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No. 1110-3-1301

30 December 2016

Engineering and Design
ENVIRONMENTAL REMEDIATION AND REMOVAL PROGRAMS
COST ENGINEERING

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DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

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Engineering and Design
ENVIRONMENTAL REMEDIATION AND REMOVAL PROGRAMS COST
ENGINEERING

1. Purpose. A revised publication is issued to reflect up-to-date information and references. This engineer regulation (ER) provides specific policy and guidance for the development of cost estimates in support of projects assigned to the U.S. Army Corps of Engineers (USACE) for the remediation of sites contaminated with hazardous waste, radioactive materials, and munitions and their constituents. Specifically written to address cost engineering for the identification and cleanup of contaminated defense and commercial sites throughout the nation by or for the Department of Defense within its established remediation and removal requirements and authorities, the content of this document applies to hazardous substances remediation, hazardous waste remediation, radioactive waste remediation, munitions response actions, and chemical warfare materials responses. Herein these areas will be collectively referred to as 'Environmental Remediation and Removal Programs'. This regulation does not apply to civil works-based ecosystem restoration projects, environmental compliance and monitoring for civil works projects, or environmental regulatory efforts, which are addressed under different regulations, unless those projects or efforts include remediation and removal of contamination. This regulation complements the general cost engineering policies and guidance in ER 1110-1-1300, Cost Engineering Policy and General Requirements.

2. Applicability. This regulation applies to all Headquarters, U.S. Army Corps of Engineers (HQUSACE) elements, and all USACE elements having responsibility for developing cost estimates for environmental remediation and removal programs projects assigned to USACE.

3. Distribution Statement. This publication is approved for public release; dissemination is unlimited.

This regulation supersedes ER 1110-3-1301, dated 10 March 1999.

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4. References.

- a. Public Law (PL) 94-580, Resource Conservation and Recovery Act (RCRA) of 1976 as amended by PL 98-616, Hazardous and Solid Waste Amendments of 1984
- b. PL 96-510, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by PL 99-499, Superfund Amendments and Reauthorization Act of 1986
- c. Department of Energy (DOE) G 413.3-21, Cost Estimating Guide
- d. Environmental Protection Agency (EPA) 540-R-00-002, OSWER 9355.0-75, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study DOD Manual Number 4715.20, Defense Environmental Restoration Program (DERP) Management
- e. Department of Defense (DOD) Instruction 4715.07, Defense Environmental Restoration Program (DERP)
- f. DOD Manual Number 4715.20, Defense Environmental Restoration Program (DERP) Management
- g. Unified Facilities Criteria (UFC) 3-740-05, Handbook: Construction Cost Estimating
- h. ER 5-1-11, USACE Business Process
- i. ER 200-1-5, Policy For Implementation and Integrated Application Of The USACE Environmental Operating Principles (EOO) And Doctrine
- j. ER 200-3-1, Formerly Used Defense Sites (FUDS) Program Policy
- k. ER 385-1-92, Safety and Occupational Health Requirements For Hazardous, Toxic, and Radioactive Waste (HTRW) Activities
- l. ER 415-1-16, Fiscal Management
- m. ER 1110-1-12, Quality Management
- n. ER 1110-1-1300, Cost Engineering Policy and General Requirements

- o. ER 1110-2-1302, Civil Works Cost Engineering
- p. ER 1110-3-1300, Military Programs Cost Engineering
- q. ER 1165-2-132, HTRW Guidance for Civil Works Projects

5. Policy. The cost expertise, cost databases, estimating programs, and responsibility and accountability for environmental remediation and removal programs cost engineering must be centralized in the cost engineering office per ER 1110-1-1300. All environmental remediation and removal programs project cost estimates must be prepared in accordance with this regulation and all referenced regulations. The term 'Hazardous, Toxic and Radioactive Waste (HTRW)' is expanded to 'environmental remediation and removal programs' to ensure consistency with related policy and guidance. The policy contained in this document is intended to cover cost engineering performed by USACE regardless of specific program, e.g. civil works, Formerly Used Sites Remedial Action Program (FUSRAP), EPA/Superfund, Army Base Realignment and Closure (BRAC), Defense and State Memorandum of Agreement (DSMOA), Army Environmental Command (AEC), G-3 Readiness, FUDS, and additional work for others.

