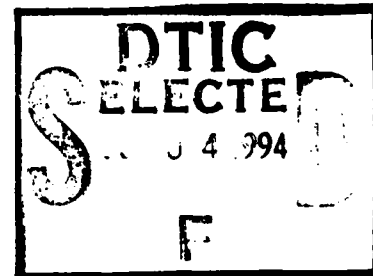


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**ENVIRONMENTAL MANAGEMENT
CATEGORY REPORT
FOR THE
SURVEY OF RESOURCES AVAILABLE FOR
ESTIMATING THE ENVIRONMENTAL COSTS OF
MAJOR DEFENSE ACQUISITION PROGRAMS**

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13. ABSTRACT (Maximum 200 words) This report is the second from the Survey of Resources Available for Estimating the Environmental Costs of Major Defense Acquisition Programs. It presents a cost breakdown structure (CBS) and a cost driver category structure for environmental management (EM). These structures were developed to support a systematic assessment of environmental cost estimating tools; they also should assist analysts in organizing an estimate of environmental costs in a specific acquisition program. The first level cost elements in the CBS are: environmental program management; HTR material management; waste management; environmental resortation/corrective action; and transportation of HTR material and waste. Three additional levels of indenture allow for further definition and detail.				
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**ENVIRONMENTAL MANAGEMENT CATEGORY REPORT
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MAJOR DEFENSE ACQUISITION PROGRAMS**

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PREFACE

Environmental restoration and cleanup costs throughout the Department of Defense (DoD) are increasing. The impact of such costs on Major Defense Acquisition Programs (MDAP) is now looked at much more closely than in years past. Stronger and more stringent environmental, legislative, and regulatory requirements have made existing methods and procedures for identifying, estimating, evaluating, and periodically revisiting the life cycle environmental costs of MDAPs increasingly critical. Various Department of Defense initiatives are being implemented to assess and manage these environmental costs in order to avoid or mitigate the costly alternative of environmental restoration. Specifically, a project established by the Chairman of the Cost Analysis Improvement Group, under the Office of the Secretary of Defense, to ensure that relevant expenses of protecting or restoring the environment are reflected in the Life Cycle Cost (LCC) estimates presented to the Defense Acquisition Board. This project will identify, classify, and critically evaluate cost-estimating models, cost databases, engineering case studies, and other analytical tools to form an understanding of existing Environmental Management (EM) cost estimation and analysis capabilities and to develop plans to improve such capabilities. The intent of this project is to improve the ability of cost analysts, project engineers, program managers, and others to assess the cost impacts of environmental conditions on MDAP LCC estimates and to make design decisions recognizing these environmental cost impacts.

This document, the *Environmental Management Category Report*, provides the framework to address EM activities and cost drivers. In order to establish this framework, two primary questions were addressed: What does EM include? How does EM apply to the LCC of a MDAP?

What Does EM Include?

EM is broadly defined as the management of activities, processes, and products that can or do have an impact on the environment. This impact can take the following different forms:

- Energy releases, including
 - Electromagnetic forces
 - Ionizing radiation
 - Noise
 - Excess heat
- Substance releases comprising
 - Non-hazardous substance releases to air, water, or land
 - Hazardous/toxic substance releases to air, water, or land
 - Ozone-depleting compounds (ODC)
 - Radiological substance releases to air, water, or land

- Physical disruptions to natural habitats caused by activities such as
 - Facility construction
 - Development (e.g., excavation, irrigation)

Impacts to the environment are revealed by degradation or disruption to:

- Ecosystems
- Endangered species
- Cultural and archeological resources
- Human health

The management of such impacts and the associated costs is accomplished through these environmental programs:

- Pollution prevention
- Compliance
- Conservation
- Cleanup

How Does EM Apply to MDAP LCC?

In April 1994, a workshop entitled "Environmental Life Cycle Cost Estimating for Weapon Systems", was convened to address this question. Participants were from the DoD, other Government agencies, the regulatory community, and industry, along with consultants and academia. The result of this workshop was the advent of the Environmental Cost Element Structure (ECES), which is based on the environmental programs of Pollution Prevention, Compliance, Conservation, and Cleanup. ECES provides a foundation for defining EM costs in relation to a weapon system's Work Breakdown Structure (WBS) as defined in the *Work Breakdown Structure Defense Material Items* (MIL-STD-881B). Figure 1 depicts this relationship between the ECES and the WBS.

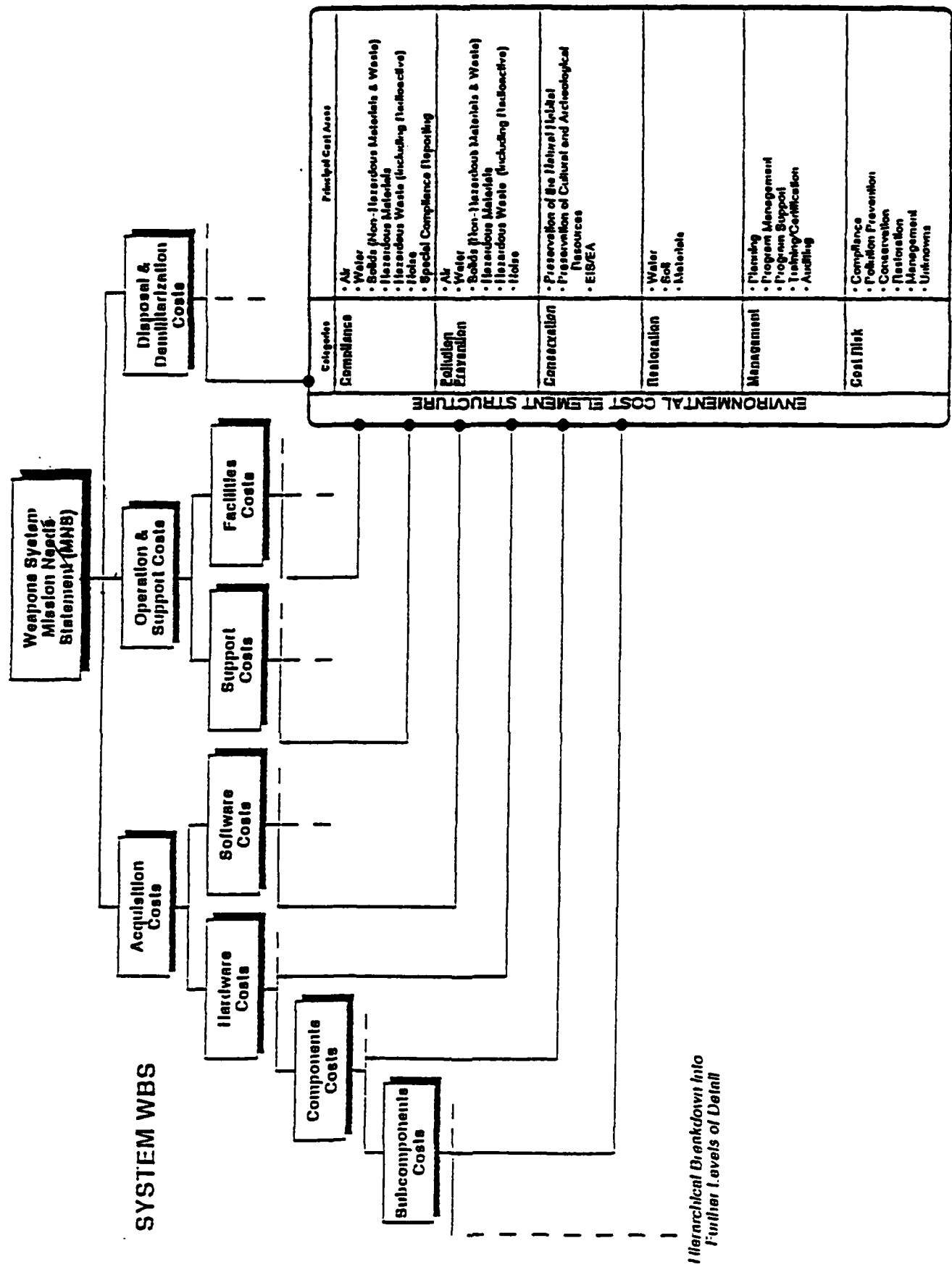


Figure 1. - Integration of the Environmental Cost Element Structure in the Work Breakdown Structure (diagram courtesy of U.S. Air Force)

For the purposes of the project, and specifically this *Environmental Management Category Report*, a derivative of the ECES was established to identify those elements of EM activities that drive environmental cost or are directly influenced by the design of an MDAP. This report focuses on and describes those EM activities that deal with Hazardous, Toxic, and Radiological (HTR) materials and waste management. This ECES derivative is divided into two individual structures:

- Cost Breakdown Structure (CBS) developed to address specific EM activities
- Cost Driver Category (CDC) developed to address major factors that influence EM cost

In order to explain the relationship between the ECES and the CBS and CDC, a crosswalk between them is provided in appendix A.

The CBS is a framework of EM activities (broken down into elements of work) associated with HTR materials and wastes. The activities include management, procurement, distribution, control, treatment, storage, disposal and final disposition of the HTR substances. For completeness, the CBS also includes environmental restoration activities. It is the intent of the DoD that environmental restoration and/or corrective measures activities will not be required, or will be minimized through the implementation of pollution prevention measures and through HTR material management and waste management initiatives.

Similar to the ECES, the CBS applies to each phase of an MDAP's life cycle. That is, the CBS is applicable in an iterative fashion by sub-component and/or facility throughout the life cycle. The portion of the CBS that is applicable will change depending on the phase of the life cycle. For example, the HTR Material Management element (CBS 2.0) is of primary concern during the manufacturing and base operations phases, whereas the Environmental Restoration/Corrective Measures element (CBS 4.0) is of concern during the decommissioning and demilitarization phase. The summary levels of the CBS are shown in figure 2.

CBS Level 1	CBS Level 2
1.0 Environmental Program Management	<ul style="list-style-type: none"> • Program Management • Program Support
2.0 HTR Material Management	<ul style="list-style-type: none"> • HTR Material Management & Support • HTR Material Control & Distribution • HTR Material Management Facilities
3.0 HTR Waste Management	<ul style="list-style-type: none"> • HTR Waste Operations Management & Support • On-site Waste Management Facility Construction/Operations • Off-site HTR Waste Disposal
4.0 Environmental Restoration / Corrective Measures	<ul style="list-style-type: none"> • PA/SI or RFA • RI/FS or RFI/CMS • Remedial Design • Remedial Action/Corrective Measures
5.0 HTR Material & Waste Transportation	<ul style="list-style-type: none"> • Transportation Management • Transportation

Figure 2. - Environmental Management Cost Breakdown Structure

The CDC is organized by major cost-driving factors and considerations associated with EM that can or do significantly influence an MDAP's LCC. The CDC will be used by the project team in conjunction with the CBS to develop an EM cost-estimating evaluation matrix. The primary purpose for developing this matrix is to measure the range and depth of coverage that existing EM cost-estimating tools provide. While the CBS provides the activities associated with EM, the CDC provides other important factors that affect the costs of the activities. For example, the HTR material management activities associated with a highly toxic substance, such as PCB, will be more costly than those for a less toxic substance and the potential for incurring other costs due to medical risks (e.g., exposure, illness, loss of time) and liability risks is greater.

In addition to their use by the project team, the CBS and CDC can be employed as a checklist by cost analysts and project engineers to develop cost estimates and by program managers and others throughout DoD to assess the completeness of the resulting estimates. The summary levels of the CDC are shown in figure 3.

CDC Level 1	CDC Level 2
A. HTR Substance	<ul style="list-style-type: none"> • Hazardous/Toxic • Contact Handled Radiological • Remote Handled Radiological
B. HTR Waste Sources	<ul style="list-style-type: none"> • Process Management • Environmental Restorations
C. Personnel Protection Levels	<ul style="list-style-type: none"> • Protection Levels A-E
D. Mode of Transportation	<ul style="list-style-type: none"> • Truck • Rail • Water • Air
E. Environmental Management Cost Risk	<ul style="list-style-type: none"> • Medical Risk (Exposure/Illness/Loss of Time) • Liability Damages Risk • Regulatory Compliance Risk • Technology Risk • Scope • Unknown

Figure 3. - Environmental Management Cost Driver Categories

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1.0 INTRODUCTION

The Chairman of the Cost Analysis Improvement Group, under the Office of the Secretary of Defense, has initiated an effort to ensure that expenses relevant to protecting or restoring the environment are reflected in the Life Cycle Cost (LCC) estimates presented to the Defense Acquisition Board. As part of this initiative, a project has been established to identify, classify, and critically evaluate cost-estimating models, cost databases, engineering case studies, and other analytical tools to establish an understanding of the existing Environmental Management (EM) cost estimation and analysis capabilities and to develop plans to improve these capabilities. The resulting set of analytical tools will be useful to cost analysts, project engineers, program managers, and others to assess the cost impact of environmental conditions on Major Defense Acquisition Program (MDAP) LCC estimates and to make design decisions recognizing the impacts.

The Preface of this report provides a broad definition of EM and discusses the focus of the project. In short, this project focuses on environmental activities associated with Hazardous, Toxic, and Radiological (HTR) materials and waste. This *Environmental Management Category Report* provides the framework to address EM activities and cost-driving factors associated with MDAPs. EM, as defined in this report, is the environmental management of HTR substances including Ozone-Depleting Compounds (ODC)— throughout the life cycle of the MDAP. As defined in this report, EM comprises five major categories of work:

- Environmental Program Management
- HTR Material Management
- HTR Waste Management
- Environmental Restoration/Corrective Measures
- HTR Material and Waste Transportation

This report defines two individual structures: the first is an activity-based Cost Breakdown Structure (CBS); the second is a cost-driving structure, the Cost Driver Category (CDC), which addresses major factors influencing EM cost. These structures are a derivative of the Environmental Cost Element Structure (ECES) discussed in the Preface of this report (crosswalk between the ECES and the CBS and CDC is provided in appendix A). The primary purpose of the CBS and the CDC is to give the project team a means to measure the range and depth of coverage that existing EM cost-estimating models, cost databases, engineering case studies, and other analytical tools provide. The CBS and the CDC can also be used as a checklist by cost analysts and project engineers in developing cost estimates and by program managers and others throughout the DoD to assess the completeness of the resulting estimates.

The *Environmental Management Category Report* is the second in a series of related reports to be generated by this project, the *Environmental Management Tool Screening Report* being the first. The remaining reports will be included in the next phase of this project, which will provide an evaluation of the tools selected from the *Environmental Management Tool*

Screening Report. The evaluation phase will use an evaluation matrix comprising the CBS and CDC, as well as other evaluation criteria, to critically evaluate the tools and develop short-term and mid-term plans to address any deficiencies.

The following is a brief description of key reports generated by this project:

- The *Environmental Management Tool Screening Report* includes a comprehensive survey of more than 190 cost-estimating models, databases, studies, and other tools, all of which were screened to select an optimal set of tools for full evaluation. Seven cost models and databases and 37 engineering case studies and reports were selected for further evaluation. The results of this evaluation will be included in the third report, the *Environmental Management Tool Evaluation Report*.
- The *Environmental Management Category Report* consists of the EM CBS and EM CDCs. The primary purpose for developing the CBS and CDC is to measure the range and depth of coverage that existing EM cost-estimating tools provide. Evaluation will occur during the next phase of the project, as described below.
- The *Environmental Management Tool Evaluation Report* will provide the results of a detailed, independent evaluation of the selected tools identified in the *Environmental Management Tool Screening Report*. Each selected tool will be evaluated to assess its range and depth of coverage according to the cost categories developed in the *Environment Management Category Report*. Any shortcomings or gaps in this coverage will be addressed in short-term and mid-term plans. Pertinent information from all the reports will be included in the final report.

Together, the reports offer a comprehensive analysis of existing models, databases, case studies, and reports; identify current EM cost-estimating and analysis capabilities; and provide a foundation for further research and analysis to address environmental costs associated with MDAPs.

2.0 DEVELOPMENT OF THE COST BREAKDOWN STRUCTURE

The Cost Breakdown Structure (CBS) is a hierarchical structure with the five level 1 elements:

1. Environmental Program Management;
2. Hazardous, Toxic, and Radiological (HTR) Material Management;
3. HTR Waste Management;
4. Environmental Restoration/Corrective Measures; and
5. HTR Material and Waste Transportation.

There are three more levels of indenture included in the CBS. Along with level 1, CBS level 2 is intended to include all environmental management activities associated with HTR materials and wastes at the various depot facilities, manufacturing facilities, and operational bases. Level 3 is intended to be comprehensive, but not all-inclusive of all EM activities. As discussed in the Preface, the CBS is similar to the Environmental Cost Element Structure (ECES) in that it applies to each phase of the MDAP's life cycle phase in an iterative fashion by sub-component and/or facility. Level 4 of the CBS is provided for information and only gives examples of the activities included in level 3.

The CBS is derived from the following five cost structures:

- DOE, Idaho National Engineering Laboratory, Prepared by EG&G Idaho Inc., Cost Modules and Work Breakdown Structure contained in *Waste Management Facilities Cost Information for Mixed Low-Level Waste*, March, 1994.
- DoD Environmental Cost Estimating Workshop Documentation, *Final Report of the Environmental Life Cycle Cost Estimating for Weapons Systems Workshop* (the "Environmental Cost Element Structure"), June 1994.
- Interagency Cost Estimating Group (ICEG) Remedial Studies (assessment) and Remedial Design Work Breakdown Structure, *Composite Work Breakdown Structure*, June 1994.
- Interagency Cost Estimating Group (ICEG) Remedial Action Work Breakdown Structure, *HTRW [Hazardous, Toxic, and Radioactive Waste] Remedial Action Work Breakdown Structure (WBS)*, October 27, 1993.
- TASC, Cost Element Definitions, *Hazardous Materials Life Cycle Estimator User's Guide Version 3.1*, Brooks Air Force Base Human Systems Center, July 8, 1994.

Note: More information on the above is provided in the Annotated Bibliography of this report.

The first referenced cost structure was principal in the development of HTR Waste Management (CBS element 3.0). The second referenced cost structure was principal in the development of the Environmental Program Management (CBS element 1.0) and provided a frame of reference for the development of the CBS and CDC. The relationship between the CBS and CDC to the ECES is discussed in the Preface to this report, and a crosswalk between them is provided in appendix A. The third and fourth referenced cost structures were used directly without change for the Environmental Restoration/Corrective Measures (CBS element 4.0). These WBSs were developed by the ICEG, an informal, ad hoc group with representatives from the DoD, the Department of Energy (DOE), the Environmental Protection Agency, and other agencies. These WBSs are in a formal interagency review and approval process. The U.S. Navy and the U.S. Army Corps of Engineers currently use these WBSs to contract specific environmental restoration projects. The studies and design *Composite Work Breakdown Structure* is established to three levels of detail, with examples of work elements provided at the fourth level. As of the date of this report, a WBS dictionary has not been developed. The *Remedial Action Work Breakdown Structure* is established to five levels of detail. A dictionary has been developed but is not included in this report. Together, the two WBSs comprise the Environmental Restoration/Corrective Measures (CBS element 4.0) and are provided in appendix C. The fifth referenced cost structure was principal in the development of HTR Material Management (CBS element 2.0) and the cost risk category included in the CDC.

The CBS has been reviewed and analyzed by environmental professionals and cost analysts from both the DOE and DoD. The project team visited the DOE's Idaho Engineering Laboratory, the F-16 depot at Hill Air Force Base, and the U.S. Army Program Management Office, Special Operations Aircraft installation at St. Louis, Missouri. In addition to these visits, tele-conferences were held with contract and environmental management professionals from Lockheed's Fort Worth, Texas Facility and Wright-Patterson Air Force Base. Review and comments on the draft of this report were also provided by the Air Force Civil Engineering Support Agency, Tyndall Air Force Base. All comments were analyzed, discussed, and reconciled with the project team, resulting in appropriate modification to the CBS and CDC. The resulting CBS and CDC are sufficient for the purposes of this project, to measure the range and depth of coverage of existing (EM) cost estimating tools and should prove useful as a checklist for cost analysts, project engineers, program managers, and others throughout the DoD.

3.0 APPLICATION OF THE COST BREAKDOWN STRUCTURE

The Cost Breakdown Structure (CBS), in conjunction with the Cost Driver Category (CDC) (included in section 5.0 of this report), will be used by the project team to assess the range and depth of coverage of existing cost-estimating tools, as discussed in the Introduction of this report. The range is a measure of the number of major elements (CBS levels 1 and 2) of work addressed by the tool. The depth is measured by the number of levels of detail in a given category that is addressed by the tool. For example, a tool's range may address only the remedial activities portion of the Environmental Restoration category, yet its depth of coverage may provide unit price analysis to the fifth level of detail.

