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13. ABSTRACT *(Maximum 200 words)*

This report is the first from the Survey of Resources Available for Estimating the Environmental Costs of Major Defense Acquisition Programs. It identifies existing environmental management (EM) cost estimating methods, data bases, engineering case studies, and management systems to determine their usefulness for estimating EM costs for major defense acquisition program (MDAPs). EM, for purposes of this report entails the management of hazardous, toxic, and radiological (HTR) substances throughout the life cycle of an MDAP. It comprises five major categories of work: environmental program management; HTR material management; waste management; environmental resortation/corrective action; and transportation of HTR material and waste. Over 190 cost-related tools were identified in a literature search. Of these 71 were found to address EM and underwent further screening for desired attributes and sorting by categories of application. This process was used to select a balanced set of tools for full evaluation in the next phase of the project.

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ENVIRONMENTAL MANAGEMENT TOOL SCREENING REPORT
FOR THE
SURVEY OF RESOURCES AVAILABLE FOR ESTIMATING THE ENVIRONMENTAL COSTS OF MAJOR DEFENSE ACQUISITION PROGRAMS

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ENVIRONMENTAL MANAGEMENT TOOL SCREENING REPORT FOR THE SURVEY OF RESOURCES AVAILABLE FOR ESTIMATING THE ENVIRONMENTAL COSTS OF MAJOR DEFENSE ACQUISITION PROGRAMS

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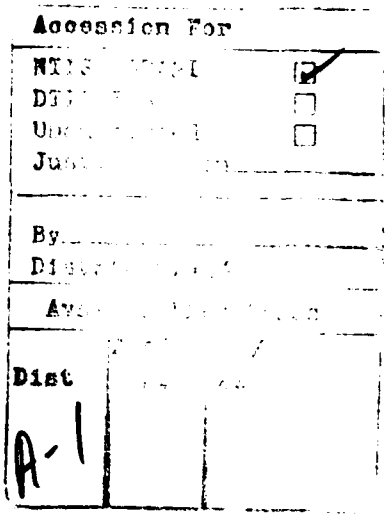

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EXECUTIVE SUMMARY

The Chairman of the Cost Analysis Improvement Group (CAIG), under the Office of the Secretary of Defense (OSD), has initiated an effort 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. A project has been established to improve the ability of 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 these environmental cost impacts. A survey of Environmental Management (EM) cost estimating and analysis resources is a key component of this project.

This report identifies existing EM cost estimating models, EM cost databases, relevant engineering case studies and reports, and management systems and determines their ability to evaluate and/or estimate environmental management costs associated with MDAPs. EM, as defined in this report, is the management of hazardous, toxic, and radiological substances throughout the life cycle of the MDAP. EM comprises five major categories of work: Environmental Program Management, Hazardous, Toxic, and Radiological (HTR) Material Management, (HTR) Waste Management, Environmental Restoration/Corrective Action, and HTR Material and Waste Transportation.

Over 190 cost-related tools were identified in a literature search. Of these, 71 address EM. The majority of excluded cost-related tools address conventional construction projects that have no provision for EM. While this survey is comprehensive, it is not exhaustive. There may exist valuable tools that are under development, are not published, or escaped our attention. If a viable cost-related tool is brought to our attention, it may be incorporated in the full evaluation of cost tools during the next phase of the project. A list of the 71 candidate EM cost tools is provided in appendix A.

The 71 candidate EM cost-related tools were screened for desired attributes and sorted by the EM categories they address. This screening process is to establish an optimal set of EM cost-related tools for full evaluation during the next phase of this project. The full evaluation will establish the existing EM cost estimating and analysis capabilities. Those tools excluded during this process may be of equal or greater value for other purposes, however. For example, if cost model algorithms and databases are not available, that tool was excluded. This does not mean it is not valuable.

This report explains the procedures and results of this selection process. Of the 71 tools identified, 7 cost models and databases and 37 engineering case studies and reports were selected for full evaluation. The remaining 27 systems can be used for project management activities or in support of cost estimate development but do not include the attributes required for our purposes.

1.0 INTRODUCTION

The Chairman of the Cost Analysis Improvement Group (CAIG), under the Office of the Secretary of Defense (OSD), has initiated an effort 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. 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 the existing Environmental Management (EM) cost estimating and analysis capabilities and to develop plans to improve this capability. 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 these environmental cost impacts.

This survey of Environmental Management (EM) cost estimating and analysis resources is a key component of this project. The purpose of this survey is to identify existing cost estimating and analysis resources and determine the availability and applicability of them to evaluate and/or estimate environmental costs associated with MDAPs. To accomplish this, a comprehensive literature search was performed to identify these resources; from them, candidate tools were selected and screened through a multi-phase selection process. The candidate analytical tools identified include EM cost estimating models, EM cost databases, engineering case studies and reports, and management systems. EM, as defined in this report, is the management of Hazardous, Toxic, and Radiological (HTR) substances throughout the life cycle of the MDAP. This management comprises five major categories of work: including Environmental Program Management, HTR Material Management, HTR Waste Management, Environmental Restoration/Corrective Action, and HTR Material and Waste Transportation.

This *Environmental Management Tool Screening Report* is the first of a series of related reports to be generated by this project. The second and third reports are the *Environmental Management Category Report* and the *Environmental Management Tool Evaluation Report*, respectively. The following is a brief description of each report.

- The *EM Tool Screening Report* includes a comprehensive survey of over 190 cost estimating models, databases, studies, and other tools. These tools were screened to select an optimal set of tools for full evaluation. The results of this evaluation will be included in the third report.

- The *EM Category Report* will consist of a Cost Breakdown Structure (CBS) and EM Cost Driver Categories. The CBS is a framework of environmental management activities developed to identify those elements of work specific to MDAPs. The CBS is specific in scope and focuses on activities associated with the management of

HTR materials and wastes. The CBS does not address the environmental management costs for non-hazardous materials or wastes or other aspects of environmental management, such as conservation. The EM Cost Driver Categories will be organized by major factors and considerations that significantly influence costs associated with environmental management, and will include potential cost risk factors.

- 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 of the selected tools 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 (quick-fix) and longer term plans.

Together these reports provide a comprehensive analysis of existing models, databases, case studies, and reports.

This project will identify current EM cost estimating and analysis capabilities and will provide a foundation for further research and analysis to address environmental costs associated with MDAPs.

2.0 BACKGROUND

As environmental legislative and regulatory requirements become progressively stronger and more stringent, existing methods and procedures for identifying, estimating, evaluating, and periodically revisiting the life cycle environmental costs of MDAPs have not kept pace.

Under various Department of Defense (DoD) initiatives, programs are being implemented to address environmental requirements. These initiatives will ensure that the costs of environmental requirements in every weapon system's life cycle will be considered on the same level as every other component (e.g., reliability, maintainability, and survivability). The importance of environmental requirements will be determined by their cost in relation to the total project cost. For instance, if it is anticipated that environmental costs equal approximately 5 percent of the program, an experienced cost estimator should devote about 5 percent of his/her effort to estimating these costs.

In the past, such costs have not been identified and reviewed, particularly in the early life-cycle phase of a weapon system. By addressing these costs early in the system's life cycle, detrimental environmental effects can be prevented or controlled with greater ease, effectiveness, and economy. The tools identified in this report may provide the capability to estimate and/or evaluate these environmental management cost impacts.

3.0 METHODOLOGY

This section describes the multi-phased process of selecting and screening the tools included in this survey for their specific attributes or characteristics and subject areas. This screening process is to establish an optimal set of EM cost-related tools for full evaluation during the next phase of this project. The full evaluation will establish the existing EM cost estimating and analysis capabilities. Those tools excluded during this process may be of equal or greater value for other purposes, however. For example, if cost model algorithms and databases are not available, that tool was excluded. This does not mean it is not valuable.

3.1 Literature Search

This survey began with a search of current surveys, reports, and lists of software programs to identify existing EM-related cost estimating models, EM cost databases, engineering case studies, management systems, and other tools. The primary sources (listed below) are cited in the appendix E.

- *The Remedial Action Program Information Center (RAPIC) Database*
- *Westinghouse GOCO Cost Estimating Manual*, August 1992
- *1990 Survey of Personal Computer Based Cost Estimating Software*
- *1992 Environmental Software Study*
- *Cost Estimating Handbook for Environmental Restoration (EM CAT) Handbook*, September 1990
- *National Environmental Journal's Annual Hazardous Material Management Software Buying Guide*, July/August 1993
- *Literature on Cost Analysis of Military Environmental Impacts*, April 1993
- *Life-Cycle Cost Assessment (LCCA) Preliminary Scoping Report*, October 1993
- Company brochures and reports.

The initial search identified approximately 190 potential cost estimating tools for further review and consideration. While this survey is comprehensive, it is not exhaustive. There may exist valuable tools that are under development, are not published, or escaped our attention. If a viable cost-related tool is brought to our attention, it may be incorporated in the full evaluation of cost tools during the next phase of the project.

3.2 Selection Process

To select an optimal set of EM cost estimating tools, a four-phased process was used.

Phase 1: The project team reviewed the reference material on every tool identified in the literature search and selected those tools that address costs of environmental management, and are available to DoD.

Many software tools and reports were eliminated during this phase because they did not address environmental cost or schedule estimating or were limited to conventional project cost estimating. Also eliminated were those EM cost databases and models that are not available to the Government, Government contractors, or the public. ***Phase 1 reduced the number of candidate tools from approximately 190 to 71.***

Phase 2 To identify each tool's attributes and subject matter, descriptive information was obtained through questionnaires sent to tool developers and users. (A developer questionnaire and actual responses are provided in appendix B. A users questionnaire and actual responses are contained in appendix C.) Based on the analysis of responses to the completed questionnaires and the primary reference material, each tool was placed in one of the six classifications described below.

Classification 1: Unit Cost Models and Databases

Unit cost models and databases are primarily used for construction project type estimates using a quantity take-off (or bottom-up) estimating methodology. This estimating approach requires at least a 30% complete design and is not appropriate for budgetary or conceptual design estimates. The engineering design and assumptions are used by the cost engineer to determine the quantity of units including the required crew mix, equipment, and materials. The unit cost database provides most of the required pricing information for the units, and the associated unit cost model provides the structure to develop the project estimates from these units and adds other project-level costs and overhead.

Classification 2: Parametric Cost Models

The term "parametric cost model" is more loosely defined here than is generally accepted. Typically, a parametric model has a statistical basis. For the purpose of classifying the tools in this survey, a parametric model is as any model that uses key parameters, such as square feet or cubic yards, and uses factors such as type of hazardous material. These models are based on a series of related Cost Estimating Relationships (CERs) developed by using quantitative techniques, such as linear regression analysis, or engineering techniques based on an initial design with algorithms to adjust the estimate for the given parameters.

Classification 3: EM Project Costs Databases

These databases contain historical cost information at the project level and below. They provide project information regarding technology used, specific project scope and requirements, particular circumstances or conditions affecting costs, and other cost-driving factors.

Classification 4: Engineering Case Studies and Reports

This classification includes case studies, documented speeches from conferences, journal articles, and other reports that concentrate on various environmental management cost issues. These case studies and reports were written by university professors, engineers, and cost analysts from the private sector and Federal agencies.

Classification 5: Project Management Systems

This classification includes software that addresses project management activities such as technology description and selection criteria, waste inventory tracking systems, environmental health and safety tracking systems, cost and schedule control systems, and regulatory compliance. This classification is provided for information only and is not considered for further evaluation in this report.

Classification 6: Application Software Platforms

This classification includes application software platforms that are deemed useful for estimating EM costs but that do not provide the capabilities included in the other classifications. These applications generally require both project design and cost information and provide only the structure for aggregating these costs. This classification is provided for information only and is not considered for further evaluation in this report.

Table 3-1 is a complete listing by classification of the 71 tools reviewed during this phase. Additionally, appendix A includes a list of these tools with the developer's name and address, contact person and phone number, and a bibliographic citation for each Classification 4 study.

As mentioned in the descriptions, the tools that fell into Classifications 5 and 6 were not selected for further analysis. *By selecting only those tools falling in Classifications 1-4 the number of candidate tools was reduced from 71 to 49.*

Note: A database was developed by the project team to coordinate the screening process for the 71 tools.