6. General.

a. Estimate Compliance. Environmental remediation and removal programs project cost estimates must be prepared for project scopes of work that comply with environmental laws, such as the CERCLA and the RCRA. These laws require extensive federal, state, and public coordination of the projects to which they apply. Environmental remediation and removal programs cost estimates prepared for others must also comply with the procedures required by those entities, such as the DOE and the EPA. These agencies have developed unique program procedures for implementing the public laws that apply specifically to their projects, such as DOE G430.1 and EPA Guidance 540-R-D-/002. The seven 'Environmental Operating Principles' listed in ER 200-1-5 must be considered and incorporated in the scope of work for any original or revised work to be carried out for USACE.

b. Contracting Methods. Environmental remediation and removal programs projects are administered using a variety of contracting methods including performance based, fixed price, and cost reimbursable contracts. Examples of contracts include, but are not limited to, environmental remediation services (ERS) contracts, preplaced remedial action contracts (PRAC), multiple award remediation contracts (MARC), and rapid response contracts. Increasingly, environmental remediation and removal programs cleanup work is being competed among a pool of contractors by award of a task order.

c. Environmental Remediation and Removal Programs Characteristics.

Environmental remediation and removal programs estimates have unique characteristics compared with estimates for other types of USACE projects, for example, building construction. Accordingly, the cost engineer must pay particular attention to concerns such as the following:

(1) Probability of unforeseen site conditions or incomplete site characterization due to additional underground contamination unforeseen at time of design, which results in higher contingencies,

(2) Production rates that are generally lower due to stringent health and safety requirements, and

(3) Indirect costs and contractor risk that are typically, and can be significantly, higher for environmental remediation and removal programs projects than for conventional civil works or military projects.

7. Project Phases. USACE may not be involved in all phases of a project. Other agencies may hire USACE to support selected phases of a project.

a. CERCLA Phases. Many existing environmental remediation and removal programs projects are remediated under CERCLA, which defines distinct and legally required phases. A comparison of CERCLA and RCRA terminology is located in Appendix B. Additional environmental remediation and removal programs project phases may exist that are not specifically addressed in CERCLA, such as Interim Removal Action (IRA.) CERCLA project phases include the following:

(1) Preliminary Assessment. The preliminary assessment (PA) is the initial evaluation of a potential environmental program site. The purposes of the PA are to determine if a hazardous condition exists, whether there is risk to human health and the environment, if there is a need for immediate removal, and if there is a need for additional study. The PA is completed with readily available information gained from visual site inspection, reviews of records, interviews with site personnel, and so forth.

(2) Site Inspection. If the PA indicates the existence or possible existence of contamination, a site inspection (SI) is initiated to perform a more detailed investigation, to include initial sampling and testing. The SI is concluded with one of three decisions, as follows:

(a) The site does not require environmental program remedial action,

(b) An immediate corrective action is required, or

(c) Additional study is needed.

(3) Remedial Investigation/Feasibility Study. The remedial investigation (RI)/Feasibility Study (FS) is a combined study process to characterize the contamination and develop approaches to remediate the site. The RI must identify and assess the following:

(a) The source and extent of the contamination,

(b) The possible pathways for migration or release to the environment, and

(c) The risk to human health and the environment.

(4) The FS must yield a number of specific engineering or remedial action alternatives. The FS must also provide the following:

(a) A comparative analysis of the remedial cost, and

(b) The engineering feasibility, health risk, and environmental impact of each major alternative.

(5) Record of Decision. The record of decision (ROD) is the formal agreement on the method of remedial action that documents the selection of the best alternative studied in the FS phase. This ROD process results in a signed and legally binding document that contains responsibilities, RA method and anticipated cost, schedules, cost sharing plans, and penalties for noncompliance.

(6) Remedial Design. Remedial design (RD) is the engineering design process that results in work plans, drawings, or specifications. The RA and O&M cost estimate is developed from the design documents.

(7) Remedial Action. RA is the actual site cleanup. Typically, this is the construction phase. The RA phase also includes any O&M (short term) during construction.

(8) Long-Term Operation and Maintenance. Long-term O&M occurs after completion of construction.

b. RCRA Phases. Environmental remediation and removal programs projects not covered by CERCLA may fall under other applicable public laws such as RCRA. In general, the RCRA identification, study, decision, design, and RA processes are similar to CERCLA and have similar cost engineering implications (refer to Appendix B for a listing of the RCRA phases.)

c. Other Phases. Environmental remediation and removal programs projects may also require other project phases such as those required by the Defense Environmental Restoration Plan (DERP) Installation Restoration Program (IRP) and the FUDS programs. Examples of these phases are the Interim Removal Action phase in which highly contaminated media must be removed quickly and the long-term management (LTM) phase where management and monitoring of the protectiveness of the remedy must take place over an extended period of time.