In addition to its application for this project, the CBS provides DoD program managers, cost analysts, and the technical community with a common structure of work elements directly associated with HTR materials, waste management, and environmental restoration. As stated earlier, the CBS can be used as a checklist by cost analysts to develop MDAP LCC estimates or to perform various trade studies concerning environmental management activities. An example CBS and CDC application is provided in appendix B of this report. The trade study example highlights the fact that the CBS excludes activities that are not directly associated with the environmental management of HTR materials and wastes. (Examples of the activities not included in the CBS are the manufacturing and maintenance operations, which are primary activities already included in the LCC estimates.) Refer to appendix B for further explanation of this CBS application.

The CBS may also have application as a structure to collect and analyze historical environmental management cost data. However, it is important to note that *the CBS is not intended to be used as a cost-accounting structure*. Many of the costs included in Environmental Program Management (CBS element 1.0) are generally considered to be part of the overhead pool and are not readily separable. Additionally, many of the elements of work in the CBS are performed on a facility-wide basis (in a batch process) and are not readily separable by program.

The topic of environmental cost reporting was addressed at the "Workshop on the Environmental Life Cycle Cost Estimating for Weapons Systems" which developed the ECES (refer to the Preface of this report for a brief discussion on the workshop). The following is an excerpt from the workshop's final report dated June 1994.

Requirements to identify costs reported separately from those of weapons systems as environmental costs are to be addressed as follows:

- The weapon system cost analysis requirement document (CARD) must have all environmental (C3P2, etc.) requirements and environmental goals/directives stated explicitly. The goal of the component cost element structure and its integration into the [Component Cost Analysis] CCA process is to examine environmental quality issues.

- All environmentally-related costs are therefore fully integrated into the life-cycle cost of a weapons system, just as are other categories of costs (e.g., weight limitations, radar avoidance requirements, target detection and combat maneuverability). Therefore, although environmental issues may stimulate process changes or system improvements in weapons systems, the costs for these changes and improvements inherent in the acquisition process are difficult and, in some cases, impractical to separate from other costs.
- If required to identify environmental costs associated with the introduction of a weapons system, the consensus on which costs are to be specified as environmental costs are those costs directly associated with compliance-driven activities (e.g., processes, equipment, fees, labor, materials). These costs are those that can be directly allocated to meeting specific regulations and directives imposing the limitation on environmental impacts.
- In some scenarios, separate reporting of environmental costs may be required or mandated. This approach is inappropriate given the above integration of these costs into the overall design and costing of the weapons system.

Although the CBS cost elements should be considered when developing a LCC estimate, they can be included in the estimate either explicitly or implicitly. The important point is that the environmental management costs are included (and only once) in the LCC estimates.

4.0 COST BREAKDOWN STRUCTURE DICTIONARY

1.0	Environmental Program Management
<p>Definition: Environmental Program Management includes the development of plans and programs associated with environmental pollution prevention, compliance, and conservation. The professional support functions associated with these plans, programs, and other environmental management activities are also included in this element. These activities are the infrastructure required of every program to conduct business and are generally considered as overhead.</p>	
<p>Subordinate Elements: 1.01 Program Management 1.02 Program Support</p>	
<p>Notes: The activities included in Environmental Program Management are often considered to be overhead functions (included in the indirect cost accounting pool) and are generally not separable by MDAP. These CBS elements are provided for consideration during the development of an MDAP LCC estimate and other cost analyses. Special MDAP requirements such as new facility construction may require additional Environmental Program Management resources. An example of this consideration is provided in appendix B of this report.</p>	

1.01

Program Management

Definition:

Program Management includes activities performed by professional staff to develop plans and programs to manage, procure, distribute, control, treat, store, dispose, and monitor HTR materials and waste. This element provides the program management activities that deal most directly with these HTR environmental requirements.

Subordinate Elements:

1.01.01 Program Planning

Examples:

- Compliance
- Pollution Prevention
- Conservation
- Cleanup

1.01.02 Compliance Management

Examples:

- Regulatory Interaction (...reporting, permitting)
- Executive Order Compliance
- Environmental Law Compliance (air, water, solids, and noise)
- State Statutes/State Law Compliance
- Local and Municipal Law Compliance
- Environmental Management Audits
- Record Keeping

1.01.03 Pollution Prevention Management

Examples:

- Air, Water, Solids, and Noise Pollution Prevention Programs
- HTR Material Elimination/Reduction/Substitution Programs
- Waste Minimization Program
- Reuse/Recycle Programs

1.01.04 Conservation Management

Examples:

- Preservation of Natural Habitat
- Preservation of Cultural and Archeological Resources
- EIS/EA

1.01.XX Other

Notes:

Program Management is separated from Program Support to provide visibility to those management activities more directly related to Compliance, Pollution Prevention, Conservation and Cleanup.

1.02	Program Support
<p>Definition:</p> <p>This element includes the legal, medical, and other professional support that can be affected by HTR material and waste management activities. These support activities include several program support functions required to conduct any program (including environmental programs), such as systems engineering, cost and schedule estimating, financial management, and contracting activities. The activities included in this element provide support for those areas most likely to be affected by the environmental management requirements or by responding to environmental conditions.</p>	
<p>Subordinate Elements:</p> <p>1.02.01 Training/Certification</p> <p><u>Examples:</u></p> <ul style="list-style-type: none"> - Personal Protection Training - Hazardous Communication Training - HTR Material and Waste Handling Training - Emergency Response Training <p>1.02.02 Public Affairs</p> <p>1.02.03 Engineering and Administrative Support</p> <p><u>Examples:</u></p> <ul style="list-style-type: none"> - Cost Estimate/Analysis - Cost/Schedule Control System Criteria - Engineering Network Analysis - Prepare Reports/Participate in Reviews - Subcontract Administration <p>1.02.04 Legal Support</p> <p><u>Examples:</u></p> <ul style="list-style-type: none"> - Enforcement Actions (e.g., civil, criminal, citizen suits) - Civil Suit/Toxic Torts Defense <p>1.02.03 Medical</p> <p><u>Examples:</u></p> <ul style="list-style-type: none"> - Occupational Physical Examinations - Industrial Hygiene Surveys <p>1.02.04 Health and Safety</p> <p>1.02.05 Quality Assurance/Quality Control</p> <p>1.02.06 Emergency Response</p> <p>1.02.XX Other</p>	
<p>Notes:</p> <p>This element is included in the CBS for consideration and/or incorporation, as appropriate, in LCC estimates, but is less sensitive to specific HTR material management decisions than the Program Management element.</p>	

2.0	HTR Material Management
<p>Definition:</p> <p>This element addresses the hands-on management and control of HTR materials for each phase (or portion thereof) of the life cycle of weapons system programs and projects that involve the use of HTR materials. This element also includes activities that implement pollution prevention and compliance initiatives including construction or acquisition of facilities and/or equipment unique to HTR materials.</p>	
<p>Subordinate Elements:</p> <p>2.01 HTR Material Management and Support</p> <p>2.02 HTR Material Control and Distribution</p> <p>2.03 HTR Material Management Facilities</p>	
<p>Notes:</p> <p>The activities included under HTR Material Management are considered to be directly associated with a given MDAP. Although this element is direct, some costs associated with it may not be separable because many of these activities are facility oriented and are performed in a batch process with other MDAPs.</p>	

2.01	HTR Material Management and Support
<p>Definition: This element specifically includes activities that implement pollution prevention and compliance initiatives developed under Environmental Program Management (CBS element 1.0). The activities to implement Pollution Prevention and Compliance programs are directly correlated to the particular MDAP generating the requirement.</p>	
<p>Subordinate Elements: 2.01.01 Pollution Prevention Program Implementation <u>Examples:</u> - HTR Material Studies - HTR Material Bench Scale Test - HTR Material Demonstration - HTR Material Conservation (recovery, reuse, recycle) 2.01.02 Compliance Program Implementation <u>Examples:</u> - Surveillance of Process Operations - Quality Assurance/Quality Control - Industrial Hygiene Surveys - Waste Management Coordination 2.01.XX Other</p>	
<p>Notes: These activities are primarily the implementation of the plans and programs established under CBS element 1.0.</p>	

2.02

HTR Material Control and Distribution

Definition:

This element implements the programs to control and distribute HTR materials. This element has been referred to as a HTR material pharmacy because the strict control of HTR materials is analogous to the control of pharmaceuticals. At some DoD installations, in order to acquire HTR materials, the user must present a requisition form displaying a certification to handle these materials as well as the reason for their use and the expected quantity required. This element also implements pollution prevention initiatives specific to the conservation of HTR materials through such programs as recycling.

Subordinate Elements:

- 2.02.01 Requisition/Acquisition
- 2.02.02 Handling/Distribution
- 2.02.03 Management/Control of Use
- 2.02.04 Recovery
- 2.02.05 Reuse
- 2.02.06 Recycle
- 2.02.XX Other

Notes:

These activities are associated with the strict management and control of HTR materials. The process of acquiring, control, and using these materials is similar to that of the medical pharmacy industry.

2.03	HTR Material Management Facilities
<p>Definition: HTR Material Management Facilities include any specific or peculiar equipment or facility required to handle, control or use HTR materials. Examples include personnel protection equipment and installation and use of a ventilation system and/or filtering system .</p>	
<p>Subordinate Elements: 2.03.01 Personnel Protection <u>Examples:</u> - Protection Equipment Procurement - Equipment Dispensing and Tracking 2.03.02 HTR Capital Facilities/Equipment 2.03.XX Other</p>	
<p>Notes: Only those facilities unique to HTR material management are included in this element. All facilities dealing with HTR waste streams are included in HTR Waste Management (CBS element 3.0).</p>	

3.0	HTR Waste Management (On-site and/or Off-site)
<p>Definition: HTR Waste Management includes taking custody of the generated waste streams and conducting all HTR waste treatments, storage, and disposal activities required, whether the activity is an extensive on-site operation or simply off-site disposal. The disposal in this case is specific to process waste streams and does not include environmental restoration waste which is included under Remedial Action and/or Corrective Measures (CBS element 4.0).</p>	
<p>Subordinate Elements:</p> <ul style="list-style-type: none"> 3.01 HTR Waste Operations Management and Support 3.02 On-site Waste Management Facility Construction/Operations 3.03 Off-site HTR Waste Disposal 	
<p>Notes: This element includes all activities associated with HTR waste management. The HTR waste may have been produced during a process operation or may be generated by the disposal of a HTR material.</p>	

3.01	HTR Waste Operations Management and Support
<p>Definition: This element addresses the hands-on management and control of HTR waste streams for each phase (or portion thereof) of the life cycle of weapons system programs and projects that generate HTR waste. This element specifically includes activities that implement pollution prevention (see notes below) and compliance management initiatives developed under Environmental Program Management (CBS element 1.0)</p>	
<p>Subordinate Elements: 3.01.01 Pollution Prevention Program Implementation <u>Examples:</u></p> <ul style="list-style-type: none"> - Waste Operations Studies - Waste Operations Bench Scale Tests - Waste Operations Demonstration - Waste Operations Decision Support - Waste Preparation - Waste Monitoring <p>3.01.02 Compliance Program Implementation <u>Examples:</u></p> <ul style="list-style-type: none"> - Interface with Waste Generator - Waste Assessment/Characterization - Waste Stream Control - Quality Assurance/Quality Control <p>3.01.XX Other</p>	
<p>Notes: Pollution Prevention as it applies to HTR Waste Management primarily consists of waste minimization programs. Activities such as bench scale tests are implemented to test treatment technologies that can reduce the volume and/or toxicity of the process waste streams.</p> <p>The activities included under HTR Waste Management are considered to be directly associated with a given MDAP. Although this element is direct, some costs associated with it may not be separable because many of these activities are facility oriented and are performed in a batch process with other MDAPs.</p>	

3.02

On-site Waste Management Facility Construction/Operations

Definition:

This element includes the construction and operations of treatment, storage, and disposal facilities that deal with HTR waste. The treatment facility may include several technologies such as biological, chemical, physical, thermal, and stabilization. The storage facilities may address long-term, short-term, and temporary requirements. The disposal facilities include RCRA Landfills, Shallow Disposal Facilities, and Engineered Disposal Facilities. Facility closure activities are included for all treatment, storage, and disposal facilities mentioned above.

Subordinate Elements:

3.02.01 Treatment Facility Construction/Operations

Examples:

- Building(s) Design/Construction
- Treatment Equipment Procurement/Installation
- Treatment Operations and Equipment Maintenance
(e.g. Biological, Chemical, Physical, Thermal and Stabilization)

3.02.02 Treatment Facility Decontamination and Decommissioning (D&D)

3.02.03 Storage Facility Construction/Operations

Examples:

- Building(s) Design/Construction
- Storage Facility Equipment Procurement/Installation
- Storage Operations & Equipment Maintenance
(e.g., long-term, short-term, temporary)

3.02.04 Storage Facility D&D

3.02.05 Disposal Facility Construction/Operations

Examples:

- Building(s) Design/Construction
- Disposal Facility Equipment Procurement/Installation
- Disposal Operations and Equipment Maintenance
(RCRA Landfill, Shallow Disposal Facility, Engineered Disposal Facility)

3.02.06 Treatment, Storage, and Disposal Facility Closure

3.02.XX Other

Notes:

This element includes all handling of HTR wastes with the exception of HTR Off-site Waste Disposal (CBS element 3.03).

3.03	Off-site HTR Waste Disposal
Definition: This element includes the payment of fees to either commercial or other than commercial (Government-owned) disposal operations. The loading and transportation cost of these wastes may be included in the disposal fee. If it is not then this task should be included in the HTR Materials and Waste Transportation (CBS element 5.0).	
Subordinate Elements: 3.03.01 Commercial (Fee) 3.03.02 Other than Commercial (Fee)	
Notes: This element does not include disposal of waste acquired from environmental restoration programs.	

4.0	Environmental Restoration/Corrective Measures
<p>Definition: This element includes site investigations, studies, design, and cleanup activities under both RCRA and CERCLA required to restore polluted sites to an acceptable level.</p>	
<p>Subordinate Elements:</p> <ul style="list-style-type: none"> 4.01 Preliminary Assessment/Site Investigation (PA/SI) and/or RCRA Facility Assessment (RFA) 4.02 Remedial Investigation/Feasibility Study (RI/FS) and/or RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) 4.03 Remedial Design 4.04 Remedial Action and/or Corrective Measures 	
<p>Notes: This category of the CBS is taken directly without change from the final draft Work Breakdown Structure (WBS) developed by the Interagency Cost Estimating Group (ICEG). The ICEG is an informal, ad hoc group with representatives from DoD, the Department of Energy, the Environmental Protection Agency, and other agencies. This WBS is currently in a formal interagency review and approval process. The U.S. Navy and the U.S. Army Corps of Engineers are currently using this WBS to contract specific environmental restoration projects. The complete Environmental Restoration/Corrective Measures WBS, adapted from the ICEG, is provided in appendix C of this report.</p>	

4.1

**Preliminary Assessment/Site Investigation
(PA/SI) and/or RCRA Facility Assessment (RFA)**

Definition:

This element includes the activities involved in one of the first stages in remediating a site. the PA/SI under CERCLA or the RFA under RCRA is conducted to evaluate all known information about the site. The preliminary investigation or assessment is limited and usually non-intrusive conducted to determine the extent and nature of the contamination of the site. The purpose is to determine if further action or investigation is appropriate.

Notes:

The subordinate elements to this section are listed in appendix C within the *Composite Work Breakdown Structure* under column .01.

4.2	Remedial Investigation/Feasibility Study (RI/FS) and/or RCRA Facility Investigation/Corrective Measures Study (RFI/CMS)
Definition: RI under CERCLA or the RFI under RCRA is conducted to determining the extent of hazardous substance contamination and to conduct treatability investigations. The objective of the FS under CERCLA or the CMS under RCRA is to identify alternatives for remediation and to select and describe a remedial action.	
Notes: The subordinate elements to this section are listed in appendix C within the <i>Composite Work Breakdown Structure</i> under column .02.	

4.3	Remedial Design
<p>Definition:</p> <p>This element includes the engineering design activities to develop drawings and specifications required to implement the chosen remedial alternative.</p>	
<p>Notes:</p> <p>The subordinate elements to this section are listed in appendix C within the <i>Composite Work Breakdown Structure</i> under column .03.</p>	

4.4	Remedial Action and/or Corrective Measures
<p>Definition:</p> <p>This element includes all cleanup activities associated with the contaminated site. These activities include removal actions, emergency response actions, interim remedial actions, remedial (or corrective) actions, and long-term monitoring. This element usually involves implementing, monitoring, and overseeing cleanup activities and ensuring that the remedy is constructed properly and in conformance with Remedial Design plans and is not completed until all closure requirements are met.</p>	
<p>Notes:</p> <p>The subordinate elements to this section include all the line items listed in appendix C under the (Hazardous, Toxic, and Radioactive Waste) HTRW Remedial Action March 1992 Work Breakdown Structure (WBS) under CSI code 33.</p>	

5.0	HTR Material and Waste Transportation
Definition: This element includes activities to manifest, permit, load, transport, and unload HTR materials and waste throughout the life cycle of the weapon system.	
Subordinate Elements: 5.01 Transportation Management 5.02 Transportation	
Notes: The activities reported under this element are pervasive throughout the HTR Material Management, HTR Waste Management and Environmental Restoration/Corrective Action programs, but are separated here for independent consideration.	

5.0 ENVIRONMENTAL MANAGEMENT COST DRIVER CATEGORIES

5.1 Description of the Environmental Management Cost Driver Categories

In addition to assessing each tool's range and depth of coverage according to the Cost Breakdown Structure (CBS), each tool will be evaluated to determine which cost drivers it addresses. The Cost Driver Category (CDC) is a list or grouping of factors that are likely to significantly affect the costs of activities detailed in the CBS. The major categories are as follows:

- HTR Substances
- Waste Sources
- Personnel Protection Level
- Mode of Transportation
- Cost/Schedule Risk.

Each cost category applies to one or more of the CBS summary level elements. For instance, cost categories under HTR Substances (CDC A) affect CBS elements 2.0 through 5.0, whereas cost categories under Mode of Transportation (CDC D) affect only CBS element 5.0.

The HTR substances were derived from the OSHA requirements listed in Title 29 CFR 1910.120, the Environmental Protection Agency list of substances identified in Title 40 CFR Part 302, and the Department of Transportation (DOT) list of substances identified in Title 49 of the CFR Part 172. The definitions for these substances were taken from the DOE *EM Safety and Health Introduction Manual*, and DOE Order 5820.2A. The other cost drivers were identified from experience and knowledge of the subject matter and are self-explanatory.

5.2 Application of the Environmental Management Cost Driver Categories

The CDC will be use by the project team to assess the cost tools and their coverage of important cost driving factors. For example, the factor addressing the type of HTR materials used in a process operation (CDC A) can significantly affect the process costs. Activities affected by this cost driving factor include the costs of necessary compliance management issues (e.g., permits, record keeping, audit preparation), waste management decisions (such as whether a HTR waste should be diluted and dumped, chemically treated, or contained in special drums for off-site disposal), and others.

In addition to use by the project team, these cost driving factors can be used for consideration by cost estimators/analysts during the development of a MDAPs LCC estimate or trade studies (see appendix B). The CDC was developed for the purposes of this project

environmental cost drivers. For example, a comprehensive list of environmental restoration cost driving factors used by the U. S. Air Force Center for Environmental Excellence is included in appendix D of this report listing relative complexity factor rankings for environmental cost estimating.

The EM Cost Risk (CDC E) is an important consideration that every tool should address. This involves the potential cost impacts inherent in a project due to the materials/substances used, produced, or disposed (e.g., liability damages to property or personnel, noncompliance risks and the subsequent fines or orders to halt production).

5.3 Environmental Management Cost Driver Categories

A listing of the EM CDCs is provided below.

A. HTR Substances (CBS 2.0 - 5.0)

A.1 Hazardous/Toxic

- Flammable Liquids
- Flammable Solids
- Corrosive
- Reactive
- Poisonous/Toxic
- Oxidizer
- Explosive
- Prohibited

A.2 Contact Handled Radiological

- Low-Level
- Low-Level Mixed
- Alpha Low-Level
- Alpha Low-Level Mixed
- Greater than Class C

A.3 Remote Handled Radiological

- Alpha Low-Level
- Alpha Low-Level Mixed
- Greater than Class C

B. HTR Waste Sources (CBS 3.0, 4.0)

B.1 Process Management (e.g., manufacturing, maintenance) (CBS elements 2.0, 3.0)

Manufacturing Facility
Operational Bases
Depot Facilities
Other

B.2 Environmental Restorations (CBS element 4.0)

Landfill
Waste Piles
Tanks, Drums, and Loose Debris
Structural Decontamination and Decommissioning:
- Buildings
- Systems
- Machinery/Other
Pits and Trenches
Buried Tanks/Drums
Lakes and Ponds
Swamps, Lagoons, and Impoundments
River and Streams
Groundwater

C. Personnel Protection Levels (CBS elements 2.0 - 5.0)

C.1 Protection Level - A

Positive Pressure Breathing Apparatus and Fully Encapsulated Suit

C.2 Protection Level - B

Positive Pressure Breathing Apparatus and Chemical Resistant Suit

C.3 Protection Level - C

Respirator and Chemical Resistant Suit

C.4 Protection Level - D

Normal Work Uniforms and No Special Protection

C.5 Protection Level - E (or D+)

Gloves, Goggles, Tyveks Suits, Steel-Toed Boots and Hard Hats

D. Mode of Transportation (CBS element 5.0)

- D.1 Truck
- D.2 Rail
- D.3 Water
- D.4 Air

E. Environmental Management Cost Risk (CBS elements 1.0 - 5.0)

- E.1 Medical Risk (Exposure/Illness Loss of Time)
- E.2 Liability Damages Risk
 - Toxic Torts
 - Real Property Devaluation Calculation
 - Contaminated Groundwater Calculation
 - Natural Resource Damages
- E.3 Regulatory Compliance Risk
- E.4 Technology Risk
- E.5 Scope
- E.6 Unknown

5.4 Definitions of HTR Substances

Hazardous/Toxic are materials and wastes that may have adverse effects on the environment or on the health and safety of exposed individuals. "Hazardous" refers to a potential danger to the environment or human health. "Toxic" refers to a present danger to the human health. These two conditions are closely related and not separately defined. Brief definitions of hazardous/toxic substances are provided below.

