CHAPTER III

SECTION 1 - CONCEPT DESIGN

1.0 Concept Design Submittal. The Concept Design submittal shall consist of the following documents:

- Design Analysis
- Drawings
- Outline Specifications
- Cost Estimate
- Draft of Environmental Permit Matrix (if required by the Scope of Work)
- Draft of Engineering Considerations and Instructions for Field Personnel Report
- Other Items as Required by the Scope of Work

This chapter will define, by discipline, the requirements of the Design Analysis and the Drawings. Guidance for the preparation of the Outline Specifications is described in the A-E Guide, Volume 3, Specifications. Requirements of the Cost Estimate are provided in the A-E Guide, Volume 2, Cost Estimating. Refer also to Chapter 11, "Presentation of Data" of this Guide for design analysis format, drawing format, and quality requirements. See appropriate appendices of this volume for Environmental Permit Matrix and Engineering Considerations and Instructions for Field Personnel Report requirements.

1.1. Objective. The Concept Design data must be presented in sufficient detail to accomplish the following:

1.1.1. Show the User (customer) how the proposed design satisfies his functional, special, technical, and aesthetic needs.

1.1.2. Show all reviewing agencies that (1) the designer's approach to solution of technical aspects of the project is sound and (2) he intends to utilize appropriate controlling technical criteria (such as TM's, DM's, Guide Specifications, etc.).

1.1.3. Prepare an accurate cost estimate to verify that the project's

1.1.4. Show that appropriate and economical civil, architectural, structural, mechanical and electrical systems have been selected for the project.

1.2. Design Analysis - General

1.2.1. Project Description.

1.2.1.1. Construction site. Include a synopsis of the construction site conditions, project requirements and conformance with the master plan.

1.2.1.2. Function. Describe the basic functional objective and capacities of the proposed facility and the estimated function life. Describe the types of activities involved.

1.2.1.3. Personnel and equipment. Describe the range and number of civilian/ military personnel, equipment and vehicles to be accommodated.

1.2.1.4. Constructability. Describe the basic construction systems selected, temporary or permanent, and the estimated structural life of the facility.

1.2.1.5. Desired image or visual appearance to include design of the exterior and interior of the building.

1.2.2. Economic Summary. Describe the economic factors influencing the choice of basic materials, and the civil, architectural, structural, mechanical, electrical and fire safety systems used. The summary shall include :

1.2.2.1. Results of economic studies, which consider not only the initial construction cost, but costs incurred over the projected life of the facility as determined on the basis of the best information available, and in view of the estimated functional life of the facility.

1.2.2.2. Results of value engineering studies performed on the project design.

1.2.3. Energy Conservation: In consideration of the serious national energy shortage and escalating utility costs, designs must incorporate features that can reduce energy consumption. Systems that are energy intensive must be avoided. From among several areas of consideration the following examples are offered:

1.2.3.1. Install automatic programming devices where possible to shut off or curtail air conditioning, heating, lighting, etc., during periods when such services are not required. Where automatic controls are not available, manually reduce or shut off entire building heating and cooling systems at night and during

the weekends if unoccupied and unused during those periods.

1.2.3.2. Improve base electrical power factors whenever possible by use of capacitors or synchronous equipment.

1.2.3.3. In lieu of reducing lighting intensities, provide sufficient switching in the lighting layout to allow reduction of utilization and occupant control of smaller areas.

1.2.4. Asbestos Removal. Asbestos removal for all rehab projects when new work ties into existing work, or if demolition must take place before new construction:

1.2.4.1. If, in any earlier correspondence between the A-E and the Corps of Engineers, the presence of asbestos is stated to be known or suspected or, if, during the A-E's field investigation, the presence of friable asbestos is discovered or suspected, or the presence of non-friable asbestos is known to exist in products scheduled for removal, the following becomes a requirement of the project:

1.2.4.1.1. Preparation of an asbestos report and asbestos control plan by a qualified asbestos abatement professional. See EPA 560/5-83-002 (Guidance for Controlling Friable Asbestos-Containing Materials in Buildings) for guidance.

1.2.4.1.2. Preparation of plans and elevations indicating the location and extent of all known asbestos containing products which will require removal, enclosure, encapsulation or encasement.

1.2.4.1.3. Preparation of the Asbestos Specifications CEGS-02080 thru CEGS-02083, as applicable.

1.2.4.1.4. Removal of asbestos shall always be considered the primary goal. When this is not possible, the A-E shall determine the best alternative approach (enclosure, encasement or encapsulation) and shall modify the guide specification accordingly.

1.2.4.1.5. If the project does not contain asbestos, so state.

1.3. Drawings - General Requirements. Throughout the contract documents the designers will not attempt to assign work among the various construction subcontractors. The documents will depict the work to be performed and not attempt to determine which trade will actually do the work.