8. Roles and Responsibilities.

a. Environmental and Munitions Center of Expertise (EM CX). The function of the EM CX is to support USACE, the Army and the Nation for environmental and munitions response missions across the world protecting public health and the environment. Specific to environmental remediation and removal programs cost engineering, the EM CX provides environmental cost engineering support for all program categories to USACE and the AEC, focuses on both development and QA of FUDS Cost-To-Complete (CTC) estimates, develops and updates environmental cost engineering tools such as RACER, participates on the environmental Unit Price Book (UPB) technical team, participates on the Remedial Action Cost Engineering Requirements (RACER) Steering Committee and Technical Review Group, and conducts Environmental Liability, CTC process, and RACER training. Furthermore, the EM CX provides cost engineering services to assist in the documentation preparation required by environmental remediation and removal programs, including preparing site specific files Corps-wide in accordance with EPA record keeping guidance for federal agencies, managing the cost documentation contract for EPA, performing QA reviews on all cost packages for EPA, providing technical assistance on cost documentation and record management procedures for all programs, testifying as an expert witness for Corps costs upon request by the U.S. Department of Justice, preparing draft technical policy guidance, and participating on working committees relevant to environmental remediation and removal programs requirements.

b. Division Cost Engineer. The division cost engineer is responsible for oversight of district environmental remediation and removal programs cost engineering quality control and quality assurance.

c. Project Delivery Team. USACE is committed to effective management of the scope, quality, cost, and schedule of each project by using project delivery teams (PDTs). ER 5-1-11 presents the requirements for establishing a PDT for all projects. A project manager (PM) leads each PDT, which is composed of representatives from each discipline necessary for successful development and execution of all phases of the project. The PDT may consist of individuals from more than one USACE district and may include specialists, consultants/contractors, stakeholders, or representatives from other federal and state agencies. Team members are chosen for their skills and abilities to successfully execute a quality project. The project cost estimator must be an integral member of the PDT.

d. Chief, Cost Engineering. The chief of each cost engineering office is responsible to ensure cost engineers support the PDT. The chief must ensure that all appropriate estimating activities, including site visits prior to and during construction, have been adequately funded and scheduled by the PM. When cost engineering products are to be obtained by architect-engineer (A-E) contracting, the chief must ensure that the A-E contract statement of work requires the A-E to comply with USACE estimating policies, including but not limited to this regulation and ER 1110-1-1300.

e. Cost Engineer. The cost engineer has an important team role in determining costs and schedules of environmental remediation and removal projects assigned to USACE, as well as providing any other cost support to the PDT. The cost engineer member of the PDT must provide the labor estimate for cost engineering product development and must develop the cost estimate with input from PDT members. The cost engineer must be involved in the PDT partnering and decision-making process with the contractor and customer in the development of project scope and assumptions, which become the basis for the government's estimate of cost and the contractor's proposal target contract cost. The cost estimate must be recognized as a major management resource for establishing, monitoring, and managing costs from the study phase through project completion. The cost engineer is a resource to the PDT in all matters pertaining to cost and must support the PDT as follows:

(1) Develop estimating instructions to the contractor or A-E, including target RA and O&M costs for establishment of contractor fees, when applicable,

(2) Prepare or review all environmental remediation and removal programs cost estimates,

(3) Provide cost support for each project phase, examples of which are shown below:

(a) Preliminary Assessment. A site requiring a PA may not require further action, and a significant time period may occur between the PA and the SI. Thus, limited involvement of the cost engineering office during the PA is typical. There is no detailed remediation cost estimate typically required for this phase. However, for time critical projects, the PM may involve the cost engineering office, in which case, the role of the cost engineer could be the preparation or review of estimates for any immediate removal actions necessary during the PA phase. This involvement must enhance the preparation or review of the RA and O&M estimates in subsequent phases and must ensure that cost engineers have an historical knowledge of the project to assist them in preparation of quality cost estimates.

(b) Site Inspection. A site requiring an SI may not require further action, and a significant time period may occur between the SI and the RI/FS. Thus, a limited involvement of the cost engineering office during the SI is typical. There is generally no detailed remediation cost estimate required for this phase. However, for time critical projects, the PM may involve the cost engineering office in which case the role of the cost engineer during the SI is analogous to the role during the PA, preparation or review of cost estimates for any immediate removal action required at the site. Thus, the cost engineer should gain an understanding of the history of the site.

