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	Engineering and Design QUALITY MANAGEMENT	
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DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
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Regulation
No. 1110-1-12

1 June 1993

Engineering and Design
QUALITY MANAGEMENT

1. Purpose. This engineer regulation (ER) provides general policy and principles for improving the quality of engineering and design services and products delivered to customers of the U.S. Army Corps of Engineers. Specific quality procedures, practices and tools are also provided in this ER.

2. Amicability. This regulation applies to Headquarters, U.S. Army Corps of Engineers (HQUSACE), major subordinate commands (MSC), districts, laboratories, and field operating activities (FOA) having engineering and design responsibility.

3. References.

a. AR 5-1, Army Management Philosophy.
b. ER 5-7-l (FR), Project Management.
c. ER 385-1-92, Safety and Occupational Health Document Requirements Hazardous Waste Site Remedial Act.
d. ER 415-1-11, Biddability, Constructibility, Operability.
e. ER 415-3-11, Post Completion Inspection and Design Criteria Feedback Inspection.
f. ER 415-345-38, Transfer and Warranties.
g. ER 415-345-42, Costs, Cost Estimating, and Reserves for Contingencies.
h. ER 715-1-8, Architect-Engineer Contract Administration Support System.
i. ER 715-1-10, Architect-Engineer Responsibility Management Program (AERMP).
j. ER 715-1-15, Time Standards for the Architect-Engineer Acquisition Process.
k. ER 1110-1-263, Chemical Quality Management for Hazardous Waste Remedial Activities.
1. ER 1110-1-1300, Cost Engineering Policy and General Requirements.
m. ER 1110-2-109, Hydroelectric Design Center.
n. ER 1110-2-1150, Engineering and Design for Civil Works Projects.
0. ER 1110-2-1200, Drawings and Specifications.
p. ER 1110-3-109, Corps-Wide Centers of Expertise.
q. ER 1110-345-100, Design Policy for Military Construction.
r. ER 1110-345-700, Design Analyses.
s. ER 1110-345-710, Drawings.
t. ER 1110-345-720, Construction Specifications.
u. ER 1180-1-6 Construction Quality Management.
"Leadership for Total Army Quality" Concept Plan, February 1993, OCSA, HQDA (DACS-DMM).

4. Policy. The policy of the U.S. Army Corps of Engineers (USACE) is to deliver excellent engineering and design services and products to customers on schedule and within budget. Adherence to the following principles will contribute to achieving this policy.

a. Customer focused environment. Agreements shall be developed and documented with customers and project managers on their requirements and expectations. In addition to functional, technical, aesthetic and environmental requirements, these agreements shall reflect schedules and budgets that are reasonable and attainable. These agreements must be incorporated in the project management plan (PMP). Cooperation and open communication shall be established and sustained between customers, and technical and management elements.

b. Co ntinuous process improvement. An organized, systematic approach shall be employed to assure continuous process improvement. This approach will be employed to the extent that implementation costs are reasonable for the results that are potentially achievable.

c. Empowerment of people. People shall be provided maximum authority commensurate with their responsibilities and held accountable for results. In addition to technically~oriented training, training in teamwork and process improvement concepts shall be provided.

5. Definitions.

a. Acronyms. A list of acronyms is at Appendix A.

b. Customer. The owner, client, user, project manager (PM), or beneficiary of a USACE service or product.

c. Design. The process of (1) developing the analyses that define the required technical systems (e.g., geotechnical, hydraulic, architectural, structural, electrical, mechanical, fire protection) which will be utilized, (2) producing the technical portions of the construction contract documents (i. e., the drawings and specifications), and (3) preparing the construction cost estimate.

d. Engineering. For the purpose of this regulation, the efforts of technical disciplines involved in producing a technical service or product (e.g., a design, engineering feasibility study, geotechnical report, design analysis, facility master plan, hydraulics/hydrology analysis, construction cost estimate).

e. Menu of Services. A list of planning, engineering and administrative services required for execution of a project (also called a “design element menu”). This list is established by the PM with the customer with the assistance of the Engineering Division’s technical manager (TM) prior to initiation of the design process. The menu serves to document the understanding of what services are to be provided and what products are to be furnished. The menu also provides the basis for the design cost estimate and the project specific work breakdown structure (WBS).

f. Partnering. Partnering may be defined as “the development and sustainment of a relationship that promotes achievement of mutually beneficial goals. ” The relationship is based on trust, dedication to common goals, and an understanding of each other’s individual needs, expectations and values. Expected benefits include improved effciency and cost effectiveness, increased opportunity for innovation and the continuous improvement of delivered products and services, Partnering is a

voluntary relationship which builds upon the good relationship which exists among the professional participants involved in any engineering or design activity. Partnering is further described in Appendix B, which includes a sample design quality partnering agreement.

g. Project Management Plan (PMP). The detailed, specific plan, used to manage and control the delivery of a project from its inception to completion. Generally, no distinction is made in this regulation between the PMP and subplans, or other types of plans for accomplishing projects. See ER 5-7-1 (FR) for a full definition of PMP.

h. Project Manager (PM). The PM is the leader of the project team comprised of Technical Managers (TM) and other members as appropriate, and has the responsibility for development and management of the PMP. The PM is the primary contact with the Corps' customer and is responsible for delivery of the project and insuring that all commitments are met, or exceeded. See ER 5-7-1 (FR).

i. Quality. Conformance to properly developed requirements.

j. Quality Control. The process employed by the USACE engineering organization for the performance of a task that meets the agreed-upon requirements of the customer, on schedule and within budget.

k. Quality Control Plan (QCP). A USACE written technical management plan for a specific technical product or service (i.e., a contract requirement or an in-house effort). The QCP becomes part of the project management plan (PMP). For Civil Works projects the QCP may be part of the initial project management plan (IPMP), as well as the PMP.

l. Quality Design. In general, a design that conforms to the customer's requirements (functional, technical, aesthetic, environmental) and expectations, am! is consistent with the appropriate technical criteria. An acceptable level of quality does not imply perfection, however, there should be no compromise of functional, health or safety requirements. In addition, design modifications determined necessary during construction should be relatively minor and have minimal cost and schedule impacts.

m. Quality Verification. The process by which an engineering organization determines whether the desired quality of service or product is being realized. Design quality verification includes appropriate design reviews, the biddability, constructibility, operability (BCO) review process, and other reviews as necessary.

n. Technical Manager (TM). Unless specifically stated otherwise, TM in this regulation refers to the Engineering Division TM. The TM is the Engineering Division point of contact with the PM and the coordinator of the technical engineering and design support requirements for the project.

o. Total Army Quality (TAQ). A leadership philosophy and management approach. It is a leadership philosophy which empowers all individuals to build on the aggregate capabilities of our

quality Army. As a management approach, TAQ focuses on continuous process improvement to meet or exceed the expectations of internal and external customers. In this regards, TAQ embodies the fundamental aspects of the Total Quality Management (TQM) approaches being used in today's private sector.

p. USACE Commands. Subordinate entities of the U.S. Army Corps of Engineers.

6. Quality Management Plan (QMP). The Engineering Division in each USACE command shall establish a QMP that complies with the policy and principles presented in this regulation, adapting the procedures and tools herein as appropriate. This plan should be tailored to the specific missions and structure of the local organization and based on the concepts of TAQ. The pamphlet, "Leadership for Total Army Quality Concept Plan," distributed to USACE Commands by HQUSACE in April 1993, should serve as the basis for the QMP.

Note: The requirements of ER 1110-1-263, Chemical Quality Management for Hazardous Waste Remedial Activities, and the roles/responsibilities of technical managers (TM) and project managers (PM), as described in Appendix l-G, ER 5-7-l (FR), Project Management, take precedence in the event of a conflict with this regulation.

a. Quality control plan (QCP).

(1) The QCP is a management plan for executing a quality engineering product or service, on schedule and within budget. A QCP should be prepared for every engineering product or service, whether obtained using in-house forces or an architect-engineer (A-E). The QCP for small or non-complex projects should be a very simple document, setting forth the schedule and a minimum of coordination information. A more comprehensive document shall be prepared for large or complex projects. While an in-house "design" QCP should be complete, it need not duplicate items of a definitional or procedural nature that are in the QMP. The TM should submit the QCP to the PM for review and incorporation into the PMP prior to initiation of the technical work on the project.

(2) An exception to the QCP requirements in paragraph 6a(1) above may be made on a case by case basis by the engineering functional chief, provided all aspects of the designer's QCP are documented in formal correspondence and/or the contract document, and/or the PMP.

(3) The A-E shall be required to submit a QCP with the fee proposal. A list of items that would normally be included in an A-E "design" QCP is provided at Appendix C. The nature of the QCP for design, or other products or services, shall be determined with the A-E in pre-proposal meetings. For large or complex projects, the A-E may be allowed to submit a generic QCP with his fee proposal, with a fully-detailed QCP furnished early in the first phase of the work.

(4) Design of large, technically-complex construction projects may involve specialized processes, such as chemical/incineration processes or automation, that require expertise not found within the executing commands' purview. In these instances, the QCP shall cover how the specialized technical

expertise required for reviews of the design and shop drawings will be resourced from within the USACE or from the commercial sector.

b. Appointment of TMs. Appointment of qualified persons to act as TMs is critical to achieving the objectives of an effective quality management plan. Management must ensure that the persons appointed to these positions have the requisite knowledge and experience. For in-house design, the TM shou!d be the design team leader in addition to other duties (see paragraph 7b below). This individual should be chosen according to the nature of the project. For example, a civil engineer would normally serve as the TM on a levee project, while an architect would be the TM for design of most buildings. For projects where the design will be done by an A-E, the TM should have expertise in the technical aspects of procurement of A-E services and daily administration of these contracts.

c. Engeering and design criteria management.

(1) Engineering Divisions shall develop a system for documenting the criteria applicable to each engineering or design service or product. This document shall list the criteria obtained from the customer (by reference, if documented in a satisfactory manner), and as developed in prenegotiation and/or predesign conferences with the PM, customer and designer. This document shall be updated to reflect all changes in the criteria after initial development.

(2) Engineering Divisions should develop a criteria management process to ensure design criteria and standard design details appropriate for each customer's requirements are developed, updated as required, and made readily available to the designers and reviewers.

(3) Engineering Divisions doing an appreciable amount of contracting for A-E services should develop an A-E services manual. The manual should include general instructions for the A-E on preparation of construction contract documents, design standards, technical guidance, guide specifications, drawing organization, etc. Responsibility for maintaining the Manual in a current condition should be specifically assigned.

d. Design quality tools. The development and promulgation of design tools is a continuing, dynamic process. Engineering Divisions are encouraged to investigate design tools as they come into the marketplace. A list of design tools related to design quality are listed in Appendix D. A short description of each and the USACE proponent office, where it exists, are provided.

e. Designer selection process. The availability and level of expertise required in all disciplines shall be fully considered prior to making any decision to design a project in-house. Designer selection decisions (i. e., whether the design is to be done by in-house forces or by an A-E) are made by the technical organization responsible for engineering and design execution.

f. Project coordination.