1.4. Civil Design.

1.4.1. Design Analysis - Narrative/Calculations.

1.4.1.1. Siting: Describe site conditions, including existing topographic features and improvements, affecting or relating to the proposed work. Consider any special or unusual conditions such as former refuse dump areas, a potential for flooding, ground stability, rock outcrops, drainage features and unusual soil conditions. Discuss reasons for facility orientation. Consider such factors as prevailing winds, existing structures, adjacent site conditions, solar loads, clearance restrictions and future development areas. Generally state building siting reasons. Discuss the impact of new construction on existing facilities, considerations for future expansion, requirements for flood protection, set-back requirements or specific clearance requirements, unusual cut or fill requirements.

1.4.1.2. Water Service and Fire Lines. Determine the hydraulic grade line (HGL) at the point of connection to the existing, or new, water distribution system.

1.4.1.3. Water Supply Line and Distribution System. Develop basic and controlling water demands and show required residual pressure. Include fire, domestic and industrial average and/or peak demands as applicable; include information such as known flow tests. For distribution systems, indicate whether additional fire hydrants are needed, and discuss their spacing. Discuss water storage, transient pressure, pump stations, corrosion and scale control needs, and soil boring requirements.

1.4.1.4. Water Supply Works. Provide information on type, condition, and adequacy of existing units such as wells, pumps, reservoirs, etc., and current water use. If these items are already described in an existing report, give summary statement and appropriate reference.

1.4.1.5. Water Treatment. Where water treatment is included in the project, the designer shall provide a copy of the water chemical and physical analysis. For water to be accepted for human consumption it must be palatable; additionally, it should not be destructive to the materials used in its transportation and storage; it should also be suitable for the ancillary uses associated with human habitation (i.e., personal hygiene, laundering of clothes, dishwashing).

1.4.1.6. Building sewer connection, Gravity type building sewers are preferable, if feasible; duplex pneumatic ejectors or sewage pumps are the alternatives when gravity sewage connections cannot be provided.

1.4.1.7. Sanitary and Industrial Sewer Systems. Discuss and determine average, peak, infiltration, inflow, and industrial waste flows for building connections, individual sewers, and force mains from population, measurement, or fixture units as applicable. Describe type of proposed system; where lift stations are required, state type of construction and tentative pump type. Indicate controlling elevations and compliance with minimum velocities and sizes. Discuss nature of industrial wastes.

1.4.1.8. Wastewater Treatment. Analyze wastewater characteristics, degree of treatment required, treatment process, and anticipated effluent quality. Describe anticipated effect of treatment plant effluent. Provide a brief description of units involved including basic data (population, flows, etc.) which will be used in sizing units. Discuss Army and State wastewater discharge regulations, the National Pollutant Discharge Elimination System (NPDES) permit, and pretreatment to discharge to municipal treatment systems. Evaluate and recommend EPA innovative and alternative technologies involving less costly solutions.

1.4.1.9. Percolation tests. Percolation tests are to be used to determine the acceptability of the site and for the design of the subsurface disposal systems. Whenever the Architect-Engineer determines that percolation tests are required for the project, the percolation tests will be made by the District at the request of the COE Project Manager. Discuss the need for percolation tests,

and if required, indicate the required depth. Whenever periodic high water conditions are expected, consider another type of absorption field, other than the conventional septic tank-tile field design, such as mounds, fill systems, and underdrain systems.

1.4.1.10. Corrosion Survey. For each new project with utilities systems and/or metallic structures that are buried, submerged, or in contact with either the ground or a substance which may be corrosive, a preliminary survey will be made by the District or Architect-Engineer (depending on contractural provisions) to determine the need for corrosion protection. If the Architect- Engineer determines further tests are required, this recommendation will be presented to the COE Project Manager. Submit a summary of the conclusions on the need for protection against corrosion. When water utility systems are involved in locations where the soils are known to be very corrosive, it may be desireable to use cathodic protection systems as a supplement to (but not inplace of) coal tar or cement mortar coatings.

1.4.1.11. Surveying. The existing topography is to be shown on the Site Plan; provide the name of the surveyor, the date of the survey or aerial photography, along with all control points with a note on the site plan. The specific surveying and topography drawing requirements are given in Section 2, Preliminary Design.

1.4.1.12. Demolition. Describe any required demolition.

1.4.1.13. Storm Drainage and Grading. Discuss any grading problems, and related system site and tributary area, affecting the drainage requirements. Determine the location, type, size, elevations, and condition of the existing storm drainage system, as well as topography, size and shape of the drainage area, extent and type of development. Acceptable surface drainage systems includes, among others, swales, ditches, gutters, channels, underground pipes and conduits, culverts, and detention ponds. The storm drainage plan must be selected with respect to the existing storm drainage system. Give consideration to future expansion and change in land use within the watershed.