Phase 3 Based on descriptive information or abstracts, the project team identified engineering case studies and reports and placed them in Classification 4. Application of these reports to EM cost estimating will be analyzed during the next phase of this project. Consequently, this classification was removed to identify the remaining tools to be selected as candidates. *This phase reduced the number of candidate tools from 49 to 12.*

Phase 4 An important criterion to OSD (PA&E) is whether the algorithms and supporting database would be made available for evaluation. Thus, during this

phase of the selection process, the developers of the 12 remaining EM cost estimating models were contacted to determine if the project team would be able to acquire not only the model but also the model's basis and rationale including the equations, algorithms, and supporting database(s). Proprietary systems algorithms and databases would not be provided were excluded from this selection. The HAZRISK model was excluded for this reason. (It may be included in the final tool evaluation report during the next phase of this project if the terms of the requisite nondisclosure agreement and licensure agreement can be reached.) The RACES model was eliminated because the model's development effort has been suspended indefinitely at the time of this survey. *This phase reduced the number of candidate tools from 12 to 7.*

TABLE 3-1.—List of Tools by Classification

Classification 1: Unit Cost Models and Databases
Micro-Computer Aided Cost Engineering Support System (M-CACES)
Classification 2: Parametric Cost Models
Cost of Remedial Action (CORA)
Freiman Analysis of Systems Techniques Models (FAST)
Hazardous Materials Life Cycle Cost Estimator (HAZMAT)
HAZRISK Model (HAZRISK)
INSITE (INSITE)
Remedial Action Cost Estimating System (RACES)
Remedial Action Cost Engineering and Requirements System (RACER or ENVEST)
Superfund Cost Estimating Expert System (SCEES)
Systems Cost Model (SCM)
Classification 3: ER and/or WM Project Cost Databases
Decommissioning and Decontamination Cost Database
Historical Cost Analysis System (HCAS)

TABLE 3-1.—List of Tools by Classification (Continued)

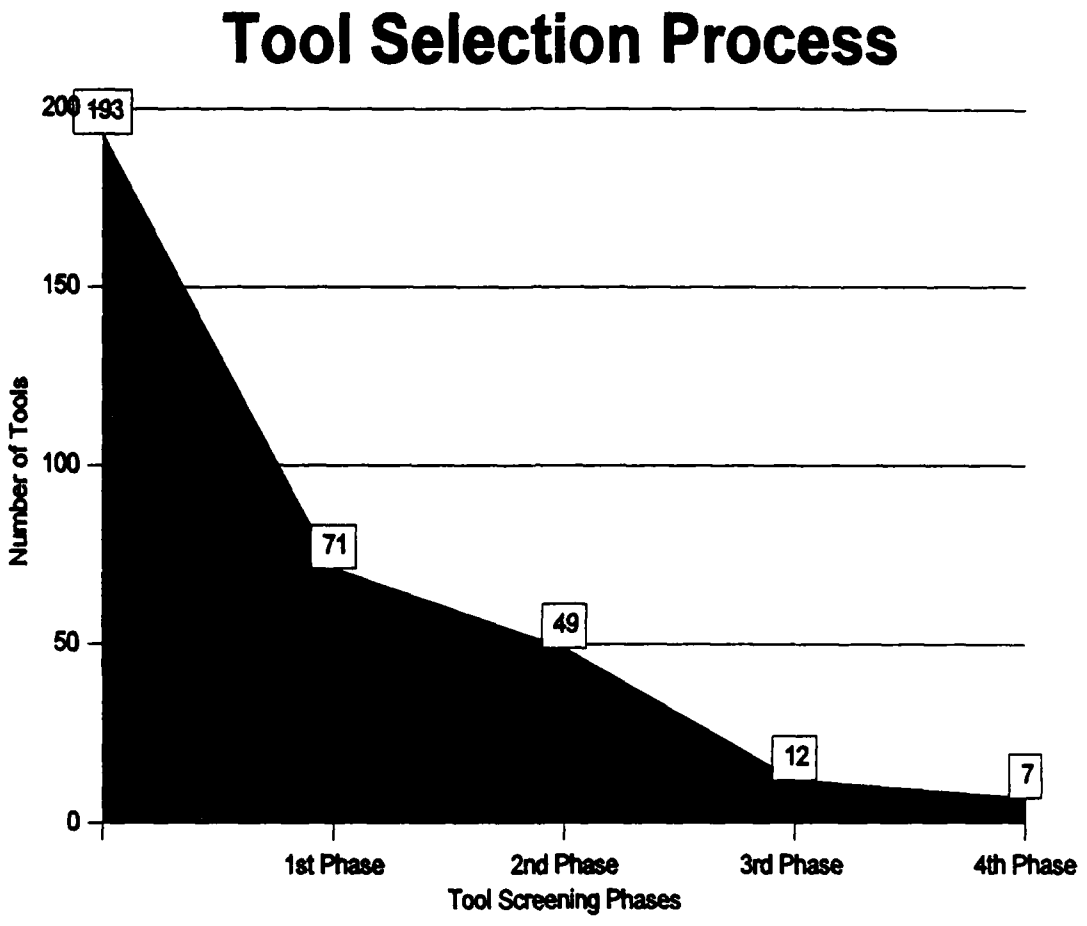
Classification 4: Engineering Case Studies and Reports
Accuracy of Hazardous Waste Project Estimates
An Analysis of Army Hazardous Waste Disposal Cost Data
Challenges in the Development of Integrated Cost Models
Compendium of Cost Data for Environmental Restoration Technologies, Methods and Processes
Compendium of Costs of Remedial Technology at Hazardous Waste Sites
Computer Program for Estimating Decommissioning Costs of Nuclear Power Plants
Cost Estimating Relationships for Environmental Cleanup
Cost of RCRA Correction Action
Decommissioning Waste
Development Program and Demonstration to Reduce Remediation Treatment Costs
DoD Environment Cleanup; Information on Contractor Cleanup
Economic Analysis of Hazardous Waste Minimization Alternatives
Economic Analysis of the Recovery & Reuse of Explosives
Economic Analysis for Demilitarization & Disposal
Economic & Environmental Considerations - Mitigation Plans
Environmental Management Cost Assessment (EM CAT) Handbook
Environmental Restoration Program Cost Estimating Handbook
Environmental Solutions Software Database
Future Costs of Hazardous Waste Remediation
Hazardous Material Life - Cycle Cost Model Systems Manager's Guide
Hazardous Material Life - Cycle Cost Model Technical Manual
Hazardous Material Life - Cycle Cost Model User/Operators Guide
Hazardous Waste Minimization Initiation Decision Report
In-Situ Volitization (ISV) Remedial System Cost Analysis
Lessons Learned and New Initiatives in Cost and Schedule Estimating
Low Level and Transuranic Waste Transportation and Disposal
Manual for Estimating Cost of VOC Removal from Groundwater
Method for Calculating Costs of Underground Storage Tank Closure
Methodology for Estimating AF Weapon Systems Environmental Compliance
Models Developed for the Total System LCC Analysis
Nuclear-Powered Ships :Accounting for Shipyard Costs and Nuclear Waste Disposal Plans

TABLE 3-1.—List of Tools by Classification (Continued)

Classification 4: Engineering Case Studies and Reports (Continued)
Performance Evaluation - Cost of Remedial Action (CORA)
Remedial Action Costing Procedures Manual
Remediation Versus Prevention of PCB Contamination
Use of Database for Calculating Nuclear Power Plant Decommissioning
Validation of the U.S. Army's Current Hazardous Waste Data
Waste Minimization Assessment Centers - Cost Savings
Classification 5: Project Management Sources
AWARE
CHEMMIX
Cost Time Management
Docuwaste for Hazardous Waste
Enflex Data
Environmental Tracking System
Environscreen
Facility Tracking System
Hazardous Material Life Cycle Cost Model User Guide
LCIMS
Linear Location (Health) Risk and Cost Analysis Model
Remedial Action Assessment System (RACER - RAAS)
Removal Cost Management System
RCRA (Health) Risk and Cost Analysis Model
TINIA
Waste DB
Classification 6: Applications Software Platforms
COSTPRO
G2 Estimator
Independent Cost Estimating Contingency Analyzer (ICECAN)
Modular Oriented Uncertainty System (MOUSE)
Precision Estimating Plus
Project Tracking for Environmental Restoration (TRAC-ER)
Range Estimating

Figure 3-1 summarizes the tool selection process.

Figure 3-1.-Tool Screening Process



PHASE 1 — Approximately 190 tools were reviewed. Those tools that met the initial criteria were selected. The initial criteria: 1) the tool could be used for environmental cost estimating, and 2) if the tool was available to the public or DoD.

PHASE 2 — Each of the remaining 71 tools was placed under the pre-determined classifications, and those tools in Classifications 1-4 were selected. This included 1) Unit Cost Models and Databases, 2) Parametric Cost Models, 3) Project Cost Databases, and 4) Engineering Case Studies.

PHASE 3 — During this phase each of the remaining 49 tools were reviewed and those tools that fell under classifications 1-3 were selected. The Engineering Case Studies were set aside and will be analyzed in the next phase of the contract.

PHASE 4 — During this phase the remaining 12 tools were reviewed to determine which tools' developers would release the algorithms and databases to the DoD for evaluation. Of the twelve, seven tools were selected.

4.0 PROJECT TEAM ASSESSMENT

4.1 Tool Description

This section provides the initial assessment of each of the tools included in Classifications 1, 2 and 3. This preliminary assessment is based on the responses provided in the Developers and Users Questionnaires (see appendices B and C, respectively), any other information provided by the developers (e.g., brochures), and project team's experience regarding attributes of the specific methodology employed by each tool. A full evaluation of the selected tools will be performed during the next phase of this project and may result in a revision to the tool description, advantages, and disadvantages.

CLASSIFICATION 1 - UNIT COST MODELS AND DATABASES

Micro-Computer Aided Cost Engineering Support System (M-CACES)

Description: M-CACES is the only cost model classified as a unit cost model and database. It has all of the attributes discussed in the description of Classification 1 (p. 8). Therefore, it is best suited for quantity take-off (or bottom-up) estimating. The M-CACES database, called the Unit Price Book, provides labor rates, crew mix, material cost, and equipment costs line items for both conventional construction and environmental restoration projects. The unit cost database contains over 4,000 unit cost line items.

M-CACES has a modeling capability to allow an experienced user to develop higher level estimates (estimates requiring less detailed information), similar to the RACER - ENVEST model described below.

Advantages: M-CACES estimates are defensible, correlated to design, generally well documented, very comprehensive, and based on a significant amount of data. They are particularly well suited to estimating conventional construction and environmental restoration cleanup projects.

Disadvantages: M-CACES estimates the need to have at least a 30% complete design and require the input and/or selection of many detailed line items.

The user/estimator must be a professional cost engineer and experienced with M-CACES. The estimates are subject to the experience and judgment of the estimator.

CLASSIFICATION 2 - PARAMETRIC COST MODELS

Cost Of Remedial Action (CORA)

Description: CORA is an engineering-based model. That is, most of the equations are based on the developer's engineering experience and judgment. CORA requires only minimal design data and other parameters to run and is useful during the conceptual design phases of a project. The users manual provides most of the pertinent design information and assumptions.

Advantages: CORA is applicable to environmental management cleanup projects. The model can estimate several different remedial technologies. CORA does not require training; however, the users manual must be carefully reviewed for stated cost element exclusions.

Disadvantages: The algorithms were developed in 1987 and have not been updated. The model does not provide escalation, engineering design, and other costs. The resulting estimates are within + 50% or - 30% according to CORA documentation.

Because the algorithms and databases are not available for review and analysis, this tool will not be considered for further evaluation.

Freiman Analysis of Systems Techniques (FAST) and INSITE

Description: The FAST and INSITE models are based on statistically developed equations associated with high-level project parameters. They are best used for conceptual design estimates. These models require input of project design and cost information from similar (or analogous) projects. They are based on a series of related CERs that estimate cost for a project based on changes in project parameters.

Advantages: These models do not require a large amount of detailed information. A conceptual design, cost and design parameters information from an analogous project, and a few assumptions are usually sufficient to perform an estimate. This estimating methodology is often the best alternative for innovative or unusual projects provided that information from at least one similar project is available. Therefore, these models may have application in several of the EM areas.

Disadvantages: These models cannot be used without at least one analogous project.

The applicability of the algorithms for estimating EM projects has not been determined.