(c) Remedial Investigation/Feasibility Study. The cost engineer must be involved during the RI/FS phase in preparation or review of the cost estimates for the specific RA alternatives and the comparative life cycle cost analysis of each alternative. If the cost engineering office has not participated during the PA or SI process, time must also be allotted to the cost engineer to gain an understanding of what contamination has occurred at the site, become familiar with the site geography, constraints, and so forth. The role of the cost engineer during the RI phase is similar to the role during the PA and SI phases, as described in the paragraphs above. During the FS phase however, enough site information should have been collected in order for the cost engineer to develop a project cost estimate for RA and O&M for each alternative. For this phase, life cycle cost software or other life cycle cost techniques may be useful. The discount rate and estimated life cycle duration of each alternative are important considerations in the development of the present worth cost of each alternative for comparative purposes. The project cost estimate during the FS phase typically includes all capital RA costs, including short term O&M during RA, and all O&M (long-term after RA) costs. A variety of software (e.g., spreadsheet, Micro-Computer Aided Cost Estimating System (MCACES,) RACER) can be employed in preparing estimates used in feasibility studies. When using MCACES, the latest HQUSACE approved version must be used. When using RACER, the latest version approved by the agency USACE is supporting must be used.

(d) Record of Decision. The cost engineering office must be involved during the development of the ROD to verify that the cost information developed in the RI/FS for the selected alternative is included, has undergone quality control, and has been updated if necessary to include all costs required for the selected alternative.

(e) Remedial Design. During the RD, the cost engineering office must prepare or review the RA and O&M cost estimate with the design information provided such as work plans, drawings, and specifications. At the end of this phase, the Independent Government Estimate (IGE) for procurement must be prepared by the cost engineer.

(f) Remedial Action. The cost engineering office must be involved during the RA to prepare or review cost estimates for modifications, or other contractual documents during construction.

(g) Operation and Maintenance. The cost engineering office must be involved during O&M to prepare or review cost estimates for modifications, or other contractual documents generated during long-term O&M.

(h) Long Term Management. The cost engineering office must be involved during LTM to prepare or review cost estimates for modifications, or other contractual documents generated during long term management.

9. Work Breakdown Structures. The cost engineering office must use the latest Corps approved activity-based HTRW RA Work Breakdown Structure (RA WBS) and O&M Work Breakdown Structure (O&M WBS), to categorize environmental remediation and removal programs costs in order to standardize cost estimate data. The cost engineering office must coordinate with the PDT to ensure contractor or A-E compliance with use of the HTRW RA WBS and the HTRW O&M WBS. This standard WBS must be in addition to any other project-specific cost breakdown required by the PDT. The cost engineering office must prepare or review cost data for upward reporting for cost reports when required. Refer to Appendix C for the HTRW RA WBS and Appendix D for the HTRW O&M WBS.

10. Quality Management Plan. Cost engineering offices must follow the established USACE guidance for quality management systems, for example, that contained in ER 1110-1-12. Environmental remediation and removal programs review guidance must also be followed when it is more stringent than USACE review guidance. Only qualified cost engineers must be used for quality control (QC) or quality assurance (QA) reviews.

a. District Cost Quality Management Plan Responsibilities. The district Quality Control Plan (QCP) and Quality Assurance Plan (QAP) are both written plans that define how quality control and quality assurance must be executed for products. The initial plans are prepared by the PDT during the project planning phase and are implemented during the project execution phase. The cost engineering office must be responsible for QC of the environmental remediation and removal programs cost estimates prepared in-house and QA for those prepared by A-Es and others. In the district's QA role, the requirements of the cost engineering office are to ensure that the A-E's cost engineers are qualified to prepare the environmental remediation and removal programs cost estimate; to ensure that the cost estimate is prepared in accordance with the A-E's QCP; to approve the A/E QCP for preparation of cost estimates; and that the A-E accomplishes and documents a thorough independent technical review of the cost estimate. The district's QA audit may resemble a technical review, except that it is not generally as detailed as a typical QC technical review. To assure contract compliance, the district performs QA on all RA and O&M cost estimates developed by A-Es or other contractors.

b. Division Cost Responsibilities. The division cost engineer is responsible for ensuring that district QMPs appropriately address cost engineering reviews and for auditing districts' cost engineering QA/QC programs.

c. Environmental and Munitions Center of Expertise Cost Responsibilities. The EM CX must review and approve all environmental remediation and removal programs cost estimates prior to their submission to the customer. This includes reviewing and approving the portions of civil works cost estimates pertaining to environmental/HTRW construction/remediation that are submitted to the Cost Engineering Mandatory Center of Expertise in accordance with civil works review policy and guidance.