Flammable includes any solid, liquid, vapor, or gas that ignites easily and burns rapidly. Solid flammables include dusts and powders, such as charcoal and aluminum, and low-ignition-point materials. According to the Department of Transportation, flammable liquids include any liquid that produces enough vapor to ignite at temperatures lower than 141°F. Flammable gases ignite easily and may be explosive if confined in a canister or cylinder.

Corrosive includes substances that cause the deterioration of other materials. A corrosive may disintegrate metal, body tissue, plastics, and other materials. Corrosives can be in a solid, liquid, or gas form. The strength of a corrosive liquid is generally measured by pH numbers (1-14).

Reactive includes substances that undergo a violent reaction when they come in contact with water or are otherwise normally unstable. Examples of reactives include organic peroxides, pyrophorics, or water-reactives.

Poisonous/toxic includes substances that can cause health hazards by damaging living cells and tissues. Each unique chemical compound possesses inherent properties that determine the type and degree of hazard it presents. These materials include pesticides, herbicides, solvents, asbestos, mercury, lead, polychlorinated biphenyls (PCBs), and heavy metals. Toxic chemicals include carcinogens, mutagens, teratogens, systemic poisons, asphyxiants, irritants, and allergic sensitizers.

Oxidizer includes substances able to supply oxygen chemically or supplement oxygen with other oxidizing gases enabling the support of fire. Oxidizers can exist in a solid, liquid, or gas form. Fires supported by pure or highly concentrated oxidizers are extremely difficult to control and extinguish. Oxidizers can also produce toxic materials during decomposition. Common oxidizers include, chlorates, pool chlorinators, peroxides, and nitrates.

Explosive includes substances that undergo very rapid chemical transformation with a violent release of pressure and heat. Some explosives can be detonated by shock, heat, or friction, while others are less volatile and need a booster to detonate.

Prohibited includes substances that are or will be illegal for use throughout the DoD. Examples include ozone-depleting compounds such as freon-12, which cannot be purchased after 1995, and freon-22, after 2005.

Radioactive Waste, as defined in this document, is divided into two major categories, "contact handled" and "remote handled." The remote handling of radioactive waste is required when the external dose rate of the waste or waste container exceeds 200 mrem/hr. This waste category is further subdivided into three categories, low-level non-alpha contaminated waste, low-level alpha contaminated waste, and Greater-Than-Class C waste. Low-level waste includes all radioactively contaminated waste that is not classified as high level, transuranic, spent nuclear fuel, or fission by-products. Alpha (alpha emitting particles) contaminated low-level waste contains a concentration of less than 100 nCi/g of Transuranic (TRU) radiation. The radioactive waste classified as Greater-Than-Class C generally contains some alpha contamination and high levels of gamma radiation.

Greater-Than-Class C is a classification developed by the Nuclear Regulatory Commission to designate the waste generally unacceptable for near-surface disposal. Waste that exceeds low-level waste disposal criteria based on concentration of radionuclides is placed in classes greater than C (Classes A or B).

TRU waste (or materials) containing TRU elements of greater than 100 nCi/g are not included in the CDC. TRU waste refers to waste materials containing elements with atomic numbers greater than 92. These elements are generally alpha-emitting radionuclides with half-lives of greater than 20 years.

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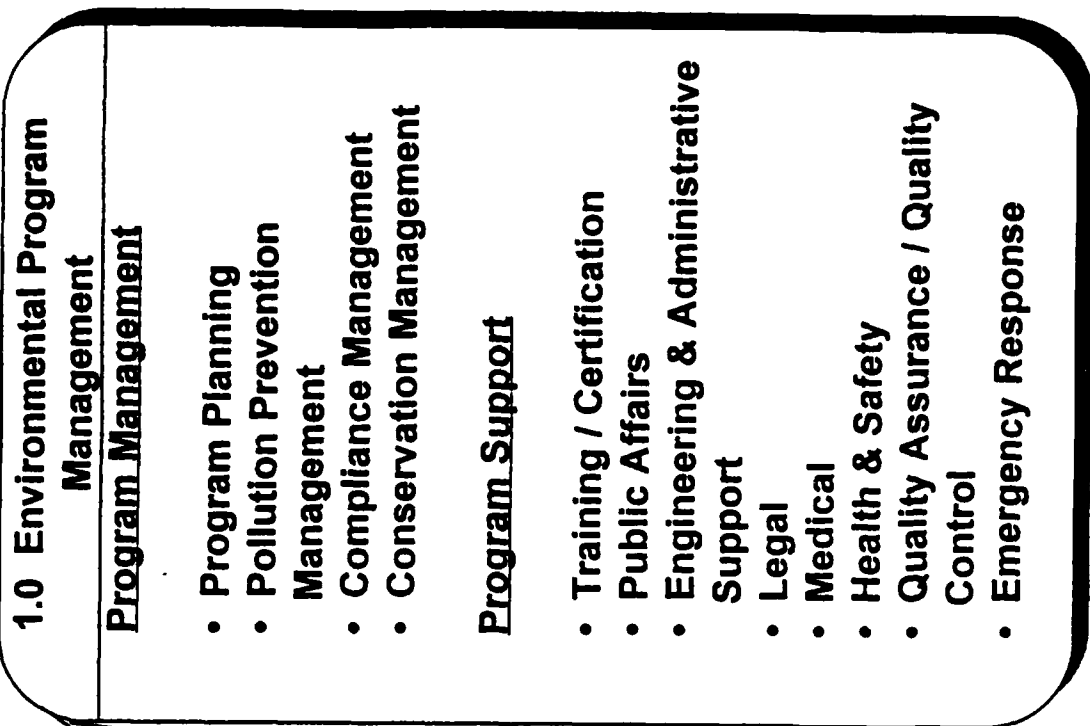
Document available through U. S. Air Force Center for Environmental Excellence, 8108 Chennault Road, Brooks AFB, TX 78235, Tel: (210) 536-5268.

Appendix A

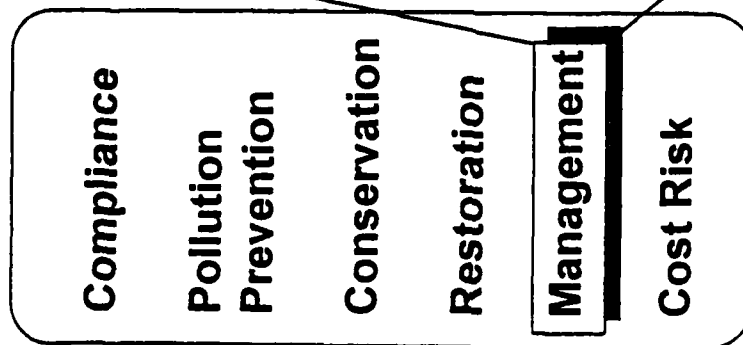
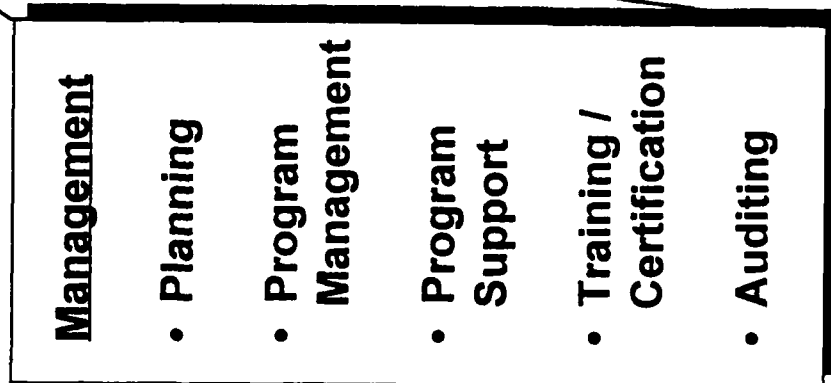
Appendix A provides a crosswalk between the Environmental Cost Element Structure (ECES) developed during the Environmental Life Cycle Cost Estimating for Weapons System Workshop and the Cost Breakdown Structure (CBS) and Cost Driver Category (CDC). The relationship between these structures is further explained in the Preface to this report. The primary difference between these structures is that the CBS and CDC focus on environmental management activities and cost driving factors associated with Hazardous, Toxic, and Radiological (HTR) materials and wastes only.

ENVIRONMENTAL COST STRUCTURES CROSSWALK

Environmental Management Cost Breakdown Structure



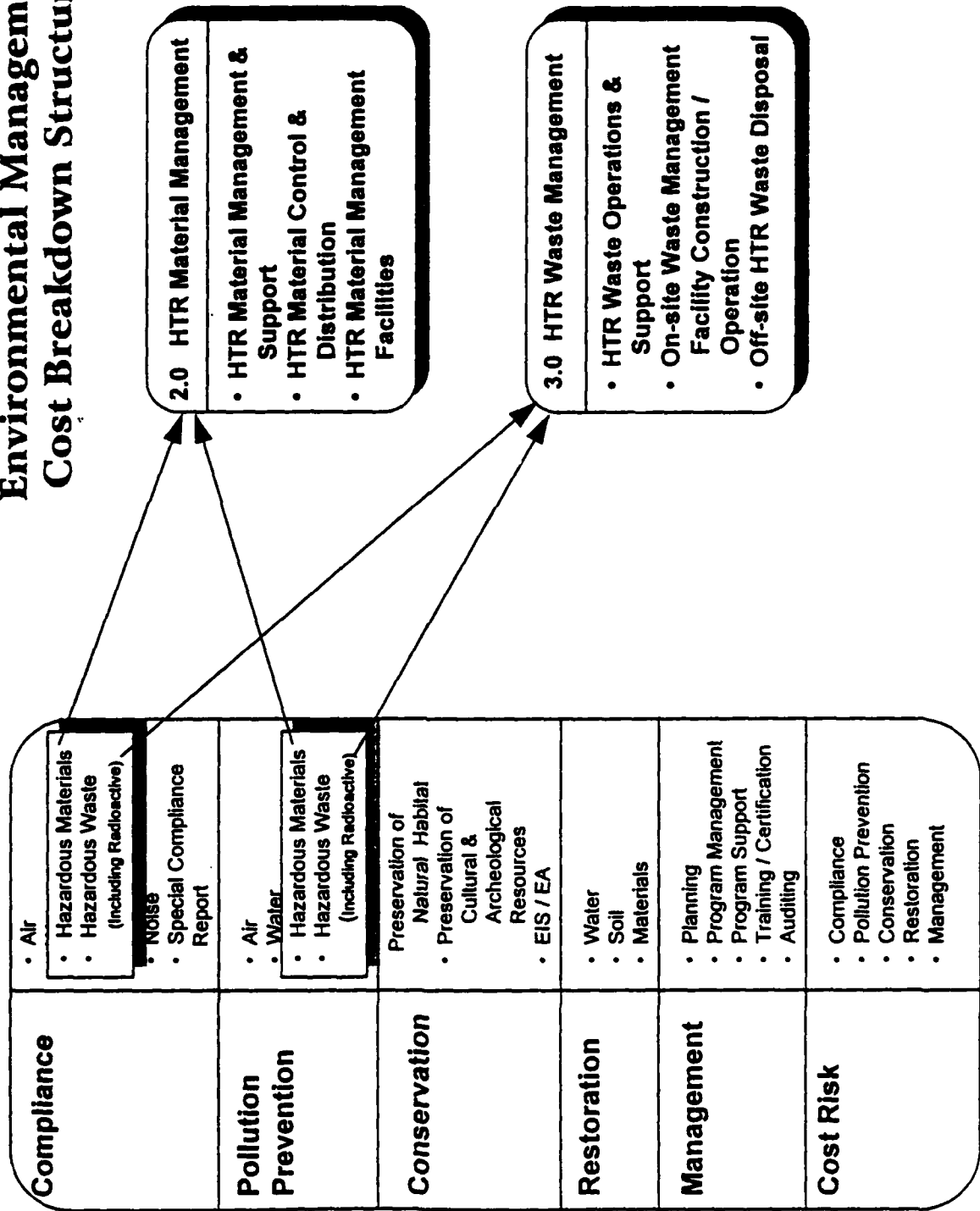
Environmental Cost Element Structure



ENVIRONMENTAL COST STRUCTURES CROSSWALK

Environmental Cost Element Structure

Environmental Management Cost Breakdown Structure



ENVIRONMENTAL COST STRUCTURES CROSSWALK

Environmental Cost Element Structure

Compliance	<ul style="list-style-type: none"> • Air • Water • Solids • Hazardous Materials • Hazardous Waste • Noise • Special Compliance Report
Pollution Prevention	<ul style="list-style-type: none"> • Air • Water • Solids • Hazardous Materials • Hazardous Waste • Noise
Conservation	<ul style="list-style-type: none"> • Preservation of Natural Habitat • Preservation of Cultural & Archeological Resources • EIS / EA
Restoration	<ul style="list-style-type: none"> • Water • Soil • Materials
Management	<ul style="list-style-type: none"> • Planning • Program Management • Program Support • Training / Certification • Auditing
Cost Risk	<ul style="list-style-type: none"> • Compliance • Pollution Prevention • Conservation • Restoration • Management

Environmental Management Cost Breakdown Structure

4.0 Environmental Restoration / Corrective Action

- PA/SI or RFA
- RI/FS or RFI/CMS
- Remedial Design
- Remedial Action / Corrective Measures

5.0 HTR Material & Waste Transportation

- Transportation Management
- Transportation

ENVIRONMENTAL COST STRUCTURES CROSSWALK

Environmental Cost Element Structure

Environmental Management Cost Driver Categories

Compliance	<ul style="list-style-type: none"> • Air • Water • Solids • Hazardous Materials • Hazardous Waste • Noise • Special Compliance Report
Pollution Prevention	<ul style="list-style-type: none"> • Air • Water • Solids • Hazardous Materials • Hazardous Waste • Noise
Conservation	<ul style="list-style-type: none"> • Preservation of Natural Habitat • Preservation of Cultural & Archeological Resources • EIS / EA
Restoration	<ul style="list-style-type: none"> • Water • Soil • Materials
Management	<ul style="list-style-type: none"> • Planning • Program Management • Program Support • Training / Certification • Auditing
Cost Risk	<ul style="list-style-type: none"> • Pollution Prevention • Conservation • Restoration • Management • Compliance

HTR Substance

- Hazardous / Toxic
- Contact Handled Radiological
- Remote Handled Radiological

HTR Waste Sources

- Form Process Management
- Environmental Restorations

Personnel Protection Level

- Protection Levels A-E

Model of Transportation

- Truck
- Rail
- Sea
- Air

Environmental Management Cost Risk

- Medical Risk (Exposure/Illness/Loss of Time)
- Liability Damages Risk
- Regulatory Compliance Risk
- Technology Risk
- Scope
- Unknown

Appendix B

Appendix B provides an example of a trade-off study between the use of a toxic cleaning agent currently used for the scheduled maintenance of a weapon system and an alternative non-toxic cleaning agent. This example illustrates the use of the Cost Breakdown Structure (CBS) and the Cost Driver Category (CDC) in these types of trade studies. It also is provided here to illustrate how activities, such as process operations (in this example the cleaning operation itself) not included in the CBS or CDC can also be included in a trade study.

The CBS and CDC address only those activities directly associated with the management, procurement, distribution, control, treatment, storage, disposal, and final disposition of Hazardous, Toxic, and Radiological (HTR) materials and waste. An example of activities not included in the CBS or CDC are process operations such as manufacturing or maintenance operations, which are primary activities already included in the weapons systems Work Breakdown Structure (WBS) (e.g., MIL-STD-881B). It is recognized that the selection and use of HTR materials can influence the productivity associated with these process operations, but this change in productivity will be addressed in the Life Cycle Cost (LCC) estimate where the primary activity is found. To illustrate this point, consider the following case: A process operation such as parts cleaning can be influenced by the selection of the cleaning agent, but the activity of cleaning the part is addressed under scheduled maintenance in the LCC estimate.

The following example trade study comparing two alternative cleaning solutions includes the affected CBS elements of work as well as the change in productivity for those elements of work accounted for outside of the CBS. The trade study also includes the cost risk for each alternative. The hypothetical trade study is comparing the LCC of continuing the use of a toxic cleaning solvent to the cost of converting to a proposed nontoxic cleaning solution. The results of the trade study may look something like the following table.

Table 3-2 - Trade Study Example (Alternative Cleaning Agents)

Cost Element (includes only affected elements)	Source/ Definition	Alternative A Toxic Solvent	Alternative B Nontoxic Solvent
Compliance Management	CBS 1.01.02	> \$	< \$
HTR Pollution Prev. Program Implementation (bench scale tests)	CBS 2.01.01	—	> \$
HTR Material Control and Distribution	CBS 2.02	> \$	< \$
Waste Management Off-Site Disposal	CBS 3.03	> \$	< \$
Cleaning Operation	Operations and Support Scheduled Maintenance	<< \$	>> \$
Loss Time Exposure/Illness (refer to Cost Risk in Section 5 of this report)	CDC E.1	> \$	< \$
Liability Risk (refer to Cost Risk in Section 5 of this report)	CDC E.2	> \$	< \$
Total Cost (alternative A preferred)		< \$	> \$

- Notes:
- The Operations and Support Estimate is not contained in the CBS or the CDC.
 - This trade study example is only illustrative, it is not intended to be all inclusive.

As shown in this example, only those activities directly dealing with the environmental management of the HTR materials and waste are included in the CBS. The preferred alternative (alternative A) shows that, although cost is greater for all elements included in the CBS (with the exception of bench scale test conducted on the proposed cleaning solution), the actual cleaning operation (the scheduled maintenance process operation) more than compensates for these costs. This example also illustrates how the cost risk factors included in the CDC can be used.

Appendix C

Appendix C includes a copy of the final draft Work Breakdown Structure (WBS) developed by the Interagency Cost Estimating Group (ICEG) as described in this report. There are two WBSs in this appendix. The first is the environmental restoration studies and design WBS entitled the *Composite Work Breakdown Structure* and the second is a cleanup WBS, the *HTRW Remedial Action Work Breakdown Structure*. The first WBS is depicted in a matrix format because there are several elements of work that are common to the three major phases (e.g. preliminary assessment, assessment, and design). The Remedial Action (RA) WBS is provided in standard WBS format. A dictionary exists for the first three levels of the RA WBS but is not included in this report.