Neither FAST nor INSITE will provide equations, algorithms or access to the associated databases. Therefore, these models will not be considered for further evaluation.

Hazardous Materials Life Cycle Cost Estimator (HAZMAT)

Description: HAZMAT is an engineering-based cost model with an associated project cost database. It estimates the cost of using and managing hazardous materials during the production, maintenance, and operations of weapon systems. The project database and CERs were developed by an analysis of weapons system programs including the Titan IV launch vehicle; the F-16; F-15; B-1B; and C-130 aircraft; the Mark 50 torpedo; the M1 Abrams tank; and the Blackhawk helicopter programs. HAZMAT was designed as a pollution-prevention estimating system for program office, contractor, base support, and depot personnel to facilitate cost trade-off analyses for alternative hazardous, toxic, and radiological (HTR) materials.

Advantages: HAZMAT is the only model reviewed that estimates hazardous material management programs and projects. In addition to direct costs, HAZMAT considers the cost of medical and liability risk associated with hazardous material handling and disposal.

Disadvantages: The weapon system project cost data contained in the database are limited to eight DoD programs. Some of the project cost may not have broad application. It may prove difficult to disaggregate historical project data of a given weapon system not included in the database into the categories required by HAZMAT. To use this program, the user must determine which of these weapons systems is the most similar to the given program and then make appropriate changes.

These algorithms are based on the developer's engineering judgment and assumptions regarding how changes in parameters effect changes in design and, consequently, the resulting estimate.

Estimates are subject to errors if not prepared by estimators familiar with the appropriate design of the given project.

HAZRISK

Description: HAZRISK is a statistical model based on a series of related CERs. These CERs were developed using quantitative techniques such as multiple linear regression analysis. The dependent value is cost, and the independent variables include quantity (e.g., cubic yards) and other cost driving factors (e.g., waste source, media, and type of contaminant).

Advantages: HAZRISK produces an estimate with upper and lower bounds reflected in a normal distribution. HAZRISK is applicable to environmental restoration

project estimates, including both the assessment and cleanup phases. It also produces an associated cost risk estimate.

Disadvantages: The user must be familiar with the database and the underlying regression analysis to use the model with confidence.

Because the algorithms and databases are not currently available for review and analysis, this tool will not be considered for further evaluation. If an agreement can be reached to acquire them, this decision may be reversed.

Remedial Action Cost Engineering and Requirements (RACER - ENVEST)

Description: RACER comprises an expert system called the Remedial Action Assessment System (RAAS) and a cost estimating model called ENVEST. Because RAAS is considered to be a project management system (Classification 5), it is not described here.

ENVEST, an engineering-design-based model, was largely developed through a reverse engineering process. Reverse engineering is accomplished by acquiring or establishing a detailed design and the associated unit costs and quantities of selected projects. The unit costs and quantities for each project type are then modeled and parameters established to extrapolate or interpolate the quantities and costs. After the user enters the required parameters, the model provides a detailed output of the extrapolated or interpolated quantities and unit costs in the form of a detailed design estimate. The resulting estimate is based on the extrapolation or interpolation of the original project quantities according to the changes in the required parameters. ENVEST also provides the user with the capability to change any of the quantities or unit costs in the estimate.

Advantages: ENVEST is flexible throughout the design phases of an environmental restoration project. Because the model provides a detailed design based on conceptual information, the design can be modified and re-estimated as the design definition evolves. Therefore, ENVEST can be used as a parametric estimating tool as well as a unit cost model. ENVEST is applicable for Environmental Restoration project estimates, including both the assessment and cleanup phases.

Disadvantages: Because ENVEST is based on the reverse engineering of a single project for each project type, a change in parameters results in a change in output that is dependent on the model developer's algorithms. These algorithms are based on the developer's engineering judgment and assumptions regarding how changes in parameters affect changes in design and, consequently, the estimate.

The resulting estimates are subject to errors if not prepared by estimators familiar with the appropriate design for the given project estimate.

Remedial Action Cost Estimating System (RACES)

Description: RACES uses a methodology similar to that of RACER - ENVEST to provide a detailed line-item estimate based on high-level parameters.

Note: The development effort for this system has been indefinitely suspended. the following quotation is from the Developer's Questionnaire (see appendix B).

Our work effort in developing a superfund cost estimating tool began several years ago. Over time, the project evolved into a engineering-based order-of-magnitude estimating tool, designed to work within the M-CACES framework. Unfortunately, the work effort was suspended over a year ago by our agency's Contract Management Division.

At the time the project was suspended, we had released a beta-version of the software for review. This version contained a fully functional operating shell and one technology cost module. Approximately 10 additional technology cost modules were in development at the time the work stopped.

Given this development, this cost model will not be evaluated during the next phase of this project.

Advantages: The advantages as quoted from the user questionnaire (see appendix C): "Ease of use; engineering basis; customization possibilities."

Disadvantages: The disadvantages as quoted from the user questionnaire (see appendix C): "Requires a lot of knowledge of a site to get an accurate cost estimate; i.e., the tool is very conservative and you get a high estimate."

Superfund Cost Estimating Expert System (SCEES)

Description: SCEES is an engineering expert system model. It provides an estimate for the assessment phase of an environmental restoration project. The model requires answers to several questions, many of which come from the EPA Hazardous Ranking System (HRS). The model uses several logic nodes to develop the implied design requirements and then estimates design cost according to unit costs, labor rates, and other project-level costs.

Advantages: SCEES can be used in early phases of the assessment project because the HRS of a project is usually developed by then. This model is appropriate for estimating environmental restoration assessment projects.

Disadvantages: SCEES only addresses assessment projects associated with landfills and lagoons. The algorithms are based on the developer's engineering

judgment and assumptions regarding how changes in parameters affect changes in design and, consequently, the resulting estimate.

Much of the required input data have little or no impact on the resulting cost estimate.

The resulting estimate is subject to error if not prepared by estimators familiar with the appropriate design for the given project estimate.

Systems Cost Model (SCM)

Description: SCM is an engineering-design-based model developed largely through a reverse engineering process. The SCM methodology is similar to that of ENVEST but the resulting estimates provide less detailed information. SCM bases its algorithms on a point design of several facilities (and operations) and modules (major parts of a facility) and on varying sizes of the subject facilities.

Advantages: SCM is the only model in this survey that estimates Waste Management programs and projects. It is appropriate for both conceptual design estimates and as the project matures more detailed engineering design estimates.

Disadvantages: SCM is still in development and is currently a working prototype. Because SCM is based on the reverse engineering for each project type, a change in parameters results in a change in output dependent on the model developer's algorithms. These algorithms are based on the developer's engineering judgment and assumptions regarding how changes in parameters affect changes in design and, consequently, the resulting estimate.

The resulting estimates are subject to error if not prepared by estimators familiar with the appropriate design for the given project estimate.

Classification 3 - EM Project Cost Databases

Decontamination and Decommissioning (D&D) Cost Database and Historical Cost Analysis System (HCAS)

Description: The D&D database provides historical cost information, at the project level and below, on the Department of Energy (DOE) decontamination and decommissioning projects. The HCAS database provides environmental restoration cleanup cost information from the Environmental Protection Agency (EPA), DoD, and DOE. Project information usually includes technology used, specific project scope and requirements, particular circumstances or conditions affecting the project, and other cost-driving factors.

Advantages: The information in both databases can be used to develop CERs and provide analogous projects for consideration while developing conceptual design estimates or performing independent cost reviews.

Disadvantages: The data contained in theboth databases may not be of sufficient definition for direct use. The data may cover only limited project scope. It is often difficult and expensive to desegregate historical project data into the categories required for these databases.

4.2 Tool Applicability to the Cost Breakdown Structure

To assess the applicability or coverage provided by the candidate cost estimating tools, a CBS was developed. The CBS provides a means of measuring this coverage by defining the major elements of work specifically dealing with HTR material management, waste management, and environmental restoration. Only an initial assessment of the application of the selected tools to this CBS is provided in this report. These tools will be fully evaluated during the next phase of this project. The results will be reported in the *Environmental Management Tool Evaluation Report*. Figure 4.1 illustrates this initial assessment.

FIGURE 4.1—Application of Selected Tools to the Cost Breakdown Structure

Cost Models & Databases	Environmental Management Cost Breakdown Structure (CBS) (to the First Level)				
	1.0 Environmental Program Management	2.0 HTR Material Management	3.0 HTR Waste Management	4.0 Environmental Restoration	5.0 Transportation
D&D Cost Database					
HCAS					
HAZMAT					
M-CACES					
RACER					
SCEES					
SCM					

LEGEND					
Significant Coverage		Limited Coverage		Cursory or No Coverage	

- For the purposes of this initial assessment, a tool is considered to provide **significant coverage** if it addresses (to some extent) at least half of the subordinate elements of the given CBS category.

- A tool is considered to provide **limited coverage** if it addresses at least one fourth of the subordinate elements of the given CBS category.

- If the tool is considered to provide **only cursory or no coverage** at all the cell in this figure is blank.

The definitions of the five first-level CBS elements shown in Figure 4-1 are provided in Table 4.1 along with the associated subordinate elements. A definition of each of these subordinate elements and another two levels of indenture below them are provided in the *Environmental Management Category Report.*

TABLE 4-1.—Cost Breakdown Structure Dictionary

1.0	**Environmental Program Management**
Subordinate Elements • Program Management • Program Support	
Definition This element is made up of the management activities required to comply with regulatory requirements associated with the procurement, use, and disposal of HTR materials and waste. This element also includes management of environmental programs (e.g., pollution prevention and compliance programs) and legal, medical, and other professional support. These activities are the infrastructure required of every program to conduct business and are generally considered as overhead. They are provided here for consideration and/or incorporation in life- cycle cost estimates that involve some component of HTR materials and/or wastes.	

2.0	**HTR Material Management**
Subordinate Elements • HTR Material Management and Support • HTR Material Pharmacy • HTR Material Conservation • HTR Material Management Facilities	
Definition This element addresses the hands-on management and control of HTR materials for each phase (or portion) of the life cycle of weapons system programs and projects that involve HTR materials or that generate HTR waste. This element also includes activities that implement pollution prevention and compliance initiatives as well as any facilities and/or equipment particular to HTR materials. One of the primary elements is the implementation of the HTR material pharmacy, which is a principal component of HTR material management.	

TABLE 4-1.—Cost Breakdown Structure Dictionary (Continued)

3.0	HTR Waste Management (On-Site and Off-Site)

Subordinate Elements

- HTR Waste Operations Management and Support
- On-site Waste Management Facility Construction/Operations
- Off-site HTR Waste Disposal

Definition

This element addresses the generated waste streams and conducts all HTR waste treatments, storage, and disposal activities, whether the activity is an extensive on-site operation or simply off-site disposal. The disposal in this case is specific to waste streams and does not include environmental restoration waste, which is included under Remedial Action and/or Corrective Measures.

4.0	Environmental Restoration/Corrective Action

Subordinate Elements

- Preliminary Assessment/Site Investigation (PA/SI) and/or RCRA Facility Assessment (RFA)
- Remedial Investigation/Feasibility Study (RI/FS) and/or RCRA Facility Investigation/Corrective Measures Study (RFI/CMS)
- Remedial Design
- Remedial Action and/or Corrective Measures

Definition

This element includes all activities associated with environmental restoration under both RCRA and CERCLA. All studies conducted to characterize a polluted site, select the remedy, and develop a working design are included in the first three subordinate elements. The actual cleanup activities, including complete restoration and closure of the site, are included in the fourth subordinate element.

TABLE 4-1.—Cost Breakdown Structure Dictionary (Continued)

5.0	**HTR Material & Waste Transportation**
Subordinate Elements • Transportation Management • Load • Transport • Unload	
Definition This element includes activities to manifest, permit, load, haul, and unload HTR materials and waste throughout the life cycle of the weapon system. This element also includes management activities required to comply with regulatory requirements. The activities reported under this element are pervasive throughout the HTR material management, waste management, and environmental restoration activities in CBS element 2.0, but are separated here for independent consideration.	

5.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Seven of the cost models and databases reviewed satisfy the selection criteria of this survey: D&D Cost Database, HAZMAT, HCAS, M-CACES, RACER-ENVEST, SCEES, and SCM.

- At least one of the recommended tools addresses each of the first-level Cost Breakdown Structure (CBS) elements to some extent (figure 5-1).