11. Types of Cost Estimates.

a. Preliminary Budget Estimates. All available databases and software such as the RACER software, or other sources, and parametric estimating procedures may be used to develop a preliminary budget estimate of costs. CTC estimates are preliminary budget estimates that can be prepared at any phase of the project to estimate the remaining costs of the project to completion. CTC estimates may include the cost of site inspection, remedial investigation, feasibility study, and RD as well as RA, O&M, and LTM costs. All assumptions and limitations must be clearly documented.

b. Feasibility Study Comparison Estimates. The FS phase of an environmental remediation and removal programs project compares the technical and cost merits of

alternative RA methods. Project adjusted historical data, parametric estimating, detailed quantity take-off estimating, and life cycle cost (LCC) techniques may be used to compare the present worth costs of competing technologies. Capital RA, including short term O&M and long-term O&M costs must be included in all LCC comparisons. FS estimates for remediation must include the estimated capital RA contract cost priced currently for the year the study is done; design and construction contingencies; construction management supervision and administration (S&A); RD cost; and other appropriate costs. The estimate must also include the estimated yearly long-term O&M contract cost; contingencies; S&A; and other annual recurring costs. Escalation is not applied to capital RA or long-term O&M costs. However, long-term O&M costs are discounted for the “present worth” analysis. Capital (RA) costs should be discounted if construction is expected to take more than one year. Present worth cost based on the capital cost, annual O&M cost, latest discount rate, and estimated life cycle duration must be developed for each alternative. The discount rate and estimated life-cycle duration of each alternative are important considerations in developing the present worth cost of each alternative for comparative purposes. All assumptions and limitations must be clearly documented.

c. Record of Decision Estimates. The ROD estimate must include all RA and O&M costs as discounted to “present worth” cost. The discounted rate must be the published OMB escalation rate for the particular year that the estimate is made. Cost estimates reflected in the ROD must be based on the selected alternative from the feasibility study and be detailed similarly to the FS estimate. All assumptions and limitations must be clearly documented.

d. Current Working Estimates. The current working estimate (CWE) is the detailed RA and O&M cost estimate developed during the engineering RD phase of a project. The estimate must be crew based for labor, materials, equipment, and productivity and resource loaded in order to arrive at an optimum construction schedule. The CWE must include the estimated contract cost, design and construction contingencies, S&A, RD cost, other applicable costs, escalation of construction costs to the midpoint of construction, and escalation of long-term O&M costs. All assumptions and limitations must be clearly documented.

e. Independent Government Estimates. All contracts for amounts greater than the simplified acquisition threshold require IGEs of fair and reasonable cost. The IGE is the official, signed bid (or proposal) form summary of costs and consists in the title page, signature page and bid schedule. Signatories to the IGE must include the preparer, reviewer, and approver, in keeping with cost engineering and contracting policy and guidance. Backup to the IGE includes the detailed estimate for RA and O&M contract

costs, sometimes used in negotiations with contractors or to evaluate contractor bids. The estimate must include estimated contract cost, contingencies, escalation of construction costs to the midpoint of construction, and escalation of long-term O&M costs (as required by the contract documents). Profit must be included in the IGE for an environmental program project, unless the funds are appropriated from the Corps' civil works program. When included in the IGE, profit must be calculated as outlined in the Federal Acquisition Regulation using the weighted profit guidelines established for the agency for which the IGE is being prepared. All assumptions and limitations must be clearly documented. Although an IGE is not required for contract amounts less than the simplified acquisition threshold, preparation of an independent cost estimate is recommended to determine the reasonableness of a contractor's bid or cost proposal. In no case is the contractor's cost proposal to be used as the IGE. Estimates prepared by A/Es for the Government may be used as the basis of the IGE provided they are reviewed by the Government and revised as necessary.

12. Preparation of the Estimate.

a. Regulation Requirements. Preparation, documentation, and approval of the environmental remediation and removal programs cost estimates must be in accordance with 1) ER 1110-1-1300 and this regulation, and 2) agency and program-specific policy and guidance (e.g., DOD Manual 4715.20 and DOD Instruction 4715.07). For more detailed estimating "how to" information for environmental remediation and removal programs-specific requirements, refer to UFC 3-740-05, Handbook: Construction Cost Estimating, and other Corps of Engineers cost engineering guidance.

b. Capital Remedial Action Costs. Capital RA construction (RA-C) costs consist of costs required to construct environmental remediation and removal programs remediation processes and include when necessary costs of short term O&M during RA. The cost engineering office must include, as appropriate, the cost of all unique environmental remediation and removal programs requirements such as (but not limited to), pollution liability insurance, disposal permits, transportation permits, and short-term O&M during construction. The cost engineering office must also account for the productivity impacts of (but not limited to) health and safety requirements, personnel and equipment decontamination, and security requirements. Escalation to the midpoint of construction must also be included.