PA/SI (RFA)	RI/FS (RFI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE	
.01	.02	.03		
			.01	PREPARATION OF PLANS
			.02	PROJECT MANAGEMENT / SUPPORT / ADMIN
			.03	ADMINISTRATIVE RECORD
			.04	COMMUNITY RELATIONS
			.05	REGULATORY INTERACTION
			.06	FIELD INVESTIGATION
			.07	SITE WORK / TEMPORARY FACILITIES
			.08	OFF-SITE LABORATORY SAMPLE ANALYSIS
			.09	ON-SITE LABORATORY SAMPLE ANALYSIS
			.10	ANALYTICAL SUPPORT/SAMPLE MANAGEMENT/DATA VALIDATION
			.11	DATA EVALUATION
		N/A	.12	RISK ASSESSMENT
		N/A	.13	DOCUMENT ASSESSMENT
N/A		N/A	.14	ALTERNATIVE EVALUATION (RA / CM)
N/A			.15	TREATABILITY STUDIES
N/A		N/A	.16	DOCUMENT FS (CMS)
		N/A	.17	POST ASSESSMENT SUPPORT
		N/A	.18	ENFORCEMENT SUPPORT
N/A	N/A		.19	IDENTIFICATION OF LONG LEAD ITEMS
N/A	N/A		.20	DESIGN PREPARATION (6% Limit)
N/A	N/A		.21	VALUE ENGINEERING / SPECIAL STUDIES
N/A	N/A		.22	POST DESIGN SUPPORT
N/A	N/A		.23	A/E SUPPORT DURING REMEDIAL ACTION
			.9X	OTHER

* RISK ASSESSMENT for PA/SI (RFA) is the Hazardous Ranking System; for RI/FS (RFI) it is the BASELINE RISK ASSESSMENT

** DOCUMENT ASSESSMENT refers to PA/SI (RFA) Documentation or RI (RFI) Documentation

*** POST ASSESSMENT SUPPORT refers to POST PA/SI (RFA) SUPPORT or POST RI (RFI) SUPP

PA/SI (RFA)	RI/FS (RFI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE
.01	.02	.03	
			.01 PREPARATION OF PLANS
			.01 WORK PLAN
			.02 CHEMICAL DATA ACQUISITION PLAN
			.03 SAMPLING AND ANALYSIS PLAN
			QUALITY ASSURANCE PROJECT PLAN
			FIELD SAMPLING PLAN
			.04 SITE HEALTH & SAFETY PLAN
			.05 POLLUTION CONTROL AND MITIGATION PLAN
			.06 DATA MANAGEMENT PLAN
			.07 COMMUNITY RELATIONS PLAN
			.08 TRANSPORTATION & DISPOSAL PLAN (WASTE MGT PLAN)
			.09 SITE MANAGEMENT PLAN
N/A		N/A	.10 RISK ASSESSMENT PLAN
			.11 DEVELOP TECHNICAL PROJECT GOALS & OBJECTIVES
			DEVELOP CONCEPTUAL SITE MODEL
			ID OF DATA NEEDS & DQOs
			ID OF PRELIM. RA OBJECTIVES & POTENTIAL ALTS
			ID OF TREATABILITY STUDIES
			PRELIMINARY ID OF ARARs OR STDs
			ID OF NEPA REQUIREMENTS
			ID OF OTHER REGULATORY REQUIREMENTS
			.12 DEVELOP EMERGENCY RESPONSE PLANS/RPRT/APPRVL
			ENGINEERING EVAL. & COST ANALYSES
			ACTION MEMO PREPARATION
			REMOVAL ACTION PLANS & SPECS.
			.13 DEVELOP INTERIM REMEDIAL PLANS/REPORTS/APPRVL
			.9X OTHER
			.02 PROJECT MANAGEMENT / SUPPORT / ADMIN .
			.01 CONDUCT PROJECT MANAGEMENT
			DEVELOP COST ESTIMATE
			COST/SCHEDULE CONTROL SYSTEM
			VALUE ENGINEERING / COST ANALYSIS
			ENGINEERING NETWORK ANALYSIS
			MANAGE, TRACK AND REPORT EQUIP. STATUS
			CONDUCT SITE VISIT
			ATTEND SCOPING MEETING
			EVALUATE EXISTING DATA
			PREPARE REPORTS / PARTICIPATE IN REVIEWS
			PROJECT CLOSEOUT
			.02 SUPPORT SUBCONTRACTING ACTIVITIES
			PROCUREMENT OF SUBS
			CONTRACTOR QA PROGRAM
			COORDINATE WITH ANALYTICAL LABORATORY
			.03 ADMINISTRATION / REPORTING
			DOCUMENT COST AND PERFORMANCE STATUS
			BILLINGS
			.9X OTHER
			.03 ADMINISTRATIVE RECORD
			.01 ATTEND MEETINGS
			.02 COMPILE DOCUMENTS
			PREPARE DRAFT ADMINISTRATIVE RECORD INDEX

PA/SI (RFA)	RI/FS (RPI)	RD
.01	.02	.03

COMPOSITE WORK BREAKDOWN STRUCTURE

- PREPARE ADMINISTRATIVE RECORD INDEX
- COORDINATE DUPLICATION OF ADMINISTRATIVE RECORD
- .03 ASSEMBLE/UPDATE ADMINISTRATIVE RECORD AND INDEX
- .9X OTHER
- .04 COMMUNITY RELATIONS
 - .01 CONDUCT COMMUNITY INTERVIEWS
 - .02 PROVIDE SUPPORT FOR COMMUNITY RELATIONS
 - PREPARE FACT SHEETS
 - PARTICIPATE IN PUBLIC MEETINGS / HEARINGS
 - SUPPORT BRIEFINGS
 - .03 MAINTAIN PUBLIC INFORMATION REPOSITORY
 - .9X OTHER
- .05 REGULATORY INTERACTION
 - .01 SUPPORT MEETINGS WITH REGULATORS
 - .02 COORDINATION OF LAWS & REGULATIONS
 - PREPARE INITIAL NOTIFICATION
 - .03 DEVELOP INTERAGENCY AGREEMENT
 - AGENCY REVIEW SUPPORT
 - STATE & LOCAL AGENCY REVIEW
 - .04 DEVELOP REGULATORY REPORTS / PERMITS / REVIEWS
 - .9X OTHER
- .06 FIELD INVESTIGATION
 - .01 SITE RECONAISSANCE
 - ECOLOGICAL RESOURCES RECONAISSANCE
 - WELL INVENTORY
 - RESIDENTIAL WELL SAMPLING
 - LAND SURVEY
 - TOPOGRAPHIC MAPPING
 - FIELD SCREENING
 - .02 PERFORM MOBILIZATION/DEMobilIZATION (FIELD CREW)
 - .03 CONDUCT GEOLOGICAL INVESTIGATIONS (SOILS/SEDIMENTS)
 - SURFACE SOIL SAMPLE COLLECTION
 - SUBSURFACE SOIL SAMPLE COLLECTION
 - SOIL BORING/PERMEABILITY SAMPLING
 - SEDIMENTS SAMPLE COLLECTION
 - SOIL GAS SURVEY
 - TEST PIT
 - .04 CONDUCT AIR INVESTIGATIONS
 - SAMPLE COLLECTION
 - AIR MONITORING STATION
 - .05 CONDUCT HYDROGEOLOGICAL INVESTIGATIONS - GROUNDWATER
 - WELL SYSTEMS INSTALLATION
 - ACCOMPLISH MOBILIZATION
 - PERFORM WELL DEVELOPMENT
 - CONDUCT DOWNHOLE GEOPHYSICS
 - INSTALL MONITORING WELLS
 - INSTALL TEST WELLS
 - INSTALL GAS WELLS
 - SAMPLE COLLECTION
 - HYDRO PUNCH
 - TIDAL INFLUENCE STUDY
 - HYDRAULIC TESTS (PUMP TEST)
 - GROUNDWATER ELEVATION MEASUREMENT
 - OTHER
 - .06 CONDUCT HYDROGEOLOGICAL INVESTIGATIONS - SURFACE WATER

PA/SI (RFA)	RI/FS (RFI)	RD
.01	.02	.03

COMPOSITE WORK BREAKDOWN STRUCTURE

- SAMPLE COLLECTION
- TIDAL INFLUENCE STUDY
- SURFACE WATER ELEVATION MEASUREMENT
- .07 CONDUCT WASTE INVESTIGATION
 - SAMPLE COLLECTION (GAS, LIQUID, SOLID)
 - DERIVED WASTE DISPOSAL (GAS, LIQUID, SOLID)
- .08 CONDUCT GEOPHYSICAL INVESTIGATION
 - SURFACE GEOPHYSICAL ACTIVITY
 - MAGNETOMETER
 - ELECTROMAGNETICS
 - GROUND PENETRATING RADAR
 - SEISMIC REFRACTION
 - RESISTIVITY
 - SITE METEOROLOGY
 - CONE PENETROMETER SURVEY
 - REMOTE SENSOR SURVEY
- .09 CONDUCT ECOLOGICAL INVESTIGATION
 - WETLAND AND HABITAT DELINEATION
 - WILDLIFE OBSERVATIONS
 - COMMUNITY CHARACTERIZATION
 - IDENTIFICATION OF ENDANGERED SPECIES
 - BIOTA SAMPLING/POPULATION STUDIES
- .10 COLLECT CONTAMINATED BUILDING SAMPLES
- .9X OTHER
- .07 SITE WORK / TEMPORARY FACILITIES
 - .01 PERFORM MOBILIZATION/DEMOLITION
 - .02 CLEARING AND GRUBBING
 - .03 PERFORM EARTHWORK
 - .04 BUILD ROADS/PARKING/CURBS/WALKS
 - .05 INSTALL FENCING
 - .06 INSTALL ELECTRICAL DISTRIBUTION
 - .07 INSTALL TELEPHONE/COMMUNICATION DISTRIBUTION
 - .08 INSTALL WATER/SEWER/GAS DISTRIBUTION
 - .09 INSTALL STEAM AND CONDENSATE DISTRIBUTION
 - .10 INSTALL FUEL LINE DISTRIBUTION
 - .11 INSTALL STORM DRAINAGE/SUBDRAINAGE
 - .12 PROVIDE COVER STRUCTURE OVER CONT. AREA
 - .13 PROVIDE BORROW PIT/HAUL ROADS
 - .14 CONSTRUCT TEMPORARY DECONTAMINATION FACILITIES
 - .15 CONSTRUCT SAMPLE / DERIVED WASTE STORAGE FACILITY
 - .16 CONSTRUCT OTHER TEMPORARY FACILITIES
 - .17 CONSTRUCT TEMPORARY/MOBILE LABORATORY
 - .18 SITE RESTORATION
 - .9X OTHER
- .08 OFF-SITE LABORATORY SAMPLE ANALYSIS
 - .01 ANALYZE AIR/GAS SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
 - .02 ANALYZE GROUNDWATER SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY

PA/SI (RPA)	RI/FS (RFI)	RD
.01	.02	.03

COMPOSITE WORK BREAKDOWN STRUCTURE

- OTHER
- .03 ANALYZE SURFACE WATER SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .04 ANALYZE SOIL / SEDIMENT SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .05 ANALYZE WASTE (GAS) SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .06 ANALYZE WASTE (LIQUID) SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .07 ANALYZE WASTE (SOLID) SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .08 ANALYZE BIOTA SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
- .09 ANALYZE BIOASSAY SAMPLES
- .10 PERFORM BIOACCUMULATION STUDIES
- .9X OTHER
- .09 ON-SITE LABORATORY SAMPLE ANALYSIS
 - .01 ANALYZE AIR/GAS SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
 - .02 ANALYZE GROUNDWATER SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
 - .03 ANALYZE SURFACE WATER SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER
 - .04 ANALYZE SOIL/SEDIMENT SAMPLES
 - ORGANIC
 - INORGANIC
 - RADIOCHEMISTRY
 - OTHER

PA/SI (RPA)	RI/FS (RPI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE
.01	.02	.03	
			.05 ANALYZE WASTE (GAS) SAMPLES ORGANIC INORGANIC RADIOCHEMISTRY OTHER
			.06 ANALYZE WASTE (LIQUID) SAMPLES ORGANIC INORGANIC RADIOCHEMISTRY OTHER
			.07 ANALYZE WASTE (SOLID) SAMPLES ORGANIC INORGANIC RADIOCHEMISTRY OTHER
			.08 ANALYZE BIOTA SAMPLES ORGANIC INORGANIC RADIOCHEMISTRY OTHER
			.09 ANALYZE BIOASSAY SAMPLES
			.10 PERFORM BIOACCUMULATION STUDIES
			.11 PERFORM TEMPORARY/MOBILE LABORATORY ANALYSIS AIR / GAS GROUNDWATER SURFACE WATER SOIL / SEDIMENT WASTE - GAS WASTE - LIQUID WASTE - SOLID BIOTA BIOASSAYS BIOACCUMULATION STUDIES OTHER SAMPLE ANALYSIS
			.9X OTHER
		.10	ANALYTICAL SUPPORT/SAMPLE MANAGEMENT/DATA VALIDATION (PREPARE, SHIP, TRACK, & RETAIN ENVIRONMENTAL SAMPLES)
		.01	PREPARE AND SHIP ENVIRONMENTAL SAMPLES GROUNDWATER SAMPLES SURFACE AND SUBSURFACE SOIL SAMPLES SURFACE WATER & SEDIMENT SAMPLES AIR SAMPLES BIOTA SAMPLES OTHER TYPES OF MEDIA SAMPLING AND SCREENING
		.02	COORDINATE WITH SAMPLE MGT PERSONNEL/REGULATORS
		.03	IMPLEMENT EPA-APPROVED LABORATORY QA PROGRAM
		.04	PROVIDE SAMPLE MANAGEMENT CHAIN OF CUSTODY SAMPLE RETENSION DATA STORAGE
		.05	PERFORM DATA VALIDATION REVIEW ANALYSIS RESULTS TO VALIDATION CRITERIA PROVIDE WRITTEN DOCUMENTATION OF VALIDATION EFFORTS
		.9X	OTHER
		.11	DATA EVALUATION

PA/SI (RFA)	RI/VS (RPI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE
.01	.02	.03	
N/A			.01 DATA USEABILITY EVALUATION/FIELD QA/QC
			.02 DATA REDUCTION, TABULATION AND EVALUATION
			EVALUATE GEOLOGICAL DATA (SOILS/SEDIMENTS)
			EVALUATE AIR DATA
			EVALUATE HYDROGEOLOGICAL DATA - GROUNDWATER
			EVALUATE HYDROGEOLOGICAL DATA - SURFACE WATER
			EVALUATE WASTE DATA
			EVALUATE GEOPHYSICAL DATA
			EVALUATE ECOLOGICAL DATA
			.03 CONTAMINANT FATE AND TRANSPORT MODELING
			.04 OTHER MODELING
			.05 DOCUMENT DATA EVALUATION
			.9X OTHER
	N/A	.12	RISK ASSESSMENT
		.01	HUMAN HEALTH RISK ASSESSMENT
			HAZARD IDENTIFICATION (SOURCES)
			DOSE-RESPONSE ASSESSMENT
			PREPARE CONCEPTUAL EXP./PATHWAY ANALYSIS
			CHARACTERIZATION OF SITE AND POTENTIAL RECEPTORS
			EXPOSURE ASSESSMENT
			RISK CHARACTERIZATION
			LIMITATIONS/UNCERTAINTIES
			SITE CONCEPTUAL MODEL
		.02	ECOLOGICAL RISK ASSESSMENT
			HAZARD IDENTIFICATION (SOURCES)
			PREPARE CONCEPTUAL EXP./PATHWAY ANALYSIS
			CHARACTERIZATION OF SITE AND POTENTIAL RECEPTORS
			SELECT CHEMICALS, INDICATOR SPECIES, & END POINTS
			EXPOSURE ASSESSMENT
			TOXICITY ASSESSMENT/ECOLOGICAL EFFECTS ASSESSMENT
			RISK CHARACTERIZATION
			LIMITATIONS/UNCERTAINTIES
			SITE CONCEPTUAL MODEL
		.03	DOCUMENT RISK (HRS)
		.9X	OTHER
	N/A	.13	DOCUMENT ASSESSMENT
		.01	COMPOSE DRAFT REPORT(s)
			PERFORM DATA COMPILATION
			PRESENT DATA (FORMAT TABLES & PREPARE GRAPHICS)
			SITE BACKGROUND
			INVESTIGATION
			SITE CHARACTERISTICS
			NATURE AND EXTENT OF CONTAMINATION
			FATE AND TRANSPORT
			SUMMARY AND CONCLUSIONS
			REPRODUCTION / DISTRIBUTION
		.02	RESPOND TO COMMENTS
		.03	FINALIZE REPORT
			REPRODUCTION / DISTRIBUTION
		.9X	OTHER
N/A	N/A	.14	ALTERNATIVE EVALUATION (RA / CM)
		.01	DEVELOP REMEDIAL ALTERNATIVES
			ESTABLISH REMEDIAL ACTION OBJECTIVES
			ESTABLISH GENERAL RESPONSE ACTIONS
			ID PRELIMINARY ALTS

PA/SI	RI/FS	
(RFA)	(RFI)	RD
.01	.02	.03

COMPOSITE WORK BREAKDOWN STRUCTURE

			IDENTIFY & SCREEN APPLICABLE REMEDIAL TECHNOLOGIES
			IDENTIFY TREATABILITY STUDY REQUIREMENT
			ASSEMBLE TECHNOLOGIES INTO ACTIONS
			DEVELOP CONCEPTUAL SITE MODEL
	.02		SCREEN REMEDIAL ALTERNATIVES
			SCREEN ALTS BASED ON SELECTED CRITERIA
			SCREEN ALTS FOR EFFECTIVENESS
			SCREEN ALTS FOR IMPLEMENTABILITY
			IDENTIFY PROJECT SIZE / QUANTITIES
			SCREEN ALTS FOR COSTS & VALUE ENGR
			ID / EVALUATE ACTION-SPECIFIC ARARS
			REFINE LIST OF ALTERNATIVES
	.03		EVALUATE ALTERNATIVES
			OVERALL PROTECTION OF HUMAN HEALTH & ENVIRONMENT
			COMPLIANCE WITH ARARS
			LONG-TERM EFFECTIVENESS AND PERMANENCE
			REDUCTION IN TOXICITY, MOBILITY OR VOLUME
			SHORT-TERM EFFECTIVENESS
			IMPLEMENTABILITY - TECHNICAL AND ADMINISTRATIVE
			COST
			STATE ACCEPTANCE
			COMMUNITY ACCEPTANCE
	.04		REFINEMENT OF ALTERNATIVES
			PRIORITY MODEL SCORING
			SELECTION OF REMEDY / DOCUMENTATION
	.9X		OTHER
N/A	.15		TREATABILITY STUDIES
	.01		LITERATURE SEARCH
	.02		DEVELOP TREATABILITY WORK PLAN
	.03		BENCH TEST
			PROVIDE TEST FACILITY AND EQUIPMENT
			PROVIDE VENDOR & ANALYTICAL SERVICE
			TEST AND OPERATE EQUIPMENT
			RETRIEVE SAMPLE FOR TESTING
			LABORATORY ANALYSIS
			CHARACTERIZE AND DISPOSE OF RESIDUALS
	.04		PILOT SCALE TEST
			PROVIDE TEST FACILITY AND EQUIPMENT
			PROVIDE VENDOR & ANALYTICAL SERVICE
			TEST AND OPERATE EQUIPMENT
			RETRIEVE SAMPLE FOR TESTING
			LABORATORY ANALYSIS
			CHARACTERIZE AND DISPOSE OF RESIDUALS
	.05		FIELD TEST
			PROVIDE TEST FACILITY AND EQUIPMENT
			PROVIDE VENDOR & ANALYTICAL SERVICE
			TEST AND OPERATE EQUIPMENT
			RETRIEVE SAMPLE FOR TESTING
			LABORATORY ANALYSIS
			CHARACTERIZE AND DISPOSE OF RESIDUALS
	.06		DOCUMENT TREATABILITY STUDY
			COMPOSE DRAFT REPORT
			RESPOND TO COMMENTS / FINALIZE REPORT
			REPRODUCTION / DISTRIBUTION
	.9X		OTHER

PA/SI (RFA)	RI/FS (RFI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE	
.01	.02	.03		
N/A		N/A	.16	DOCUMENT FS (CMS)
			.01	COMPOSE DRAFT FS (CMS) REPORT PERFORM DATA COMPILATION PRESENT DATA (FORMAT TABLES & PREPARE GRAPHICS) FEASIBILITY STUDY OBJECTIVES REMEDIAL OBJECTIVES GENERAL RESPONSE ACTIONS ID AND SCREENING OF REMEDIAL TECHNOLOGIES REMEDIAL ALTERNATIVES DESCRIPTION DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES DEVELOP ENGINEERING COST ANALYSIS OF SELECTED ALT SUMMARY AND CONCLUSIONS REPRODUCTION / DISTRIBUTION
			.02	RESPOND TO COMMENTS
			.03	FINALIZE REPORT REPRODUCTION / DISTRIBUTION
			.9X	OTHER
		N/A	.17	POST ASSESSMENT SUPPORT
			.01	ATTEND PUBLIC MEETINGS/HEARINGS/MEETINGS WITH PRP'S
			.02	PREPARE PRESENTATION MATERIALS
			.03	ASSIST IN PREPARATION OF DOCUMENTS PROPOSED PLAN RESPONSIVENESS SUMMARY DECISION DOCUMENT
N/A			.04	PREPARE FEASIBILITY STUDY ADDENDUM
			.9X	OTHER
		N/A	.18	ENFORCEMENT SUPPORT
			.01	PRP SEARCHES / FIELD INVESTIGATIONS
			.02	PRP NEGOTIATION SUPPORT ATTEND NEGOTIATION SESSIONS AND MEETINGS REVIEW OF PRP DOCUMENTS DOCUMENT FINDINGS
			.9X	OTHER
N/A	N/A		.19	IDENTIFICATION OF LONG LEAD ITEMS
N/A	N/A		.20	DESIGN PREPARATION (6% Limit)
			.01	PRELIMINARY DESIGN RECOMMEND PROJECT DELIVERY STRATEGY AND SCHEDULING PREPARE PRELIMINARY CONSTRUCTION SCHEDULE PREPARE SPECIFICATIONS OUTLINE PREPARE PRELIMINARY DRAWINGS PREPARE BASIS OF DESIGN REPORT/DESIGN ANALYSIS PREPARE PRELIMINARY COST ESTIMATE
			.02	INTERMEDIATE DESIGN UPDATE CONSTRUCTION SCHEDULE PREPARE PRELIMINARY SPECIFICATIONS PREPARE INTERMEDIATE DRAWINGS PREPARE BASIS OF DESIGN REPORT/DESIGN ANALYSIS PREPARE REVISED COST ESTIMATE PARTICIPATE IN INTERMEDIATE DESIGN REVIEW/BRIEFING
			.03	PRE-FINAL / FINAL DESIGN PREPARE PRE-FINAL DESIGN SPECIFICATIONS PREPARE PRE-FINAL DRAWINGS PREPARE BASIS OF DESIGN REPORT/DESIGN ANALYSIS PREPARE REVISED COST ESTIMATE PARTICIPATE IN PRE-FINAL/FINAL DESIGN REVIEW