FIGURE 5-1.— Application of Selected Tools to the Cost Breakdown Structure

Cost Models & Databases	Environmental Management Cost Breakdown Structure (CBS) (to the First Level)				
	1.0 Environmental Program Management	2.0 HTR Material Management	3.0 HTR Waste Management	4.0 Environmental Restoration	5.0 Transportation
D&D Cost Database					
HCAS					
HAZMAT					
M-CACES					
RACER					
SCEES					
SCM					

LEGEND					
Significant Coverage		Limited Coverage		Cursory or No Coverage	

- Important subordinate elements of each of the five CBS categories are not covered.

Recommendations

- Conduct a full evaluation on the seven selected environmental management cost models and databases to verify the range (number of major elements of work addressed) and depth (number of levels of detail in any given category) of coverage each provides.

- Assess other important attributes of each of the selected cost models and databases. For example, a cost model's ability to estimate EM cost risk is an important attribute. A preliminary list of criteria to measure these attributes is provided in appendix D.

- Analyze the 37 EM-related engineering case studies and reports to determine which specific elements of the EM categories each may address.

- Evaluate the selected set of tools to determine the EM cost estimating and analysis capabilities they provide in aggregate.

- Develop short-term (quick-fix) and a longer term plans to establish the capability necessary to address important elements not covered by the aggregate set of existing EM cost tools.

APPENDIX A

LIST OF 71 CANDIDATE ENVIRONMENTAL MANAGEMENT COST TOOLS

Classification 1: Unit Cost Models and Databases

Tool	Developer	Developer's Address	Point of Contact	Phone Number
Micro-Computer Aided Cost Engineering Support System (M-CACES)	Building Systems Design, Inc.	One Georgia Center 600 W, Peachtree St., Suite 1440 Atlanta, GA 30308	Peggy Woodall	(404) 876-4700

Classification 2: Parametric Cost Models

Cost of Remedial Action (CORA)	CH2M Hill	P.O. Box 4400 Mid Atlantic Office Reston, VA 22090	Kelly McGrill	(703) 471-1441
Freiman Analysis of Systems Techniques Models (FAST)	Freiman Parametric Systems, Inc.	1703 Andros, Coconut Beach, FL 33066	Frank Freiman	(305) 978-9597
Hazardous Materials Life Cycle Cost Estimator (HAZMAT)	U.S. Air Force - HCS/EMP	8213 14th Street Brooks Air Force Base, Texas 78235-5246	Betty West	(210) 536-5121
HAZRISK Model	Independent Project Analysis, Inc.	1840 Michael Faraday Dr. Suite 100 Reston, VA 22090	Jenny Painter	(703) 709-0777
INSITE	Primetime	650 E Swedsford Rd., 8 VF Exec Mall Wayne, PA 19087	Richard Seel	(215) 964-8200
Remedial Action Cost Engineering and Req'ts. (RACER-ENVEST)	Delta Research Corporation	1501 Merchants Way Niceville, FL 32578	Michael Reid	(904) 897-5380
Remedial Action Cost Estimating System (RACES)	U.S. EPA, Risk Reduction Engineering Laboratory	26 West Martin Luther King, Room 215 Cincinnati, OH 45268	Gordon Evans	(513) 569-7684
Superfund Cost Estimating Expert System (SCEES)	CDM Federal Programs Corporation	13135 Lee Jackson Memorial Highway, Suite 200 Fairfax, VA 22033	Andrew Stevenson	(703) 968-0900
Systems Cost Model (SCM)	EG&G, Idaho	P.O. Box 1625 Idaho Falls, Idaho 83415	Dave Shropshire	(208) 526-6800

Classification 3: EM Project Cost Databases

Tool	Developer	Developer's Address	Point of Contact	Phone Number
Decommissioning and Decontamination (D&D) Cost Database	Argonne National Laboratory	9800 S. Cass Ave. Bldg 900 Argonne, IL 60439	Jerry Guillett	(708) 252-7475
Historical Cost Analysis System (HCAS)	U.S. Navy - HQ LANTNAVFAC-ENGCOM	1510 Gilbert Street Norfolk, VA 23511-2699	Aubrey Sadler	(804) 444-9907

Classification 4: Engineering Case Studies and Reports

Burgher, Brian, Mike Culpepper and Werner Zieger, *Remedial Action Costing Procedures Manual*, JRB Associates and CH2M Hill, October 1987. (available from NTIS)

Castro, J. M., *Cost Estimating Relationships for Environmental Cleanup Projects at U.S. DOE Facilities*, IT Corporation, Arlington, Texas, February 1990, U.S. Department of Energy - Remedial Action Program Information Center (DOE-RAPIC), No. 9623.

Colglazier, E. W. and T. Cox, *Future costs of Hazardous Waste Remediation: Report on the Results of the University of Tennessee Study*, University of Tennessee, Knoxville, TN, CONF-910277, February 1991, DOE-RAPIC, 10351.

Comptroller General, *DoD Environment Cleanup; Information on Contractor Cleanup*, General Accounting Office, Washington, D.C., NSIAD-92-253FS, June 1992, AD-A253432.

Comptroller General, *Nuclear-Powered Ships: Accounting for Shipyard Costs and Nuclear Waste Disposal Plans*, U.S. General Accounting Office, Washington, D.C., NSIAD-92-256, July 1992, AD-A253452.

Cost Estimating Handbook for Environmental Restoration (EMCAT), U.S. Department of Energy, September 1990, Rev. 0.

Counce, R.M., J.H. Wilson, and C. O. Thomas, *Manual for Estimating Cost of VOC Removal from Groundwater*, Oak Ridge National Laboratory for U.S. Air Force Civil Engineering Support Agency, ESL-TR-90-50, May 1992, AD-A260303.

Diggs, I.W. and R.F. Gimpel, *A Development Program and Demonstration to Reduce Vitrification Remediation Treatment Costs*, Westinghouse Environmental Management Company of Ohio, Fernald Environmental Management Project, Cincinnati, OH, FEMP-2263, CONF-920851, August 1992, DOE-RAPIC, No. 9981.

Economic and Environmental Considerations for Incremental Cost Analysis in Mitigation Planning, Greeley-Poltemus Group, Inc. for the U.S. Army Corps of Engineers Water Resources Support Center, Institute for Water Resources, IWR Report 91-R-1, March 1991, AD-A238927.

Graves, M. J. and D. Saul, *Decommissioning Waste: Less Volume, Less Cost*, International Research and Development Limited, Newcastle upon Tyne, United Kingdom, February 1992, DOE-RAPIC, No. 9810.

Hackney, John W., *Accuracy of Hazardous Waste Project Estimates*, AACE Transactions, 1989, pp 0.1.1-12.

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Hutterman, Leonard, *Environmental Restoration Program Cost Estimating Handbook*, WINCO, Idaho Falls, Idaho.

Kim, B.J., *An Analysis of Army Hazardous Waste Disposal Cost Data*,U.S. Army Corps of Engineers, Construction Research Laboratory, CERL-TR-N-91/71, April 1990, AD-A221242.

Kim, B.J., *Validation of the U.S. Army's Current Hazardous Waste Data*, U.S. Army Corps of Engineers, Construction Research Laboratory, CERL-TR-N-90/10, April 1990, AD-A1221242.

Kirsch, F.W. and G.P. Looby, *Waste Minimization Assessment Centers - cost Savings Recommended and Implemented in Twelve Manufacturing Plants*, University City Sciences Center, Philadelphia, PA, CONF-9104243, April 1991, DOE-RAPIC, No. 9918.

Kuryk, B.A., *Economic Analysis of the Recovery and Reuse of Explosives*, Arthur D. Little, Inc., ADl/REF-54144-03, 31 May 1986, AD-A170445.

Kwist, Thomas A., *Remediation Versus Prevention of PCB Contamination: A Comparison Based on Risk and Cost Analysis*, AFT non-thesis paper, AFIT/CI/CIA-89-167, 1989, AD-A218486.

Leham, William L. and Fred D. Peter, *Methodology for Estimating AF Weapon Systems Environmental Compliance*, University of New Mexico, Albuquerque, New Mexico, April 1989.

Ly, H.L. and D.M. Pearsall, *Hazardous Material Life Cycle Cost Model Technical Manual Version 1.0*, Naval Medical Research and Development Command, Naval Health Research Center, TR-92-19, September 1992, AD-A259208.

Metzer, Nacy, Michael Corbin and Scott Cullinan, *In-Situ Volitization (ISV) Remedial System Cost Analysis*, Roy F. Weston, Inc., U.S. Army Toxic, AMXTH-TE-CR87123, August 1987, LD-72372A, AD-A184447, DOD Literature.

Mooney, J.A. and L.A. Hermansen, *Hazardous Material Life-Cycle Cost Model Systems User/Operators Guide*, Naval Medical Research and Development Command, Naval Health Research Center, Report No. 92-18, September 1992, AD-A259154.

Mount, J.F., et al. *Economic Analysis of Hazardous Waste Minimization Alternatives*, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, TR-EN-92/05, August 1992, AD-A256989.

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Piskin, Kemal and Bernard A. Donahue, *Method for Calculating Costs of Underground Storage Tank Closure at Fort Dix, New Jersey*, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, USACERL-SR-N-91-28, September 1991, AD-A242357.

Pratapagiri, Gopal, *Computer Program for Estimating Decommissioning Costs of Nuclear Power Plants*, Atomic Energy of Canada Limited, Montreal, Quebec, Canada, CONF-871018, Vol.2 (DE87012822), October 1987. DOE-RAPIC, No. 5442.

Rivera, A. L., I. Ahmed, M.M. Alsharif and D. L. Phung, *Challenges in the Development of Integrated Cost Models to Address the Economic Aspects of Waste Confinement Systems*, Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, TN, October 1989, DOE-RAPIC, No. 10578.

Roberts, R.M., et al. *Hazardous Waste Minimization Initiation Decision Report*, Naval Civil Engineering Research Laboratory, TN-1787, June 1988, Volume 1, AD-A199221, Volume 2, AD-A199222.

Schlueter, R. and J.J. Schafer, *Low-Level and Transuranic Waste Transportation, Disposal and Facility Decommissioning Cost Sensitivity Analysis*, EG&G Idaho, Inc. Idaho Falls, ID, DFF-STD-10092, May 1992, DOE-RAPIC, No. 10463.

Tonn, Bruce, et al. *Cost of RCRA Correction Action*, Oak Ridge National Laboratory for the U.S. Department of Energy, ORNL/TM-11864, August 1991, DOE-RAPIC 04236.

Watson, James P., *Economic Analysis for Demilitarization and Disposal*, Joint Conventional Ammunition Program, JCAP-DM-T713, January 1978, AD-A053011, DOD Literature.

Wisenbaker, W., G. Turi, and R. Shangraw, "Lessons Learned and New Initiatives in Cost and Schedule Estimating, American Nuclear Society 1991 Annual Meeting Transactions, Volume 63, TANSAO 631-464 (1991), June 1991, DOE-RAPIC 05470.

Yong, Edward.C., et al. *Compendium of Costs of Remedial Technology at Hazardous Waste Sites*, Environmental Law Institute, Washington, D.C. for the U.S. Environmental Protection Agency, EPA/600/2-87/087, October 1987, DOE-RAPIC, No. 06524.

Youngblood, A. and C. Ulibarri, *A Compendium of Cost Data For Environmental Restoration Technologies, Methods, and Processes*, Los Alamos National Laboratory for the U.S. Department of Energy, LA-UR-91-2455, August 1991.

Zavrel, J. J. Blazek, P. Menyhardt, V. Nulicek and M. Vrba, *Use of a Database for Calculating Nuclear Power Plant Decommissioning Costs*, Prague, Ceskoslovenska, Jaderna Energie 38(1):27-30, January 1992, DOE-RAPIC, No. 10649.

Environmental Solutions Software Database, Solutions Software, Inc., (407)621-7912, *Models Developed for the Total System LCC Analysis*, U.S. Department of Energy Office of Civilian Radioactive Waste.