1.4.1.14. Roads, Streets. Discuss traffic volume and composition, as well as design speed, sight distance requirements, intersections or connections to existing roads, streets or parking areas, and traffic routing during construction.

1.4.1.15. Parking, Open Storage, and Hardstand Areas. Determine the general location of parking, storage and hardstand areas, the type of vehicle to be accommodated, location of ingress and egress, pedestrian access, need of handicapped parking spaces, curbs, and curbs-and-gutters.

1.4.1.16. Sidewalks, Fencing, Signage. The walk requirements are determined on the basis of need, regardless of how built-up or isolated an area may be; the width of the walk will be based on pedestrian traffic volume. Fences define perimeters, and when integrated with lighting and with the fence line cleared of vegetation, can be a very important component of the security system; state the justification and location of gates, and determine if they are to be used for a controlled area or for higher security. Discuss the need for parking, pedestrian, and traffic signal signs.

1.4.1.17. Pavement Design and Logs of Explorations. The Sacramento District's Geotechnical Report includes, among other items, all pavement design. The Geotechnical Report shall be referenced and a copy appended to the Design Analysis as an appendix. The pavement design consists of a cross section of the pavement structure including subgrade, subbase, base course, and surface course or concrete pavement as applicable. The geometric layout of all pavement is the responsibility of the Architect-Engineer.

1.4.1.17.1. District prepared logs of borings are made available as part of the Geotechnical Report. If the Architect-Engineer determines that additional explorations are necessary, they should be requested through the COE Project Manager.

1.4.1.17.2. Additional borings may be required along the route of water supply lines and distribution systems, trunk, branch and lateral sewers, storm drainage systems, and reservoir sites.

1.4.1.18. Military Airfield Pavements. Airfield pavement design, requiring aircraft operation criteria, is accomplished only by the Corps of Engineers. The pavement structure is included in the District's Geotechnical Report without any reference to aircraft operation criteria. The width and length of the airfield pavement is to be obtained from the COE Project Manager.

1.4.1.19. Railroads. State type of service for which railroad track will be provided, the anticipated volume, type of traffic, and the name of the operating agency.

1.4.2. Drawings.

1.4.2.1. General: Layout all utility systems and appurtenances, pavement structures, railroads, fences and surveying data, using the symbols covered in the Civil Legend of Materials, Sheet No. 116 of the District's "Standard Details for Utilities, Foundations, Paving and Railroads.

1.4.2.2. Site Plan: Show new and existing building locations, access roads, parking areas, existing topography, survey control points, fences, bench marks, drainage, sidewalks, landscaping, and demolition requirements. Where drainage facilities are to be provided, indicate direction of flow and points of discharge. Also, show all electrical and mechanical site work that is visible.

1.4.2.3. Utilities Plan: Show new and existing utility lines; points of connection to existing utilities, and any demolition or rerouting of existing utility lines, and all new and existing electrical and mechanical utility lines.

1.5. Landscaping Desig.

1.5.1. Design Analysis - Narrative/Calculations. State what general type of landscape treatment exists both on the installation and in the immediate vicinity of the project. Although this project should be harmonious with adjacent landscape treatments or vegetative communities, the design need not necessarily be identical. Refer to the Base Design Guide or Base Plant List, if available. The theme must consider future long range design continuity, and compatibility with user needs and maintenance constraints.

Describe how this design satisfies these requirements and provide rationale for the proposed landscape treatment (e.g., mitigation, enhancement, erosion control). All new Army irrigation projects require specific authorization from Headquarters, Department of the Army. In general, irrigation systems receive consideration only in arid or semi-arid areas where rainfall is less than 25-inches annually. Indicate if an irrigation system is authorized.

1.5.2. Drawings. Landscaping drawings are not required at the Concept submittal, but areas to be landscaped shall be indicated on the civil site plan.

1.6. Architectural Design.

1.6.1. Design Analysis - Narrative/Calculations.

1.6.1.1. State the general type of architectural treatment that exists both on the installation, and in the immediate vicinity of the project. Although selected design features of this structure should be repeated from existing structures, the design need not necessarily be identical. Motif must follow the most recent, predominant, existing theme of the installation to insure future long range design continuity. Give description as to how this design satisfies these requirements. Give a description of particular framing and wall systems selected, others considered, and reasons for selection. If setbacks are involved, establish the relevance of setback design provisions.

1.6.1.2. Type of Construction: Provide statement as to type of construction per MIL-HNDBK-1008A and Architectural/Engineering Instructions, e.g., Fire-resistive, protected non-combustible, permanent or temporary, etc.

1.6.1.3. Indicate programmed and computed floor area (for each space or activity): Gross and net areas shall be calculated as indicated in Plate 18, Chapter IV. Indicate occupancy capacities allowed and actual per criteria.

