18.00	MONTHS	5,000.00	90,000	
		Labor	432	TS	60.89	26,304	116,304

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	90,000	59,185	149,185
TOTAL	90,000	(hrs. 972) 59,185	149,185

WBS ..... 4.0.3.01 Surveillance & Maintenance
Code ..... 7100 SURVEILLANCE & MAINTENANCE
cipant ..... SC01 OFFSITE SUBCONTRACT
Level of Estimate . P Planning/Feasibility Estimate
B/M Attribute ..... 4.0.3.1 SITE MAINTENANCE
Discipline ..... O OTHER
B/M Title ..... SITE MAINTENANCE
Receiving Site .... OTHER
Cross-Cut Code .... 01-03-09 RA/S & M/S & M
Standard Value File C:\AES60F\ERFEB96A.val
Estimate File ..... C:\AES60F\DWI\ALT4\ALT-4.Est 10-01-96 4:11p

Building/Area ..... SITE
Plant Site ..... O
Contracting Type ..... G General
Funding Type ..... EXPENSE
Source Site ..... OTHER
Discipline Estimator ... DH BOLL/J Klew
Quantity Take-Off By ... DHB
Trace Number 0.3.1 0

Expiration Date: 05/23/1997

Item	Description	MATL. / LABOR	Quantity / Hours	Unit / Craft	Unit Price / Rate	Total Material / Total Labor	Total Cost M + L
	SITE MAINTENANCE						
1 -A	MOWING OF SITE 4 TIMES PER YEAR FOR 5 YEARS	Matl.	20.00	EACH	200.00	4,000	
		Labor	480	L	0.00	0	4,000

BILL OF MATERIAL SUMMARY	Material	Labor	Total Cost M + L
TOTAL DIRECT	4,000	0	4,000
TOTAL	4,000	(hrs. 480) 0	4,000

Disciplines
O: OTHER

Total Labor Hours: 63,311

COST SUMMARY

COST SUMMARY	Material	Labor	Total Cost M + L
Line Item Cost	14,313,687	2,843,500	17,157,187
Total Sales Tax	240,495		240,495
SUBTOTAL	14,554,182	2,843,500	17,397,682
Total Indirect	3,176,830	148,332	3,325,162
SUBTOTAL	17,731,012	2,991,832	20,722,844
Overhead	0	0	0
SUBTOTAL	17,731,012	2,991,832	20,722,844
Contingency	6,205,854	1,047,141	7,252,995
SUBTOTAL	23,936,866	4,038,973	27,975,839
Market Adjustment			0
TOTAL			27,975,[illegible]

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* N I S T  B L C C - D E T A I L E D  L C C  A N A L Y S I S (version 4.20-95)*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

PART I - INITIAL ASSUMPTIONS AND COST DATA

Project alternative: DWI ALT4
Run date: 10-02-1996 17:08:43
Run type: Federal Analysis--Projects Subject to OMB A-94
Comment: $1=$1000
Input data file: DWIALT4.DAT, last modified: 10-02-1996/17:08:10
LCC output file: DWIALT4.LCC, created: 10-02-1996/17:08:12
Base Date of Study: OCT 1996
Service Date: OCT 2004
Study period: 13.00 years (OCT 1996 through SEP 2009)
Plan/constr. period: 8.00 years (OCT 1996 through SEP 2004)
Service Period: 5.00 years (OCT 2004 through SEP 2009)
Discount rate: 7.0% Real (exclusive of general inflation)
End-of-year discounting convention

INITIAL CAPITAL ASSET COSTS (NOT DISCOUNTED)
(ADJUSTED FOR PRICE CHANGES DURING PLAN/CONST. PERIOD, IF ANY)

	YEAR (Beginning)	Cost Phasing	Yearly Cost	Total Cost
	OCT 2001	4.0%	$1,342	
	OCT 2002	9.8%	$3,295	
	OCT 2003	84.4%	$28,237	
	OCT 2004	1.7%	$582	
AT SERVICE DATE:	OCT 2005	0.0%	$0	
TOTAL INITIAL CAPITAL ASSET COSTS				$33,456

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

PART II - LIFE-CYCLE COST ANALYSIS
Discount Rate = 7.0% Real (exclusive of general inflation)

PROJECT ALTERNATIVE: DWI ALT4 RUN DATE: 10-02-1996/17:08:43

	PRESENT VALUE (1997 DOLLARS)	ANNUAL VALUE (1997 DOLLARS)
CASH REQUIREMENTS AS OF SERVICE DATE:		
DURING CONSTRUCTION	$22,551	$2,698
AT SERVICE DATE	$0	$0
SUBTOTAL	$22,551	$2,698
OPERATING, MAINTENANCE & REPAIR COSTS:		
NON-ANNUALLY RECURRING COSTS	$2	$0
SUBTOTAL	$2	$0
SALE VALUE OF ORIG CAPITAL COMPONENTS	$0	$0
RESALE VALUE OF CAPITAL REPLACEMENTS	$0	$0
TOTAL LIFE-CYCLE PROJECT COST	$22,553	$2,699