Classification 5: Project Management Systems

Tool	Developer	Developer's Address	Point of Contact	Phone Number
AWARE	RERCA Environmental, Inc.	10 Hazelwood Drive Amherst, NY 14228-2298	Mary	(716) 691-2600
CHEMMIX	Environmental Software and Systems, Inc.	P.O. Box 1182 Bowling Green, KY 43402	Roger Weith	(419) 353-8540
Cost Time Management	Westinghouse Electric Corporation	11 Stanwix Street Pittsburgh, PA 15221	Stephen Green	(412) 642-2455
DocuWaste for Hazardous Waste	Chemtox, a Division of Resource Consultants, Inc.	7121 CrossRoads Blvd P.O. Box 1848 Brentwood, TN 37204-1848	Patrice Rowbal	1 (800) 338-2815
ENFLEX Data	ERM Computer Services	855 Spring Street Exton, PA 19341	Harold Scott, Al Condit	(610) 524-3600
Environmental Tracking System	Chemical Safety	1301 S. 46th St., Suite 180 Richmond, CA 94804	Tony	(510) 231-9490
ENVIRSCREEN	Environmental Data Resources	187 South Woodward Suite 204 Birmingham, AL 48009	Mark Bennett	(313) 647-5408
Facility Tracking System	Quantum Compliance Systems	4251 Plymouth Road Suite 1200 Ann Arbor, MI 48105	Lisa	(313) 761-2175
LCIMS	Safety Sciences, Inc.	7586 Trade Street San Diego, CA 92121	Kelly King	(619) 578-8400
Linear Location (Health) Risk and Cost Analysis Model (LLM)	ICF Kaiser Engineers	9300 Lee Highway Fairfax, VA 22031	Joanne Colt	(703) 934-3000

Classification 5: Project Management Systems (Continued)

Tool	Developer	Developer's Address	Point of Contact	Phone Number
Remedial Action Assessment System (RACER-RAAS)	Battelle PNL	P.O. Box 999 MSIN K7-94 Richland, WA 99352	Mike White	(509) 375-6518
Removal Cost Management System	U.S. EPA	Emergency Response Division Washington, D.C. 20460	Bob Ciboulkis	(202) 321-6746
RCRA (Health) Risk and Cost Analysis Model (WET)	ICF Kaiser Engineers	9300 Lee Highway Fairfax, VA 22031	Bill Mendez	(703) 934-3000
TINIA	Alternative Systems, Inc.	225 S. Cabrillo Highway, Suite 124C Halfmoon Bay, CA 94019	Michael Brinck	(415) 726-5700
WASTE DB	Environgenics	65 S. Main St., Bldg. C Pennington, NJ 08534	Dick Voorhees	(609) 737-3233

Classification 6: Applications Software Platform

Modular Oriented Uncertainty System (MOUSE)	Risk Reduction Engineering Laboratory	U.S. EPA 26 Martin Luther King Cincinnati, OH 45268	Albert Klee	(513) 569-7931
Precision Estimating Plus	Timberline Software Corporation	9405 S.W. Gemini Beaverton, OR 97005	John Geffel	(503) 626-6775
Project Tracking for Environmental Restoration (TRAC-ER)	Los Alamos National Laboratory	ER Tech. Support Office, P.O. Box 1663 Suite MS-K485 Los Alamos, NM 87545	Dr. Kenneth Rea	(505) 667-2415
Range Estimating	Decision Science Corporation	P.O. Box 28848 St. Louis, MI 63123	Kevin Curran	(314) 739-2662

APPENDIX B

DEVELOPER QUESTIONNAIRE AND RESPONSES

CAPSTONE Corporation
1800 Diagonal Road, Suite 355
Alexandria, VA 22314
(703) 683-4220, Fax (703) 683-4430

[Name and address of Software Developer]

June 6, 1994

Dear **[Name of Developer]:**

The Department of Defense (DoD) has contracted with CAPSTONE Corporation, under contract number MDA903-94-C-0043, to identify, collect and critically evaluate selected environmental cost engineering and analysis tools. These tools include unit cost models, engineering studies, project management and application software. The selected tools would be provided as a reference list to help DoD program and project managers in their estimation process for determining the environmental costs of major defense acquisition programs.

These tools will be compiled in a report to be widely distributed within the DoD acquisition, environmental and cost analysis communities. The list will also be made available to the public.

Initially, we are screening existing cost engineering and analysis tools to decide which can be considered for further evaluation. We are asking for your assistance in obtaining specific information pertaining to your product(s) by completing the questionnaire and check-off list. Please return them to CAPSTONE Corporation by June 17, 1994. Specific questions on filling out the questionnaire/check-off list may be addressed to our senior analyst, _____.

If you prefer, you may use your own format, correlating your responses to the numbers on the questionnaire/check-off list. The use of a FAX machine is encouraged. However, I have enclosed a pre-addressed and pre-stamped envelope. Also, we would like to receive any brochures, demonstration diskettes or any critical articles written about your product.

We have a contractual obligation to accomplish this effort in a specific manner and the questionnaire/check-off list is a required step. To assist us, we must have the enclosures completed. We are sorry, but no further evaluation will be performed without the completed questionnaire/check-off list.

Thank you for your cooperation,

_____
Program Manager

Enclosures

Cost Engineering and Analysis Questionnaire

1. Company Name:_____

2. Address:_____

3. Contact:_____Telephone:_____

4. Tool Name:_____

5. Does this tool estimate environmental costs?_____yes/no

6. Does this tool estimate environmental schedule information?_____yes/no

7. Are the algorithms published or available to the DoD for evaluation?_____yes/no

8. Is the database used to develop the algorithms available to the DoD for evaluation?_____yes/no

9. Please mark the attached cost breakdown structure list and environmental management category codes list for each category that is applicable to your tool. *

10. Enter the cost of the tool if it is sold commercially._____

11. Is tool support documentation (background material, functional description, etc.) available?_____yes/no

    Is a user's manual provided with the tool?_____yes/no

    If yes, please provide a copy along with your answers.

    As a minimum, provide copies of the output reports and input parameters.

12. Is training provided?_____yes/no

13. Is training necessary?_____yes/no; if yes, cost?_____

---

* Although Question 9 was included in the questionnaire, the applicability of the tool to the Cost Breakdown Structure and Cost Drivers will be determined and explained in the Evaluation Report. Additionally, the CBS and EM Category Codes were revised subsequent to the disbursement of the questionnaires. This responses provided to Question 9 have been overcome by events and omitted in this report.

14. Check the operating environment required:

IBM PC(or compatible)____, mainframe____, MAC_____, other_____

RAM Requirements:_____, Hard drive size:_____

Special needs:(explain)_____

(Please provide on additional sheets of paper, if required).

15. If your cost engineering and analysis tool is selected, will your company be willing to provide a copy of the tool to CAPSTONE for further evaluation?_____yes/no

16. Provide a comprehensive list of projects that were used to validate the tool:

a. _____

b. _____

c. _____

d. _____

(Please provide on additional sheets of paper, if required).

17. Provide a list of commercial users whom we may contact in order to verify the tool's capability/attributes:

a. _____

b. _____

c. _____

d. _____

(Please provide on additional sheets of paper, if required).

18. Provide a list of government users whom we may contact in order to verify the tool's capability/attributes:

a. _____

b. _____

c. _____

d. _____

(Please provide on additional sheets of paper, if required).

19. When was the original version developed? _____(year); when was the current version developed? _____(year)

20. How many versions have they been produced between the original and current versions?_____. What release is the current version?_____.

21. Are your results exportable to any industry standard format?; (please check) LOTUS 1-2-3___, EXCEL___, DBF____, ASCII____, other____. If so, please provide a sample of the output for each format checked.

22. Could the program be updated/modified to a Department of Defense requirement? ___yes/no

Are you willing to provide the source code to DoD for modifications by DoD?___yes/no

23. List the unique features or methodologies of the tool:

a. _____

b. _____

c. _____

(Please provide on additional sheets of paper, if required).

24. What type of program support is available to users (i.e., telephone help line)?

_____

_____

(Please provide on additional sheets of paper, if required).

25. Does the model include economies of scale? yes/no____.

_____

_____

(Please provide on additional sheets of paper, if required).

26. Does the model include escalation factors? yes/no____.

DEVELOPER RESPONSES

Developers Questionnaires

Date: 07/02/94

1. Company Name: **ALTERNATIVE SYSTEMS,INC**

2. Address: **225 S. CABRILLO HIGHWAY**
HALFMOON BAY CA 94019

3. Contact: **MICHAEL BRINCK**
Tel:(415)-726-5700; Fax: 726-7846

4. Tool Name: **TINIA**
Acronym: **TINIA**
Description:
Cost, Risk and RI/FS

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **N**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **45,000**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **1,600**

14. Check the applicable operating environment:
IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other **VAX UNIX**
RAM Requirements: **0 M** Hard drive size: **0 M**
Special Needs:
RAM 16-256MB
HARD DRIVE 500MB-2.0 GB
SPECIAL NEEDS: ORACLE RDBMS ENVIRONMENT

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **FURTHER DISCUSSION**

16. Provide a comprehensive list of projects that were used to validate the tool:
Customer cost analysis requirements.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1994**

When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **0**
What release is the current version? **1**

21. Are your results portable to any industry standard format?
EXCELL,ASCII,ORACLE

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD?

23. List the unique features or methodologies of the tool:
a. Tracks material and engineering costs in real time.
b. Costing model is integrated with overall environmental, health and safety information management system.

24. What type of program support is available to users?
Telephone help support; consulting services regarding implementation.

25. Does the model include economies of scale? **Y**

26. Does the model include escalation factors?

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
1. Source code license would require seperate negotiations.
2. There are no users at this time, the program is in the process of being fielded.

Developers Questionnaires

Date: 07/02/94

1. Company Name: **ARGONNE NATIONAL LAB**

2. Address: **9800 S. CASS AVE.**
   ARGONNE IL 60439

3. Contact: **JERRY GUILLETT**
   Tel:(708)-252-7475; Fax: 252-6073

4. Tool Name: **ER HISTORICAL DATABASE**
   Acronym:
   Description:

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**
    not sold

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **N**
    Is there a manual with the tool? **N**

12. Is training provided? **N**

13. Is training necessary? **N** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **0 M** Hard drive size: **0 M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y AFTER COMPL OF DEVEL**

16. Provide a comprehensive list of projects that were used to validate the tool:

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

19. When was the original version developed? **1993**
    When was the current version developed? **0**

20. How many versions have been produced between the original and the current version? 1
What release is the current version? 0

21. Are your results portable to any industry standard format?
EXCEL

22. Could the program be updated/modified to a DOD requirement?
Are you willing to provide the source code to the DOD for modification by the DOD?

23. List the unique features or methodologies of the tool:

24. What type of program support is available to users?

25. Does the model include economies of scale? **N**

26. Does the model include escalation factors? **N**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments

Developers Questionnaires

Date: 07/02/94

1. Company Name: **BUILDING SYSTEMS DESIGN, INC**

2. Address: **1175 PEACHTREE, 100 COLONY SQUARE**
ATLANTA GA 30308

3. Contact: **PEGGY WOODALL**
Tel:**(404)-876-4700**; Fax:

4. Tool Name: **MICRO-COMPUTER AIDED COST ENGINEERING SUPPORT SYSTEM**
Acronym: **M-CACES**
Description:
M-CASES is a cost estimating system designed to deal with budget estimating needs early in the design phase through detail estimating needs at the bidding and construction phases.

It is a system for detailed "bottoms-up" estimating at various construction projects. A unit cost library for environmental restoration project. The system is currently being enhanced to support developing of building cost estimates during design phases.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **4,000**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **995**

14. Check the applicable operating environment:
IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
RAM Requirements: **1 M** Hard drive size: **25 M**
Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:
   a. **Corps of Engineers**
   b. **DOE**
   c. **Hanford**
   d. **Rocky Flats**
   e. **Savanah River**

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1985**
When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **0**
What release is the current version? **5**

21. Are your results portable to any industry standard format?
Lotus, EXCEL, ASCII

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD?

23. List the unique features or methodologies of the tool:
a. Parametric Modeling
b. Currency Conversion
c. Metric Conversion
d. Extensive DB Management

24. What type of program support is available to users?
Has 800 number for support

25. Does the model include economies of scale? **N**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments

Date: 07/02/94

1. Company Name: **DELTA RESEARCH CORPORATION**

2. Address: **1501 MERCHANTS WAY**
NICEVILLE FL 32578

3. Contact: **MICHAEL REID**
Tel:(904)-897-5380; Fax:

4. Tool Name: **REMEDIAL ACTION COST ENGINEERING AND REQUIREMENTS SYSTEM**
Acronym: **RACER**
Description:
RACER contains 2 primary system components: 1)ENVEST; which provides programming, budgeting and cost engineering support during RI/FS, RD and RA and 2) RAAS which considers containment, media risk and ARAR's to determine feasible remediation approaches for specific sites.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **1,200**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **3,000**

14. Check the applicable operating environment:
IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
RAM Requirements: **4 M** Hard drive size: **20 M**
Special Needs:
486 preferred, 386 will work.