(1) General. The PM is responsible for managing the project scope, schedule changes, funding needs, cost estimate changes and authorization matters with the customer and higher authority. The

TM is responsible for coordinating all project activities within the Engineering Division including the A-E, when utilized, and is the day-today interface between Engineering Division and the PM.

(2) Design basis. The TM is responsible for ensuring that the basis for design is adequate prior to starting the actual design effort. This is a fundamental requirement in meeting the customer's requirements and expectations. i.e.. successful delivery of a quality project. Further, many projects involve investigation into alternatives in the early design stages. Therefore, it may be necessary to hold meetings in addition to those mentioned herein to ensure that there is a complete understanding between the designer, the PM, and the customer on what is to be done.

(3) Design coordination.

(a) The TM should hold project meetings with the PM, the Engineering Division personnel that will be associated with the project, and any other key personnel selected by the PM. There should be an initial meeting prior to start of any substantive work to review the project and start building the team identity and partnering spirit that will contribute to project success. These meetings should be held at intervals determined by the TM, or PM, to keep the team members informal on status of the project and foster the partnering spirit.

(b) The PM, TM, and the designer should attend a predesign conference with the customer to discuss the project scope and requirements prior to initiating the engineering services, studies or design work. Technical disciplines should be represented as deemed appropriate by the designer and the TM. For medical projects, representatives of the HQUSACE Medical Facilities Design Office shall be included. The conference should include a visit to the construction site whenever possible. The designer should have a statement of design and functional requirements for the project, and technical criteria in hand, prior to this conference. The use of a design element menu is strongly recommended as a means of initially defining the work to be done. The design element menu (a sample is enclosed at Appendix D) should be reviewed at this conference to ensure that there is a complete understanding of the customer's requirements and expectations. Deviations, exceptions, deletions, and additions to the project definition documents shall be reduced to writing. Appendix E contains information on specific design documents that the designer may be required to prepare.

(4) Design coordination - A-E designs. Every effort shall be made to ensure that the A-E understands the scope of the project, the requirements of the Government, and the services and/or products to be delivered. It may be necessary to hold an additional meeting after the predesign conference for this purpose. At this followup meeting the predesign conference minutes, scope of work, requirement for the QCP, and all phases of the required effort affecting the designer's fee will be discussed. A "lessons-learned list" of common design deficiencies is a valuable source of information and would appropriately be discussed at this meeting, if it has not been covered in an earlier conference. An example lessons-learned list is at Appendix F. If applicable, the requirements for a health and/or safety plan should also be discussed.

g. Designer site visits. Designers shall visit the project site prior to the start of design to observe and evaluate existing field conditions, adjacent structures and other features that could have an impact

on the design. The first visit of this nature would normally be included in the predesign conference mentioned in paragraph 6f(3). Visits shall be made as necessary during design at appropriate times to ascertain compatibility of proposed design with the site, including utility connections, and survey data. A visit after completion of design may be advisable to ensure that all features of the design are compatible with existing conditions and that the customer's requirements will be met by the design.

h. Desire verification process. Engineering Division's QCP shall clearly define quality verification activities for specific organizational elements. The design verification process is intended to ensure that an acceptable design is produced by the designer. It does not eliminate the necessity for the designer to perform the checks described in paragraph 7c(3), or relieve him of the responsibility for design quality.

(1) General. The design verification process must be planned carefully to obtain the desired results and stay within budget and schedule. To ensure an adequate review the reviewer must be instructed as to the purpose of the review, the criteria which the design is to be reviewed against, how the review is to be performed, and the level of effort planned for the review. On some projects it may be advisable for reviewers to visit the project site in order to verify critical aspects of the design. The reviewer should be cautioned not to give unauthorized direction to the designer and to avoid comments which reflect personal preferences.

(2) Design criteria. It may be advisable to have technical reviewers conduct a review of the appropriate design memoranda, design directives, and the scope of work prior to the initiation of design to ensure that the appropriate design parameters necessary to define the project are presented and that mandatory design criteria (such as safety codes and standards) will be considered. This effort may include selective attendance at the predesign conference (or conferences during design period) to discuss the design approach with the designer.

(3) Design review.

(a) An independent review of the designer's work shall be performed to verify that an acceptable design has been provided for a particular design phase of a project. This independent design review is not intended to be a detailed check of the designer's work. The detailed check of the design is to be performed by the designer's organization in accordance with the designer's QCP. For A-E designed projects, and in-house designed military projects, the design verification review will be done by the local USACE command. Civil Works projects designed in-house will be reviewed by the USACE command's "one-level" higher organization. See ER 1110-2-1150 and ER 1110-2-1200 for special requirements for Civil Works projects. Review of military projects is covered by ER 1110-345-100.

(b) Management of review comments. The Automated Review Management System (ARMS) shall be used to manage design review comments for all military projects where the parties involved provide written comments to the designer. The use of this system is strongly encouraged on Civil Works projects as well. ARMS provides an effective and economical means of compiling and assembling comments from all reviewing elements, coordinating comments by deleting inappropriate

or duplicate comments, and back checking to ensure proper resolution by the designer. All comments should be screened by the TM for consistency with project requirements, criteria, and freedom from inappropriate directives or "personal preferences. " ARMS is the only approved system for automated management of review comments for Corps projects. See Appendix D for additional information on this important design quality tool.

(c) Checklists can be a powerful tool for reviewers. To be most effective, each individual reviewer should develop his "own" checklist from standard checklists that may be available. The checklist should be used at the end of the review rather than used as a list of the only areas that will be considered during review. A standard checklist can also be used as a training aid for new reviewers. Sample checklists are at Appendices G, H, I and J of this regulation.

(d) Value engineering (VE). A value engineering study is required for all projects with an estimated construction cost of $2,000,000, or over. Exceptions must be approved by a general officer or a member of the senior executive service. Rejections of VE proposals exceeding one million dollars require division engineer approval. See the discussion of VE in Appendix D.

(4) Centers of expertise. Where applicable, designs must be reviewed by the appropriate mandatory center of expertise (MCX). Also, the voluntary use of technical centers of expertise (TCX) is encouraged. See Appendix D, paragraph 12. The HQUSACE Medical Facilities Design Office is a MCX for medical projects on which they have Contracting Officer's Representative authority. Use of the technical medical expertise of that office is mandatory in these instances.

(5) Biddability, constructibility, operability (BCO) review. These reviews are conducted in accordance with ER 415-1-11. BCO is the term normally applied to the reviews made by construction and operations personnel, however, the items listed in ER 415-1-11 should be addressed by all personnel reviewing construction designs. Construction and Operations personnel are usually in the best position to comment on the designer's depiction of existing conditions, design of interfaces, and potential construction problems. This is especially true on retrofit, rehabilitation and remodel projects, and for utility tie-ins. Engineering and Construction Divisions are required to provide a formal, written certification that all appropriate comments have been incorporated in the construction documents prior to opening of construction bids. When the Operations Division is involved, they should be required to provide this certification also.

(6) Plan-In-Hand review. As the name implies, the objective of this type of review is to compare the drawings to existing conditions to discover inconsistencies. Ideally, the review team should be composed of the Project Manager, Technical Manager, Construction Division representative(s), Engineering Division reviewers, the customer and the designer. This review takes place at the project site and is particularly important for retrofit, rehabilitation, or remodel projects where accurate depiction of existing conditions is critical. This particular review is most effective near the end of the design process when the drawings and the specifications are complete, or nearly so.

i. Design guidance improvement. Design deficiencies, improvements, and field changes necessitated by missing or incomplete design guidance/criteria data shall be documented and, along

with recommendations, recorded on a ENG Form 3078. The form is forwarded to the appropriate office in HQUSACE in accordance with procedures in ER 1110-345-100. HQUSACE will review and incorporate the recommendations into the criteria, policy and guidance documents as appropriate.

j. Designer involvement during construction.

(1) The designer should support the project by being involved in the construction. On complex projects the designer should visit the construction site at critical points of construction and as requested by the USACE construction office for consultation. In the case of A-E design, the design contract should include these services as options, The TM shall request the PM to budget funds for this purpose.

(2) Engineering Division shall review construction changes that have a significant impact on design, and all value engineering proposals, waivers, and system changes. The purpose is to ensure that changes will not impair design quality; cause safety, health, environmental problems; or otherwise create unsatisfactory conditions. Also, this review permits the designer to check for recurring deficiencies, which could indicate that changes are needed in guide specifications or design criteria. Procedures should be set up with the Construction and Planning Divisions, and Project Management for this review. It should be possible to define categories of changes for correction of design deficiencies where the coordination with Engineering can be effected by means of information copies of the change documents, to avoid construction delays.

(3) All shop drawings identified as extension of design (i.e., requiring Engineering Division review) shall be reviewed by the designer. All A-E contracts for design of work that may require such submittals from the construction contractor shall include a provision notifying the A-E that he may be required to perform these reviews.

(4) It is desirable that the designers also visit the site after completion of construction to obtain feedback from users that can be used to improve quality and customer service for future projects. Such visits would be particularly beneficial on those projects where newly developed criteria were applied, or where construction changes were made as the result of inadequate design criteria. Organizations that would most directly benefit from this interaction with customers should be represented on the team making these visits. The scheduling of these visits should be coordinated with the Construction Division. These visits should be coordinated with those made under ER 415-3-11, Post Completion Inspection and Design Criteria Feedback Inspection, to avoid duplication of effort.

k. Designer Performance evaluation.

(1) Current HQUSACE guidance on A-E performance evaluation reports shall be fully implemented. An important aspect of this guidance is the timely preparation of interim poor/unsatisfactory evaluations when warranted, and the submittal of these evaluations to the Architect-Engineer Contract Administration Support System (ACASS), maintained by CENPD-CT. This action will make this information available to other Department of Defense contracting offices

who may be considering award of work to A-Es who are performing poorly for the Corps of Engineers.

(2) The performance of USACE in-house designers shall be evaluated using the evaluation factors/attributes on the A-E performance evaluation form. This evaluation shall be made by the organization that reviews the design. These evaluations should be reviewed by the Branch Chiefs of the design organization, and used as a source of information for improving individual and organization performance.

l. Lessons-learned feedback system. A formalized "lessons learned" feedback system should be implemented by each USACE command. Lessons-learned data should be systematically gathered, fully integrated with the design criteria management process, and made readily available to designers and reviewers. Each construction change order of the "design deficiency" category should be evaluated to determine if it is one-of-a-kind or a potentially recurring deficiency. If the item is recurring, a criteria document such as a guide specification or a technical manual may be in error or unclear and should be revised by submitting a ENG Form 3078 in accordance with Engineering Improvement Recommendation System (EIRS) procedures. A "Lessons Learned List - Typical Examples, " is at Appendix F. Information on the "Lessons-Learned System; Hazardous, Toxic and Radioactive Waste Program (HTRW)" is in Appendix D, paragraph 8.

m. Training. A training program should be developed for training all personnel in the engineering organization in the concepts of TQM, TAQ, and the policy, principles, procedures, practices and tools in this regulation.

7. Responsibilities.

a. Accountability.

(1) In-house designers are responsible for producing quality services and/or products, on schedule and within budget. All project documents produced by in-house designers shall be clearly identified with the project description and designer's name, and dated.