1.6.1.3.1. Net room areas, occupant capacity and gross building areas: Provide gross floor area computations in accordance with Plate 18, Chapter IV. The floor area for each room shall be presented in tabular form

in the computation. These areas will not be shown on the drawings. Break down the areas into two categories, those calculated on the basis of full area and those calculated on the basis of one-half area, then show the grand total. Also, show the programmed area for each room and criteria data used.

1.6.1.3.1.1. Calculate full areas (including all openings in floor slabs) measured to the outer surface of the enclosing walls for the following:

1.6.1.3.1.1.1. Floors, including basements.

1.6.1.3.1.1.2. Mezzanines and balconies.

1.6.1.3.1.1.3. Penthouses.

1.6.1.3.1.1.4. Enclosed passages and walks.

1.6.1.3.1.1.5. Furnished usable space with sloping ceilings, with an average height of 7-feet and.minimum of 5-feet at perimeter walls.

1.6.1.3.1.1.6. Attached covered shipping and receiving platforms measured from the face of the building walls to edge of the platform.

1.6.1.3.1.2. One-half of the actual area of the following shall be calculated:

1.6.1.3.1.2.1. Covered or open porches and walkways.

1.6.1.3.1.2.2. Roof overhang, if greater than 2'-0".

1.6.1.3.1.2.3. Attached, uncovered, shipping and receiving platforms at truck or railroad car height, measured from the face of the building wall to the edge of the platform. (See Plate 18, Chapter IV)

1.6.1.3.2. "U"-values for each building section.

1.6.1.3.3. Ratio of exterior window and room area, if applicable.

1.6.1.3.4. Estimated annual unit energy consumption.

1.6.1.3.5. Acoustics, if applicable.

1.6.1.3.6. Estimated cost of construction.

1.6.1.4. Economy of Building Construction, Operation, and Maintenance: In order to apply life cycle cost effectiveness, an acceptable method of wall and roof construction including roof profiles shall be defined as early as possible in the design effort. Therefore, include details of proposed wall and roof construction and an analysis to verify the "U" values. The narrative description will present a discussion of different systems and alternative methods together with the reason for a particular selection. Coordinate with mechanical designer.

1.6.1.5. Toilet Room Privacy: Provide a statement defining measures taken in the design to prevent persons outside the toilets from viewing into the toilet area including the mirror and sink areas.

1.6.1.6. Occupational Safety and Health Act (OSHA): Designs will be consistent with the standards issued by the Department of Labor under Section 6 of the Williams-Steiger Occupational Safety and Health Act. Basic materials, equipment, and functional requirements must be in accordance with the criteria contained in Technical manuals (TM's) and Federal Construction Guide Specifications (FCGS). Any conflicts discovered will be brought to the attention of the Project Manager, in writing for resolution.

1.6.1.7. Handicapped Data: Design for the Physically Handicapped shall be IAW Uniform Federal Accessibility Standards. For purposes of determining handicapped requirements, provide a completed handicapped checklist. If facility is not designed for physically handicapped, state the reason.

1.6.1.8. Fire Protection Analysis. Coordinate with the mechanical and electrical designers and provide the following:

1.6.1.8.1. Basic NFPA occupancy classification and hazard (low, ordinary, high) on which analysis is based; type of construction from UBC; area of ground

floor and total floor area; building height in feet, and number of stories.

1.6.1.8.2. Building separation distances and access thereto, based on Paragraph 1.6.1.8.1. above, and Military Handbook 1008A.

1.6.1.8.3. Hour (Fire) ratings (show required, not actual) of exterior building walls, exit passageways, corridors, stairs, boiler/mechanical rooms, shafts, storage areas, janitor closets, and other hazard areas; fire and smoke floor areas; hourly rating of fire/smoke walls; corridor lengths and dead ends; corridor doors and other rated doors. Provide the UL listing for all fire rated walls, floor/ceiling, roof/ceiling systems.

1.6.1.8.4. Extinguishing and/or fire sprinkler systems: Type (wet or dry system) ; special systems, such as ''Carbon Dioxide", "Deluge", or "Standpipe", **AFFF**, or "Halon" Systems. Coordinate with mechanical designer.

1.6.1.8.5. Fire alarm and evacuation system: Type, extent, and zoning. Coordinate with electrical designer.

1.6.1.8.6. Operations involving use or storage of flammable and System shall be explosive liquids and gases, or accumulation of dusts: System shall be for all designed to comply with NFPA and UBC. Provide the flash point liquids. Describe type of electrical equipment, lighting fixtures, ventilation and other related fire protection features required to minimize hazard(s).

1.6.1.8.7. The analysis shall list applicable NFPA and UBC number references as well as "required" and "design" conditions.