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y HQAFCESA APPROVAL**

16. Provide a comprehensive list of projects that were used to validate the tool:
Myrtle Beach, AFB
Cape Canaveral, AFB
Patrick, AFB

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to

verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1991**
When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **2**
What release is the current version? **3**

21. Are your results portable to any industry standard format?
ascii, word proc

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD?

23. List the unique features or methodologies of the tool:

24. What type of program support is available to users?
Telephone

25. Does the model include economies of scale? **Y**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments

Developers Questionnaires

Date: 07/02/94

1. Company Name: **E G & G, IDAHO**

2. Address: **P.O. BOX 1625**
IDAHO FALLS ID 83415-2420

3. Contact: **DAVE SHROPSHIRE**
Tel:(208)-526-6800; Fax: 526-8878

4. Tool Name: **SYSTEMS COST MODEL**
Acronym: **SCM**
Description:
A program that is applicable to EM-30 projects and provides a Life Cycle Cost Estimating system to support management planning for the Programmatic Environmental Impact Statement (PEIS) and DOE's Cost Baseline for the total program estimate. It will also take into consideration, during development, the capability to provide comparison of mixed waste options for the Federal Facility Compliance Act (FFC Act) Site Treatment Plans.

A nonintegrated version of the SCM has already been developed. This version is currently being used for developing cost estimates and socioeconimic data for the PEIS project. The PEIS model consists of the following programming elements:
- **Volume Input Model (VIM)**
- **Bottom-up Model (BUM)**
- **Waste Management Estimating Program (WMEP)**
- **Socioeconomic Model (SEM)**
- **Transportation Model**

These models will be integrated into a single program in SCM.

A complete product description is presented in document EGG-WM-11352, Rev. 0, June 1994.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**
Free to DOE users

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **0**

14. Check the applicable operating environment:
IBM PC (or compatible) **Y** , Mainframe: , MAC , Other
RAM Requirements: **16 M** Hard drive size: **6 M**

Special Needs:
33 Mhz 486 standalone
Access can also be acheived via Internet

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:
a. Programmatic Environmental Impact Statement EM (DOE-HQ)
b. Site treatment plans (Idaho National Engineering Laboratory
c. Activities and facilities within DOE complex

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1996**
When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **6**
What release is the current version? **1**

21. Are your results portable to any industry standard format?
Lotus 123

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD? **Y**

23. List the unique features or methodologies of the tool:
a. Database includes waste load data for 49 DOE sites by treatment category.
b. Estimating programs with cost equations for a wide range of TSD options.
c. Transportation cost information.

24. What type of program support is available to users?
E G & G Idaho Technical contacts are available for support.

25. Does the model include economies of scale? **Y**
Cost/Capacity equations have been defined for a wide range of treatment, storage and disposal modules.

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
This tool has been developed using a Lotus 123 format. This represents version 6.1. This version includes Lice Cycle cost estimating capability for several waste types. These include: LLW, Mixed LLW, Alpha, Hazardous Waste, Remote Handling, TRU Contact Handling and TRU Remote Handling.

Effort is underway to develop the program into a database format. This version is SCM 1.0. Much of this effort will be accomplished by October 1994. It will be for 1 to 2 programs (LLW/Mixed LLW) with others to follow.

1. Company Name: **FREIMAN PARAMETRIC SYSTEMS, INC.**

2. Address: **1703 ANDROS**
   COCONUT BEACH FL 33066

3. Contact: **FRANK FREIMAN**
   Tel:(305)-978-9597; Fax: 978-9597

4. Tool Name: **FREIMAN ANALYSIS OF SYSTEMS TECHNIQUES MODELS**
   Acronym: **FAST**
   Description:
FAST-Equipment, FAST-Construction, FAST-Cost-of-Ownership are parametric models. They are based on mathematical relationships that were created by Frank Freiman. The models utilize these relationships to allow the user to create his/her own unique set of CERs. This process is called calibration and the result is a value called the reference factor. Once a project has been calibrated the user can perform many costing variations by simply modifying the reference factor or changing the products characteristics or entering different programmatic (qty, location, size, capability, etc.) data to simulate the project being estimated.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **N**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **1,000**
    PER MODEL FASTE, C, CO

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **N** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **0 M** Hard drive size: **0 M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1963**
When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **6**
What release is the current version? **6**

21. Are your results portable to any industry standard format?
ASCII

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD? **N**

23. List the unique features or methodologies of the tool:

24. What type of program support is available to users?
Telephone

25. Does the model include economies of scale? **Y**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
There are three(3) models available. These are FASTE, C and CO.
FASTE: Estimates the cost of equipment.
FASTC: Is a construction model estimator.
FASTCO: Calculates costs for the life cycle of the project.

The developer check all the CBS and Category Codes. This was done because the FAST models are relationship models and do not have a specific databases. There are sets of equations that are used in the models. Therefore, the user can develop a relationship for any type of product at any level of the CBS. However, this would require the user to have accumulated cost for these activities or have developed reference factors by using the FAST model calibration capability.

Date: 07/02/94

1. Company Name: **HCS/YAQ**

2. Address: **8213 14TH STREET**
   BROOKS AFB TX 78235-5246

3. Contact: **BETTY WEST**
   Tel:**(210)-536-5121**; Fax: **536-3228**

4. Tool Name: **HAZARDOUS MATERIALS LIFE CYCLE COST ESTIMATOR**
   Acronym: **HAZMAT**
   Description:

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**
    Not sold commercially

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **N**

13. Is training necessary? **N** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **1 M** Hard drive size: **20 M**
    Special Needs:
    Software requires 5 MB.

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:
    Model was validated using F-15 Study.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

19. When was the original version developed? **1991**
    When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? 4
What release is the current version? 3

21. Are your results portable to any industry standard format?
Lotus123,Excel,AscII

22. Could the program be updated/modified to a DOD requirement? Y
Are you willing to provide the source code to the DOD for modification by the DOD? Y

23. List the unique features or methodologies of the tool:
a. Process oriented.
b. Chemical specific.
c. User access to database.

24. What type of program support is available to users?
Telephone (HSC)

25. Does the model include economies of scale? Y
Users weapon system surface area to extrapulate to systems larger or smaller than those in the database.

26. Does the model include escalation factors? Y

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
The program was to create a command-wide, integrated oversight process for ensuring that consideration was given to hazardous materials issues selection, use and life cycle costs during each step of the weapon systems acquisition process.

The program enables system program offices (SPO's) and their prime contractors to input hazardous materials cost considerations into the engineering trade-off studies performed during weapon system development.

Date: 07/02/94

1. Company Name: **HQ LANTNAVFACENGCOM**

2. Address: **1510 GILBERT STREET**
   NORFOLK VA 23511-2699

3. Contact: **AUBREY SADLER**
   Tel:(804)-444-9907; Fax:

4. Tool Name: **HISTORICAL COST ANALYSIS SYSTEM**
   Acronym: **HCAS**
   Description:
   Historical project cost database developed by the Interagency Cost Estimating Group (ICEG). Includes actual Remedial Action (Clean-up) project cost data from the Corps of Engineers, Navy, Air Force and DOE.

5. Does this tool estimate environmental cost? **N**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**
    no cost

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **N**

13. Is training necessary? **N** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **1 M** Hard drive size: **2 M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:
    New programwith limited number of projects loaded.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

19. When was the original version developed? 1993
When was the current version developed? 1993

20. How many versions have been produced between the original and the current version? 2
What release is the current version? 1

21. Are your results portable to any industry standard format?

22. Could the program be updated/modified to a DOD requirement? Y
Are you willing to provide the source code to the DOD for modification by the DOD? Y

23. List the unique features or methodologies of the tool:
a. Storage of historical cost for environmental cleanup. To the best of our knowledge, this is the only program that stores environmental costs in the WBS format.
b. Specific data retreival through multi field query screen. Data search can be specific to one piece of criteria such as location or category code, or all inclusive to all data fields which include cost, date, WBS#, contract #, scope and many more. See chapter 6 of the users manual.
c. To be distributed on CDROM for widespread use. This program was developed by an interagency group that includes people from the Army, Navy, Air Force, EPA, DOE, NASA, and the Dept. of Interior. All agencies have agreed to the format and output of the program making it highly compatible to all users.

24. What type of program support is available to users?
Telephone Help Line.
P.O.C. for each project loaded on system.

25. Does the model include economies of scale? N
It stores data.

26. Does the model include escalation factors? N

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
All the CBS and Cost Categories have been checked because HCAS can accept data in all these categories.

Developers Questionnaires

Date: 07/02/94

1. Company Name: **INDEPENDENT PROJECT ANALYSIS, INC,**

2. Address: **1840 MICHAEL FARADAY DRIVE**
   RESTON VA 22090

3. Contact: **JENNY PAINTER**
   Tel:(703)-709-0777; Fax:

4. Tool Name: **HAZRISK MODEL**
   Acronym: **HAZRISK**
   Description:
The HAZRISK models will assist estimators in building order-of-magnitude cost estimates and cost contingency estimates for the remedial investigation/feasibility stage and the remedial design/remedial action stage of an environmental project.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **4,000**
    SEE PRICE LIST

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **800**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **550** Hard drive size: **1** **M**
    Special Needs:
OPTIONAL: GRAPHICS CARD, MOUSE

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y LICENSE ONLY**

16. Provide a comprehensive list of projects that were used to validate the tool:
Non Provided.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1990**

When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **5**
What release is the current version? **3**

21. Are your results portable to any industry standard format?
None

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD? **N**

23. List the unique features or methodologies of the tool:
a. Provides cost and schedule estimates of remediation projects.
b. Provides estimates of cost contingencies.
c. All results are historically based.
d. All results presented as probabilities so that uncertainty around estimate is known.

24. What type of program support is available to users?
Technical and analysis support available through telephone.

25. Does the model include economies of scale? **Y**
Results are based on actual project results.

26. Does the model include escalation factors? **N**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
The algoritms, databases and/or equations are available to the DOD subject to nondisclosure agreements and site licenses.

Date: 07/02/94

1. Company Name: **PRIMETIME**

2. Address: **650 E SWEDSFORD ROAD**
   WAYNE PA 19087

3. Contact: **RICHARD SEEL**
   Tel:(215)-964-8200; Fax:

4. Tool Name: **INSITE**
   Acronym: **INSITE**
   Description:
INSITE-Equipment, INSITE-Construction, INSITE-Cost-of-Ownership are parametric models. They are based on mathematical relationships. The models utilize these relationships to allow the user to create his/her own unique set of CERs. This process is called calibration and the result is a value called the reference factor. Once a project has been calibrated the user can perform many costing variations by simply modifying the reference factor or changing the products characteristics or entering different programmatic (qty, location, size, capability, etc.) data to simulate the project being estimated.

Fuzzy Operations Generator (FOG) is a tool which has been developed to write your own CERs.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **N**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **8** M Hard drive size: **120** M
    Special Needs:
Modem
Microsoft Windows 3.1

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:

Numerous DOE projects were used. Some classified.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
SEE USERS LIST

19. When was the original version developed? **1991**
When was the current version developed? **1994**

20. How many versions have been produced between the original and the current version? **4**
What release is the current version? **1**

21. Are your results portable to any industry standard format?
EXCEL, ASCII

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD? **N**

23. List the unique features or methodologies of the tool:
Insite integrates nine areas of disciplines into one universal model. These areas are:
1. Equipment
2. Construction
3. Software
4. Funding
5. Production
6. Mining (excavation)
FOG uses fuzzy logic to build specific CERs.

24. What type of program support is available to users?
800 line telephone support and on-line support.

25. Does the model include economies of scale? **Y**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments

The developer check all the CBS and Category Codes. This was done because the Insite models are relationship models and do not have a specific databases. There are sets of equations that are used in the models. Therefore, the user can develop a relationship for any type of product at any level of the CBS. However, this would require the user to have accumulated cost for these activities or have developed reference factors by using the Insite model calibration capability.