PA/SI (RFA)	RI/FS (RFI)	RD	COMPOSITE WORK BREAKDOWN STRUCTURE	
.01	.02	.03		
N/A	N/A		PREPARE 100% DESIGN SUBMITTAL	
			.21	VALUE ENGINEERING / SPECIAL STUDIES
			.01	PERFORM VE SCREENING
			.02	PERFORM VALUE ENGINEERING STUDY
			.03	DOCUMENT VE STUDY RESULTS
			.04	DEVELOP LAND ACQUISITION/EASEMENT REQUIREMENTS PROVIDE TECHNICAL SUPPORT IN LAND ACQUISITION
			.05	PARTICIPATE IN BIDDABILITY/CONSTRUCTABILITY REVIEWS
			.9X	OTHER
N/A	N/A		.22	POST DESIGN SUPPORT
			.01	PERFORM PREBID (PRE-SOLICITATION) ACTIVITIES SUPPORT PREPARATION OF SOLICITATION PACKAGE PRINTING AND DISTRIBUTION OF CONTRACT DOCUMENTS ADVERTISING/SOLICITING OF BIDS ISSUING ADDENDA PREBID(PRE-SOLICITATION) MEETINGS RESOLUTION OF BIDDER (OFFEROR) INQUIRIES ON-SITE VISITS
			.02	PERFORM PREAMWARD ACTIVITIES RECEIPT OF BIDS (OFFERS) DETERMINATION OF RESPONSIVE, RESPONSIBLE BIDDERS BID TABULATION BID ANALYSIS RECEIPT OF FOLLOW-UP ITEMS FROM LOW. RESP. BIDDER REVIEW OF EEO, MBE REQUIRE., SDB SUBCONTR. PLANS REFERENCE CHECKS REQUEST FOR CONSENT FROM EPA SUPPORT PREPARATION OF CONTRACT DOCUMENTS
			.9X	OTHER
N/A	N/A		.23	A/E SUPPORT DURING REMEDIAL ACTION
			.01	SUBMITTAL REVIEWS
			.02	SITE INSPECTION
			.03	DOCUMENT ACTIVITIES
			.04	PARTICIPATE IN CONSTRUCTION MANAGEMENT MEETINGS
			.9X	OTHER
			.9X	OTHER

* RISK ASSESSEMENT for PA/SI (RFA) is the Hazardous Ranking System; for RI/FS (RFI) it is the BASELINE RISK ASSESSMENT

** DOCUMENT ASSESSMENT refers to PA/SI (RFA) Documentation or RI (RFI) Documentation

*** POST ASSESSMENT SUPPORT refers to POST PA/SI (RFA) SUPPORT or POST RI (RFI) SUPP

TABLE OF CONTENT
 HTRW REMEDIAL ACTION March 1992
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Second Level)

WBS Number	Description of Item	Page Number
33	HTRW REMEDIAL ACTION (ACCOUNT CODE 33)	
33 01	MOBILIZATION AND PREPARATORY WORK	
33 02	MONITORING, SAMPLING, TESTING, AND ANALYSIS	
33 03	SITE WORK	
33 05	SURFACE WATER COLLECTION AND CONTROL	
33 06	GROUNDWATER COLLECTION AND CONTROL	
33 07	AIR POLLUTION/GAS COLLECTION AND CONTROL	
33 08	SOLIDS COLLECTION AND CONTAINMENT	
33 09	LIQUIDS/SEDIMENTS/SLUDGES COLLECTION AND CONTAINMENT	
33 10	DRUMS/TANKS/STRUCTURES/MISCELLANEOUS DEMOLITION AND REMOVAL	
33 11	BIOLOGICAL TREATMENT	
33 12	CHEMICAL TREATMENT	
33 13	PHYSICAL TREATMENT	
33 14	THERMAL TREATMENT	
33 15	STABILIZATION/FIXATION/ENCAPSULATION	
33 17	DECONTAMINATION AND DECOMMISSIONING (D&D)	
33 18	DISPOSAL (OTHER THAN COMMERCIAL)	
33 19	DISPOSAL (COMMERCIAL)	
33 20	SITE RESTORATION	
33 21	DEMOBILIZATION	
33 9x	OTHER (use numbers 90-99)	

- NOTES: 1. Level 2 designators 04 and 16 are reserved for future use.
2. This WBS is intended to also be used for "Emergency Response", "Rapid Response", "Immediate Response", "Interim Remediation", and "Preplaced Remedial Action"

March 1992

HTRW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33	HTRW REMEDIAL ACTION	(See NOTE)
33 01	MOBILIZATION AND PREPARATORY WORK	
01 01	Mobilization of Construction Equipment and Facilities	LS
01 02	Mobilization of Personnel	EA
01 03	Preconstruction Submittals/Implementation Plans	LS
01 04	Setup/Construct Temporary Facilities	LS
01 05	Construct Temporary Utilities	LS
01 06	Temporary Relocations of Roads/Structures/Utilities	LS
01 07	Construction Plant Erection	LS
01 9x	Other (use numbers 90-99)	
33 02	MONITORING, SAMPLING, TESTING, AND ANALYSIS	
02 01	Meteorological Monitoring	LS
02 02	Radiation Monitoring	LS
02 03	Air Monitoring and Sampling	LS
02 04	Monitoring Wells	EA
02 05	Sampling Surface Water/Groundwater/ Liquid Waste	EA
02 06	Sampling Soil and Sediment	EA
02 07	Sampling Asbestos	EA
02 08	Sampling Radioactive Contaminated Media	EA
02 09	Laboratory Chemical Analysis	EA
02 10	Radioactive Waste Analysis	EA
02 11	Geotechnical Testing	EA
02 12	Geotechnical Instrumentation	LS
02 13	On-site Laboratory Facilities	LS
02 14	Off-site Laboratory Facilities	LS
02 9x	Other (use numbers 90-99)	

NOTE: Units of Measure (UOM) assigned at the third level basically reflect subsystem or assembly costs, much the same as gross square foot (SF) costs for building systems. Fourth level UOM will in many cases vary from third level UOM, since the fourth level reflects more detailed information. UOM for the Treatment categories in this document (33 11 thru 33 15) generally reflect total treatment quantity (gal, cy, ton, etc.) as would be used for portable treatment systems. For treatment systems that will be permanent however, units could also be measured over time (gpm, cy/dy, ton/dy). UOM may be modified to meet specific requirements.

**ETRW REMEDIAL ACTION
WORK BREAKDOWN STRUCTURE (WBS)
(To The Third Level)**

WBS Number	Description of Item	Unit of Measure
33 03	SITE WORK	
03 01	Demolition	LS
03 02	Clearing and Grubbing	AC
03 03	Earthwork	CY
03 04	Roads/Parking/Curbs/Walks	SY
03 05	Fencing	LF
03 06	Electrical Distribution	LF
03 07	Telephone/Communication Distribution	LF
03 08	Water/Sewer/Gas Distribution	LF
03 09	Steam and Condensate Distribution	LF
03 10	Fuel Line Distribution	LF
03 11	Storm Drainage/Subdrainage	LF
03 12	Permanent Cover Structure Over Contaminated Area	SF
03 13	Development of Borrow Pit/Haul Roads	LS
03 9x	Other (use numbers 90-99)	
33 05	SURFACE WATER COLLECTION AND CONTROL	
05 01	Berms/Dikes	CY
05 02	Floodwalls	LF
05 03	Levees	CY
05 04	Terraces and Benches	CY
05 05	Excavation for Channels/Waterways (Soil/Rock)	CY
05 06	Chutes or Flumes	LF
05 07	Sediment Barriers	LF
05 08	Storm Drainage	LF
05 09	Lagoons/Basins/Tanks/Dikes	CY
05 10	Pumping/Draining/Collection	GAL
05 11	Transport to Treatment Plant	GAL
05 12	Earthwork	CY
05 13	Erosion Control	AC
05 14	Development of Borrow Pit/Haul Roads	LS
05 9x	Other (use numbers 90-99)	
33 06	GROUNDWATER COLLECTION AND CONTROL	
06 01	Extraction and Injection Wells	EA
06 02	Subsurface Drainage/Collection	LF
06 03	Slurry Walls	SF
06 04	Grout Curtain	SF
06 05	Sheet Piling	SF
06 06	Lagoons/Basins/Tanks/Dikes	CY
06 07	Pumping/Collection	GAL
06 08	Transport to Treatment Plant	GAL
06 09	Development of Borrow Pit/Haul Roads	LS
06 9x	Other (use numbers 90-99)	

ETPW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33 07	AIR POLLUTION/GAS COLLECTION AND CONTROL	
07 01	Gas/Vapor Collection Trench System	LF
07 02	Gas/Vapor Collection Well System	EA
07 03	Gas/Vapor Collection at Lagoon Cover	SY
07 04	Fugitive Dust/Vapor/Gas Emissions Control	AC
07 9x	Other (use numbers 90-99)	
33 08	SOLIDS COLLECTION AND CONTAINMENT	
08 01	Excavation	CY
08 02	Waste Containment, Portable (Furnish/Fill)	CY
08 03	Transport to Treatment Plant	CY
08 04	Radioactive Specific Waste Containment (Furnish/Fill)	CY
08 05	Capping of Contaminated Area/Waste Pile (Soil/Asphalt Cap)	SY
08 06	Nuclear Waste Densification (Dynamic Compaction)	CY
08 07	Development of Borrow Pit/Haul Roads	LS
08 9x	Other (use numbers 90-99)	
33 09	LIQUIDS/SEDIMENTS/SLUDGES COLLECTION AND CONTAINMENT	
09 01	Dredging/Excavating	CY
09 02	Industrial Vacuuming	CY
09 03	Waste Containment, Portable (Furnish/Fill)	GAL
09 04	Transport to Treatment Plant	GAL
09 05	Radioactive Specific Waste Containment (Furnish/Fill)	GAL
09 06	Pumping/Draining/Collection	GAL
09 07	Lagoons/Basins/Tanks/Dikes	CY
09 08	Development of Borrow Pit/Haul Roads	LS
09 9x	Other (use numbers 90-99)	
33 10	DRUMS/TANKS/STRUCTURES/MISCELLANEOUS DEMOLITION AND REMOVAL	
10 01	Drum Removal	EA
10 02	Tank Removal	EA
10 03	Structure Removal	SF
10 04	Asbestos Abatement	SF
10 05	Ordnance Removal	LS
10 06	Radioactive Specific Waste Containment (Furnish/Fill)	CY
10 07	Miscellaneous Items	LS
10 9x	Other (use numbers 90-99)	

HTRW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33 11	BIOLOGICAL TREATMENT	
11 01	Activated Sludge (Seq Batch Reactors)	GPD
11 02	Rotating Biological Contactors	CY
11 03	Land Treatment/Farming (Solid Phase Biodegradation)	CY
11 04	In-Situ Biodegradation/Bioreclamation	CY
11 05	Trickling Filters	GPD
11 06	Biological Lagoons	CY
11 07	Composting	CY
11 08	Sludge Stabilization - Aerobic	CY
11 09	Sludge Stabilization - Anaerobic	CY
11 10	Genetically Engineered Organisms (White Rot Fungus)	CY
11 11	Slurry Biodegradation	CY
11 9x	Other (use numbers 90-99)	
33 12	CHEMICAL TREATMENT	
12 01	Oxidation/Reduction (Catalytic)	GAL
12 02	Solvent Extraction	CY
12 03	Chlorination	GAL
12 04	Ozonation	GAL
12 05	Ion Exchange	GAL
12 06	Neutralization	GAL
12 07	Chemical Hydrolysis	GAL
12 08	Ultraviolet Photolysis	GAL
12 09	Dehalogenation (Catalytic Dechlorination)	CY
12 10	Alkali Metal Dechlorination	CY
12 11	Alkali Metal/Polyethylene Glycol (A/PEG)	CY
12 12	Base-Catalyzed Decomposition Process	CY
12 13	Electrolysis	GAL
12 9x	Other (use numbers 90-99)	
33 13	PHYSICAL TREATMENT	
13 01	Filtration/Ultrafiltration	GAL
13 02	Sedimentation	GAL
13 03	Straining	GAL
13 04	Coagulation/Flocculation/Precipitation	GAL
13 05	Equalization	GAL
13 06	Evaporation	GAL
13 07	Air Stripping	GAL
13 08	Steam Stripping	GAL
13 09	Soil Washing (Surfactant/Solvent)	CY
13 10	Soil Flushing (Surfactant/Solvent)	CY
13 11	Solids Dewatering	CY

HTRW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33 13	PHYSICAL TREATMENT, cont.	
13 12	Oil/Water Separation	GAL
13 13	Dissolved Air Floatation	GPD
13 14	Heavy Media Separation	CY
13 15	Distillation	GAL
13 16	Chelation	GAL
13 17	Solvent Extraction	GAL
13 18	Supercritical Extraction	GAL
13 19	Carbon Adsorption - Gases	CFM
13 20	Carbon Adsorption - Liquids	GAL
13 21	Membrane Separation - Reverse Osmosis	GAL
13 22	Electrodialysis	GAL
13 23	Vapor Extraction	CY
13 24	Shredding	TON
13 25	Aeration	CY
13 26	Advanced Electrical Reactor	CY
13 27	Low Level Waste (LLW) Compaction	CY
13 28	Agglomeration	CY
13 29	In-Situ Steam Extraction	GAL
13 30	Filter Presses	GAL
13 31	Lignin Adsorption/Sorptive Clays	CY
13 9x	Other (use numbers 90-99)	
33 14	THERMAL TREATMENT	
14 01	Incineration	TON
14 02	Low Temperature Thermal Desorption	TON
14 03	Supercritical Water Oxidation	TON
14 04	Molten Salt Destruction	TON
14 05	Detonation	LS
14 06	Solar Detoxification	TON
14 9x	Other (use numbers 90-99)	
33 15	STABILIZATION/FIXATION/ENCAPSULATION	
15 01	Molten Glass	TON
15 02	In-Situ Vitrification	CY
15 03	In-Situ Pozzolan Process (Lime/Portland Cement)	CY
15 04	Pozzolan Process (Lime/Portland Cement)	CY
15 05	Asphalt-Based Encapsulation	SY
15 06	Radioactive Waste Solidification (Grouting/Other)	CY
15 07	Sludge Stabilization (Aggregate/Rock/Slag)	CY
15 9x	Other (use numbers 90-99)	

HTRW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33 17	DECONTAMINATION AND DECOMMISSIONING (D&D)	
17 01	Pre-Decommissioning Operations	LS
17 02	Facility Shutdown Activities	LS
17 03	Procurement of Equipment Material	LS
17 04	Dismantling Activities	LS
17 05	Research and Development (R&D)	LS
17 06	Spent Fuel Handling	LS
17 07	Hot Cell Cleanup	LS
17 9x	Other (use numbers 90-99)	
33 18	DISPOSAL (OTHER THAN COMMERCIAL)	
18 01	Storage/Disposal Facility Construction/ Operation	LS
18 02	Container Handling	EA
18 03	Transportation to Storage/Disposal Facility	CY
18 04	Sorting	CY
18 05	Spreading	CY
18 06	Compacting	CY
18 07	Placement	CY
18 08	Final Closure	CY
18 09	Disposal Fees and Taxes	CF
18 10	Mixed Waste Storage Fees and Taxes	CF
18 9x	Other (use numbers 90-99)	
33 19	DISPOSAL (COMMERCIAL)	
19 01	Container Handling	EA
19 02	Transportation to Storage/Disposal Facility	TON
19 03	Disposal Fees and Taxes	CF
19 9x	Other (use numbers 90-99)	
33 20	SITE RESTORATION	
20 01	Earthwork	CY
20 02	Permanent Markers	EA
20 03	Re-establish Roads/Structures/Utilities	LS
20 04	Revegetation and Planting	AC
20 05	Removal of Barriers	EA
20 06	Post-Construction Maintenance	AC
20 9x	Other (use numbers 90-99)	

HTRW REMEDIAL ACTION
 WORK BREAKDOWN STRUCTURE (WBS)
 (To The Third Level)

WBS Number	Description of Item	Unit of Measure
33 21	DEMOBILIZATION	
21 01	Removal of Temporary Facilities	LS
21 02	Removal of Temporary Utilities	LS
21 03	Final Decontamination	LS
21 04	Demobilization of Construction Equipment and Facilities	LS
21 05	Demobilization of Personnel	EA
21 06	Post-Construction Submittals	LS
21 07	Construction Plant Takedown	LS
21 9x	Other (use numbers 90-99)	

HTRW REMEDIAL ACTION
WBS
(To The Fourth Level)

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WBS Number	Description of Item	Unit of Measure
33	HTRW REMEDIAL ACTION	
33 01	MOBILIZATION AND PREPARATORY WORK	
01 01	Mobilization of Construction Equipment and Facilities	
01 01	Transport Vehicles Ownership/Operation	HR
01 02	Drivers	HR
01 03	Manifests	EA
01 04	Tolls	EA
01 05	Permits	EA
01 06	Escort Vehicles Ownership/Operation	HR
01 07	Construction Equipment Ownership/Operation	HR
01 08	Equipment Operators	HR
01 09	Initial Assembly and Setup	EA
01 02	Mobilization of Personnel	
02 01	Relocation of Supervisory Personnel	EA
01 03	Preconstruction Submittals/Implementation Plans	
03 01	Chemical Data Acquisition Plan	EA
03 02	Spill Control Plan	EA
03 03	Erosion Control Plan	LS
03 04	Environmental Protection Plan	EA
03 05	Sedimentation Control Plan	EA
03 06	Pollution Control Plan	EA
03 07	Letters of Commitment	EA
03 08	Site Safety and Health Plan (SSHP)	EA
03 09	Air Monitoring Plan	EA
03 10	Traffic Control Plan	EA
03 11	Site Security Plan	EA
03 12	Contaminated Water Storage and Treatment Plan	EA
03 13	General Site Work Plan	EA
03 14	Construction Quality Control Plan	EA
03 15	Materials Handling/Transportation/Disposal Plan	EA
03 16	Asbestos Hazard Abatement Plan	EA
03 17	Phase-Out Report	EA
03 18	Accident Prevention Plan	EA

ETRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 01 03 19	Phase Safety Plan	EA
03 20	Emergency Response Plan	EA
03 21	Trial Burn Plan	EA
03 22	Other Technology Plans	EA
03 23	Experience Record	EA
03 24	Financial Statement	EA
03 25	Small Business Plan	EA
03 26	Subcontracting Plan	EA
03 27	Construction Scheduling (CPM)	LS
03 28	Training Certifications	EA
03 29	Medical Surveillance Certifications	EA
03 30	Local Permits	EA
03 31	State Permits	EA
03 32	Federal Permits	EA
03 33	Patent Fees	EA
01 04	Setup/Construct Temporary Facilities	
04 01	Office Trailers	EA
04 02	Storage Facilities	EA
04 03	Observation Tower	EA
04 04	Decontamination Facilities for Personnel	EA
04 05	Decontamination Facilities for Construction Equip/Vehicles	EA
04 06	Temporary Cover Structure Over Contaminated Area	SY
04 07	Lunch/Break Trailer	EA
04 08	Laundry Facilities	LS
04 09	Emergency Medical Trailer/Facilities	EA
04 10	Toilets	EA
04 11	Barricades	EA
04 12	Equipment Maintenance Shop	EA
04 13	Warehouses	EA
04 14	Government Trailers	EA
04 15	Guard Houses	EA
04 16	Truck Scales	EA
04 17	Wastewater Holding Tanks	EA
04 18	Fire Suppression Systems	EA
04 19	POL Dispensing Station	EA
04 20	Photographic Laboratory	EA
04 21	Housing	LS
04 22	Shop Facilities	LS
04 23	Aggregate Surfacing	TON
04 24	Security Fencing	LF
04 25	Roads and Parking	SY
04 26	Culverts	LF
04 27	Walks	SF
04 28	Signs	EA
04 29	Grading	SY