(2) For contracted design work, the A-E shall be held accountable for the professional quality, technical accuracy, and coordination of all designs, drawings, specifications, cost estimates, and other services provided. A-Es are also to be held accountable for meeting contract schedules and construction project cost limitations. (See ER 715-1-10, Architect-Engineer Responsibility Management Program, for further information.) All items produced by A-E firms shall be clearly identified with the name of the firm, project description and contract number, and dated.

(3) All formal design reviews shall be documented, with the project description, name of reviewer(s), and date shown. This requirement applies to reviews of both A-E and in-house designs.

b. Technical manager (TM). The TM is responsible for:

(1) Ensuring that customer requirements are fully understood, that clear and accurate criteria are established, and that guidance and direction for the designer is fully documented.

(2) Coordination of Engineering Division's work on assigned products, including administration of the A-E contract if the design is contracted. The TM is the point of contact between Engineering Division and the project manager (PM) on all matters concerning project execution during design. The TM shall closely monitor progress of the work and costs for technical products against the PMP. The TM shall advise the PM of the status periodically, and of all significant developments as they arise.

c. Designer responsibility. The following tasks are basic responsibilities of the designer:

(1) The designer should execute the work diligently and aggressively, and promptly advise the TM of all significant developments adversely impacting the quality, schedule, or cost of the project. Project aesthetics, including interior design and landscaping efforts, must be fully addressed, as these features substantially affect the customer's perception of quality.

(2) Environmental considerations. The designer must give utmost attention to environmental factors in the design of facilities to eliminate or minimize environmental degradation in accordance with Federal, State, and local environmental quality laws and standards. Existing on-site hazardous, toxic, and radioactive waste problems in particular must be addressed. Appropriate coordination should be conducted with Project Management and Planning Division to ensure that authorized, or otherwise required, environmental features have been incorporated into the project design.

(3) Design check:

(a) The designer must have his work checked before each design submittal. This checking procedure is essential to the production of a quality product and must be incorporated into every QCP. Checkers should be highly experienced technical persons in the designer's organization who provide reviews of the design documents to verify that they are technically adequate and complete. Checkers shall initial all design calculations and all drawings. While the project design engineer or architect may review work by others in their administration of the design effort, they should not act as the checkers in the formal procedure called for in this paragraph on projects where they have lead responsibility.

(b) Quality control checklists. These checklists are helpful to designers and their checkers (and reviewers) to ensure that all considerations are systematically addressed. Checklists should be continually revised as dictated by knowledge and experience but must never become a substitute for professional design effort. Checklists are not intended to be comprehensive, and should be modified to fit specific requirements of the designer's office.

(4) Interdisciplinary checks. Interdisciplinary coordination is a key element of the QCP. It begins at the start of design and continues throughout the entire design process. The requirement for an formal interdisciplinary check should be addressed during the predesign conference so that sufficient

time for this activity can be included in the project delivery schedule. The check should be a scheduled activity. It is usually conducted by the design team members who check each other's work for the purpose of assuring compatibility between drawings and between drawings and specifications produced by the various disciplines (e.g., civil, architectural, mechanical, structural, geotechnicai, electrical, hydraulic).

d. Engineer of record (EOR). For in-house design, the EOR is the chief of the engineering office performing the design. Design responsibility of all structural steel connections will remain with the Corps designer, transfer of this responsibility to the contractor will not be permitted.

8. Quality management review. To assure that the requirements of this regulation are met; HQUSACE, in coordination and cooperation with MSC, will conduct quality management reviews. These reviews will be made to assess the effectiveness and implementation of individual USACE command's quality management plans. The reviews will be accomplished in a stand-alone mode or in conjunction with other command inspections/reviews (i.e., command inspections, Engineer Inspector General inspections). Regardless of how conducted, higher authority review of quality management plans at all operating USACE commands shall be accomplished on a three-year frequency, as a minimum.

FOR THE COMMANDER:

WILLIAM D. BROWN
Colonel, Corps of Engineers
Chief of Staff

10 Appendices:
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App B - Partnering
App C - Architect-Engineer Design Quality Control Plan
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App J - Example Construction Cost Estimate Checklist

APPENDIX A
ACRONYMS

A-E	Architect-Engineer
AEI	Architectural and Engineering Instructions: Design Criteria
AERMP	Architect-Engineer Responsibility Management Program
AFM	Air Force Manual
AFR	Air Force Regulation
AIC	Ampere Interrupting Capacity
ANSI	American National Standards Institute
ARMS	Automated Review Management System
ARAR	Applicable, Relevant, and Appropriate Requirements
BCE	Base Civil Engineer
BCO	Biddability, Constructibility and Operability
MCACES	Microcomputer-Aided Cost Engineering System
CADD	Computer - Aided Design and Drafting
CCB	Construction Criteria Base
CDAP	Chemical Data Acquisition Plan
CD-ROM	Compact Disc - Read Only Memory
CEAGS	Corps of Engineers Abridged Guide Specifications
CEGS	Corps of Engineers Guide Specifications
CERCLA	Comprehensive Environmental Response Compensation Liability Act
CES	Cost Estimating System
Con Doc	Construction Documentation
CID	Comprehensive Interior Design
CMU	Concrete Masonry Unit
Cos	Center of Standardization
CPM	Critical Path Method
CSI	Construction Specification Institute
DCIS	Design Criteria Information System
DEH	Director of Engineering and Housing
DERP	Defense Environmental Restoration Program
DM	Design Memoranda
EIRS	Engineering Improvement Recommendation System
EOR	Engineer of Record
ER	Engineer Regulation
ETL	Engineer Technical Letter
FDM	Feature Design Memorandum
FIP	Federal Information Processing
FOA	Field Operating Activity (obsolete term, with respect to USACE districts and MSCS)

GDM	General Design Memorandum
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HSDA	Health and Safety Design Analysis
HTRW	Hazardous, Toxic, and Radioactive Waste
HVAC	Heating, Ventilation and Air Conditioning
IDS	Intrusion Detection System
IPMP	Initial Project Management Plan
MACOM	Major Command
MCX	Mandatory Center of Expertise
MSC	Major Subordinate Command
NDT	Non-Destructive Testing
NEC	National Electric Code
NFPA	National Fire Protection Association
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completenesss
PPE	Personal Protective Equipment
PM	Project Manager
PMP	Project Management Plan
P&S	Plans and Specifications
QMP	Quality Management Program
QCP	Quality Control Plan
RA	Remedial Action
RFI	Radio Frequency Interference
RFP	Request for Proposal
SDM	Simplified Design Method
SHER	Safety, Health, and Emergency Response
SSHP	Site Safety and Health Plan
SOP	Standard Operating Procedures
TCX	Technical Center of Expertise
TM	Technical Manager (or, Technical Manual)
TAQ	Total Army Quality
TQM	Total Quality Management
UBC	Uniform Building Code
USACE	United States Army Corps of Engineers
VE	Value Engineering
WBS	Work Breakdown Structure

APPENDIX B
PARTNERING

1. The partnering concept seeks a cooperative environment, not a confrontational one. A win/win outcome for all parties is the ultimate goal. Experience has demonstrated that when win/lose strategies are employed by one or more parties to gain advantage, a lose/lose reality results (i.e., quality degradation and/or unreasonable cost and time growth for the Corps and its customers, and unprofitable ventures for private sector A-E firms and construction contractors). Partnering agreements accomplished by Engineering Divisions must be consistent with, and part of, the total project partnering plans of PMP.

2. The "partnering model" seeks to identify and communicate the needs, expectations and strengths of all parties (participants). The partnering model recognizes that a synergistic approach to accomplishing the required activity will enhance the opportunity to produce a quality service or product on schedule and within budget, to the mutual satisfaction of all participants. In the cooperative environment of the partnering model, creative solutions to "problems can be developed.

3. To be successful, however, partnering must first be a voluntary effort. Second, all participants must be willing to embrace the concept. Third, successful partnering must be focused on the communication of needs, strengths and expectations of each party at appropriately specified milestones during the performance of the required activity. Therefore, a "partnering process" must be mutually developed and followed. Fourth, goals must be established so that the degree of success of the partnering effort can be measured throughout the performance period.

4. A sample "Design Quality Partnering Agreement" is provided for information. This agreement provides a framework for all parties to obtain a quality service on schedule and within budget. It also provides the basis for the development of the follow-up partnering process document.

5. Partnering agreements are not contractually binding. These agreements do not affect any aspect of the contracts between the Army Corps of Engineers and A-E firms.

SAMPLE DESIGN QUALITY PARTNERING AGREEMENT
BETWEEN
THE CORPS CUSTOMER, USACE, AND THE PRIVATE SECTOR ARCHITECT-ENGINEER.

1. Mission Statement. As signatories of this agreement we dedicate ourselves to a professional, enjoyable and productive relationship. We will strive to work as a team to produce quality work, on schedule and within budget.

2. Objectives. We support this mission statement through our voluntary and enthusiastic commitment to subscribe to the following objectives.

a. To increase the resources available to the Government by effective, friendly, knowledgeable teaming.

b. To include all work-related participants in our partnership.

c. To develop an informed, practical understanding of the needs, strengths and expectations of all partners.

d. To reach a common understanding of the needed requirements including participation in scope development, criteria review and technical guidance evaluation.

e. To strive for open, honest, clear, and timely communications among all participants.

f. To respond swiftly to concerns, deadlines and requests.

g. To mutually explore and utilize new, innovative and proven technologies and applications to produce technically excellent products which advance the state-of-the-art.

h. To do "the right thing right, the first time" throughout the performance of the work.

i. To eliminate the need for litigation by producing a quality service and/or product that is worthy of an "exceptional" rating.

j. To maintain a steady, uniform work flow; minimizing processing time, finalization of technical requirements, and promptly processing payment invoices.

k. To recognize that safety and health are primary concerns. Our goal will be to complete all work without injury or death from any controllable cause.

l. To evaluate the effectiveness of this partnering agreement at predetermined points throughout the performance period.

3. Signatories.

For (the Army Corps of Engineers' Client/Partners):

(Name)	(Position)	(Date)
(Name)	(Position)	(Date)

For (the USACE Command):

(Name)	(Chief, Engineering Division)	(Date)
(Name)	(DDE(PPM))	(Date)

For (the Architect-Engineer):

(Name)	(Firm Principal)	(Date)
(Name)	(Firm Project Engineer)	(Date)

APPENDIX C
ARCHITECT-ENGINEER DESIGN QUALITY CONTROL PLAN

The "design" quality control plan (QCP) is the A-E's management plan for execution of the contract. The QCP describes the way in which the A-E will produce the deliverables and the steps that will be taken to control quality. The following items are key components of a design QCP, but should not be interpreted as excluding others.

1. Management Philosophy. Discuss the organization's technical management philosophy relative to its commitment to quality. If the firm has undergone a peer review of its organization, practices and procedures, a statement should be made describing it. Give the date, who made the peer review, and a brief description of resulting changes.

2. Management Approach. Define the specific management methodology to be followed during the performance of the work, including such aspects as; documentation management and control, communications, design coordination procedures, checking, and managerial continuity and flexibility.