Developers Questionnaires

Date: 07/02/94

1. Company Name: **U.S. ARMY CORPS OF ENGINEERS**

2. Address: **20 MASSACHUSETTS AVE., N.W.**
   WASHINGTON DC 20314

3. Contact: **BERT JERMOTT**
   Tel:(202)-272-1240; Fax:

4. Tool Name: **TRI-SERVICES COST ENGINEERING SYSTEM**
   Acronym: **TRACES**
   Description:

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **Y**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **3,000**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **Y**

12. Is training provided? **Y**

13. Is training necessary? **Y** If yes cost? $ **1,000**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **640** Hard drive size: **50** **M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

19. When was the original version developed? **1970**
    When was the current version developed? **1993**

20. How many versions have been produced between the original and the current version? 0
What release is the current version? 0

21. Are your results portable to any industry standard format?
DBF

22. Could the program be updated/modified to a DOD requirement? Y
Are you willing to provide the source code to the DOD for modification by the DOD? N

23. List the unique features or methodologies of the tool.

24. What type of program support is available to users?
TELEPHONE

25. Does the model include economies of scale? N

26. Does the model include escalation factors? Y

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments

1. Company Name: **U.S. EPA RISK REDUCTION ENG LAB**

2. Address: **26 WEST MARTIN LUTHER KING**
   CINCINATTI OH 45268

3. Contact: **GORDON EVANS**
   Tel:(513)-569-7684; Fax:

4. Tool Name: **REMEDIAL ACTION COST ESTIMATING SYSTEM**
   Acronym: **RACES**
   Description:
RACES is a menu driven system that allows the user to model costs at a component level. The system is structured to cost out remedial technologies and actions at a site on a line-item approach from a unit cost, cost estimating relationship, and operations and maintenance item databases.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **N**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **Y**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **N**

12. Is training provided? **N**

13. Is training necessary? If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) **Y** , Mainframe: ,MAC ,Other
    RAM Requirements: **0 M** Hard drive size: **0 M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation?

16. Provide a comprehensive list of projects that were used to validate the tool:

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:

SEE USERS LIST

19. When was the original version developed? 0
When was the current version developed? 0

20. How many versions have been produced between the original and the current version? 0
What release is the current version? 0

21. Are your results portable to any industry standard format?
MCACES

22. Could the program be updated/modified to a DOD requirement?
Are you willing to provide the source code to the DOD for modification by the DOD? **Y**

23. List the unique features or methodologies of the tool:
a. Engineering based.
b. Works with MCACES

24. What type of program support is available to users?

25. Does the model include economies of scale? **N**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
This is an excerpt from the letter that accompanied the developers questionnaire:

Our work effort in developing a Superfund cost estimating tool began several years ago. Over time, the project evolved into a engineering-based order-of-magnitude estimating tool, designed to work within the M-CACES framework. Unfortunitly, the work effort was suspended over a year ago by our agency's Contract Management Division.

At the time the project was suspended, we had released a beta-version of the software for review. This version contained a fully functional operating shell and one technology cost module. Approximately 10 additional technology cost modules were in development at the time the work stopped.

Given the time and effort it would take to issue a new research contract, it's very unlikely that our laboratory will ever complete development of this tool.

1. Company Name: **WESTINGHOUSE HANFORD COMPANY**

2. Address: **P.O. BOX 1970**
   RICHLAND WA 99352

3. Contact: **J. K. PATTERSON**
   Tel:**(509)-376-0902**; Fax:

4. Tool Name: **RI/FS BASELINE COST METHODOLOGY**
   Acronym:
   Description:
   It is a system used for the determination of RI/FS costs required for input to the 5 year plan. It is a series of spread sheet (7) calcluations that determine the variable cost (# of boreholes, samples, etc.) and standard cost (work plans, FS reports, etc.) for 78 operable inits at Hanford.

5. Does this tool estimate environmental cost? **Y**

6. Does this tool estimate environmental schedule information? **Y**

7. Are the algoritms published or available to the DOD for evaluation? **N**

8. Is the database used to develop the algoritms availabe to the DOD for evaluation? **N**

9. See CBS and Category Codes

10. Enter the cost of the tool if it is sold commercially $ **0**
    not sold commercially

11. Is there tool support documentation (background material, functional descriptions, etc.) available? **Y**
    Is there a manual with the tool? **N**

12. Is training provided? **N**

13. Is training necessary? **Y** If yes cost? $ **0**

14. Check the applicable operating environment:
    IBM PC (or compatible) , Mainframe: ,MAC **Y** ,Other
    RAM Requirements: **0 M** Hard drive size: **0 M**
    Special Needs:

15. If selected will your company be willing to provide a copy of the tool to Capstone for further evaluation? **Y**

16. Provide a comprehensive list of projects that were used to validate the tool:
    78 mixed waste operable units at Hanford.

17. Provide a list of commercial users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

18. Provide a list of government users that we can contact in order to verify the tools capability/attributes:
    SEE USERS LIST

19. When was the original version developed? **1989**
When was the current version developed? **1993**

20. How many versions have been produced between the original and the current version? **4**
What release is the current version? **0**

21. Are your results portable to any industry standard format?
N/A

22. Could the program be updated/modified to a DOD requirement? **Y**
Are you willing to provide the source code to the DOD for modification by the DOD? **N**

23. List the unique features or methodologies of the tool:

24. What type of program support is available to users?

25. Does the model include economies of scale? **Y**

26. Does the model include escalation factors? **Y**

27. Composite Advantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

28. Composite Disadvantages:
This information will be provided in the tool evaluation report during Phase II of this contract.

29. Composite Limitations:
This information will be provided in the tool evaluation report during Phase II of this contract.

30. Comments
This is a methology to estimate RI/FS cost and is not a piece of software.

APPENDIX C

USER QUESTIONNAIRE AND RESPONSES

CAPSTONE Corporation
1800 Diagonal Road, Suite 355
Alexandria, VA 22314
(703) 683-4220, Fax (703) 683-4430

[Name and address of Software User]

Date: (Revised May 31, 1994)

Dear [Name of User],

The Department of Defense (DoD) has contracted with CAPSTONE Corporation, under contract number MDA903-94-C-0043, to identify, collect and critically evaluate selected environmental cost engineering and analysis tools. These tools include unit cost models, engineering studies, project management and application software. The selected tools would be provided as a reference list to help DoD program and project managers in their estimation process for determining the environmental costs of major defense acquisition programs.

These tools will be compiled in a report to be widely distributed within the DoD acquisition, environmental and cost analysis communities. The list will also be made available to the public.

Initially, we are screening existing cost engineering and analysis tools to decide which can be considered for further evaluation. In order to accomplish this task, we have contracted the tool developer for information pertaining to their product. However, we need to obtain specific information that only a user can provide. Your name has been provided by the tool developer.

Please complete the attached questionnaire and return it to the CAPSTONE Corporation by DATE. If you prefer, you may use your own format in responding, correlating your responses to the numbers on the questionnaire/check-off list provided. The use of a FAX machine is encouraged.

Thank you for your cooperation,

_____
Project Manager

Enclosures

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name:_____

2. Address:_____

3. Type of business/organization:_____

4. Contact:_____Telephone:_____
FAX: _____

5. Position: _____

6. Tool Name:_____

7. How long have you used this tool?_____

8. List the products that you have estimated with this tool:

_____
_____
_____

(Please use additional sheets of paper, if required.)

9. Approximately how many products has the tool been used to estimate? _____

10. What is the range of product values that has been estimated using the tool? $ _____ low
$ _____ high.

11. What type of accuracy does the tool exhibit? +/- _____ per cent.

12. Is the tool well documented? Yes/ no _____. If no, please comment: _____
_____
_____

(Please use additional sheets of paper, if required.)

13. Is the tool user friendly? Yes/no _____. If no, please comment:_____
_____
_____

(Please use additional sheets of paper, if required.)

14. Is training necessary for this tool? Yes/no____. If yes, please comment:_____
_____
_____

15. Is the depth of coverage commensurate with the input requirements? Yes/no ____. If no, please comment:_____

_____

_____

(Please use additional sheets of paper, if required.)

16. Are the input parameters easy to obtain and define? Yes/no ____. If no, please comment:

_____

_____

_____

(Please use additional sheets of paper, if required.)

17. Do the input parameters define ____almost all; ____some; ____few of the project's total cost?

18. Do you have to add costs to the results in order to calculate the projects total costs? Yes/no ____. If yes, which costs?_____

_____

_____

(Please use additional sheets of paper, if required.)

19. Please list some of the tool's advantages:_____

_____

_____

(Please use additional sheets of paper, if required.)

20. Please list some of the tool's disadvantages:_____

_____

_____

(Please use additional sheets of paper, if required.)

21. Please list some of the tool's limitations:_____

_____

(Please use additional sheets of paper, if required.)

22. Have you performed your own validation of the tool? Yes/no ____. If yes, can you provide information pertaining to this validation? Yes/no ____. If yes, please attach it to this questionnaire.

USER RESPONSES

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: U.S. Army Corps of Engineers, South Atlantic Division

2. Address: 77 Forsyth Street, NW, Atlanta, GA 30335-6801

3. Type of business/organization: Government Construction

4. Contact: Joel Clifton Telephone: (404) 331-6827
FAX: (404) 331-6677

5. Position: Civil Engineer /Cost Engineer

6. Tool Name: "Micro-Computer Aided Cost Engineering Support System"

7. How long have you used this tool?" 8 years"

8. List the products that you have estimated with this tool:
"Construction Cost Estimates for Forest Lake Design. My primary responsibility is to review of District Projects, I have reviewed hundreds of In-House and AE military construction cost estimates and In-House Civil works Construction Cost estimator processed on MCACES and MCACES Gold"
(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? "1000+ projects"

10. What is the range of product values that have been estimated using the tool? $25K low $ 250M high.

11. What type of accuracy does the tool exhibit? +/- _____percent. "This is much more dependant on the human estimates than the tool."

12. Is the tool well documented? Yes/no "Yes." If no, please comment._____

_____

_____

(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "Yes." If no, please comment.
"MCACES Gold user friendliness could be and will be improved when this system is put into windows format."

_____

(Please use additional sheets of paper, if required)

14. Is training necessary for this tool?Yes/no "Yes". If yes, please comment.
"The MCACES Gold system is necessarily very involved in order to accomplish all of the requirements of Military and Civil works construction cost estimating"

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no ? If no, please
comment_____

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no____If no, please comment.
"The project design determines input parameters. The estimation must determine proper input when the design is lacking."

(Please use additional sheets of paper, if required)

17. Do the input parameters define ? almost____some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no ? If yes, which costs? "All costs associated with a project can be input to the MCACES cost estimate."

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Variable format, access to various data bases for material, labor, equipment/crews, various summaries for owner, contract, direct, indirect sub contract, feature, facility etc., CSI, codes of accounts"

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages:"Long learning curves, some what difficult to use, but for expert user probably only tool which will do every thing we need to do."

---

21. Please list the tool's limitations: "Primarily designed for government work in to accordance with cost engineering regulations for Military and Civil works construction. Not as easy to use, ideal system for a contractor."

(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "No." If yes, can provide information pertaining to this validation ?Yes/no____. If yes, please attach to this.

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: Morrison Knudsen

2. Address: 180 Howard Street, San Francisco, CA 94105

3. Type of business/organization: Design & Construction

4. Contact: Fred Feizollahi Telephone: (415) 442-7600
FAX: (415) 442-7673

5. Position: Project manager

6. Tool Name: "System Cost model (What Cost)"

7. How long have you used this tool? "Being integrated into one model pieces available".

8. List the products that you have estimated with this tool:
"Capital costs for Radioactive Waste Facilities, Operating Costs for Radioactive Waste Facilities"
(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? 30

10. What is the range of product values that have been estimated using the tool? $ 9M low $ 25B high.

11. What type of accuracy does the tool exhibit? +/- 30 percent." This is much more dependant on the human estimates than the tool."

12. Is the tool well documented? Yes/no "Yes." If no, please comment._____

_____

_____
(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "Yes." If no, please comment.

_____

_____
(Please use additional sheets of paper, if required)

14. Is training necessary for this tool?Yes/no "Yes". If yes, please comment.

"A brief review of the instructions would be necessary user should be able to use program after about 4 hours of self-taught"

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no "Yes" If no, please comment

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no "Yes" If no, please comment.