c. HTRW Remedial Action Work Breakdown Structure. A standardized WBS is critical for tracking the RA costs throughout the life of the project and for the effective collection of historical cost data. Cost estimates for environmental remediation and removal programs RA throughout the various phases of the project must use the latest

Corps approved HTRW RA WBS. As a minimum, all RA estimates must be summarized to the third (subsystem) level of the HTRW RA WBS for all items. The environmental remediation and removal programs portion of civil works or military construction projects, involving other non-environmental remediation and removal programs work, must be segregated. The portion of the estimate prepared for the environmental remediation and removal programs work must use the HTRW RA WBS. The RA total project cost estimate must include all contractors' direct and indirect costs and must also include any Government-furnished material, labor, and equipment costs.

d. Long-Term Operation and Maintenance Costs. Environmental remediation and removal programs projects may include long-term O&M of the facility over a period of time that could range from months to years. Wage rates, escalation rates, and other costs may be different between construction and long-term O&M. Therefore, the cost engineering office must separate construction and long-term O&M costs and ensure proper application of construction and service rates. Escalation of long-term O&M costs must also be included.

e. Environmental Remediation and Removal Programs Operation and Maintenance WBS. Cost estimates for long-term environmental remediation and removal programs O&M must use the latest Corps approved HTRW O&M WBS. As a minimum, all long-term O&M estimates must be summarized to the third (subsystem) level of the HTRW O&M WBS for all items.

f. Cost and Schedule Risk Analysis and Contingency Costs.

(1) Cost and Schedule Risk Analysis. Cost and schedule risk analysis (CSRA) is the process of identifying and measuring the cost and schedule impact of project uncertainties on the estimated cost of a project. It must be accomplished as a joint analysis between the cost engineer and the PDT members. A CSRA must be prepared to calculate the contingency and to identify cost risks and cost risk mitigation.

(2) RA Contingencies. Contingencies included in the total project construction (RA) cost estimate are for unknown or unforeseen conditions and must be based on a documented CSRA. Contingencies must be applied to the RA estimates, regardless of what phase (PA, SI, RI, FS, RD, or RA) of the project for which the RA estimates were prepared. The CSRA must be developed as prescribed by USACE policy and guidance using approved software. Contingencies must be applied at the second level of the environmental remediation and removal programs RA WBS. Two types of contingencies may be applied to an environmental remediation and removal programs project: design contingency and construction contingency:

(a) Design contingency is an estimate of the construction costs that are needed to account for unknowns during the project planning and design process. For example, design contingency may be added to the construction cost estimate during the RI/FS phase to account for the fact that design is less than 100 percent complete, uncertainty in types and quantities of contaminants, and uncertainty regarding the remediation process. Design contingency must decrease as information becomes known during the planning and design process and must be reduced to zero at design completion.

(b) Construction contingency is a reserve to provide for costs of unforeseen construction condition changes, beyond interpretation at the time of contract award. Construction contingency reserve is not to be included in IGEs used for the purpose of bidding or comparison to a construction contractor's bid or proposal.

(3) Operations and Maintenance Contingencies. Contingencies are also included in the long-term O&M cost estimate for unknown or unforeseen conditions. Contingencies must be applied at the second level of the environmental program O&M WBS.

g. Construction Supervision and Administration. Costs for S&A must be in accordance with ER 415-1-16. S&A is also termed construction management, or supervision, inspection, and overhead (SIOH).

h. Fee Establishment. For all procurement contracts, a fee or profit must be developed by the cost estimator using the USACE weighted profit guidelines. This profit margin must be used in the negotiations with the contractor for negotiated procurement contracts.

i. Other Costs. Examples of other costs that may be needed in the estimate include the preparation of as-built drawings, O&M manuals, laboratory QA, and design costs.

13. Cost Engineering Software. The use of cost engineering software enhances the efficiency, accuracy, and credibility of estimates. Estimating software assists in the standardization of estimating procedures and provides estimates that are easily reviewed, revised, and adapted to new projects or situations. However, the use of computerized software and techniques must not replace professional cost engineering knowledge or judgment. Output should be checked for reasonableness, and assumptions and methodology should be verified and documented. CTC estimates may be developed using the latest approved versions of cost engineering software such as MCACES, RACER, spreadsheets, or other approved software. RACER should only

be used for early project stage budget estimating, but as more specific detailed project information becomes available, MCACES should be used to prepare the detailed estimate.