3. Management Structure. Delineate the organizational composition of the A-E firm to clearly show the interrelationship of management and the design team components, including all consultants. Include an organization chart to identify by name the key design and review team members, and show their specific responsibilities related to the project.

4. Desire Tools. Describe the design tools that will be used in execution of the contract, such as CADD, MCACES, computer application programs, etc.

5. Scheduling. Include a time-scale bar chart or Critical Path Method (CPM) design schedule showing the sequence of events involved in carrying out specific tasks within the specified period of service. Clearly show the design review and correction periods scheduled prior to submittals.

6. cost control. For cost reimbursement contracts, describe how project costs will be monitored and controlled.

7. Construction Cost Estimate Control. Discuss the organization's internal controls to minimize construction cost limitation overruns, and ensure the accuracy and integrity of the construction cost estimate. Indicate how construction cost information will be handled and communicated to the Government.

8. Communication. Discuss the methods by which clear and accurate communications are to be achieved within the organization, and outside the organization. Indicate the names of all parties authorized to request modifications to the work, and specifically how these modifications will be coordinated and documented.

APPENDIX D
QUALITY DESIGN TOOLS

1. Design Criteria Information System (DCIS). The DCIS is a computer program in the Programming, Administration, and Execution (PAX) system available to all Army elements worldwide. The Architectural and Engineering Instructions (AEI) developed by HQUSACE (which include medical design standards), selected technical manuals and other design criteria documents are available electronically from the DCIS. Newsletter Number 38 in the PAX system provides information on DCIS and instructions on obtaining access. The proponent office in HQUSACE for DCIS is CEMP-EA.

2. Commuter-Aided Design and Drafting (CADD) Systems. The application of CADD and related technology can affect every phase of the design process positively. This technology offers the potential of cost reductions and shorter design schedules by increasing the productivity and capability of the design agency, while maintaining or enhancing the quality of projects. Maximum implementation and integration of this technology is encouraged. The proponent for CADD in HQUSACE is CEMP-ES.

3. Corm of Engineers Guide Specifications (CEGS). The Government can derive the benefits of maximum competition if specifications used throughout the Corps of Engineers are uniform. Use of the CEGS and other industry recognized standard specifications for preparing project specifications is mandatory to the maximum extent practicable. Requirements in connection with using guide specifications for the preparation of military project specifications are contained in ER 1110-345-720. Requirements for Civil Works are in ER 1110-2-1200. The HQUSACE proponents are CEMP-E and CECW-E, respectively.

4. Corps of Engineers Abridged Guide Specifications (CEAGS). These short form guide specifications have been developed from CEGS. CEAGS replace DoD Family Housing Guide Specifications and Army Reserve Guide Specifications. Their use is optional for small projects, small portions of large projects, or maintenance and repair work. These simple, direct-language specifications follow the Construction Specification Institute (CSI) format, as do the CEGS. Minimum shop drawing submittal requirements are a feature of the CEAGS, and heavy reliance is placed on manufacturers' installation requirements. In addition, most references to standards are deleted. The proponent office in HQUSACE for CEAGS is CEMP-EA.

5. Consturction Criteria Base (CCB)/Compact disc - Read Only Memory (CD-ROM). In cooperation with the Department of Defense (Naval Facilities Engineering Command and the Corps of Engineers), the National Institute of Building Sciences (NIBS) developed an electronic database (CCB) of military and other federal construction agencies' guide specifications, technical manuals, standards, cost estimating system, and other information. Optical disc (CD-ROM) technology has been utilized as the transmission media. The CCB/CD-ROM is available on an annual subscription basis; updates are issued quarterly. Updates from DoD and other federal agencies such as the Veteran Administration and the National Air and Space Administration are also included. The proponent office in HQUSACE is CEMP-EA.

6. Microcomputer-Aided Cost Engineering System (MCACES). MCACES is an automated cost estimating tool which can be used in the programming, planning, design and construction process (i.e., throughout the project delivery process). MCACES had its beginning with the initial development of the Cost Estimating System (CES) in 1978 by the Middle East Division (now the Transatlantic Division). Huntsville Division expanded the system into CACES in 1982 and promoted its use in CONUS. MICRO-CACES was developed by CESAS and fielded to USACE Commands in 1989. A CACES (and MCACES) System Steering Committee, (MSC and HQUSACE members) now directs future development. The proponent in HQUSACE for CACES and MCACES is CEMP-EC, the Civil Works point of contact is CECW-EC.

7. Automated Review Management System (ARMS). ARMS is a minicomputer resident system developed by CECER to provide an effective mechanism for management of design review comments. It provides support at four primary user levels: (1) technical manager, (2) review manager, (3) reviewer, and (4) project designer. ARMS capitalizes on the computer's ability to organize and track multiple aspects of an information database. This relieves reviewers and designers of many of the laborious aspects of generating and responding to design review comments. The proponent office in HQUSACE is CEMP-ES. The TCX is CESPK-ED-T, 916/557-7999.

8. Lessons-learned System: Hazardous. Toxic and Radioactive Waste Program (HTRW). This system has been developed to provide a means to identify real or potential problem areas in the HTRW program, collect ideas on solutions to these problems and to make the information available to all USACE Commands engaged in this work. Ideas are loaded to the central electronic file through district and MSC charnels. Design and construction personnel use personal computers to access the central file.

9. Engineering Improvement Recommendation System (EIRS) Bulletins. EIRS Bulletins are part of a system for implementation of recommendations from various feedback sources (designers, area/resident engineers, DEH/BCE personnel, etc.) and are used in Military Programs to expedite dissemination of information regarding problems. The probable solutions included in EIRS Bulletins have not been thoroughly explored or staffed. As such, these probable solutions may not represent a final HQUSACE position and their use will not be mandatory. Probable solutions are considered as informational in nature and for the purpose of permitting prompt consideration by the field. EIRS Bulletin recipients are encouraged to comment on the probable solutions presented so that other viewpoints can be considered in the development of the final HQUSACE position. Since changes to guide specifications issued in EIRS Bulletins are expected to remain firm; they are identified as solutions, rather than as probable solutions, and should be used in current design. The proponent office in HQUSACE is CEMP-EA.

10. Technical Centers of Expertise. Successful execution of the Civil Works and military construction programs require a thorough working knowledge of a wide variety of highly specialized engineering, design, and operational activities. Centers of expertise were established in the Corps to provide specialized engineering services, and support USACE commands for purposes of economy and efficiency. The five types of centers currently established in the Corps are:

- Technical Centers of Expertise (TCX)
- Mandatory Centers of Expertise (MCX)

-Design Centers
- Technical Management Centers
- Centers of Standardization

The missions and their respective responsibilities assigned to the centers of expertise are defined in ER 1110-3-109 (for military). ER 1110-2-109 covers hydroelectric design centers for Civil Works programs. U.S. Army Engineer Division, Missouri River, has been designated the MCX for the hazardous, toxic and radioactive waste (HTRW) program. The USACE HTRW Management Plan describes the responsibilities of the MCX in this program. The services to be rendered by each of the technical centers to a USACE Command are generally advisory in nature, unless the use of these services has been made mandatory by HQUSACE in regulations or directives. HQUSACE proponent offices are CEMP-ET, CECW-EE and CEMP-R (for HTRW).

11. HOUSACE Consultants Services. When major or unusual design (or construction) problems are encountered, USACE command personnel may wish to seek the consulting services of technical specialists at HQUSACE. This service is available on a reimbursable basis. Generally, at least two weeks advance notice should be given. HQUSACE proponents for these services are the technical branches in CEMP-E and CECW-E.

12. Department of the Army Facilities Standardization Program. This program consists of applying a formal process for selecting types of facilities for standardization; defining requirements; developing, coordinating, approving, and implementing Army standard designs; and reviewing and updating approved Army standard designs. To provide flexibility to meet the varying needs of the Army, the thrust of the program is to develop standard designs in the form of definitive design drawings. This allows each Army standard design package to be adapted to the installation's architectural theme. This approach to standardization ensures facility users and installations that their facilities will be "Facilities of Excellence" and supports such new concepts as the Army Chief of Staffs "Communities of Excellence". Approval and implementation of standard designs are based on the recommendations of the Department of Army Committee, USACE Facilities Standardization Committee, and facility type subcommittees. These designs are mandatory for use in the Army for the planning, programming, design, and construction of the facility types for which they were intended. Standard designs are listed in Engineer Pamphlet 1110-345-2. Copies of approved Army standard design packages are available from the U.S. Army Engineer Division, Huntsville. The proponent office for this program is CEMP-EA.

13. Simplified Design Method (SDM). The SDM is intended for small, non-complex maintenance projects for installations. The basic idea is to use unique and innovative design methods and present these on plans, specifications and design analyses that are printable on a standard copier. The proponent office in HQUSACE for SDM is CEMP-EA.

14. Value Engineering (VE). VE is an effective tool to reduce the construction costs of a project. VE should be implemented early in the design process to minimize impact on the design schedule and lost design effort. Approved VE changes will result in a more life cycle cost-effective design, and will not reduce quality or adversely affect the function of the project. The availability of the VE tool, however, does not relieve the designer of his responsibilities to investigate and analyze alternate

systems/approaches during the initial design phases. The proponent office in HQUSACE for VE is CEMP-EV.

15. Peer Review. Two general types of peer review can be utilized to improve the delivery of quality services and products in a timely and cost-effective manner. The first is a management review which seeks to identify systemic weaknesses in the structural makeup or processes (procedures and practices) of the organization. These reviews will be initiated by MSC or HQUSACE and based on the methods developed by the American Society of Civil Engineers, the American Consulting Engineers Council, or others. The results are usually confidential with the information retained by the organization. A second type of review is the individual project review. This type of review shall be used for large or complex (state-of-the-art) projects. This is a thorough review of a project design by an independent individual or group which results in a report. The conclusions and recommendations are considered advisory in nature, and are not generally released outside the office being reviewed.

16. Speciall Design Instructions. USACE has recently initiated a system to advise design agencies of special design features for specific projects. A standard form will accompany all DD Form 1391's highlighting the following information: the Center of Standardization (COS) for the facility type, site adaptation drawings that are available from the (COS), any special expertise required to design the project, and any other unique or mandatory features of the project, such as use of MCXs, and TCXs. HQUSACE will include any special design instructions in authorizing design directives to USACE Programs and Project Management Organizations.

17. Design Element Menus. These "menus" are lists of technical and administrative services and products required for execution of a project, showing in some manner the anticipated costs for each item. These lists have proven to be very effective in establishing the expectations of customers prior to design. They are also used as a "design contract" between the Corps and customers to delineate the estimated cost of each element of design and later the actual cost of each element. Districts should develop a menu of design services for each project that will be compatible with the work breakdown structure that will be used, to ensure that the actual costs can be tracked in the Corps of Engineers Financial Management System. A sample is enclosed (excerpt from Logistics Management Report No. CEOOR1, Oct 91).