"For those for which the program is intended."

(Please use additional sheets of paper, if required)

17. Do the input parameters define X almost____some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no "No" . If yes, which costs? "Have option to add cost if desired".

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Can produce reports which can give capital cost, operating cost, numbers of workers, pre-operational costs for some 35 treatment modules"

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages:"Accuracy is dependent on data placed in database which is currently only accurate to +30%."

21. Please list the tool's limitations: "Can handle only 19 waste systems types and limited to a prescribed processing scheme."

(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "Yes."If yes, can you provide information pertaining to this validation ?Yes/no "Yes." If yes, please attach to this questionnaire.

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: Morrison Knudsen

2. Address: 180 Howard Street, San Francisco, CA 94105

3. Type of business/organization: Design & Construction

4. Contact: Fred Feizollahi Telephone: (415) 442-7600
FAX: (415) 442-7673

5. Position: Project manager

6. Tool Name: "BUM (Bottoms Up Model))"

7. How long have you used this tool ? "2 Years".

8. List the products that you have estimated with this tool:
"Capital Costs / Full Time-workers Operating Costs/Full Time- workers Decon /Decommissing Cost "
(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? 60

10. What is the range of product values that have been estimated using the tool? $ 2M low $ 2B high.

11. What type of accuracy does the tool exhibit? +/- 30 percent." This is much more dependant on the human estimates than the tool."

12. Is the tool well documented? Yes/no "Yes" If no, please comment._____

_____

_____

(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "No." If no, please comment. "Must know the basis of the program in order to properly obtain the values desired."

_____

(Please use additional sheets of paper, if required)

14. Is training necessary for this tool ? "Yes/no "Yes". If yes, please comment.
"Must have good knowledge of Lotus 3.1"

_____

_____

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no "Yes" If no, please comment_____

_____

_____

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no "Yes" If no, please comment.

"For those for which the program is intended."

_____

(Please use additional sheets of paper, if required)

17. Do the input parameters define ____almost_ X _some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no "No". If yes, which costs? "Have option to add cost if desired".

_____

_____

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Good starting point of estimating treatment costs of Radioactive Waste"

_____

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages: "Not very user friendly, gives only three data points and if values between points are desired they must be estimated."_____

21. Please list the tool's limitations: Range of effectiveness is limited extrapolation beyond cure ends is not recommended."

(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "Yes." If yes, can you provide information pertaining to this validation ?Yes/no "Yes." If yes, please attach to this questionnaire.

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: The City of San Diego Water Utilities Department

2. Address: 600 B Street, Suite 800, San Diego, CA 92101

3. Type of business/organization: City Government

4. Contact: Iraj Asghazadeh Telephone: (619) 235-1953
FAX: (619) 533-5176

5. Position: Associate Engineer - Civil

6. Tool Name: "Micro-Computer Aided Cost Engineering Support System" (Composer Gold Cost Estimating Program)

7. How long have you used this tool ? "2 Years".

8. List the products that you have estimated with this tool: " Pipe Line Encasement"

(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? +50

10. What is the range of product values that have been estimated using the tool? $ 70K low $ 5M high.

11. What type of accuracy does the tool exhibit? +/- 75 percent.

12. Is the tool well documented? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "Yes" If no, please comment. "But if you work with it and will be easier if in windows"

(Please use additional sheets of paper, if required)

14. Is training necessary for this tool ? "Yes/no "Yes". If yes, please comment. "We have training one to two times a year."

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no "No" If no, please comment The database at this time is not what group job needs. Data for our needs, our new or modified.

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no "Yes" If no, please comment.

"An input of 3 or more vendors in the database help for an average"

(Please use additional sheets of paper, if required)

17. Do the input parameters define ____almost_ X _some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no "Yes". If yes, which costs? " Lump-sum for an item and can be modified"

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Structure of assembly & project"

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages: "Materials not in database that is use in group job, Reports are two detailed."

21. Please list the tool's limitations: "Constant up-date to the database."
(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "Yes." If yes, can you provide information pertaining to this validation ?Yes/no "Yes." If yes, please attach to this questionnaire.

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: U.S. Corps of Engineers CEMRD-ED-HC

2. Address: 12565 West Center Road, Omaha, NE 68130

3. Type of business/organization: Government

4. Contact: Jim Peterson Telephone: (402) 221-7443
FAX: (402) 221-7561

5. Position: Civil Engineer

6. Tool Name: "Remedial Action Cost Engineering & requirements systems (RACER)

7. How long have you used this tool ? "1 Years".

8. List the products that you have estimated with this tool: "Program Estimate for Remediation at Kwajalein Island"

(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? 1 for my application

10. What is the range of product values that have been estimated using the tool? $ 5M low $ 6M high. (for my application)

11. What type of accuracy does the tool exhibit? +/- 25 percent. (only a rough guess on my part)

12. Is the tool well documented? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

14. Is training necessary for this tool ? "Yes/no "Yes". If yes, please comment. "A one or two day training course greatly enhances a user to properly apply RACER defaults"

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no "Yes. If no, please comment.

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no "Yes" If no, please comment.
"New windows version makes the system very user friendly."

(Please use additional sheets of paper, if required)

17. Do the input parameters define ____almost_____some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no "No". If yes, which costs? "

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Very good tool for early stage estimating for programming purposes, RACER is well documented."

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages: "Should be used with caption beyond 30% project design stage."

21. Please list the tool's limitations:
(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "No." If yes, can you provide information pertaining to this validation ?Yes/no "No." If yes, please attach to this questionnaire.

User Cost Engineering and Analysis Tool Questionnaire

1. Company Name: U.S.Department of Interior, Office of Environmental Policy & Compliance

2. Address: 1849 C Street, NW, MS 2340, Washington, DC 20240

3. Type of business/organization: Federal Government Agency

4. Contact: John Craynon Telephone: (202) 208-7555
FAX: (202) 208-6970

5. Position: Environmental Protection Specialist

6. Tool Name: "Remedial Action Cost Engineering & Requirements Systems (RACER)

7. How long have you used this tool ? "2 Years".

8. List the products that you have estimated with this tool: (What does this mean exactly?) "Evaluating tool for DOI use"

(Please use additional sheets of paper, if required)

9. Approximately how many products has the tool been used to estimate? 10 Evaluations

10. What is the range of product values that have been estimated using the tool? $ 100K low $ 10M high. (for my application)

11. What type of accuracy does the tool exhibit? +/- 15 percent. (only a rough guess on my part)

12. Is the tool well documented? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

13. Is the tool user friendly? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

14. Is training necessary for this tool ? "Yes/no "Yes". If yes, please comment.
"To ensure that users understand the power and limitations"

(Please use additional sheets of paper, if required)

15. Is the depth of coverage commensurate with the input requirements? Yes/no "Yes. If no, please comment.

(Please use additional sheets of paper, if required)

16. Are the input parameters easy to obtain and define? Yes/no "Yes" If no, please comment.

(Please use additional sheets of paper, if required)

17. Do the input parameters define _X_almost_____some____few____of the projects total cost?

18. Do you have to add costs to the results in order to calculate the project's total cost? Yes/no "No". If yes, which costs?

(Please use additional sheets of paper, if required)

19. Please list the tool's advantages: "Ease of use; engineering basis, customization possibilities."

(Please use additional sheets of paper, if required)

20. Please list the tools disadvantages:"Should be used with caption beyond 30% project design stage."Requires a lot of knowledge of a site to get an accurate cost estimate; ie., the tool is very conservative and you get a high estimate.

21. Please list the tool's limitations: "Few"
(Please use additional sheets of paper, if required)

22. Have you performed your own validation of the tool? Yes/no "No." If yes, can you provide information pertaining to this validation ?Yes/no. If yes, please attach to this questionnaire.

APPENDIX D

CRITERIA USED TO EVALUATE ENVIRONMENTAL MANAGEMENT COST TOOLS

CRITERIA USED TO EVALUATE ENVIRONMENTAL MANAGEMENT COST TOOLS

General

Criterion: Cost models algorithms and database information are current.
Inquiry: Have the algorithms been updated to reflect current technology applications and concepts? Has the data in the database been updated to reflect actual performance?

Criterion: Available (to the DoD cost community; not a "Black Box").
Inquiry: Is the developer willing to provide the DoD with the algorithms and/or equations that were used to generate the costs that the model calculates? Is the developer willing to provide the DoD with a copy of the database(s)?

Criterion: Valid.
Inquiry: Have the algorithms and/or equations been proven to produce valid results? Have the database sources been verified? Have they been validated by an independent source? Has a user performed an independent validation?

Criterion: Hardware/system requirements, etc. are compatible.
Inquiry: The DoD's main requirement is that the tool is a DOS based system

Cost Model Algorithms and Equations are:

Criterion: Logical (clear rationale).
Inquiry: Are the algorithms and equations applied in a logical and orderly manner? Do they follow an approach commensurate with standard estimating techniques and approaches?

Criterion: Comprehensive (describes cost driving parameters).
Inquiry: Does the tool include all the costs associated with the applicable CBS and/or cost category? Do additional costs have to be added in order to develop all the costs associated with the CBS element and/or cost category?

Criterion: Documented.
Inquiry: Does the documentation include all assumptions and exclusions for each CBS element? Does the documentation include a users manual for model operation?

Criterion: Analytical flexibility is sufficient.
Inquiry: Does the tool provide the capability to estimate various alternatives and options for a project? Can the user perform "what-if" analyses?

Criterion: Cost model is user friendly.
Inquiry: Does the tool have easy to use menus, help screens, key stroke definitions and the capability to move around the screen(s) in a logical order?

Criterion: Software price and availability.
Inquiry: Is the software available to the DoD at fair market price?

Criterion: Tool uses a mature technology.
Inquiry: Have the algorithms been updated to reflect current technology applications and concepts?

Cost Database

Criterion: Organized (in a logical hierarchical progression).
Inquiry: Is the database organized in a logical and orderly manner? Can it be readily accessed and updated?

Criterion: Comprehensive (describes cost driving parameters).
Inquiry: Does the database provide sufficient descriptive information which addresses cost driving considerations.

Criterion: Training available.
Inquiry: Does the developer offer training for the tool?

Criterion: Manual well documented.
Inquiry: Has a manual been developed, and is it well documented?

Scope of Tool

Criterion: Applicable EM CBS elements are addressed for intended coverage (e.g., remedial assessment estimating model or database includes all major elements of CBS in the technical proposal).
Inquiry: Does the tool include all the applicable CBS sub-elements necessary to insure coverage of the subject element?

Criterion: Applicable EM category code elements are addressed for intended coverage (e.g., cleanup estimating tool includes all category codes in the technical proposal).
Inquiry: Does the tool include all the applicable category codes that are necessary in developing a complete estimate?

Criterion: Depth of coverage is commensurate with input requirement
Inquiry: Does the tool utilize all input information to calculate an estimate or are there additional inputs that have no cost effect?

Criterion: Cost model scope description provides assumptions of functional costs included/excluded (architectural and engineering design, program management and administration, and indirect costs).

Inquiry: Does the documentation include assumptions pertaining to the application of rates and percentages for specific functions?

Criterion: Tool addresses economies of scale.

Inquiry: Does the tool modify costs as the size of the project increases or decreases or is the cost per dimension applied the same independent of size?

Criterion: Tool addresses synergistic effects of conducting multiple projects in one program (e.g. only one community plan for the site).

Inquiry: Are common functions (community relations, EA support, etc.) estimated independently or are the costs amortized from a common pool?

Application to MDAPs

Criterion: Tool can be used for parametric estimates during MDAP conceptual process by Milestone I, II or III).

Inquiry: Does the tool utilize project parameter (dimensions, quantities, size, etc.) data as inputs?

Criterion: Tool can be used to estimate EM costs associated with each MDAP life cycle phase.

Inquiry: Does the tool include all phases of an MDAPs life cycle?

Criterion: Tool can be used for independent estimates.

Inquiry: Does the tool have sufficient versatility to perform trade-off analyses? Is it comprehensive enough to generate a complete estimate?

Criterion: Tool is applicable for detailed quantity take-off estimate.

Inquiry: Is the tool based on unit prices and quantity data entries?

APPENDIX E

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