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 01 05	Construct Temporary Utilities	
05 01	Site Lighting	LS
05 02	Power Connection/Distribution	LF
05 03	Telephone/Communications Hookup	EA
05 04	Water Connection/Distribution	LF
05 05	Sewer Connection/Distribution	LF
05 06	Gas Connection/Distribution	LF
01 06	Temporary Relocations of Roads/Structures/ Utilities	SY
01 07	Construction Plant Erection	
07 01	Concrete Batch	EA
07 02	Block	EA
07 03	Precast	EA
07 04	Asphalt	EA
07 05	Quarry Crusher/Screens	EA
01 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02	MONITORING, SAMPLING, TESTING, AND ANALYSIS	
02 01	Meteorological Monitoring	
01 01	Meteorological Monitoring Station	EA
01 02	Instrument Shelters	EA
02 02	Radiation Monitoring	
02 01	Area Monitoring	
	Alarm Systems	LS
	GM/Scintillation Survey Metering	LS
	Ion Chamber Survey Metering	LS
	Tritium Monitoring	LS
	Special Case Monitoring	LS
02 02	Personal Dosimetry	
	Audible Alarm Systems	LS
	Film Badging	LS
	Pocket Ion Chambers	LS
02 03	Personnel Radiation Counting	
	Doorway	LS
	Hand & Foot	LS
	Whole Body	LS
	Handheld	LS
02 04	Dosimetry Systems	
	Electronic Dosimeters/Readers/ Accessories	LS
	Thermoluminescent (TL) Dosimeters/ Readers/Components	LS
02 05	Diagnostics, Quality Assurance, and Calibration	
	Offsite Calibration	LS
	On-Site Calibration	LS
	Calibration Standards	LS
02 03	Air Monitoring and Sampling	
03 01	Real-Time	
	Particulate Sampling	LS
	Toxic Gas/Vapor Monitoring	LS
	Reporting	LS
03 02	Non-Real Time	
	Source Emissions Sampling	LS
	Industrial Hygiene Air Sampling	LS
	Perimeter Air Sampling	LS
03 03	Asbestos	
	Baseline Air Sampling	LS
	Airborne Compliance Monitoring	LS
	Clearance Monitoring	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 04	Monitoring Wells	
04 01	Drill Setup	EA
04 02	Well Drilling	LF
04 03	Handling of Cuttings/Water	LS
04 04	Casing	LF
04 05	Casing Removal	LF
04 06	Gravel Pack Material	CF
04 07	Grout	CF
04 08	Wet Well	EA
04 09	Well Development/Testing	EA
04 10	Well Screen	LF
04 11	Capping	EA
04 12	Well House	EA
04 13	Well Pump and Controls/Instrumentation	EA
04 14	Well Piping, Valves, Fittings	LF
04 15	Flow Meter	EA
04 16	Lysimeters	EA
04 17	Electrical	LS
04 18	Tests	EA
04 19	Operation and Maintenance	LS
04 20	Monitoring Well Abandonment	EA
02 05	Sampling Surface Water/Ground Water/ Liquid Waste	
05 01	Surface Water	EA
05 02	Ground Water	EA
05 03	Liquid Waste	EA
05 04	Treatment Process Effluents	EA
05 05	Sample Shipping and Handling	EA
02 06	Sampling Soil and Sediment	
06 01	Surface Soil	EA
06 02	Sub-surface Soil	EA
06 03	Sediment/Sludge	EA
06 04	Sample Shipping and Handling	EA
02 07	Sampling Asbestos	EA
02 08	Sampling Radioactive Contaminated Media	
08 01	Surface Water	EA
08 02	Ground Water	EA
08 03	Liquid Waste	EA
08 04	Surface Soil	EA
08 05	Sub-Surface Soil	EA
08 06	Sediment/Sludge	EA
08 07	Other Contaminated Media	EA
08 08	Sample Shipping and Handling	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 09	Laboratory Chemical Analysis	
09 01	Air/Industrial Hygiene Analysis	
	Particulate	EA
	HCl	EA
	NOx	EA
	SOx	EA
	Priority Pollutant Testing	EA
	Asbestos	EA
09 02	General Water Quality and Wastewater Analysis	
	Acidity/Alkalinity	EA
	Ammonia	EA
	Anions (Fluoride, Chloride, Nitrate, Nitrite, ortho-Phosphate, Sulfate)	EA
	Bacteriological (Fecal Coliform, Total Coliform)	EA
	Boron	EA
	Cations	EA
	Chlorine, Residual	EA
	Color	EA
	Conductivity	EA
	Cyanide	EA
	Dissolved Oxygen	EA
	Hardness	EA
	Iodine	EA
	Nitrogen (Kjeldahl, Total Organic)	EA
	Odor	EA
	Oil and Grease	EA
	Oxygen (Biochemical Oxygen Demand, Chemical Oxygen Demand)	EA
	pH	EA
	Phenolics	EA
	Phosphorous (ortho-Phosphate and Total)	EA
	Radioactivity	
	Gross Alpha and Gross Beta	EA
	Radium 226/228	EA
	Residue	
	Total	EA
	Filterable	EA
	Non-Filterable	EA
	Settleable	EA
	Volatile	EA
	Sulfite	EA
	Sulfide	EA
	Surfactant (MBAS)	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 09	Total Organic Carbon	EA
	Total Organic Halide	EA
	Trihalomethanes	EA
	TRPH (Total Recoverable Petroleum Hydrocarbons)	EA
	Turbidity	EA
09 03	Priority Pollutant Analysis (all media)	
	Acrolein/Acrylonitrile	EA
	Benzidines	EA
	Chlorinated Herbicides	EA
	Chlorinated Hydrocarbons	EA
	Dioxins/Furans	EA
	Ethylene Dibromide	EA
	Haloethers	EA
	Organophosphorus Pesticides	EA
	Metals	EA
	Nitrosoamines	EA
	Pesticides and PCB's	EA
	Phenols	EA
	Phthalate Esters	EA
	Polynuclear Aromatic Hydrocarbons	EA
	Purgeable Aromatics	EA
	Purgeable Halocarbons	EA
	Purgeable Organics	EA
	Nitroaromatics/Isophorone	EA
Semi-Volatile Organics	EA	
09 04	Biomonitoring and Bioassay Analysis	
	Daphnia Species	EA
	Pimephales Promelas	EA
	Mysidopsis Species	EA
	Cyprinodon Species	EA
	Mysidopsis Bahia	EA
	Chronic Toxicity Bioassay	EA
	Ceriodaphnia Dubia	EA
	Pimephales Pomelas Larval	EA
	Mysidopsis Species	EA
	Cryprinodon Species	EA
09 05	Hazardous Waste (RCRA) Analysis	
	Corrosivity	EA
	TCLP Extraction/Priority Pollutant Analysis	EA
	Ignitability	EA
	Reactivity (Cyanide/Sulfide)	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 09 06	Miscellaneous Waste Analysis	
	Percent Acid	EA
	Ash	EA
	Asphaltenes	EA
	Bottoms Sediment and Water	EA
	Bromine Number	EA
	BTU	EA
	Caustic Percent	EA
	Chloride	EA
	Compatibility Testing (field)	EA
	Corrosivity	EA
	Eh (Oxidation Reduction Potential)	EA
	Flash Point	EA
	Formaldehyde in Water	EA
	Freeze Point	EA
	Heavy Metals	EA
	Hydroxyl Number	EA
	Iodine Number	EA
	Mercaptan Sulfur	EA
	Metals in Oil	EA
	Moisture Percent	EA
	Neutralization Number	EA
	Oil and Grease or TPH	EA
	pH	EA
	Paint Filter Test	EA
	Priority Pollutant Testing	EA
	Radioactivity	EA
	Saponification Number	EA
	Specific Gravity/Density	EA
	Sulfur	EA
	TOX (Total Organic Halogens)	EA
	Viscosity	EA
09 07	Soil and Sediment Analysis	
	Anions (Fluoride, Chloride, Nitrate, Nitrite, Ortho-phosphate, Sulfate)	EA
	Ammonia	EA
	Bromide	EA
	Cation Exchange Capacity	EA
	Chloride	EA
	Conductivity	EA
	Cyanide	EA
	Exchangeable Sodium Percentage	EA
	Extractable Organic Halide	EA
	Iodine	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 09	Nitrogen (Kjeldahl, Total Organic)	EA
	Oil and Grease	EA
	pH	EA
	Phenolics	EA
	Phosphorus (ortho-Phosphate and Total)	EA
	Sodium Absorption Ratio	EA
	Solids, Total	EA
	Total Organic Carbon	EA
	Total Organic Halide	EA
	Total Recoverable Petroleum Hydrocarbons (TRPH)	EA
02 10	Radioactive Waste Analysis	
10 01	Rad Analytical Animal Tissue/Bone	
	Alpha Spectroscopy	EA
	Gas Flow Proportional Counting	EA
	Gamma Spectroscopy	EA
	Liquid Scintillation	EA
10 02	Rad Analytical Air	
	Alpha Spectroscopy	EA
	Gas Flow Proportional Counting	EA
	Gamma Spectroscopy	EA
	Liquid Scintillation	EA
10 03	Rad Analytical Liquid	
	Alpha Spectroscopy	EA
	Beta/Gamma Coincidence	EA
	Gas Flow Proportional Counting	EA
	Gamma Spectroscopy	EA
	Liquid Scintillation	EA
10 04	Rad Analytical Urine/Feces	
	Alpha Spectroscopy	EA
	Gas Flow Proportional Counting	EA
	Gamma Spectroscopy	EA
	Liquid Scintillation	EA
10 05	Rad Analytical Vegetation/Sediment/Soil	
	Alpha Spectroscopy	EA
	Gas Flow Proportional Counting	EA
	Gamma Spectroscopy	EA
	Liquid Scintillation	EA
10 06	Rad Analytical Miscellaneous	
	Liquid Scintillation	EA
	Sample Preparation	EA
	Data Packaging	EA
	Additional Charges/Services	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 02 11	Geotechnical Testing	
11 01	Classification	EA
11 02	Shear Strength	EA
11 03	Consolidation	EA
11 04	Permeability	EA
11 05	Geosynthetic Friction Testing	EA
11 06	Field Tests	EA
11 07	Sample Shipping and Handling	EA
02 12	Geotechnical Instrumentation	
12 01	Piezometers	EA
12 02	Inclinometers	EA
12 03	Settlement Gauges	EA
12 04	Tiltmeters	EA
12 05	Vadose Zone Monitoring	EA
12 06	Sample Shipping and Handling	EA
02 13	On-Site Laboratory Facilities	
13 01	Mobilization	LS
13 02	Rental/Ownership/Operation/ Maintenance During Construction	LS
13 03	Lab Equipment	LS
13 04	Lab Personnel	LS
13 05	Demobilization	LS
02 14	Off-Site Laboratory Facilities	
14 01	Sample Storage/Disposal	EA
02 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 03	SITE WORK	
03 01	Demolition	LS
03 02	Clearing and Grubbing	AC
03 03	Earthwork	
03 01	Rock Excavation	CY
03 02	Excavation/Fill	CY
03 03	Backfill	CY
03 04	Borrow	CY
03 05	Hauling	CY
03 06	Spreading	CY
03 07	Grading	SY
03 08	Compaction	CY
03 09	Scarification	CY
03 10	Harrowing	CY
03 11	Tracking	CY
03 12	Contour Furrowing	CY
03 13	Stockpiling	CY
03 14	Topsoil	CY
03 15	Settlement Markers	EA
03 04	Roads/Parking/Curbs/Walks	
04 01	Bituminous Surfacing	TON
04 02	Prime Coat/Tack Coat	GAL
04 03	Aggregate Surfacing	TON
04 04	Concrete Surfacing	CY
04 05	Base Courses	TON
04 06	Geotextile Fabric	SY
04 07	Guard Rails	LF
04 08	Curbs and Gutters	LF
04 09	Sidewalks	SF
04 10	Signs	EA
04 11	Striping	LF
04 12	Barricades	EA
03 05	Fencing	
05 01	Fencing	LF
05 02	Gates	EA
03 06	Electrical Distribution	
06 01	Relocations	LS
06 02	Power Distribution	LF
06 03	Site Lighting Distribution	LF
06 04	Site Lighting Fixtures	EA
06 05	Transformers	EA
06 06	Connections/Fees	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 03 07	Telephone/Communication Distribution	
07 01	Telephone Distribution	LF
07 02	Communication Systems	EA
07 03	Alarms	EA
07 04	Relocations	LF
07 05	Connections/Fees	EA
07 30	Tests	EA
03 08	Water/Sewer/Gas Distribution	
08 01	Water Distribution	LF
08 02	Sanitary Sewer Collection	LF
08 03	Gas Distribution	LF
08 04	Relocations	LF
08 05	Connections/Fees	EA
08 30	Tests	EA
03 09	Steam and Condensate Distribution	
09 01	Steam Distribution	LF
09 02	Condensate Distribution	LF
09 03	Relocations	LF
09 04	Connections/Fees	EA
09 30	Tests	EA
03 10	Fuel Line Distribution	
10 01	Fuel Line Distribution	LF
10 02	Relocations	LF
10 03	Connections/Fees	EA
10 30	Tests	EA
03 11	Storm Drainage/Subdrainage	
11 01	Pipe	LF
11 02	Manholes	EA
11 03	Inlets	EA
11 04	Drainage Structures	EA
11 30	Tests	EA
03 12	Permanent Cover Structure Over Contaminated Area	SF
03 13	Development of Borrow Pit/Haul Roads	LS
03 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 05	SURFACE WATER COLLECTION AND CONTROL	
05 01	Berms/Dikes	CY
05 02	Floodwalls	LF
05 03	Levees	CY
05 04	Terraces and Benches	CY
05 05	Excavation for Channels/ Waterways (Soil/Rock)	CY
05 06	Chutes or Flumes	
06 01	Concrete	CY
06 02	Bituminous	TON
06 03	Rip Rap	TON
06 04	Gabions	CY
05 07	Sediment Barriers	
07 01	Silt Fence	LF
07 02	Straw Bales	LF
05 08	Storm Drainage	
08 01	Pipe	LF
08 02	Structures	EA
08 03	Gabions	CY
08 04	Rip Rap	TON
05 09	Lagoons/Basins/Tanks/Dikes	
09 01	Excavation	CY
09 02	Berm Embankment and Compaction	CY
09 03	Impervious Clay Liner	CY
09 04	Bentonite Liner	CY
09 05	Geonet	SY
09 06	Geotextile	SY
09 07	Geomembrane (Synthetic)	SY
09 08	Geocomposite	SY
09 09	Granular Drainage Layer	CY
09 10	Slope Protection	
	Riprap/Stone/Rock	TON
	Seeding/Mulch/Fertilizer/Topsoil	AC
	Erosion Control Fabric	SY
	Gabions	CY

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 05 09 11	Floating Cover	
	Synthetic Cover	SY
	Floats	EA
	Anchors	EA
	Gas Vent Pipes	EA
09 12	Intake/Outlet Structure	EA
09 13	Spillway	LS
09 14	Storage Tanks w/Alarms	EA
09 30	Tests	EA
05 10	Pumping/Draining/Collection	
10 01	Pumping	LS
10 02	Manholes, Valves, Boxes	EA
10 03	Piping	LF
10 04	Hose	LF
10 05	Draining (Gravity)	GAL
10 06	Holding Tank	EA
05 11	Transport to Treatment Plant	GAL
05 12	Earthwork	
12 01	Rock Excavation	CY
12 02	Excavation/Fill	CY
12 03	Backfill	CY
12 04	Borrow	CY
12 05	Hauling	CY
12 06	Spreading	CY
12 07	Grading	SY
12 08	Compaction	CY
12 09	Scarification	CY
12 10	Harrowing	CY
12 11	Tracking	CY
12 12	Contour Furrowing	CY
12 13	Stockpiling	CY
12 14	Topsoil	CY
12 15	Settlement Markers	EA
05 13	Erosion Control	
13 01	Seeding/Mulch/Fertilizer	AC
13 02	Sodding	SY
13 03	Erosion Control Fabric	SY
13 04	Shrubs, Trees, Ground Cover	EA
13 05	Topsoil	CY
13 06	Mowing	AC
13 07	Maintenance	LS
05 14	Development of Borrow Pit/Haul Roads	LS
05 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 06	GROUNDWATER COLLECTION AND CONTROL	
06 01	Extraction and Injection Wells	
01 01	Drill Setup	EA
01 02	Well Drilling	LF
01 03	Handling of Cuttings/Water	LS
01 04	Casing	LF
01 05	Casing Removal	LF
01 06	Gravel Pack Material	CF
01 07	Grout	CF
01 08	Wet Well	EA
01 09	Well Development/Testing	LS
01 10	Well Screen	LF
01 11	Capping	EA
01 12	Well House	EA
01 13	Pitless Adapter	EA
01 14	Well Pump and Controls/Instrumentation	EA
01 15	Well Piping, Valves, Fittings	LF
01 16	Flow Meter	EA
01 17	Holding Tank	EA
01 18	Electrical	LS
01 19	Operation and Maintenance	LS
01 20	Monitoring Well Abandonment	EA
01 30	Tests	EA
06 02	Subsurface Drainage/Collection	
02 01	Trench Excavation/Soil/Rock	CY
02 02	Dewatering for Construction	LS
02 03	Sheeting and Shoring Trench	SF
02 04	Drain Piping, Fittings	LF
02 05	Aggregate Filter Material	TCN
02 06	Geotextile Fabrics	SF
02 07	Backfill	CY
02 08	Synthetic Liner	SY
02 09	Manholes	EA
02 10	Observation Risers	EA
02 11	Lift Station, Pumps and Controls/ Instrumentation	EA
02 12	Holding Tank	EA
02 30	Tests	EA
06 03	Slurry Walls	
03 01	Excavation	CY
03 02	Bentonite Slurry	CY
03 03	Soil-Bentonite Slurry	CY
03 04	Slurry Mixing/Circulation	CY
03 05	Cement-Bentonite Slurry	CY
03 06	Fill Material	CY
03 07	Backfill Placing	CY
03 30	Tests	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 06 04	Grout Curtain	
04 01	Drill Grout Holes	LF
04 02	Grout Tube	LF
04 03	Grout Injection	CF
04 04	Vibrating Beam Grout Injection	CF
06 05	Sheet Piling	
05 01	Driven Sheet Piling (left in place)	SF
05 02	Driven Sheet Piling (pulled)	SF
06 06	Lagoons/Basins/Tanks/Dikes	
06 01	Excavation	CY
06 02	Berm Embankment and Compaction	CY
06 03	Impervious Clay Liner	CY
06 04	Bentonite Liner	CY
06 05	Geonet	SY
06 06	Geotextile	SY
06 07	Geomembrane (Synthetic)	SY
06 08	Geocomposite	SY
06 09	Granular Drainage Layer	TON
06 10	Slope Protection	
	Riprap/Stone/Rock	TON
	Seeding/Mulch/Fertilizer/Topsoil	AC
	Erosion Control Fabric	SY
	Gabions	CY
06 11	Floating Cover	
	Synthetic Cover	SY
	Floats	EA
	Anchors	EA
	Gas Vent Pipes	EA
06 12	Intake/Outlet Structure	LS
06 13	Spillway	LS
06 14	Storage Tanks w/Alarms	EA
06 30	Tests	EA
06 07	Pumping/Collection	
07 01	Pumping	LS
07 02	Manholes, Valves, Boxes	EA
07 03	Piping	LF
07 04	Hose	LF
07 05	Holding Tank	EA
06 08	Transport to Treatment Plant	GAL
06 09	Development of Borrow Pit/Haul Roads	LS
06 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 07	AIR POLLUTION/GAS COLLECTION AND CONTROL	
07 01	Gas/Vapor Collection Trench System	
01 01	Trench Excavation/Soil/Rock	CY
01 02	Sheeting and Shoring Trench	SF
01 03	Vertical Piping, Fittings	LF
01 04	Aggregate Filter Material	TON
01 05	Backfill	CY
01 06	Protective Trench Cover	LF
01 07	Monitoring Probes	EA
01 08	Synthetic Membrane	SF
01 09	Gas Collection Header/Fittings/Tanks	LS
01 10	Vacuum Blower/Compressor	EA
01 11	Flare/Flame Arrestor	EA
01 12	Valves, Boxes, Manholes	EA
01 13	Gas Control/Suppression	
	Wet Scrubber	EA
	Carbon Adsorber	EA
	Baghouse	EA
	Vapor Phase Adsorption	LS
	Thermal Oxidation (incl waste gas burners)	LS
01 30	Tests	EA
07 02	Gas/Vapor Collection Well System	
02 01	Well Drilling	LF
02 02	Handling of Cuttings/Water	LS
02 03	Casing	LF
02 04	Well Screen	LF
02 05	Drilling Mud	CY
02 06	Sand	CF
02 07	Grout Cement	CF
02 08	Well House	EA
02 09	Aggregate Filter Material	TON
02 10	Vertical Piping, Fittings	LF
02 11	Monitoring Probes	EA
02 12	Gas Collection Header/Fittings/Tanks	LS
02 13	Vacuum Blower/Compressor	EA
02 14	Flare/Flame Arrestor	EA
02 15	Valves, Boxes, Manholes	EA
02 16	Gas Control/Suppression	
	Wet Scrubber	EA
	Carbon Adsorber	EA
	Baghouse	EA
	Vapor Phase Carbon Adsorption System	LS
	Thermal Oxidation (incl waste gas burners)	LS
02 30	Tests	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 07 03	Gas/Vapor Collection at Lagoon Cover	
03 01	Flexible Gas Collection Hose	LF
03 02	Gas Collection Chambers/Tank	EA
03 03	Vacuum Blower/Compressor	EA
03 04	Flare/Flame Arrestor	EA
03 05	Valves, Boxes, Manholes	EA
03 06	Gas Control/Suppression	
	Wet Scrubber	EA
	Carbon Adsorber	EA
	Baghouse	EA
	Vapor Phase Carbon Adsorption System	EA
	Thermal Oxidation (incl waste gas burners)	LS
03 30	Tests	EA
07 04	Fugitive Dust/Vapor/Gas Emissions Control	
04 01	Sprayed Chemical Dust Suppressants	AC
04 02	Wind Fences/Screens	LF
04 03	Synthetic Covers over Waste Piles	SF
04 04	Water Spraying	AC
07 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 08	SOLIDS COLLECTION AND CONTAINMENT	
08 01	Excavation	CY
08 02	Waste Containment, Portable (Furnish/Fill)	
02 01	Bulk Containers/Roll-Offs	CY
02 02	Drums	EA
02 03	Bags	CY
02 04	Liners	EA
08 03	Transport to Treatment Plant	CY
08 04	Radioactive Specific Waste Containment (Furnish/Fill)	
04 01	LSA (Low Specific Activity) Shipping Containers	
	Strong Tight Containers	EA
	Liners	EA
	Drums and Pails	EA
	Shipping Casks	EA
04 02	Miscellaneous Type A Containers	
	Fissile Uranium Containers	EA
	Californium 252 Containers	EA
04 03	Type B Shipping Containers	
	Tritium Trap	EA
	Byproduct Special Form Containers	EA
	Fissile Uranium Containers	EA
	Irradiated Fuel Element Casks	EA
	PU (Plutonium) Normal Form Containers	EA
	PU Special Form Containers	EA
	Waste B Containers	EA
	Shipping Casks	EA
	Liners	EA
	Rail Casks	EA
04 04	Temporary On-Site Storage Spent Fuel Storage Racks	EA
08 05	Capping of Contaminated Area/Waste Pile (Soil/Asphalt Cap)	
05 01	Gas Collection Layer	CY
05 02	Gas Vent Pipes	EA
05 03	Impervious Clay Layer	CY
05 04	Bentonite Layer	CY
05 05	Granular Drainage Layer	TON
05 06	Geonet	SY
05 07	Geotextile	SY