18. Standard Contract Formats. Standard contract formats for A-E, (including surveying and mapping), and construction services have been developed for use throughout the Command. Instructional Letter 92-4, issued 18 Dec 92 by the Principal Assistant Responsible for Contracting (PARC), provides the latest implementation guidance. Use of these standard contract formats - in a automation mode - will provide field offices with a new and important quality management tool. USACE, and the A-E and construction industries, will benefit from contract uniformity and completeness throughout the Corps. For more information on these formats, contact CEMP-ES.

SAMPLE DESIGN ELEMENT MENU

Engineering and design services	Typical cost	Proj. spec. cost	● udget ● st.
1.0. Concept design			
1.1 Design analysis			
1.2 Plans			
1.3 Specifications			
1.4 Cost engineering			
1.5 Life-cycle cost analysis			
1.6 Review			
1.7 Value engineering			
2.0 Final design			
2.1 Design analysis			
2.2 Plans			
2.3 Specifications			
2.4 Cost engineering			
2.5 Life-cycle cost analysis			
2.6 Review			
2.7 Value engineering			
3.0 Additional services			
3.1 Comprehensive interior design			
3.2 Existing condition survey			
3.3 Operating and maintenance support			
3.3.1 Customer training			
3.3.2 Documentation			
3.4 Preconcept design			
3.4.1 Surveys			
3.4.2 GEOTECH investigations			
3.4.3 Single line drawings			
3.5 Project definition			
3.5.1 scope			
3.52 Criteria			
3.53 Cost engineering			
3.5.4 Life-cycle cost analysis			
3.6 Promotional material			
3.6.1 Renderings			
3.6.2 Models			
3.7 Other			
3.8 Other			
3.9 Other			
4.0 A-E Contract			
4.1 Solicitation			
4.2 Selection			
4.3 Proposal			
4.4 Negotiation			
4.5 Award			
5.0 Construction contract			
5.1 Selection criteria (RFP)			
5.2 Bid Evaluation			
5.3 Other technical support			
6.0 Project management			
Total			

APPENDIX E
DESIGN DOCUMENTS

1. Design Analysis. A two-part written document in which the design team identifies all project requirements and clarifies how the proposed facility design satisfies those requirements. The first part, the Basis for Design, discusses applicable criteria, stated user needs, design, and construction considerations by discipline. The second part, Studies and Calculations, provides all appropriate supporting calculations. Any changes to the basis for design or supporting calculations shall be added to the design analysis and identified as being additions to the original document.

2. Drawings. The designer has the responsibility to show all information necessary to completely describe the project on the drawings. The final, original drawings submitted by the designer will be used for the reproduction of bidding and construction documents. The final, original drawings, generally, will also become the record as-built documents.

3. Specifications. Standardized guide specifications are issued by USACE for use in the technical provisions of construction contract specifications. They require tailoring to meet the requirements for a specific project. The tailored guide specifications are submitted by the designer, along with any required locally prepared technical specifications, and the special provisions (front-end) with the final design. Specifications will normally include descriptions of technical requirements for materials, products, or services, as well as criteria for determining whether these technical requirements are met.

4. Construction Cost Estimates. Cost estimates are made for the purpose of budgeting and programming, evaluating bids, and serving as guides in conducting negotiations and in establishing a schedule of payments. Cost estimates should be as accurate as possible, based on the latest design data and site information available. and reflect the current fair market value of the local area.

5. Submittal Register (ENG Form 4288). This form is included within the construction specifications. It lists, by technical specification section, all equipment and construction materials for which shop drawings, test reports, descriptive data, or other submittal information from the contractor will be required.

6. Engineering Considerations and Instructions to Field Personnel. This report is used to transmit special design concepts, assumptions, and instructions on how to construct unique design details to field personnel. The report also establishes a basis for communication and coordination between design and construction personnel.

7. Color Boards. The color board depicts all comprehensive interior design and structural exterior and interior design materials and finishes. The color board should coordinate samples with the finish, color, and graphics schedules of the facility contract documents. Material and finish should should be labelled with specific color names. Pattern samples must be large enough to show the full pattern, color, and texture.

8. Comprehensive Interior Desire (CID) Package (Military). The CID includes selecting and developing interior building finishings for an integrated visual and functional design theme which reflects the interior atmosphere desired by the user.

9. Environmental Documents. The designers provide an environmental permit matrix, completed applications, and any other required documents for all permits, licenses, and/or authorizations required for construction/operation of the facility.

10. DD Form 1354 Data Sheets (Military). The data sheets contain a summary of project information to be used in completing the official DD Form 1354 upon completion of construction and transfer of the facility to the owner agency. The designers should utilize the design analysis, cost estimate quantities, and costs in completing the majority of information on the data sheets.

APPENDIX F
LESSONS LEARNED LIST - TYPICAL EXAMPLES

A. GENERAL:

1. Failure of A-E Firm(s) to become thoroughly familiar and to comply with provisions of the A-E Guides, AFR 88-15 and ETL's.

2. Failure of A-E to order Corps of Engineers Guide Specifications (CEGS) at the appropriate time, resulting in use of outdated CEGS on hand or from earlier projects.

3. Use of trade names or proprietary items.

4. Improper cross-referencing or failure to cross-reference details and sections.

5. Failure to read/use technical notes in Guide Specifications.

6. Failure to coordinate all disciplines prior to submittal of projects for review.

7. Failure of designer to identify shop drawings that are extensions of design and, therefore, require designer review.

8. Failure to use CSI numbering system for specifications.

9. Poor legibility of drawings due to improper lettering size, shading, clutter, faintness of drafting, insufficient scale size.

10. Failure to assure that all publications listed in the specifications are up to date, and that those which do not apply to the particular project are deleted.

11. Failure to identify all real estate constraints.

12. Placing information on construction detail in more than one place in construction documents. For example, notes on drawing duplicating information in specifications.

13. Failure to prepare a FIP analysis, and obtain FIP procurement authority.

B. CIVIL:

1. Boring stations and boring logs missing on drawings.

2. Spot elevations at each rigid pavement joint intersection missing.

3. Failure to show invert elevations and points of entry of utility lines into buildings.

4. Failure to provide codification in design analysis for water, sewer and storm drain systems.

5. Separate trench designs for rigid and flexible pipes not shown.

6. Water lines improperly installed in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

7. Sewer lines not at least 10 feet from potab!e water lines, (6 ft. if the water line is at least 1 ft. above the sewer line). If the sewer line passes above the water line, sewer line shall be of pressure pipe with the nearest joint at least 3 ft. from the crossing, or concrete encasement shall be installed and the pressure pipe or encasement shall extend at least 10 tit. on either side of the crossing.

8. Failure to provide the following note on the utility plan: "Elevations of utilities are given to the extent of information available. Where elevations are not given at points of existing utilities crossings, such elevations shall be determined by the contractor and reported to the contracting oftlcer. When unknown lines are exposed, their location and elevation shall likewise be reported. "

9. Failure to properly edit the various earthwork related specifications so that their paragraphs do not conflict. They must all comply with specific requirements stated in the geotechnical report.

10. Designers often do not consider the ramifications of modifications to existing infrastructure (connections, taps, relocations) that are catholically protected. This can result in isolating segments of the system, leaving them unprotected from galvanic corrosion.

C. ARCHITECTURAL:

1. Handicapped water closet stalls not in accordance with the Uniform Federal Accessibility Standards.

2. Sealant or caulking details not identified by appropriate symbols that relate to fill scale illustrations.

3. Improper use of fire-retardant wood. Fire-retardant wood is not noncombustible; its use in buildings that are of noncombustible construction is extremely limited (see UBC for the minor allowable uses). Because of the potential for severe degradation, fire retardant plywood shall not be used in a roof or roofing system, or in structural applications.

4. Trade names used in door hardware specifications in lieu of ANSI numbers.

5. Improper use of gypsum wall board. Water-resistant gypsum wallboard is not to be used on ceilings; in Air Force projects, gypsum wallboard is not to be used behind ceramic tile.

6. Life Safety regulations are sometimes ignored, if work resulting from the regulations is not specifically called out in the scope of work.

7. Size and spacing of the joint reinforcement for CMU walls not shown.

8. Roof and wall designs not detailed to indicate proper vapor retarder installation, air and ventilation spaces. Calculations not provided in the design analysis to indicate that the dew point location within the assembly meets requirements..

9. Materials exposed in return air plenums that are not non-combustible.

D. STRUCTURAL:

1. Excavation and compaction not consistent with the geotechnical report.

2. Steel deck section properties not shown.

3. Steel deck diaphragm connection details not shown.

4. Space between top of partition and the roof deck or structural member not provided for deflection of the roof frames.

5. Horizontal lateral bracing on top of partitions not provided.

6. Alteration and addition to existing buildings:

a. Existing structural deficiencies not reported to the project manager.

b. Structural analysis not made of existing structural members (systems) for additional loads.

7. Footings design inconsistent on architectural and structural drawings.

8. Control joints in CMU walls not shown on both architectural and structural plans, or, are inconsistent.

9. Structural framing for mechanical equipment not provided.

10. “Nondestructive testing (NDT) of welds” notes not shown on drawings.

11. “Pipe at Footing Typical Detail” notes not provided.

12. Recessed or sloped concrete slab not shown on both architectural and structural drawings.

13. Failure to provide floating floor when recommended by geotech report. Typical violations are: (a) slabs bearing on foundation wall/grade beams at doorways, (b) hairpins embedded in column piers and floor slab, (c) dowels between foundation wall and floor slab, (d) turned down slab with line load and/or concentrated load at edge.

14. Failure to follow Corps guidance pertaining to location of CMU control joints at doors and other building openings.

15. Failure to provide a floor joint plan.

16. Failure to identify wall type (e.g., structural/nonstructural) and their locations.

E. MECHANICAL:

1. FIRE PROTECTION:

a. Water flow test not performed as required. Water supply flow tests shall be performed for projects which provide new fire sprinkler system(s). Test data shall consist of static pressure, residual pressure, flow rate and the location of the test. Test data shall be specified or indicated on the fire protection drawings. The designer shall verify by hydraulic calculations, that the water supply is sufficient to supply adequate volume and pressure to meet the system demands. Hydraulic calculations shall be included in the design analysis. REF: NFPA 13, paragraph 3-3.2.3.

b. Control valves not specified. Provide and show the correct type of control valve for the different types of sprinkler system; i.e., dry-pipe, deluge, pre-action wet pipe etc. Confer with NFPA 13 and Fire Protection Handbook.

c. Riser diagram not provided. Show all piping from the point of connection to existing, to the top of the riser(s). Indicate the location of all valves, fire department connections, and inspector's test connections. Sprinkler drain piping and location of drain discharge should be shown and detailed. The extent or limits of each type of system, each different design density, each type and temperature rating of sprinkler heads, and concealed piping shall be clearly specified or indicated.

d. Location of all fire dampers not shown.

2. HEATING. VENTILATION AND AIR CONDITIONING:

a. Correct outside design temperatures not used. These should be in accordance with TM 5-7895, Engineering Weather Data. Use the dry bulb temperature with its corresponding mean coincident wet bulb temperature (MCWB).

b. U factors (Heat Transmission) not in accordance with the AEI.

c. Adequate personnel access around equipment for service and maintenance not provided.

d. Layout of outdoor equipment area/yard does not provide for sufficient airflow to prevent short-circuiting.

e. Cooling tower design: Proper height relationship not maintained between sump outlet circulating pump, and three-way by-pass valve, so that the pump will always have a positive suction head upon shutdown of system or pump.