1.6.1.8.8. "Means of egress" sketch shall be provided for each floor indicating exit access, door swings in path of egress, required fire separations, stairs and rated exit passageways. In addition, provide a location of exit sign sketch indicating exit lights including direction and locations for which "Not An Exit" signs may be required. Illumination of @-.

means of egress and exit markings shall comply with NFPA 101.

1.6.1.8.9. Roof clutter and the trade-off of cost versus acceptable aesthetics shall be discussed in the Design Analysis and at the Concept Review Conference.

1.6.1.9. Special Requirements for Addition/Alteration Projects.

1.6.1.9.1. Asbestos. See 1.2.4 Asbestos Removal.

1.6.1.9.2. Life Safety. Perform a life safety survey to identify existing violations of means of egress and fire separation per NFPA 101, NFPA 220 and the U.B.C. and describe how new work will impact existing life safety. State the building construction types and occupancy classification. Provide "means of egress" sketches to identify existing violations and recommended corrective actions.

1.6.1.9.3. Physical Security/Anti-Terrorism Features. Coordinate with the Architectural/Engineering Instructions, Chapter 10, Paqagraph 6.

1.6.2. Drawings.

1.6.2.1. Floor Plan for each floor at l/4"=l' scale (except as stated below), showing: (1) overall dimensions, (2) functional arrangement, (3) label all rooms and spaces, (4) interior colors and finishes and exterior colors in tabular form. (Plates 10 and 13 of Chapter IV.)

1.6.2.1.1. For large, open structures, a smaller scale may be allowed on a case-by-case basis, subject to discussion with, and approval by, the Project Manager at the Pre-Negotiation Conference. If a smaller scale is approved and used, congested areas such as toilet rooms, mechanical or electrical equipment rooms, etc., must be blown up to a minimum scale of ¼" = 1'.

1.6.2.1.2. Provide interior/exterior colors and finishes in tabular form. Describe colors by words as well as a standard number designation, so that the

customer will have no doubts as to what he will receive. The color standard is Federal Standard 595.

1.6.2.1.3. Indicate all major equipment and show to scale.

1.6.2.2. Principal Elevations: Provide a minimum of two principal elevations. Coordinate and show exterior mechanical and electrical equipment and penetrations at each elevation. Scale shall be not less than 1/8"=1'.

1.6.2.3. Building Section: Provide at least one principal section showing floor and roof framing, suspended ceilings, floor-to-floor heights, concealed or open ducts, relations of fenestration to support columns or walls, etc. Due to special needs, other primary transverse or longitudinal sections may be shown. Provide wall section at ½"=1' minimum scale as required for clarity, and principal section at minimum scale of 1/8"=1'.

1.6.2.4. Wall Sections: Provide exterior and interior wall section for each type of wall system. These wall sections are to be cut from the floor plan, not the elevation.

1.7. Structural Design.

1.7.1. Design Analysis - Narrative/Calculations.

1.7.1.1. Foundation Design: Provide a statement referencing the Foundation Report which will be attached as an appendix to the Design Analysis. The Foundation Report will normally be provided by the COE. Describe the type of foundation proposed, frost depth, need and type of vapor barrier, estimated depth of bearing, allowable bearing values, compaction requirements, and any other measures mentioned in the soils report or recommended by the designer. On some projects, the soils report may recommend two foundation types as being acceptable. In these cases an economic comparison between the two shall be presented and the more cost effective type selected.

1.7.1.2. System Selection: Provide an economic comparison of at least three structural systems for each area of the building that has a distinctly different framing

scheme. Availability of local labor and materials will be considered-in selecting the systems. A portion of the structure large enough to be representative of the entire building will be designed in enough detail to provide for a labor and materials estimate that will be the basis of the structural system selection. Each of the systems should be presented on a sketch indicating the sizes of all the framing members for each area of the building with a different framing scheme. Provide calculations required to size members. Investigate various column spacings. For a one-story structure, the comparison will be done for the roof structure and the wall system. For a multi-story facility, a cost comparison will be presented for the roof structure, the floor system, and the wall system. Attach the comparison to the Design Analysis as an appendix. Provide a word description of all the candidate solutions and indicate that the most economical has been selected.

1.7.1.3. Design Loadings (TM 5-809-WAFM 88-3, Chap. 11: Provide a discussion of live loadings to be used, to include floor loads, wind, snow, earthquake, etc., together with data to justify deviations from established criteria. Seismic design shall be in accordance with TM 5-809-10/AFM 88-3, Chap. 13. State the Seismic Zone, K, I, C, and Z values. State whether wind load or seismic load governs lateral design for each direction considered and for each independent structural system.