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 08 05 08	Geomembrane (Synthetic)	SY
05 09	Geocomposite	SY
05 10	Geogrid	SY
05 11	Seeding/Mulch/Fertilizer	AC
05 12	Erosion Control Fabric	SY
05 13	Soil/Topsoil Cover Layer	CY
05 14	Crushed Rock	TON
05 15	Drainage/Leachate Piping	LF
05 16	Manholes/Sumps	EA
05 17	Lift Station, Pumps and Controls/ Instrumentation	EA
05 18	Test Fill Section	EA
05 19	Radon Barrier	SY
05 20	Asphalt/Concrete Paving Cover	SY
05 21	Blast Protective Cover Mat	SY
05 30	Tests	EA
08 06	Nuclear Waste Densification (Dynamic Compaction)	CY
08 07	Development of Borrow Pits/Haulroads	LS
08 9x	Other (use numbers 90-99)	

ETRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 09	LIQUIDS/SEDIMENTS/SLUDGES COLLECTION AND CONTAINMENT	
09 01	Dredging/Excavating	
01 01	Hydraulic	CY
01 02	Mechanical	CY
01 03	Pneumatic	CY
09 02	Industrial Vacuuming	GAL
09 03	Waste Containment, Portable (Furnish/Fill)	
03 01	Bulk Liquid Containers/Roll-Offs	GAL
03 02	Drums	GAL
03 03	Liners	EA
09 04	Transport to Treatment Plant	GAL
09 05	Radioactive Specific Waste Containment (Furnish/Fill)	
05 01	LSA (Low Specific Activity) Shipping Containers	
	Strong Tight Containers	EA
	Liners	EA
	Drums and Pails	EA
	Shipping Casks	EA
05 02	Miscellaneous Type A Containers	
	Fissile Uranium Containers	EA
	Californium 252 Containers	EA
05 03	Type B Shipping Containers	
	Tritium Trap	EA
	Byproduct Special Form Containers	EA
	Fissile Uranium Containers	EA
	Irradiated Fuel Element Casks	EA
	PU (Plutonium) Normal Form Containers	EA
	PU Special Form Containers	EA
	Waste B Containers	EA
	Shipping Casks	EA
	Liners	EA
	Rail Casks	EA
05 04	Temporary On-Site Storage Spent Fuel Storage Racks	EA
09 06	Pumping/Draining/Collection	
06 01	Pump and Controls/Instrumentation	EA
06 02	Structures, Manholes, Valves, Boxes	EA
06 03	Piping and Fittings	LF
06 04	Hose	LF
06 05	Draining (Gravity)	GAL
06 06	Holding Tank	EA
06 07	Lift Station/Controls and Instrumentation	EA

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 09 07	Lagoons/Basins/Tanks/Dikes	
07 01	Excavation	CY
07 02	Berm Embankment and Compaction	CY
07 03	Impervious Clay Liner	CY
07 04	Bentonite Liner	CY
07 05	Concrete Liner	CY
07 06	Geonet	SY
07 07	Geotextile	SY
07 08	Geomembrane (Synthetic)	SY
07 09	Geocomposite	SY
07 10	Granular Drainage Layer	TON
07 11	Slope Protection	
	Riprap/Stone/Rock	TON
	Seeding/Mulch/Fertilizer/Topsoil	AC
	Erosion Control Fabric	SY
	Gabions	CY
07 12	Floating Cover	
	Synthetic Cover	SY
	Floats	EA
	Anchors	EA
	Gas Vent Pipes	EA
07 13	Intake/Outlet Structure	LS
07 14	Spillway	LS
07 15	Storage Tanks w/Alarms	EA
07 30	Tests	EA
09 08	Development of Borrow Pit/Haul Roads	LS
09 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 10	DRUMS/TANKS/STRUCTURES/MISCELLANEOUS DEMOLITION AND REMOVAL	
10 01	Drum Removal	
01 01	Machine Excavation (Buried Drums)	CY
01 02	Hand Excavation (Buried Drums)	CY
01 03	Handling	EA
01 04	Cleaning	EA
01 05	Crushing/Shredding	EA
01 06	Drum Overpacks	EA
10 02	Tank Removal	
02 01	Machine Excavation (Buried Tanks)	CY
02 02	Hand Excavation (Buried Tanks)	CY
02 03	Tank Cutting/Demolition	LS
02 04	Handling	EA
02 05	Cleaning	EA
02 06	Crushing	EA
10 03	Structure Removal	
03 01	Decontamination	EA
03 02	Demolition	EA
10 04	Asbestos Abatement	
04 01	Preparatory Abatement Work	
	Mobilization and Fees	LS
	Removal of Furniture/Equipment	EA
	Pre-Cleaning	SF
	Isolation of Work Area (Negative Air)	SF
04 02	Abatement	
	Pipe and Fittings Insulation Removal	LF
	Boiler Insulation Removal	SF
	Acoustical (Fire Proofing/Spray-on) Removal	SY
	Encapsulation	SY
	Encasement, Floor Tile and Mastic Removal	LS
	Cement-Asbestos Siding Removal	SF
	Flat Transite Sheet Removal	SF
	Miscellaneous Removal	LS
04 03	Post-Abatement Work	
	Cleanup	LS
	Disposal of Asbestos Contaminated Matl	LS
10 05	Ordinance Removal	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 10 06	Radioactive Specific Waste Containment (Furnish/Fill)	
06 01	LSA (Low Specific Activity) Shipping Containers	
	Strong Tight Containers	EA
	Liners	EA
	Drums and Pails	EA
	Shipping Casks	EA
06 02	Miscellaneous Type A Containers	
	Fissile Uranium Containers	EA
	Californium 252 Containers	EA
06 03	Type B Shipping Containers	
	Tritium Trap	EA
	Byproduct Special Form Containers	EA
	Fissile Uranium Containers	EA
	Irradiated Fuel Element Casks	EA
	PU (Plutonium) Normal Form Containers	EA
	PU Special Form Containers	EA
	Waste B Containers	EA
	Shipping Casks	EA
	Liners	EA
	Rail Casks	EA
06 04	Temporary On-Site Storage Spent Fuel Storage Racks	EA
10 07	Miscellaneous Items	
07 01	Piping/Pipelines	LF
07 02	Pressurized Gas Cylinders	EA
10 9x	Other (use numbers 90-99)	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 11	BIOLOGICAL TREATMENT	
11 01	Activated Sludge (Sequencing Batch Reactors)	
01 01	Portable Unit	
	Solids Preparation and Handling	
	Loading/Unloading	CY
	Screening	CY
	Grinding	CY
	Pulverizing	CY
	Mixing	CY
	Moisture Control	CY
	Placement/Disposal	CY
	Liquid Preparation and Handling	
	Collection/Storage (Equalization)	GAL
	Separation	GAL
	Treatment	GAL
	Release/Disposal (POTW, Surface Discharge)	GAL
	Vapor/Gas Preparation and Handling	
	Collection/Storage	CF
	Separation	CF
	Treatment	CF
	Release/Disposal	LS
	Pads/Foundations/Spill Control	LS
	Mobilization/Setup	LS
	Startup/Testing/Permits	LS
	Training	LS
	Operation (Short Term-Up to 3 Years)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
	Operation (Long Term-Over 3 Years)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
	Cost of Ownership	LS
	Dismantling	LS
	Demobilization	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 11 01 02	Permanent Unit	
	Solids Preparation and Handling	
	Loading/Unloading	CY
	Screening	CY
	Grinding	CY
	Pulverizing	CY
	Mixing	CY
	Moisture Control	CY
	Placement/Disposal	CY
	Liquid Preparation and Handling	
	Collection/Storage (Equalization)	GAL
	Separation	GAL
	Treatment	GAL
	Release/Disposal (POTW, Surface Discharge)	GAL
	Vapor/Gas Preparation and Handling	
	Collection/Storage	CF
	Separation	CF
	Treatment	CF
	Release/Disposal	LS
	Pads/Foundations/Spill Control	LS
	Construction of Plant	
	Architectural	LS
	Structural	LS
	Mechanical	LS
	Electrical	LS
	Equipment Fabrication/Purchase	LS
	Equipment Erection/Installation	LS
	Startup/Testing/Permits	LS
	Training	LS
	Operation (Short Term-Up to 3 Years)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
	Operation (Long Term-Over 3 Years)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
	Mothballing	LS
11 02	*Rotating Biological Contactors	
11 03	*Land Treatment/Farming (Solid Phase Biodegradation)	
11 04	*In-Situ Biodegradation/Bioreclamation	

* Note: add the detail items listed under 33 11 01 01 & 02

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 11 05	*Trickling Filters	
11 06	*Biological Lagoons	
11 07	*Composting	
11 08	*Sludge Stabilization - Aerobic	
11 09	*Sludge Stabilization - Anaerobic	
11 10	*Genetically Engineered Organisms (White Rot Fungus)	
11 11	*Slurry Biodegradation	
11 9x	*Other (use numbers 90-99)	

* Note: add the detail items listed under 33 11 01 01 & 02

ETRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 12	CHEMICAL TREATMENT	
12 01	*Oxidation/Reduction (Catalytic Oxidation, UV Ozone, Peroxide, Solar Detoxification)	
12 02	*Solvent Extraction	
12 03	*Chlorination	
12 04	*Ozonation	
12 05	*Ion Exchange	
12 06	*Neutralization	
12 07	*Chemical Hydrolysis	
12 08	*Ultraviolet Photolysis	
12 09	*Dehalogenation (Catalytic Dechlorination)	
12 10	*Alkali Metal Dechlorination	
12 11	*Alkali Metal/Polyethylene Glycol (A/PEG)	
12 12	*Base-Catalyzed Decomposition Process (BCDP)	
12 13	*Electrolysis	
12 9x	*Other (use numbers 90-99)	

* Note: add the detail items listed under 33 11 01 01 & 02

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 13	PHYSICAL TREATMENT	
13 01	*Filtration/Ultrafiltration	
13 02	*Sedimentation	
13 03	*Straining	
13 04	*Coagulation/Flocculation/Precipitation	
13 05	*Equalization	
13 06	*Evaporation	
13 07	*Air Stripping	
13 08	*Steam Stripping	
13 09	*Soil Washing (Surfactant/Solvent)	
13 10	*Soil Flushing (Surfactant/Solvent)	
13 11	*Solids Dewatering	
13 12	*Oil/Water Separation	
13 13	*Dissolved Air Floatation	
13 14	*Heavy Media Separation	
13 15	*Distillation	
13 16	*Chelation	
13 17	*Solvent Extraction	
13 18	*Supercritical Extraction	
13 19	*Carbon Adsorption - Gases	
13 20	*Carbon Adsorption - Liquids	
13 21	*Membrane Separation - Reverse Osmosis	

* Note: add the detail items listed under 33 11 01 01 & 02

ETRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 13 22	*Electrodialysis	
13 23	*Vapor Extraction	
13 24	*Shredding	
13 25	*Aeration	
13 26	*Advanced Electrical Reactor	
13 27	*Low Level Waste (LLW) Compaction	
13 28	*Agglomeration	
13 29	*In-Situ Steam Extraction	
13 30	*Filter Presses	
13 31	*Lignin Adsorption/Sorptive Clays	
13 9x	*Other (use numbers 90-99)	

* Note: add the detail items listed under 33 11 01 01 & 02

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 14	THERMAL TREATMENT	
14 01	*Incineration (Fluidized Bed, Rotary Kiln, Multiple Hearth, Infrared, Circulating Bed, Liquid Injection, Infrared, Prylosis, Plasma Torch, Wet Air Oxidation)	
14 02	*Low Temperature Thermal Desorption (Fluidized Bed, Rotary Kiln, Multiple Hearth, Infrared, Circulating Bed, Liquid Injection, Infrared, Prylosis, Plasma Torch, Wet Air Oxidation)	
14 03	*Supercritical Water Oxidation	
14 04	*Molten Salt Destruction	
14 05	*Detonation	
14 06	*Solar Detoxification	
14 9x	*Other (use numbers 90-99)	

* Note: add the detail items listed under 33 11 01 01 & 02

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 15	STABILIZATION/FIXATION/ENCAPSULATION	
15 01	*Molten Glass	
15 02	*In-Situ Vitrification	
15 03	*In-Situ Pozzolan Process (Lime/Portland Cement)	
15 04	*Pozzolan Process (Lime/Portland Cement)	
15 05	*Asphalt-Based Encapsulation	
15 06	*Radioactive Waste Solidification (Grouting/Other)	
15 07	*Sludge Stabilization (Aggregate/Rock/Slag)	
15 9x	*Other (use numbers 90-99)	

* Note: add the detail items listed under 33 11 01 01 & 02

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 17	DECONTAMINATION AND DECOMMISSIONING (D&D)	
17 01	Pre-Decommissioning Operations	
01 01	Preparation of Decommissioning Plan	LS
	Description of Decommissioning Options	LS
	Selection of Decommissioning Alternative	LS
	Approval of Concept	LS
	Documenting Current Condition, Dose Rate Measurements	LS
	Inventory of Dismantling Activities	LS
	Inventory of Active and non-Active Waste Production	LS
	Estimation of Personnel Requirements	LS
	Estimation of Occupational Dose	LS
	Estimation of Contamination Levels	LS
	Estimation of Activity Levels and Exposure Rates for Neutron-Activated Products	LS
	Planning of Activities	LS
	Estimation of Decommissioning Costs	LS
	Safety, Analysis, Security Plan, ...	LS
01 02	Licensing	
	License Applications	LS
	License Documentation	LS
	Operation and Maintenance Procedures	LS
01 03	Radioactivity Surveys	LS
17 02	Facility Shutdown Activities	
02 01	Plant Shutdown and Inspection	LS
02 02	Defueling and Transfer of Fuel to Temporary Spent Fuel Storage	LS
02 03	Drainage and Drying or Blowdown of all Systems not in Operation	LS
02 04	Samples for Radioactivity Inventory Characterization	EA
02 05	Disposal of System Fluids (water, oils,..)	GAL
02 06	Disposal of Special System Fluids (D20, sodium, ...)	GAL
02 07	Decontamination of Systems for Dose Reduction	LS
02 08	Disposal of Wastes from Decontamination	
	Packaging	LS
	Transport	LS
	Conditioning	LS
	Disposal	LS
02 09	Disposal of Combustible Material	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 17 02 10	Disposal of Spent Resins	
	Packaging	LS
	Transport	LS
	Conditioning	LS
	Disposal	LS
02 11	Disposal of other Wastes from Reactor Opns	
	Packaging	LS
	Transport	LS
	Conditioning	LS
	Disposal	LS
02 12	Isolation of Power Equipment	LS
02 13	Decontamination of Areas and Equipment in all Buildings to Reduce Controlled Area	LS
02 14	Mothballing	LS
02 15	Entombment	LS
17 03	Procurement of Equipment and Material	
03 01	Site Dismantling Equipment	LS
03 02	Radiation Protection and Health Physics Equipment	LS
03 03	Security and Maintenance Equipment for Long-Term Storage	LS
17 04	Dismantling Activities	
04 01	Decontamination of Areas and Equipment in all Buildings to Facilitate Dismantling	LS
04 02	Drainage of Spent Fuel Pool and Decontamination of Linings	LS
04 03	Zoning for Long-Term Storage	LS
04 04	Radioactive Inventory Categorization	LS
04 05	Dismantling and Transfer of Contaminated Equipment and Material to Containment Structure for Long-Term Storage	
	Activated Metal Segmentation Process	LS
	Concrete Removal Process	LS
	Segmenting Process for Contaminated Piping, Tanks, and Components	LS
04 06	Isolation and Sealing of Containment Structure	LS
04 07	Layout of Dormancy Period Control Area	LS
04 08	Removal of Fuel Handling Equipment	LS
04 09	Design and Procurement of Special Tools for Dismantling of Reactor Vessels and Internals	LS
04 10	Dismantling Operations on Reactor Vessels and Internals	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 17 04 11	Removal of Primary and Auxiliary Systems	LS
04 12	Removal of Biological Shield	LS
04 13	Removal of other Material and Equipment from Containment Structure	LS
04 14	Removal and Disposal of Asbestos	LS
04 15	Removal of Pool Linings	LS
04 16	Removal of Contamination from Areas and Structures in all Buildings	LS
04 17	Radioactive Waste Characterization	LS
04 18	Radioactive Waste Characterization for Recycling	LS
04 19	Radioactive Waste Characterization for Final Disposal	LS
04 20	Personnel Training	LS
17 05	Research and Development (R&D) - Decontamination/Radiation Measurement/ Dismantling Processes/Tools and Equip	
05 01	Literature Review	LS
05 02	Data Collection	LS
05 03	Considerations on Actual and Future Dismantling	LS
05 04	Decontamination Strategies/Techniques	LS
05 05	Status Review to Determine Actual Positions for Free Release, for Decontamination with Respect to Cost Savings, and for Comparative Work Elsewhere	LS
05 06	Development of New Dismantling Equipment	LS
05 07	Development or use of New Decontamination Techniques	LS
05 08	Development of Adapted Measurement Devises and Calculation Techniques	LS
05 09	Development of Adapted Waste Treatment and Disposal Techniques	LS
05 10	Research and Development on Remotely Operated Systems	LS
05 11	Simulation of Complicated Work on Model	LS
05 12	Robotics and Manipulators (R&D)	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 17 06	Spent Fuel Handling	
06 01	Transfer of Fuel from Temporary Spent Fuel Storage to Intermediate Storage	LS
06 02	Intermediate Fuel Storage	LS
06 03	Dismantling/Disposal of Temporary Fuel Storage Facility	LS
06 04	Transfer of Fuel from Intermediate Storage to Reprocessing	LS
06 05	Reprocessing Costs	LS
06 06	Transfer and Disposal of Wastes from Reprocessing	LS
06 07	Transfer and Conditioning of Spent Fuel	LS
06 08	Transfer and Disposal of Spent Fuel	LS
17 07	Hot Cell Cleanup	
07 01	Radioactivity Survey	
	Remote Surveys	LS
	Area Surveys	LS
	Smear Contamination Surveys	LS
07 02	Decontamination of Areas and Equipment in Cell to Facilitate Dismantling	LS
07 03	Decontamination of Areas and Equipment in Cell to Reduce Contamination Levels	
	High Pressure Remote Spraying	LS
	Manned Entry Cell Washing and Spraying	LS
07 04	Decontamination of Equipment for Transfer or Disposal	LS
07 05	Cell Equipment Modification	
	Manipulator Tool Attachments	LS
	Overhead Crane Adjustments	LS
07 06	Dismantling of Primary and Auxiliary Services to Cell	
	Removal of Gallery Services	LS
	Removal of In-Cell Services	LS
07 07	Dismantling of In-Cell Equipment	
	Downsizing Equipment	LS
	Sorting and Placement into Shuttle Boxes	LS
07 08	Transfer of Material and Equipment to Airlock Services	LS
07 09	Packaging and Preparation of Cell Waste in Airlock	LS
07 10	Transfer of Material from Airlock to Shipping Dock	LS
07 11	Cell Window Maintenance and Cleaning	
	Window Cleaning	LS
	Window Filtration	LS
07 12	Cell Window Replacement/Refurbishment	
	Window Refurbishment	LS
	Window Replacement	LS
17 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 18	DISPOSAL (OTHER THAN COMMERCIAL)	
18 01	Storage/Disposal Facility Construction/ Operation	
01 01	Landfill/Burial Ground/Trench/Pits Construction of Plant	EA
	Architectural	LS
	Structural	LS
	Mechanical	LS
	Electrical	LS
	Equipment Fabrication/Purchase	LS
	Equipment Erection/Installation	LS
	Startup/Testing/Permits	LS
	Training	LS
	Operation (Short Term)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
	Operation (Long Term)	
	Bulk Chemicals/Raw Materials	LS
	Fuel and Utilities Usage	LS
	Maintenance and Repair	LS
01 02	*Above-Ground Vault	EA
01 03	*Underground Vault	EA
01 04	*Underground Mine/Shaft	EA
01 05	*Tanks	EA
01 06	*Pads (Tumulus/Retrievable Storage/Other)	EA
01 07	*Storage Buildings/Protective Cover Structures/Other Buildings and Structures	EA
01 08	*Cribs	EA
01 09	*Deep Well Injection	EA
18 02	Container Handling	
02 01	Handling of Filled Containers	EA
18 03	Transportation to Storage/Disposal Facility	
03 01	Loading/Hauling/Unloading of Solids	
	Loading	CY
	Hauling	CY
	Unloading	CY
03 02	Pumping/Hauling of Liquids/Sediments/ /Sludges	
	Pumping to Transport Tanker	GAL
	Hauling to Disposal Site	GAL
	Pumping to Permanent Container	GAL

*NOTE: See WBS Level 33 18 01 01 - For Detailed Breakdown.