F. ELECTRICAL:

1. Missing electrical site plan.

2. Missing electrical one-line diagram.

3. Size and type of existing overhead conductors 'often do not match with copper or aluminum wire gauges or available types.

4. Construction details for the transformer slab, handholes and manholes missing.

5. Failure to show adequate overview and details for complex grounding systems.

6. Failure to provide riser diagrams for intrusion detection, telephone, and fire alarm systems.

7. Mounting heights of appropriate devices on the symbol list not shown.

8. Failure to provide adequate TEMPEST requirements (attenuation, frequency, and penetration schedule).

9. Failure to indicate the transformer percent impedance and AIC rating for the power panels.

10. Failure to provide sufficient lighting protection and fixture details and design.

11. Failure to address cathodic protection design when the soil resistivity indicate the requirement for a cathodic protection system.

12. Failure to identify the hazardous areas per the National Electrical Code (NEC). Give class, division, and group.

13. Failure to show mounting detail for RFI filters and panel boards in computer room.

14. Concrete encased duct detail - failure to provide required horizontal separation between communication and power ducts.

15. Do not specify "copper only" for bussing or conductors on drawing. Let the specification govern. On "mission critical" designated Air Force projects, the sole use of copper conductors only applies to interior wiring. Exterior wiring, including service entrance conductors, may be aluminum for size No. 4 AWG copper and larger.

16. Power to the fire alarm control panel not connected ahead of the main breaker on Air Force projects.

17. Failure to provide lighting and power panel schedules with branch circuit loads balanced and a circuit directory.

18. Failure to provide lighting fixture schedule as per standard drawings or details and description for fixtures not selected from the standard drawings.

19. Failure to provide designation of all rooms and areas as shown on architectural and other drawings.

20. Failure to provide required anchoring details for electrical equipment in seismic zones.

21. Failure to provide analysis on non-linear loads and required K factor.

APPENDIX G
EXAMPLE MILITARY CHECKLIST

This checklist is intended to serve only as a guide in checking or reviewing design documents for errors and omissions. It cannot substitute for the exercise of sound engineering judgement by reviewers. Professionals must maintain control of their decisions, understand the technical basis for those decisions, and independently evaluate significant data upon which the design decisions are based. The main usefulness of a checklist such as this is to provide a "minimum" check of consistency between disciplines, and compatibility of drawings to specifications. It is expected that it will be modified by each USACE command to fit specific requirements. Each item in the checklist must be checked off to indicate that the item has been reviewed, or marked "NA" to indicate it is not applicable.

Verify:

A. GENERAL:

1. That all documents have been logically ordered and a table of contents provided. _____

2. That all documents have been signed and dated. _____

3. That the scale and orientation of the drawings are consistent throughout the complete set of drawings. _____

4. That SOW shown in the design submission has been checked against the official 1391 and current design directive. _____

5. That all real estate planning reports have been reviewed to identify real estate constraints. _____

6. That appropriate elements have been notified of any additional real estate requirements. _____

7. Schedules and budgets are in accordance with the PMP. _____

B. CIVIL:

1. Existing and proposed grades. _____

2. That haul routes, disposal/borrow sites, construction contractor's storage area, construction limits, and construction staging area are shown. _____

3. Existing utilities. _____

4. That new underground utilities have been checked for conflicts against the site plans. _____

5. That utility tie-in locations agree with mechanical stub out plan. _____

6. That profile sheets show underground utilities and avoid conflicts _____

7. That property lines and limits of clearing, grading, turfing, or mulch have been shown and are consistent with architectural and/or landscaping plans. _____

8. That fire hydrant and power/telephone pole locations correspond with electrical and architectural drawings.

9. That basis of horizontal and vertical control is given and the control points are located properly with pertinent data shown: i.e., elevations, coordinates, stationing, and/or start of construction. _____

10. That valve boxes and manholes match final finished grades or pavement, swales or sidewalks. _____

11. That boring locations, soil classifications, water table, and depth of rock are shown on the plans. _____

12. That rigid pavement joint plans are shown with reasonable spacing. _____

13. That foundation coordinates are shown on the foundation plan and coordinated with architectural drawings. _____

14. That finished floor elevations match on architectural and structural drawings. _____

15. That civil specifications are coordinated with plans. _____

16. That storm and sewage drains from the facility have adequate capacity. _____

17. That directions to contractors are not duplicated in plan notes and in the specifications. _____

C. LANDSCAPE:

1. That the sprinklers, lighting, hardscape, etc., correspond with the site limits, including the building and civil plans. _____

2. That maintenance of landscape has been provided for in the design documents. _____

D. STRUCTURAL:

1. That the design load conditions meet or exceed the Building codes and the Design Standards. _____

2. That the column orientation and grid lines on the structural and the architectural drawings match. _____

3. That the load-bearing walls and the column locations match with architectural drawings. _____

4. That the slab elevations match the architectural drawings. _____

5. That the depressed or raised slabs are indicated and match the architectural drawings. _____

6. That the limits of slabs on the structural drawings match the architectural drawings. _____

7. That the expansion joints through the structural drawings match the architectural drawings. _____

8. The footing depths and coverage with the existing and final grades. _____

9. That the foundation piers, footings, grade beams are coordinated with schedules. _____

10. The footing and pier locations with the new and existing utilities, trenches and tanks. _____

11. That the foundation wall elevations are the same as on the architectural drawings. _____

12. That the location of floor and roof framing column lines and column orientation match the foundation plan column lines and column orientation. _____

13. That the structural perimeter floor and roof lines match the architectural drawings. _____

14. That the section and detail call outs are proper and cross-referenced. _____

15. That the columns, beams, and slabs are listed in schedules and are coordinated. _____

16. That the column length, beam, and joist depths match with the architectural drawings. _____

17. That the structural dimensions match the architectural drawings. _____

18. That the drawing notes do not conflict with specifications. _____

19. That the architectural construction and rustication joints are correct. _____

20. The structural openings with the architectural, mechanical, electrical, and plumbing drawings. _____

21. The structural joist and beam location with water closets, floor urinals, floor drains and chases. _____

22. The structural design roof and floors for the superimposed loads, including the HVAC equipment, boilers, glass walls, etc. _____

23. 'Cambers, drifts, and deflections with the architectural drawings. _____

24. That the concentrated load points on joists do not conflict with design by other disciplines; i.e., large water lines or fire main lines. _____

25. That horizontal and vertical bracing, ladders, stairs and framing do not interfere with doorways, piping, duct work, electrical, equipment, etc. _____

26. That the structural fire proofing requirements are coordinated with the architectural requirements. _____

27. That the rock excavation is a base bid or a unit price. _____

E. ARCHITECTURAL:

1. That site property lines and existing conditions match with survey or civil drawings. _____

2. That building location meets all setback requirements, zoning codes, and deed restrictions. _____

3. That building limits match with civil, plumbing, and electrical on-site plans. _____

4. That locations of columns, bearing walls, grid lines and overall building dimensions match structural. _____

5. That locations of expansion joints, all floors, match with structural drawings. _____

6. That demolition instructions are clear on what to remove and what is to remain, and are coordinated with design documents. _____

7. That building elevations match floor plans and have the same scale. _____

8. That building sections match elevations, plans, and structural drawings. _____

9. Building plan match lines are consistent on structural, mechanical, plumbing, and electrical drawings. _____

10. Structural member locations are commensurate architecturally. _____

11. That elevation points match with structural drawings. _____

12. That chases match on structural, mechanical, plumbing, and electrical drawings _____

13. That section and detail call outs are proper and cross-referenced. _____

14. That large-scale plans and sections match small scale plans and sections. _____

15. Reflected architectural ceiling plans with mechanical, and electrical plans. _____

16. That columns, beams, and slabs are listed on elevations and sections. _____

17. That door schedule information matches plans, elevations, fire rating, and project manual. _____

18. That cabinets or millwork will fit in available space. _____

19. That flashing through the wall and weep holes are provided where moisture may penetrate the outer material. _____

20. Flashing materials and gauges. _____

21. Fire ratings of walls, ceilings, fire and smoke dampers. _____

22. That miscellaneous metals are detailed, noted, and coordinated with the Project Manual. _____

23. That equipment room or areas are commensurate with mechanical, electrical, and plumbing. _____

24. The limits, types, and details of waterproofing and coordination with design documents. _____

25. The limits, types, and details of insulation and coordination with design documents. _____

26. The limits, types, and details of roofing and coordination with design documents. _____

27. Skylight structures compatibility with structural design. _____

28. That piping loads hang from the roof or floors, are coordinated with the mechanical — and structural drawings, and proper inserts are called for on the drawings.

29. That all mechanical and electrical equipment is properly supported and that all architectural features are adequately framed and connected. _____

30. That all drawings showing monorails, hoists, and similar items have support details, notes, and that the locations are coordinated with the architectural, structural, mechanical, and electrical drawings. _____

31. That walls, partitions, and window walls are not inadvertently loaded through deflection. _____

32. That all window walls, expansions, and weeps are provided. _____

33. That all handicapped requirements are coordinated with plumbing and electrical. _____

34. That architectural space requirements are commensurate with duct work conduit, piping, light fixtures, and other recesses. —

35. That architectural space requirements are commensurate with elevators, escalators, and other equipment. _____

36. Dew point in walls, roof, and terraces; and that vapor barrier has been provided as required. _____

37. That concealed gutters are properly detailed, drained, waterproofed, and expansion provided for. _____

38. Compatibility of grading around perimeter of building with civil drawings. _____

39. That color finish schedules are on drawings. _____

40. That interior valleys for buildings having large flat roofs are provided with saddles or crickets to eliminate formation of bird baths. _____

F. MECHANICAL:

1. That mechanical plans match architectural and reflected ceiling plans. _____

2. That HVAC ducts are commensurate with architectural space and are not in conflict with conduit, piping, etc. _____

3. That mechanical equipment fits architectural space with room for access, safety, and maintenance. _____

4. That mechanical openings match architectural and structural drawings. _____

5. That mechanical motor sizes match electrical schedules. _____

6. That thermostat locations are not placed over dimmer controls. _____

7. That equipment schedules correspond to manufacturer's specifications and design documents. _____

8. Mechanical requirements for special equipment; i.e., kitchen, elevator, telephone, transformers, etc. _____

9. Fire damper location in ceiling and fire walls. _____

10. That all structural supports required for mechanical equipment are indicated on structural drawings. _____

11. That all roof penetrations are shown on roof plans. _____

12. That seismic bracing details are provided for all platforms which support overhead equipment and that seismic flexible coupling locations and details are shown. _____

G. FIRE PROTECTION:

1. Conduct waterflow testing for all new sprinkler systems. Indicate waterflow test data on drawings or in specifications. _____

2. Provide detailed hydraulic calculations that verifies that the water supply is sufficient to meet the fire protection system demand. _____