1.7.1.4. 1.7.1.4. Applications to Existing Buildings. For those cases in which additions are connected to existing structures (i.e., no seismic joints), the A-E shall provide calculations for the *''integral structure'' (i.e., new plus existing). In no case shall the strength of an existing "below code" structure be reduced. Where practicable, the A-E shall upgrade the lateral resistance of the existing system to meet current code. In the projects involving alterations, modifications and/or additions, the A-E shall be responsible for the investigation and design necessary to strengthen existing structural members, which are affected by additional loads. For pure alteration and repair projects, a seismic evaluation shall be performed per the following:

1.7.1.4.1. Major Alterations. When any building for which the cost of renovations or repairs exceeds 25 percent of the replacement cost of the existing building, both the existing building and the renovations must be made to resist the appropriate level of earthquake forces. An appropriate level of earthquake force is defined as that level prescribed in the latest edition of TM 5-809-10/AFM 88-3, Chap. 13. The foregoing does not preclude the use of site specific response spectra if already available, or if deemed appropriate for critical facilities.

1.7.1.4.2. Minor Alterations. Minor structural alterations may be made in existing buildings and other structures in conjunction with the upgrading of the total structure. However, the building structure's ability to resist lateral seismic forces shall not be less than that which existed before such alterations were made.

1.7.1.4.3. Seismic Evaluation Submittal Requirements. The seismic evaluation study, complete with conceptual fix (if required) and associated costs, shall be submitted. The seismic evaluation study shall be performed concurrent with other design work and coordinated with other design work to the maximum degree possible, (i.e., be feasible from a functional/architectural standpoint, etc.). The seismic evaluation study and its impact on the project current working estimate (CUE) shall be approved by the COE prior to incorporation into the project's bid documents. A minor alteration project's design documentation shall include routine structural narrative and calculations addressing structural modifications.

1.7.1.5. State the strength (working stresses or yield stresses) for all structural materials on the project.

1.7.1.6. Blast Design: For structures designed for blasts, list all appropriate design parameters such as, for the donor system, amount, type, TNT equivalent, and location of explosive material in each area. For the receiver system, state the personnel, equipment, and other explosive material which requires protection in each area. Also, define the protection categories for each area to prevent the following: (a) Communication of

detonation by fragments and high blast pressures; and (b) Mass detonation of explosives as a result of subsequent detonations produced by communication of detonation between two adjoining areas. Define blast wall, blast door, and frangible element locations to complete the description of the protective construction design approach.

1.7.1.7. Future Expansion : Where buildings are to be designed for future expansion, discuss provisions to be taken to insure the projected construction will proceed in a trouble free fashion. State that no provisions have been made for future expansion, if this is the case.

1.7.2. Drawings:

1.7.2.1. Foundation and Floor Plan: Show type of foundation proposed, depths of footings, relation of walls and floor slab to foundation system, overall dimensions, column spacing, joint pattern in slab-on-grade, tie beams, grade beams, etc.

1.7.2.2. Floor Framing Plan: Show spacing of framing members, overall depth of floor structure, column spacing, principal dimensions and shape of the building.

1.7.2.3. Roof Framing Plan: Show locations of framing members, overall shape and dimensions, diaphragm, etc.

1.8. Mechanical Design.

1.8.1. Design Analysis - Narrative/Calculations.

1.8.1.1. Design Conditions. State indoor and outdoor design temperatures for heating and cooling, proposed 'U" factors for walls, ceilings, floors , etc . , personnel load, equipment heat release (if any) ,outside air or ventilation requirements and any other special conditions.

1.8.1.2. Heating System. Indicate type of heating plant and justification for selection, operating pressure and temperature, and capacity. Briefly discuss temperature control system. NOTE: Direct Digital Controls (DDC) is prohibited for HVAC controls. DOC may be used only for internal control of individual equipment items provided it does not and will not interface with other systems or

equipment. Discuss type of conducting system, i.e., forced warm air with direct fired furnace or hot water coil, forced hot water or steam with direct radiation or unit heaters. Indicate type of heat distribution outside of buildings - steam or high temperature hot water and whether above-ground or underground. State classification of underground system per Paragraph 16 CEOS-15705 (mandatory to use) including soil investigations and survey. Describe type of piping for heating system, insulation; concealed or exposed.

1.8.1.3. Energy Conservation.

1.8.1.3.1. For new construction or major building rehabilitation projects, all architectural, air conditioning and heating design factors such as insulation, orientation, thermal storage, solar shading, size and location of glass areas, multiple glazing, alternative types of systems, and energy recovery shall be analyzed on a life-cycle cost basis and the least life cycle cost alternative chosen. Energy efficient designs shall satisfy the minimum requirements for human comfort and the operational requirements of facilities at the lowest life cycle cost. See also Paragraph 1.2.3 for energy conservation requirements.