14. Formerly Used Defense Sites Cost-to-Complete Liability Estimates. USACE is assigned the responsibility to annually develop a statement of environmental liability (EL) for the DERP FUDS Environmental Restoration Program for the Annual Report to Congress (ARC). Environmental liabilities include estimated amounts for future cleanup of contamination resulting from waste disposal methods, leaks, spills, and other past activities that have created a public health or environmental risk. Because environmental budgetary estimates are used for financial statement reporting, the estimates are subject to financial management and accounting standards and are subject to audit. These estimates are used as the basis for the environmental liabilities reported in the Army's financial statements for the FUDS Program. Financial management and accounting standards require supporting documentation for cost estimates.

a. Preparation of Formerly Used Defense Sites Cost-to-Complete Estimates. USACE guidance requires USACE districts to prepare annual CTC estimates for all approved FUDS projects that have not reached project completion. USACE cost engineers must be engaged in the development and review of CTC estimates for FUDS projects. Project estimates must include references and background information for the property and project for which the estimate is being developed. To accurately represent the government's environmental liability, the estimate must include documentation on phases selected, technologies included in each phase, quantities selected, and any assumptions made in developing the estimate. Specific guidance, details, and references on unique FUDS categories, structure, and development of FUDS CTC estimates is contained ER 200-3-1, Appendix E. The cost engineer must reference this document in order to properly structure and develop a complete and defensible FUDS CTC estimate.

b. Quality Management of Formerly Used Defense Sites Cost-to-Complete Estimates. Cost estimate QC and QA are discussed above. When additional agency or program-specific review procedures exist, such as those listed in DOD Manual 4715.20, they must be followed. In addition, the FUDS Project CTC Estimating Guidance (ER 200-3-1, Appendix E) specifies further detailed guidance on conducting quality control, supervisory, and quality assurance reviews for FUDS CTC estimates, which also must be followed. District cost engineers conducting FUDS QC must familiarize themselves with the instructions in the regulation. Additionally, a cost QC checklist specific to FUDS CTC estimates is located in Appendix E of ER 200-3-1.

15. Work for Others.

a. Preparation of Cost Estimates for Others. USACE regulations and procedures must be followed when preparing cost engineering work for other agencies, unless the changes in guidance are formally agreed to between agencies and incorporated into interagency agreements or task orders. All changes that deviate from standard USACE cost engineering guidance must be fully documented in the scope of work and in any product developed for the other agency, such as in the project notes of the estimate. Other government agencies' contracting procedures, contract administration, and allowable costs for contractors may differ from standard USACE practices. The cost engineering office must have a clear understanding of another agency's procedures, based on the interagency agreements or task orders, and that understanding must be apparent in any cost estimate that is prepared by the USACE cost estimator.

b. Review of Cost Estimates Prepared by Others. Significant USACE environmental remediation and removal programs work for others involves assisting other federal government agencies in the review of contractor-prepared cost estimates. The USACE review of project costs must be consistent with the client agency procedures that affect project costs, such as contracting procedures. The USACE cost engineering office must thoroughly document the review process to include a pre-agreed upon narrative report that addresses how the review was conducted. For example, were the estimate assumptions, factors, and quantities independently verified or were they assumed to be correct; what percentage of line items were checked; what contracting method was assumed; and what costs were considered to be indirect versus direct costs. The cost engineering office must document and provide alternative cost estimates for individual items or sections of the cost estimate that are in question, if agreed to in advance by the other funding agency.

FOR THE COMMANDER:

3 Appendices
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PAUL E. OWEN
COL, EN
Chief of Staff

APPENDIX A

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
versus Resource Conservation and Recovery Act (RCRA)

<u>CERCLA</u>		<u>RCRA</u>	
PA/SI	Preliminary Assessment/Site Inspection	RFA	RCRA Facility Assessment
RI	Remedial Investigation	RFI	RCRA Facility Investigation
FS	Feasibility Study	CMS	Corrective Measures Study
DD	Decision Document (non -NPL)	DD	Decision Document (non-NPL)
ROD	Record of Decision (NPL)		Statement of Basis & Permit Modification
RD/RA	Remedial Design/Remedial Action (including short term O&M)	CMI	Corrective Measures Implementation (including short term O&M)
O&M	Operation & Maintenance (long-term)	O&M	Operation & Maintenance (long-term)

NPL-National Priorities List

CERCLA typically covers abandoned waste sites.

RCRA typically covers current operating facilities.