3. Ensure that a complete riser diagram is shown. _____

4. Ensure that all piping from the point of connection to the existing, to the top of the sprinkler riser(s) is shown on the drawings. _____

5. Ensure that all valves, fire department connections, and inspector's test connections are indicated on drawings. _____

6. Ensure that sprinkler main drain piping and discharge point are shown and detailed. Main drains should discharge directly to the outside. _____

7. Ensure that the extent or limit of each type of sprinkler system, each design density, each type and temperature rating of sprinkler heads, and location of concealed piping is clearly specified or shown. _____

8. Ensure that water-filled sprinkler piping is not subject to freezing. _____

9. Provide detail of the sprinkler piping entry into the building, and include details of anchoring and restraints. _____

10. Ensure that aesthetics considerations are incorporated in the design of the sprinkler system, e.g. sprinkler piping is concealed in finished areas and recessed chrome-plated pendent sprinkler heads are used in finished area. _____

11. Ensure that paddle-type waterflow switches are only used in wet-pipe sprinkler systems. The other sprinkler systems shall use pressure-type flow switches. _____

12. Ensure that the main sprinkler control valves are accessible from the outside. _____

13. Ensure that fire rating of fire-rated walls, partitions, floors, shafts, and doors are indicated. _____

14. Ensure that if spray-applied fire proofing is specified that the fire rating of the steel structural members are indicated. _____

15. Ensure that the location of required fire dampers are shown. _____

16. Ensure that the location of all fire alarm indicating devices, pull stations, waterflow switches, detectors and other fire alarm and supervisory devices are indicated on the drawings. _____

17. Ensure that the connection of the fire alarm and detection system to the base-wide fire alarm system is clearly shown and detailed. _____

H. PLUMBING:

1. That plumbing plans match architectural, mechanical, and structural drawings. _____

2. That plumbing fixtures match plumbing schedules and architectural locations. _____

3. Compatibility of site piping limits interfaces with building piping. _____

4. Roof drain locations with roof plan. _____

5. That subsurface drains are located and detailed. _____

6. That roof drain overflows are provided. _____

7. That piping chase locations matches architectural and structural drawings. _____

8. That all hot and cold water piping is insulated in accordance with the contractor's approved piping insulation display sample. _____

9. That piping is commensurate with architectural space and not in conflict with conduit, duct, and structure. _____

10. That piping openings match architectural and structural drawings. _____

11. That structural design is compatible with plumbing equipment and piping requirements. _____

12. That plumbing equipment schedules correspond to manufacturers' specifications and design documents. _____

13. That floor drains match architectural and kitchen equipment plans. _____

14. That site utilities have been accurately verified, and that site water and gas service requirements are met by supply utilities. _____

15. That floor openings, i.e., drains, water closets, etc., do not conflict with structural beams, joists, or trusses. _____

16. Limits and confines where piping may be run. _____

17. That seismic bracing details are provided and that seismic flexible coupling locations are shown. _____

18. That roof drain details are coordinated with other trades to show the installation of sump pans in ribbed sheet metal decks, and the placement of roof insulation in and around the drainage fitting. _____

I. ELECTRICAL:

1. That electrical plans match architectural, mechanical, plumbing and structural. _____

2. That location of light fixtures, speakers, etc., match with reflected ceiling plans.

3.That electrical connections are shown for equipment, i.e., mechanical motors, heat strips, etc., architectural, overhead doors, stoves, dishwashers, etc. _____

4. hat locations of panel boards, transformers, are shown on architectural, mechanical, and plumbing plans.

5. That conduit chase locations match with architectural and structural drawings. _____

6. Compatibility of conduit and light fixtures with architectural space and that no conflicts exist with duct, piping, or structure.

7. That electrical equipment structural requirements are met. _____

8. That electrical equipment room fits architectural space, with clearance for safety and maintenance. _____

9. That electrical horsepower, voltage, phasing for all motors match on mechanical and architectural designs. _____

10. That fixtures, speakers, clocks, etc., schedules correspond to a manufacturer's description and design documents. _____

11. Light fixture spacing and location to eliminate dark spots. _____

12., Location of duplex outlets, telephone, fire alarms clock outlets, etc., with architectural millwork and finishes. _____

13. The limits and confines where conduits may be run. _____

14. Site electrical and telephone service requirements with supply utility. _____

15. That seismic bracing details are provided and that seismic flexible coupling locations are shown. _____

J. SPECIFICATIONS:

1. That bid and additive items are coordinated with drawings. _____

2. That the measurement and payment section is present, when appropriate. _____

3. That construction phasing is clear. _____

4. That cross-referenced specifications and drawings are numbered correctly. _____

5. That all finish materials listed in architectural finish schedule are specified. _____

6. That thicknesses and quantities of materials shown on plans agree with specifications. _____

7. That all items of material or equipment are covered by adequate specifications, including those not covered by CEGS. _____

8. That all shop drawings and material certifications to be submitted are listed in the submittal register. _____

9. That provider of utilities during construction is indicated in specifications. _____

10. That asbestos abatement and quantities are included in specs and on bid schedule. _____

11. That Government-furnished materials are identified. _____

12. That security requirements for employees are included. _____

13. That references to test methods, material specs, or other manuals are consistent with civil or military designations, as applicable. _____

14. That traffic control during construction is indicated. _____

15. That temporary dust control measures are outlined. _____

16. That proper warranties are called for in the specifications. _____

APPENDIXH
EXAMPLE CIVIL WORKS CHECKLIST

This checklist is intended to serve only as a guide in checking or reviewing design documents for errors and omissions. It cannot substitute for the exercise of sound engineering judgement by reviewers. Reviewers should be particularly cautious not to let personal preferences affect their work. Professionals must maintain control of their decisions, understand the technical basis for those decisions, and independently evaluate significant data upon which the design decisions are based. The main usefulness of a checklist such as this is to provide a "minimum" check of consistency between disciplines, compatibility of drawings to specifications, and conformance with functional requirements and design criteria. It is expected that it will be modified by each USACE command to fit specific requirements. Each item in the checklist must be checked off to indicate that the item has been reviewed, or marked "NA" to indicate it is not applicable.

1. Prior to initiation of plans and specifications, review GDM, DM, FDM (or technical appendix to the feasibility report), local cooperation agreement, and the environmental documentation. The feasibility main report, environmental documentation, and authorizing legislation should also be reviewed for added design considerations. _____

2. Identify responsibility for drawings and input for various drawings. _____

3. Review survey data, determine adequacy of available topo and request additional surveys, and establish centerline and offset reference points if necessary. _____

4. In conjunction with the PM, determine funding requirements and milestones. Check — on previously submitted funding requirements and schedules to assure compatibility.

5. Prepare work order requests to technical elements (hydrology, hydraulics, geotech, environmental, recreation, specifications and cost engineering, surveys, drafting, real estate, technical specialists, design section, etc.). Clearly identify work required, cost, and time of completion on work order. — —

6. Make field trip to study site drainage, bridges, disposal areas, work areas, borrow areas, obstructions, etc. _____

7. Through the PM, inform local sponsors that contract plans are being prepared and advise them of critical dates for their submittals (rights of way, relocations, detours, recreational facilities, site drainage, disposal areas, borrow areas, work areas, contributed finds, bridge drawings, etc.). _____

8. Through the PM, determine if any relocation contracts will be necessary for relocations that are a Federal responsibility. If so, initiate contact immediately with the owner/agency and set up a meeting. Generally, a minimum of one year is needed to obtain an executed contract. _____

9. Through the PM, initiate by letter requests for information from the local sponsor. Be specific as to what is required and when it is required. _____

a. Prepare copies of rights+ f-way required for project (including borrow areas, contractor work areas, access, detours, turnaround, etc.). _____

b. Send right-of-way (R/W) drawings to real' estate division with a memorandum requesting R/W. _____

c. With the PM, meet with the local sponsor to discuss relocations. _____

d. Obtain location and drawings of all utilities. _____

e. Obtain location and drawings of existing bridges and other structures crossing or in the project area. _____

f. Through the PM, determine if the local sponsor intends to include "Contributed Funds, Other" in Government contract (ER 1140-2-301). Notify locals of items and obtain from them the approximate cost. Arrange for obtaining funds. Prepare "spread sheet" and memo for record to accept local funds. Write memorandum to finance and accounting requesting billing of locals. _____

g. In conjunction with the PM, develop tentative pay iterms and quantities for "Contributed Funds, Other. " _____

10. Review cost-sharing agreements for recreational features and update to conform with plans and specifications. Identify recreational requirements for impacts and incorporation into the design drawings. _____

11. Request survey organization to tie our construction control line to existing survey monuments and have them prepare alinement data sheets. _____

12. Lay out plan and profile drawings and site drainage, coordinate with local sponsor. _____

13. Lay out rights-of-way and construction easement on contract drawings; do not dimension R/W easements. If easements have not been requested from local interest, do so by memorandum to real estate division. Get all requirements for placing fill, required fill areas, heights, compaction, clearing site, etc. _____

14. AU items of work and existing conditions should clearly show on the plan and profile sheets with proper drafting symbols, notes, and legends. _____

15. Sufficient details and sections should be shown so that it is evident to any contractor specifically what is required. _____

16. Label drawings with nomenclature contained in guide specifications. Also, clearly show items of work for pay purposes; e.g., “concrete, invert. ” _____

17. Prepare list of guide specifications and specifications required for project and make up technical provisions and special provisions. _____

18. Obtain listing of survey monuments and bench marks to be used for control and included in the specifications. Copies of controls should be provided to locals for their work as soon as possible. _____

19. Request preliminary review of drawings at this stage from specifications section, cost engineering branch, geotech branch, environmental branch, design section chief, and other design section project leaders; arrange constructibility review conference with construction division. _____

20. Develop quantity take off. Unit price estimating should be done to see if the project is within funding budget. _____

21. Through the PM, develop local sponsor information and requests:

a. Request and coordinate identification of items within right-of-way that will be abandoned in place, removed by others, relocated by others, removed by contractor, etc. Place information on drawings. Walk project site with locals. _____

b. Obtain list of contacts and special requirements for inclusion into the specifications. _____

c. Any design done for the local sponsor must have the local sponsor’s approval (signature) on original drawings. _____

22. Obtain file number from file room and put on drawings. Obtain all signatures on drawings. Check all drawings. _____

23. Finalize quantity takeoffs. All quantities should have had an independent check; major quantities should have had two independent checks. Quantities should be rounded off. _____

24. Finalize design analyses. All design analyses should have had an independent check and a table of contents. _____

25. Prepare draft or bid items in clear and logical order and draft special provisions and technical provisions of specification and estimating section. _____

26. Review plans and specifications and amend as necessary. It is particularly important to review the measurement and payment items to check for consistency with the quantity take off made previously and to see that terminology in bid items agrees with drawings. _____

27. Coordinate and prepare “Engineering Consideration and Instructions for Field Personnel” for transmittal to Construction Division. _____

28. Prepare and provide diversion and control of water plan to specifications and estimating after coordinating assumed discharge with hydrology. _____

29. Plans and specifications will be based upon an approved GDM, DM, FDM, or technical appendix to the feasibility report, as appropriate. The initiation of plans and specifications will not predate the approval of the appropriate document except in unusual circumstances. _____

30. For projects requiring local cooperation, detailed plans and specifications will not be prepared until there is reasonable assurance that the conditions of local cooperation will be complied with. —

31. Verify that all shop drawings and material certifications to be submitted are listed in the submittal register. _____

32. Verify that boring logs shown on drawings have soil classified in accordance with the Unified Soil Classification System. Water table and soil data obtained should also be shown. _____

33. Verify that unusual geological and ground water conditions or problems materials are clearly emphasized for contractor’s benefit. —

34. All horizontal and vertical control points are located properly with pertinent data shown; i.e., coordinates, elevations, references, stationing, and/or start of construction. —

APPENDIXI
EXAMPLE HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW) CHECKLIST

This checklist is intended to serve only as a guide in checking or reviewing HTRW investigation and design documents for errors and omissions. It cannot substitute for the exercise of sound engineering judgement by reviewers. Professionals must maintain control of their decisions, understand the technical basis for those decisions, and independently evaluate significant data upon which the design decisions are based. The main usefulness of a checklist such as this is to provide a "minimum" check of consistency between disciplines, and compatibility of drawings to specifications. It is expected that it will be modified by each W3ACE command to fit specific requirements. Each item in the checklist must be checked off to indicate that the item has been reviewed, or marked "NA" to indicate it is not applicable.