1.8.1.3.2. The design of any new building or major renovation project which is heated and exceeds 20,000 ft2 (1859 m2) gross area, or is heated and air conditioned, or air conditioned only and exceed 8,000 ft2 (685 m2) shall be analyzed using computer analysis. These analyses shall be performed using a professionally recognized and proven design computer program which allows the integration of architectural features and heating and air conditioning systems that would result in the lowest life cycle cost. A-E encouraged to use BLAST for energy analysis via KOA Family reduced time sharing rates on CDC Cybernet. For help in using BLAST, A-E may contact the BLAST Support Office, at 1-800-U1-BLAST or technical center of expertise on energy analysis at (402) 221-7381.

1.8.1.3.3. When specific Army criteria does not indicate the preferred method of heating, ventilating, and air conditioning, the designer is to discuss the alternatives considered and the final

selection based on economics, fuel cost, ease of maintenance, etc. A-E shall compare a minimum of three heating and air conditioning systems. Multizone, variable volume or constant volume air handling equipment in combination with water or air cooled reciprocating chillers, centrifugal vs. reciprocating vs. absorption chillers, double bundle condensers and other system combinations shall be considered. The following guidance referenced in the Criteria Index Chapter V under "HVAC, Computer Simulation for Buildings," present the installed first cost, Energy Consumption for Buildings, and the installed first cost, energy consumption (BTU's/sq. ft./yr.), total annual owning and operating cost, annual operating cost, etc., for each system considered. Then select the best system based on the life cycle costing/energy analysis. The U.S. Army Construction Engineering Research Laboratory (USA-CERL) has developed a new economic study computer program titled, "Life Cycle Cost in Design (LCCID)." This program is available (w/o charge) to designers of Military Projects via telecon 1-800-U1-BLAST to the Blast Support Office at the University of Illinois. A-E must fill out the Life Cycle Cost Summary Form taking input and output from computer analysis; see Plate 21, Chapter IV.

1.8.1.3.4. For energy conservation, air-to-air or other types of heat recovery systems shall be investigated. Design procedures will be in accordance with Architectural/Engineering Instructions and ASHRAE Handbook "HVAC Systems & Applications", 1987, Chapter 6.

1.8.1.3.5. Within the limits of functionality and life cycle cost effectiveness, all facilities shall be designed to meet the design energy targets shown in Table 11-1 of Architectural/Engineering Instructions.

1.8.1.3.5.1. Provide energy budget figures for buildings which are 5,000 ft2 and over (no minimum sq. ft. for family housing). If a computer simulation of the building is required, then a separate energy budget need not be performed. The energy budget is the sum total of the energy consumed in a year within the boundaries of the building for space heating, ventilating and cooling, domestic hot

water, and lighting. The analysis will not be performed on candidate building systems, but only on the final selected systems, and will be presented in BTU's per square foot per year. For additional guidance refer to the Criteria Reference Chapter V under "HVAC Computer Simulation for Buildings."

1.8.1.3.5.2. Use Energy Budget Figure summary sheet with your calculations. (See TM 5-810-1, Appendix F)

1.8.1.4. Ventilating system. State whether the ventilating system is gravity or mechanical system. If a mechanical system, indicate whether it is supply or exhaust. State the requirement for outside air and the basis for determination of quantity, i.e., number of air changes per hour, or CFM per person, or others.

1.8.1.5. Air conditioning. State as applicable under Architectural/Engineering Instructions, the extent authorized, and as to any authority for waiver of these criteria. State whether for comfort cooling or according to technical requirements or both. For technical requirements, show the authorized tolerances for temperature and humidity control, the degree of air cleaning or purity required, and any other special considerations involved. A description of the air conditioning system proposed, including the capacity; location of the major components; cooling medial (water or DX); zoning and duct arrangement; and type of controls. (See note for Direct Digital Controls (DDC) in Paragraph 1.8.1.2. above). State requirements for outside air and the basis for determination of quantity, i.e. number of air changes per hour or CFM per person, or others.

1.8.1.6. Evaporative cooling. Reference Architectural/Engineering Instructions or TM 5-810-1 as authority, or any authorized waiver of these criteria. Note if this is a single or two-stage process.

1.8.1.7. Cold storage Projects. Indicate the room holding temperatures and commodities to be held in cold storage. (May be indicated on drawings.) Also, show the approximate equipment sizes.

1.8.1.8. Service Piping Systems. Include determination and capacity of compressed air, vacuum, or other service piping systems

1.8.1.9. Plumbing. Provide plumbing fixture determination listing quantity and types of fixtures identified by Federal Specifications. Indicate male and female building population. Describe domestic water heating and storage equipment including capacity, materials, piping types, and insulation requirements.

1.8.1.10. Seismic Considerations. State that design procedure to be used for support and anchorage for mechanical equipment is in accordance with TM 5-809-10.