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APPENDIX B

HTRW Remedial Action Work Breakdown Structure (RA WBS)
To Second Level

WBS NUMBER DESCRIPTION

33XXX HTRW CONSTRUCTION ACTIVITIES
331XX HTRW REMEDIAL ACTION (CONSTRUCTION)
01 MOBILIZATION AND PREPARATORY WORK
02 MONITORING, SAMPLING, TESTING, AND ANALYSIS
03 SITE WORK
04 ORDNANCE & EXPLOSIVE - CHEMICAL WARFARE MATERIAL (OE-CWM)
REMOVAL AND DESTRUCTION
05 SURFACE WATER COLLECTION AND CONTROL
06 GROUNDWATER COLLECTION AND CONTROL
07 AIR POLLUTION/GAS COLLECTION AND CONTROL
08 SOLIDS COLLECTION AND CONTAINMENT
09 LIQUIDS/SEDIMENTS/SLUDGES COLLECTION AND
CONTAINMENT
10 DRUMS/TANKS/STRUCTURES/MISCELLANEOUS DEMOLITION AND REMOVAL
11 BIOLOGICAL TREATMENT
12 CHEMICAL TREATMENT
13 PHYSICAL TREATMENT
14 THERMAL TREATMENT
15 STABILIZATION/FIXATION/ENCAPSULATION
16 (RESERVED FOR FUTURE USE)
17 DECONTAMINATION AND DECOMMISSIONING (D&D)
18 DISPOSAL (OTHER THAN COMMERCIAL)
19 DISPOSAL (COMMERCIAL)
20 SITE RESTORATION
21 DEMOBILIZATION
22 GENERAL REQUIREMENTS (OPTIONAL BREAKOUT)
9X OTHER (Use Numbers 90-99)
332XX ENGINEERING DURING CONSTRUCTION (EDC)
333XX SUPERVISION & ADMINISTRATION (S&A)
(CONSTRUCTION MANAGEMENT

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APPENDIX C

HTRW Operation and Maintenance Work Breakdown Structure
(O&M WBS)
To Second Level

WBS NUMBER DESCRIPTION

34XXX HTRW POST CONSTRUCTION AND FINANCIAL CLOSEOUT ACTIVITIES
341XX FISCAL/FINANCIAL CLOSEOUT ACTIVITIES
342XX HTRW OPERATION AND MAINTENANCE (POST CONSTRUCTION)
02 MONITORING, SAMPLING, TESTING, AND ANALYSIS
03 SITE WORK
05 SURFACE WATER COLLECTION AND CONTROL
06 GROUNDWATER COLLECTION AND CONTROL
07 AIR POLLUTION/GAS COLLECTION AND CONTROL
08 SOLIDS COLLECTION AND CONTAINMENT
09 LIQUIDS/SEDIMENTS/SLUDGES COLLECTION AND CONTAINMENT
11 BIOLOGICAL TREATMENT
12 CHEMICAL TREATMENT
13 PHYSICAL TREATMENT
14 THERMAL TREATMENT
15 STABILIZATION/FIXATION/ENCAPSULATION
18 DISPOSAL (OTHER THAN COMMERCIAL)
22 GENERAL REQUIREMENTS (OPTIONAL BREAKOUT)
9X OTHER (Use Numbers 90-99)

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GLOSSARY

Terms and Abbreviations

A-E	Architect-Engineer
ARC	Annual Report to Congress
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CTC	Cost-to-Complete
CWE	Current Working Estimate
CX	Center of Expertise
DERP	Defense Environmental Restoration Program
DOE	Department of Energy
EI	Engineering Instruction
EL	Environmental Liability
EMCX	Environmental and Munitions Center of Expertise
EPA	Environmental Protection Agency
ER	Engineer Regulation
ER	Environmental Restoration
ER-FUDS	Environmental Restoration – Formerly Used Defense Sites
ERS	Environmental Remediation Services
FUDS	Formerly Used Defense Sites
FS	Feasibility Study
IGE	Government Estimate
HQUSACE	Headquarters, USACE
HTRW	Hazardous, Toxic, and Radioactive Waste
IRA	Interim Removal Action
IRP	Installation Restoration Program
LTM	Long Term Management
MARC	Multiple Award Remediation Contracts
MCACES	Micro Computer Aided Cost Engineering System
O&M	Operations and Maintenance

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O&M WBS	Operations and Maintenance Work Breakdown Structure
PA	Preliminary Assessment
PDT	Project Delivery Team
PM	Project Manager
PRAC	Preplaced Remedial Action Contract
QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
QCP	Quality Control Plan
QMP	Quality Management Plan
RA	Remedial Action
RA-C	Remedial Action Construction
RA WBS	Remedial Action Work Breakdown Structure
RACER	Remedial Action Cost Engineering and Requirements
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RFI	RCRA Facility Investigation
RFA	RCRA Facility Assessment
ROD	Record of Decision
S&A	Supervision and Administration
SI	Site Inspection
SR	Supervisory Review
USACE	U.S. Army Corps of Engineers
WBS	Work Breakdown Structure