A. GENERAL

All applicable items on the Military and Civil checklists should also be reviewed when reviewing a HTRW project. In addition to the traditional checklists, the following HTRW checklists should also be reviewed.

B. CHEMICAL DATA QUALITY MANAGEMENT

In accordance with ER 1110-1-263, all sampling and analytical activities being conducted by the Corps of Engineers in support of environmental restoration for HTRW projects must be carried out in accordance with an approved Chemical Data Acquisition Plan (CDAP). For an investigation, the elements for the CDAP are defined in the scope of work. For Remedial Design/Remedial Action, the elements for the CDAP are defined within the design specifications, however, the draft CDAP is prepared by the construction contractor and reviewed in accordance with the HTRW Management Plan. To the extent possible, the specification should define for remedial action activities all sampling, analytical, specific data quality objectives, and reporting requirements. For an invitation for bid contract, at a minimum, sample numbers per quantity of material or per time are to be specified so that an accurate cost estimate can be produced.

1. For investigations, verify:

a. That the scope of work specify that a laboratory validated by CEMRD-ED-EC be used for all project analysis. _____

b. That the CDAP addresses the general and specific data quality objectives as defined by EPA 540/G-87/007. —

c. That the data quality objectives presentation in the CDAP include: _____

(1) Data users _____

(2) Summary of existing data and assessment of adequacy and quality _____

(3) Presentation and evaluation of site conceptual model _____

(4) Decision types for investigation data generation _____

(5) Data use categories _____

(6) Data quality needs _____

(7) Data quantity needs _____

(8) Sampling and analysis approach (phasing) _____

(9) PARCC parameters _____

d. That the CDAP specify, to the extent possible, all sampling, analytical and reporting requirements as defined in a memorandum from CEMRD-EP-C titled "Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTRW Projects. " _____

e. That the CDAP specify the collection of split samples to be analyzed by USACE to monitor contractor generated analysis. _____

2. For remedial desigr/remedial action, verify:

a. That design analysis reports contain a chapter which addresses the general and specific data quality objectives as defined by EPA 540/G-87/003. _____

b. That the data quality objectives presentation in design analysis reports include:

(1) Data users _____

(2) Summary of existing data and assessment of adequacy and quality _____

(3) Presentation and evaluation of site conceptual model _____

(4) Decision types RA data generation _____

(5) Data use categories _____

(6) Data quality needs _____

(7) Data quantity needs _____

(8) Sampling and analysis approach (phasing) _____

(9) PARCC parameters _____

c. That the contract specifications contain a section which requires that the contractor generate a site specific chemical data acquisition plan in accordance with Appendix D of ER 1110-1-263. _____

d. That the contract specification section required in item 2c above specify, to the extent possible, all sampling, analytical and reporting requirements, including minimum data reporting requirements as defined in a memorandum from CEMRD-EP-C titled, "Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTRW Projects. " _____

e. That the contract specification section required in item 2c above specify that a laboratory validated by CEMRD-ED-EC be used for all project analysis. _____

f. That the contract specifications state that USACE reserves the right to obtain and analyze split samples to monitor any contractor generated analyses. _____

C. HEALTH AND SAFETY

In accordance with ER 385-1-92, all USACE elements shall comply with and specify contractor compliance with OSHA standards, 29 CFR 1910 and 1926, specifically 29 CFR 1910.120, throughout all investigation, design, and remedial action phases of HTRW projects. ER 385-1-92 also specifies the preparation of certain health and safety documents for all HTRW project phases. For design, a site-specific Health and Safety Design Analysis (HSDA) and a safety and health technical requirements section of the remedial action contract specifications (Titled: "Safety, Health, and Emergency Response") is required. All elements of Appendix A of ER 385-1-92 shall be addressed in the HSDA and technical provisions of the contract plans/specifications.

Verify:

1. That design analysis reports contain a chapter (HSDA) which addresses site-specific and hazard-specific health and safety considerations and protective measures to be instituted during remedial action tasks and operations, including the decision-logic used in their selection. _____

2. That the HSDA addresses each of the following safety and health elements. (Where use of an element is not applicable to the project, the HSDA should provide a negative declaration and brief justification for its omission or reduced level of detail.) _____

a. Site description and contamination characterization _____

b. Hazard/risk analysis _____

c. Accident prevention _____

d. Staff organization, qualifications, and responsibilities _____

e. Training _____

f. Personal protective equipment (PPE) _____

g. Medical surveillance _____

h. Exposure monitoring/air sampling program _____

i. Heat/cold stress monitoring _____

j. SOPS, engineering controls, and work practices _____

k. Site control measures _____

l. Personal hygiene and decontamination _____

m. Equipment decontamination _____

n. Emergency equipment/first aid requirements _____

0. Emergency response and contingency procedures (on-site and off-site) _____

p. Logs, reports, and recordkeeping requirements _____

3. That the contract specifications contain a section which delineates the minimum safety, health, and emergency response requirements (developed from the HSDA) to which the remedial action contractor shall adhere. This technical requirements section shall be entitled - "Safety, Health, and Emergency Response" (SHER). _____

4. That the SHER contract requirements specify that remedial action contractor develop and implement a Site Safety and Health Plan (Construction-SSHP), which must be submitted for USACE review and approval prior to commencement of on-site activities. _____

5. That the Site Description/Contamination Characterization and Hazard/Risk Analysis portions of the HSDA are incorporated or appended to this section of the specifications. _____

6. That the SHER contract requirements address each of the elements (as applicable to the site) listed in Para. 2a-p, above, which are biddable and enforceable. _____

D. HTRW PROCESS ENGINEERING

The following checklist contains general information pertinent to HTRW projects involving process design. If more specific information is necessary, the Environmental/Chemical Engineering Branch at CEMRD should be contacted. Information on the following topics is available from CEMRD:

Air stripping
Incineration
Bioremediation
Chemical dehalogenation
UV oxidation
Air pollution control

Underground storage tanks
Oil water separators
Ion exchange
Coagulation/flocculation
Solidification/stabilization
Soil vapor extraction
Soil washing
Adsorption
Filtration
Filter presses
Chemical feed systems
Landfill off gas collection and treatment

Verify:

1. Design calculations are clearly presented to substantiate process and equipment selection. _____

2. Treatability studies are accomplished in accordance with guidance provided in EPA/540/G-89/O04, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. _____

3. Treatability studies include information on the site, waste stream treated, a description of the technology, the apparatus, objectives of the treatability study, analytical protocols, schedule, summary, conclusions and recommendations. General information is contained in EPA/540/2-89/058 Guide for Conducting Treatability Studies Under CERCLA. _____

4. All ARARs (Applicable, Relevant, and Appropriate Requirements) are considered, including final treatment standards are documented in the Design Analysis. _____

5. A process designer is given the primary responsibility for treatability studies performed to ensure that any adjustments to the treatability study can be made with minimal schedule impacts. _____

6. That chemicals used in treatment processes are evaluated for thermal and pH effects, impacts on sludge generation, properties of residuals, efficiency, potential impacts on other discharge requirements and safety. _____

7. Incineration test burns include: toxicity evaluation of the bottom ash, destruction efficiency, the potential for slag formation, metals partitioning, and carry over. Produce enough ash to perform solidification/stabilization testing. _____

8. Feed and ash handling systems for thermal treatment processes are closely scrutinized to ensure proper operation. Impacts from stones, frozen clods, and debris to the feed system need to be addressed early in the design or as a portion of the RFP, to avoid delays during start up. _____

9. That materials of construction are compatible with the liquids, vapors, and chemicals they are in contact with at the concentrations and temperatures encountered. _____

10. A process flow diagram and process instrumentation diagram is provided for the entire treatment system. _____

11. A hydraulic profile is provided for systems that do not rely on pumping between treatment units. _____

12. Operational flexibility is designed into treatment plants which allow bypassing one or several unit operations. _____

13. Multiple treatment trains are evaluated to accommodate flow variations. _____

14. All treatment units are covered and off-gas treatment incorporated into the design where potential exists for the release of volatile materials. _____

15. Thermal treatment materials handling, staging and storage are addressed to avoid intermittent shut down of the unit. _____

16. Utilities of adequate capacity are available at the treatment facility site. If utilities are not available; provisions for extensions, connections and upgrades must be included in the project cost estimate.

APPENDIXJ
EXAMPLE CONSTRUCTION COST ESTIMATE CHECKLIST

This checklist is intended to serve only as a guide in checking or reviewing construction cost estimates for errors and omissions. It cannot substitute for the exercise of sound engineering judgement by reviewers. Professionals must maintain control of their decisions, understand the technical basis for those decisions, and independently evaluate significant data upon which the cost estimates are based. It is expected that this checklist will be modified by each USACE command to fit specific requirements. Each item in the checklist must be checked off to indicate that the item has been reviewed, or marked "NA" to indicate it is not applicable.

Verify that:

1. Estimates are based on approved scope of work and latest available design data. _____

2. Estimates are developed from Corps unit price book (UPS) or approved construction cost data (e.g., Means, Richardson). _____

3. Basis for estimates is provided or explained; all assumptions, quotes, crew sizes, and other cost factors are documented. _____

4. Estimates are escalated to the expected midpoint of construction using the latest approved MCP or OMB (for Civil Works projects) index. _____

5. Estimates are prepared in accordance with latest Corps cost engineering regulations and technical manuals. _____

6. Estimates include risk analysis to cover unknown conditions or uncertainties on work schedules. _____

7. Estimates for facilities complies with DoD cost guide, detailed justification is provided when facilities costs deviate more than 5 percent from DoD cost guide. _____

8. Construction contingencies and SIOH rates conform to latest Corps guide, contingencies and SIOH costs are shown as separate items. _____

9. Estimates are prepared using MCACES. _____

10. Estimates are internally reviewed prior to submittal. _____