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 18 04	Sorting	LS
18 05	Spreading	CY
18 06	Compacting	CY
18 07	Placement	CY
18 08	Final Closure	CY
18 09	Disposal Fees and Taxes	
09 01	Landfill	TON
09 02	Incinerator	TON
09 03	Deep Well	CF
18 10	Mixed Waste Storage Fees and Taxes	CF
18 9x	Other (use numbers 90-99)	

RTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 19	DISPOSAL (COMMERCIAL)	
19 01	Container Handling	
01 01	Handling of Filled Containers	EA
19 02	Transportation to Storage/Disposal Facility	
02 01	Loading/Hauling/Unloading of Solids	
	Loading	CY
	Hauling	CY
	Unloading	CY
02 02	Pumping/Hauling of Liquids/Sediments/ /Sludges	
	Pumping to Transport Tanker	GAL
	Hauling to Disposal Site	GAL
	Pumping to Permanent Container	GAL
19 03	Disposal Fees and Taxes	
03 01	Landfill	TON
03 02	Incineration	TON
03 03	Deep Well	CF
19 9x	Other (use numbers 90-99)	
	LS	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 20	SITE RESTORATION	
20 01	Earthwork	
01 01	Rock Excavation	CY
01 02	Excavation/Fill	CY
01 03	Backfill	CY
01 04	Borrow	CY
01 05	Hauling	CY
01 06	Spreading	CY
01 07	Grading	SY
01 08	Compaction	CY
01 09	Scarification	CY
01 10	Harrowing	CY
01 11	Tracking	CY
01 12	Contour Furrowing	CY
01 13	Stockpiling	CY
01 14	Topsoil	CY
01 15	Settlement Markers	EA
20 02	Permanent Markers	EA
20 03	Re-establish Roads/Structures/Utilities	LS
20 04	Revegetation and Planting	
04 01	Seeding/Mulch/Fertilizer	AC
04 02	Sodding	SY
04 03	Erosion Control Fabric	SY
04 04	Shrubs, Trees, Ground Cover	EA
04 05	Topsoil	CY
20 05	Removal of Barriers	EA
20 06	Post-Construction Maintenance	
06 01	Furnish Extra Cap Materials	LS
06 02	Storage Area for Extra Cap Materials	LS
06 03	Mowing	AC
06 04	Maintenance	LS
06 05	Clean-up	LS
06 06	Signs	EA
06 30	Tests	EA
20 9x	Other (use numbers 90-99)	

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 21	DEMOBILIZATION	
21 01	Removal of Temporary Facilities	
01 01	Office Trailers	EA
01 02	Storage Facilities	EA
01 03	Observation Tower	EA
01 04	Decontamination Facilities for Personnel	EA
01 05	Decontamination Facilities for Construction Equip/Vehicles	EA
01 06	Temporary Cover Structure Over Contaminated Area	SY
01 07	Lunch/Break Trailer	EA
01 08	Laundry Facilities	LS
01 09	Emergency Medical Trailer/Facilities	EA
01 10	Toilets	EA
01 11	Barricades	EA
01 12	Equipment Maintenance Shop	EA
01 13	Warehouses	EA
01 14	Government Trailers	EA
01 15	Guard Houses	EA
01 16	Truck Scales	EA
01 17	Wastewater Holding Tanks	EA
01 18	Fire Suppression Systems	EA
01 19	POL Dispensing Station	EA
01 20	Photographic Laboratory	EA
01 21	Housing	LS
01 22	Shop Facilities	LS
01 23	Aggregate Surfacing	TON
01 24	Security Fencing	LF
01 25	Roads and Parking	LS
01 26	Culverts	LF
01 27	Walks	SF
01 28	Signs	EA
01 29	Grading	SY
21 02	Removal of Temporary Utilities	
02 01	Site Lighting	LS
02 02	Power Connection/Distribution	LF
02 03	Telephone/Communications Hookup	LF
02 04	Water Connection/Distribution	LF
02 05	Sewer Connection/Distribution	LF
02 06	Gas Connection/Distribution	LF
21 03	Final Decontamination	LS

HTRW WBS (To The Fourth Level)

WBS Number	Description of Item	Unit of Measure
33 21 04	Demobilization of Construction Equipment and Facilities	
04 01	Transport Vehicles Ownership/Operation	HR
04 02	Drivers	HR
04 03	Manifests	EA
04 04	Tolls	EA
04 05	Permits	EA
04 06	Escort Vehicles Ownership/Operation	HR
04 07	Construction Equipment Ownership/ Operation	HR
04 08	Equipment Operators	HR
04 09	Final Disassembly and Takedown	LS
21 05	Demobilization of Personnel	
05 01	Relocation of Supervisory Personnel	EA
21 06	Post-Construction Submittals	
06 01	Punch List	LS
06 02	Project Acceptance	LS
06 03	Post-Construction Documentation	LS
06 04	Survey Information	LS
06 05	Final QA/QC Reports	LS
06 06	Construction Documentation Report	LS
06 07	As-Built Drawings	LS
21 07	Construction Plant Takedown	
07 01	Concrete Batch	EA
07 02	Block	EA
07 03	Precast	EA
07 04	Asphalt	EA
07 05	Quarry Crusher/Screens	EA
21 9x	Other (use numbers 90-99)	

HTRW REMEDIAL ACTION

MAJOR GROUPINGS OF DISTRIBUTIVE COSTS
FOR HTRW PROJECTS

Supervision/Management
Administration
Office Management
Engineering
Purchasing and Construction Stores
Health and Safety
Security
Equipment Maintenance and Motor Pool
Temporary Utilities
Temporary Construction Facilities
Facility Operations
Operating Supplies/Services
Computer and Data Processing
Vehicles for Personnel
Winterization
Miscellaneous Costs
Insurance Premiums
Money Costs
Home Office Costs
Profit
Bond
Cost Growth

HTRW REMEDIAL ACTION

CHECKLIST OF DISTRIBUTIVE COSTS FOR HTRW PROJECTS

(The costs for the following items will be distributed to the accounts as applicable to the particular project.)

Supervision/Management

- Project Manager
- General Superintendent
- Quality Control Superintendent
- Area Superintendent
- Civil Superintendent
- Carpenter Superintendent
- Mechanical Superintendent
- Electrical Superintendent
- Public Relations Officer

Administration

- Contract Administrator
- Comptroller
- Administrative Clerks
- Personnel Manager
- Personnel Clerks

Office Management

- Office Manager
- Interpreter
- Accountant
- Bookkeeper
- Timekeeper
- Pay Master
- Payroll Clerks
- Stenographer
- Typists
- Clerks
- Mail Clerk
- Messengers
- Reproduction Operation

CHECKLIST OF
DISTRIBUTIVE COSTS
FOR HTRW PROJECTS

Engineering

- Project Engineer
- Civil Engineer
- Mechanical Engineer
- Electrical Engineer
- Geologist
- Hydrogeologist
- Radioactive Engineer
- Field Engineer
- Surveyors
- Office Engineer
- Draftsmen
- Engineering Clerks
- Cost Estimator
- Cost Engineer
- Chief Planning Engineer
- Planners and Schedulers
- Quality Control Engineer
- Inspectors
- Construction Laboratory Technicians
- Quality Control Manager
- Chemical Quality Control Manager
- Waste Management Technician

Purchasing and Construction Stores

- Chief Purchasing Agent
- Purchasing Agent
- Buyers
- Expeditors
- Traffic Manager
- Travel Clerks
- Shipping Clerks
- Inventory Control Manager
- Inventory Control Clerks
- Chief Warehouse Manager
- Receiving Clerk
- Chargeout Clerk
- Material Clerk
- Tool House Labor
- Common Labor
- Typist
- Clerk

CHECKLIST OF
DISTRIBUTIVE COSTS
FOR HTRW PROJECTS

Security

- Security Clerk
- Security Chief
- Security Officer
- Watchman and Guard

Equipment Maintenance and Motor Pool

- Master Mechanic
- Mechanics
- Mechanic Helpers
- Spare Parts Manager
- Parts Clerk
- Motor Pool Manager
- Service Truck Driver
- Motor Pool Equipment Operator
- Motor Pool Driver
- Common Labor
- Motor Pool Vehicle Operator and Maintenance
- Equipment Maintenance Vehicles:
 - Fuel Truck and Labor
 - Lube Truck and Labor

Temporary Construction Facilities

- Rental/Ownership/Operation/Maintenance
 - Office Trailers
 - Storage Facilities
 - Observation Tower
 - Decontamination Facilities for Personnel
 - Decontamination Facilities for Const.
 - Equip/Vehicles
 - Lunch/Break Trailer
 - Laundry Facilities
 - Emergency Medical Trailer/Facilities
 - Toilets
 - Barricades
 - Equipment Maintenance Shop
 - Warehouses
 - Government Trailers
 - Guard Houses
 - Truck Scales
 - Wastewater Holding Tanks
 - Office Equipment/Furnishings
 - POL Dispensing Station
 - Photographic Laboratory
 - Testing Laboratory
 - Weather Station
 - Housing
 - Shop Facilities

CHECKLIST OF
DISTRIBUTIVE COSTS
FOR HTRW PROJECTS

Temporary Utilities - Operation/Maintenance

- Power
- Water
- Sanitary
- Telephone
- Telex
- Intercom
- Radio
- Fax

Facility Operations

- Manager
- Chefs and Cooks
- Kitchen Help
- Janitors
- Maintenance and Repair Crew
- Doctor and Nurses
- Clerks and Typists

Operating Supplies/Services

- Food
- Personnel
- Janitorial and Cleanup
- Office and Engineering Supplies
- Facilities Maintenance and Repair
- Medical/First Aid
- Reproduction and Photography
- Postage
- Freight on Supplies
- Miscellaneous Supplies
- Offsite Laundry Services

Computer and Data Processing

- Program Costs
- Input Labor Technicians
- Computer Expense

Vehicles for Personnel

- Pickup Trucks
- Automobiles

Winterization

- Temporary Heat
- Winter Protection
- Polysheeting

CHECKLIST OF
DISTRIBUTIVE COSTS
FOR HTRW PROJECTS

Health and Safety

- Certified Industrial Hygienist
- Radiation Protection Technologist (RPT)
- Certified Health Physicist
- ALARA (As Low as Reasonably Acceptable) Specialist
- Dosimetry Specialist
- Respiratory Specialist
- Health Physics Trainer
- Safety Engineer
- Safety Clerk
- Site Safety and Health Officer
- Industrial Hygiene Technician
- Air Monitoring Technician
- Safety Monitor
- Health and Safety Training - HTW Specific
- Health and Safety Training - Rad Specific
- Health and Safety Medical Exams
- Personal Protective Equipment
(Clothing, Respirators, Air Supply, etc.)
- Personal Protective Equipment - Rad Specific
(Clothing, Respirators, Air Supply, etc.)
- Laundry Service
- Heat/Cold Stress Monitoring
- Noise Monitoring
- On-Site Communications Systems
- Fire Chief
- Emergency Equipment
 - Eyewash
 - Eye and Body Wash Stations
 - Emergency Shower
 - Fire Extinguishers
 - Fire Suppression Systems
 - Sorbents, Pillows, Rolls
- Radioactive Contamination Protective Equipment
 - Glove Bag/Glove Box Containment Systems
 - Polypropylene Containment and Enclosure Systems
 - Lead Containment and Enclosure Systems
 - Stainless Steel Containment and Enclosure Systems
 - Polycarbonate Containment and Enclosure Systems
 - HEPA Filtration/Blower Systems
 - Bags/Tubing/Sheeting
 - Radiation Shielding
- Traffic Control

CHECKLIST OF
DISTRIBUTIVE COSTS FOR HTRW PROJECTS

Miscellaneous Costs

- On-Site Training Programs
- On-Site Radioactive Specific Training
- Craft Qualifications
- Start-Up Programs
- Projected Delays
 - Weather
 - Degrees
 - Logistics
- Project Travel
 - On-Site
 - Off-Site
- Project Photographs
- Video/Monitoring/Recording System
- Project Signs
- Rest and Recuperation Travel
- Periodic Construction
 - Site Cleanup
- Maintenance of Completed Facilities
- Haul Road Maintenance
- Emergency Air Freight
- Spare Parts Inventory
- Custom Fees
- Permits
- Submittals
- CPM Scheduling

Insurance Premiums

- Builders Risk Insurance Premiums
- Equipment Floater Insurance Premiums
- Liability Insurance Premiums
- Pollution Liability Insurance Premiums
- Marine Insurance Premiums
- Other Insurance Premiums

Money Costs

- Interest Costs for Financing
- Bank Letters

Home Office Costs

- Home Office Labor
- Home Office Travel
- General and Administrative

Profit

- Prime Contractor Profit

Bond Costs

- Payment Bond
- Performance Bond

Cost Growth

- Cost Growth to Construction Midpoint

Appendix D

Appendix D provides a comprehensive list of environmental restoration cost driving factors developed by the U. S. Air Force Center for Environmental Excellence. This list is an integral part of an environmental risk model used by the U.S. Air Force to derive relative complexity factors or rankings for environmental restoration projects.

Relative Complexity Factors For Environmental Restoration

Technology

Monitoring, Sampling, Testing and Analysis	4
Site Work	2
Surface Water-Collection and Control	8
Groundwater-Collection and Control	5
Air Pollution/Gas-Collection and Control	6
Solids-Collection and Containment	3
Liquids/Sediments-Collection and Control	5
Tank/Drum/Structure Removal	3
Biological Treatment	8
Chemical Treatment	10
Physical Treatment	6
Thermal Treatment	10
Stabilization/Encapsulation	6
Decontamination and Decommissioning	3
Disposal (Other than Commercial)	6
Disposal (Commercial)	4
Site Restoration	2
Other - Major Category	10

Relative Risk

High Relative Risk (Significant Contamination, Pathway Evident, Sensitive Receptors)	9
High Relative Risk (Significant Contamination, Potential Pathway, Sensitive Receptors)	8
High Relative Risk (Significant Contamination, Pathway Confined, Sensitive Receptors)	7
Medium Relative Risk (Moderate Contamination, Pathway Evident, Sensitive Receptors)	6
Medium Relative Risk (Moderate Contamination, Potential Pathway, Sensitive Receptors)	5
Medium Relative Risk (Moderate Contamination, Confined Pathway, Potential Receptors)	4
Low Relative Risk (Minimum Contamination, Pathway Evident, Potential Receptors)	3
Low Relative Risk (Minimum Contamination, Potential Pathway, Limited Receptors)	2
Low Relative Risk (Minimum Contamination, Pathway Confined, Limited Receptors)	1

Uncertainty

Known Contaminant(s), Known Location(s), Minimum Health Hazard	1
Known Contaminant(s), Unknown Location(s), Minimum Health Hazard	2
Known Contaminant(s), Known Location(s), Moderate Health Hazard	3
Known Contaminant(s), Unknown Location(s), Moderate Health Hazard	4
Known Contaminant(s), Known Location(s), Acute Hazard (Non-carcinogenic)	5
Known Contaminant(s), Unknown Location(s), Acute Hazard (Non-carcinogenic)	6
Known Contaminant(s), Known Location(s), Known Human Carcinogen	7
Known Contaminant(s), Unknown Location(s), Known Human Carcinogen	8
Unknown Contaminant(s), Known Location(s)	9
Unknown Contaminant(s), Unknown Location(s)	10

Relative Complexity Factors For Environmental Restoration (Continued)

Type of Contract

Indefinite Delivery/Indefinite Quantity (IDIQ)	1
Time and Materials (T&M)	2
Fixed Price Incentive (FPI)	3
Firm Fixed Price (FFP)	4
Firm Fixed Price/Award Fee (FFP/AF)	5
Cost Plus Fixed Fee (CPFF)	6
Cost Plus Incentive Fee (CPIF)	7
Cost Plus Award Fee (CPAF)	8
CPAF - Full Service Remedial Action	9

Location

Region 4, Southeast	1
Region 6, Southwest	2
Region 9, Pacific (South) + HI, + GU	3
Region 3, Atlantic Coast	4
Region 10, Pacific (Northwest) +AK	5
Region 7, Great Plains	6
Region 5, Great Lakes	7
Region 8, Mountain	8
Region 2, North Atlantic +PR, +VI	9
Region 1, New England	10

Size of Project

One Installation, One Job Site Location	1
One Installation, Several Similar Job Site Locations	2
One Installation, Several Different Job Site Locations	3
Municipal Area - One Installation, Several Job Sites	4
Multiple Installations, Multiple but Similar Job Sites	5
Multiple Installations, Multiple and Diverse Job Sites	6
Multiple Municipal Installations, Diverse Job Site Locations	7
Remote or International Site - One Job Site	8
Remote or International Site - Multiple Job Sites	9
Undetermined	10

Scope of Project

Preliminary Assessment/Site Investigation - Base Specific	1
Preliminary Assessment/Site Investigation - Nationwide	2
Remedial Investigation/Site Investigation (RI/FS) - Base Specific	3
Remedial Investigation/Site Investigation (RI/FS) - Nationwide	4
Remedial Design - Base Specific	5
Remedial Design - Nationwide	6
Remedial Action - Base Specific	7
Remedial Action - Nationwide	8
Full Service Remedial Action - Base Specific	9
Full Service Remedial Action - Nationwide	10

Relative Complexity Factors For Environmental Restoration (Continued)

Range of Dollars

0 to \$50K	1
\$50K to \$100K	2
\$100K to \$250K	3
\$250K to \$500K	4
\$500K to \$1M	5
\$1M to \$5M	6
\$5M to \$10M	7
\$10M to \$25M	8
\$25M to \$50M	9
Greater than \$50M	10

Time to Complete

0 to 3 Months	1
0 to 6 Months	2
0 to 12 Months	4
0 to 18 Months	5
0 to 24 Months	7
0 to 36 Months	9
Greater than 36 Months	10

Schedule Sensitive

Not Critical - Proceed at Own Schedule	1
May be Critical, Should Coordinate w/Other USAF Schedules	3
Probably Critical, Must Coordinate w/Other USAF Schedules	5
Critical, Required to Meet Non-USAF Schedules - Can Accelerate	8
Critical, Required to Meet Non-USAF Schedules, - Cannot Accelerate	12
Most Critical - Required by Laws (e.g. Res convs and Recovery Act)	15

Management Sensitive

Not Critical - Proceed with Minimum Direction	1
May be Critical - Should Coordinate at One or Two Progress Points	3
Probably Critical - Should Report Moderate Detail Quarterly	5
Critical - Requires Detailed Status (Monthly Reports)	10
Critical - Requires More Detail and May Require Clearance to Proceed	15
Most Critical - Detailed Reporting Required by Law or Directive	20