1.8.1.11. Hazardous waste. Specify only EPA approved materials, equipment and systems for use.

1.8.1.12. Fuel: State type, source, whether firm, or interruptible gas and metering arrangements. Indicate adequacy of existing gas distribution system and of existing gas supply to carry additional load. Indicate type of standby fuel for interruptible gas.

1.8.1.13. Energy Monitoring and Control System. Indicate if base-wide EMCS is existing, under construction, or planned within 5 years. For existing EMCS, identify system in operation.

1.8.1.13.1. Building EMCS shall terminate with the DTC (Data Terminal Cabinet). Individual buildings will be connected to the base-wide EMCS by a separate construction contract at a later date.

1.8.1.13.2. Use TM 5-815-2 for Criteria Reference. Include CEGS-13946 "Building Preparation For EMCS" in outline of specifications.

1.8.1.14. Fire Protection. Coordinate with the Architect to ensure all aspects of the fire protection plan are addressed.

1.8.1.14.1. For sprinkler systems, indicate type (wet or dry) system, provide evidence that the system is in compliance with criteria referenced in "CRITERIA INDEX, *' Chapter V.

1.8.1.14.2. For Halon, carbon-dioxide, foam, dry-chemical, and other special extinguishing systems, show information justifying the arrangement, size, and coverage of each system.

1.8.1.14.3. Include a fire water flow curve, based on flow test data, and determine if the available water quantities and pressures are adequate to meet project requirements. See Fire Protection Handbook, Section 16, Chapter 8C, Hydraulic Flow Curves and Chapter 8F, Analyzing Test Data. (Note that flow test data is normally provided by the installation Director of Engineering and Housing. Coordinate with your COE PM.)

1.8.1.15. Special requirement for all rehab projects. For asbestos requirements see Paragraph 1.2.4. Asbestos Removal.

1.8.1.16. Calculations.

1.8.1.16.1. Calculations of a limited nature shall include heat gain, heat loss, and equipment sizing including the method for handling diversities in the air conditioning load and method for sizing boilers. Show typical air conditioning load calculations, preferably the building peak loads. Detailed room calculations are not required.

1.8.1.16.2. Show plumbing calculations necessary to determine the number of fixtures, cold and hot water capacity requirements, and equipment or capacities of miscellaneous and special systems.

1.8.2. Drawings.

1.8.2.1. Floor Plan. Prepare a floor plan showing heating, ventilating, and air conditioning equipment layout; chillers or refrigeration compressors; boilers; pumps; condensers or cooling towers; air handling units; fans; air distribution duct layout (may be single line); hoods; and other items of major equipment required for the facility.

1.8.2.2. Plumbing. Show the plumbing fixture layout, floor and area drains, and plumbing equipment layout

(hot water generator, storage tanks, pumps, air compressors, etc.).

1.8.2.3. Mechanical Rooms.

1.8.2.3.1. Present a study of floor space in the mechanical room and roof space on roof plan by selecting the largest and heaviest of three competing makes of each piece of equipment to go into the room and to mount on the roof. The Mechanical designer shall inform the Structural designer of the selections in order to properly size the roof structure.

1.8.2.3.2. Adequate provisions shall be made in the mechanical rooms to allow for the removal of tubes from boilers, chillers, and condensers, and the removal of coils and filters from air handling units for maintenance or replacement. See "Mechanical Standard Details" by Sacramento District for the maintenance access and clearance zones required for the difference types of mechanical equipment. To save room space, full use shall be made of knockout panels or doors on outside walls for tube and other equipment removal. Equipment shall be located to allow ample room for servicing and replacement. Show service clearance required for equipment per manufacturers recommendations. Piping and valves shall be arranged so that they will not prevent personnel movement within the equipment room and all valves shall be located for ready accessibility. Where necessary because of the location of valves and headers, catwalks or ladders shall be furnished for operating and servicing the valves. Gages and thermometers shall be of such size, scale, and location as to be easily read by operating personnel.

1.8.2.3.3. If an outdoor Mechanical Equipment yard is enclosed by a solid CMU fence, adequate air movement must be provided by openings in the wall, wall section overlap with air gap between, removing blocks at certain intervals, etc.

1.9. Electrical Design.

1.9.1. Design Analysis - Narrative/Calculations.

1.9.1.1. General. Provide electrical characteristics (phase, voltage, and number of wires) or circuits.

1.9.1.2. Electrical Load Analysis. Include estimate of total connected load and demand factors, diversity, and resulting kilowatt demand. Breakdown of the estimated connected and demand load shall show: (1) Lighting and convenience outlet load; (2) power load for building equipment such as heating, air conditioning, etc., (3) loads for special operating equipment such as air compressors, generators, pumps, and for power receptacles being provided to energize special equipment. State power factor and size of transformers.

1.9.1.3. Lighting. Describe the proposed standards of design for lighting intensities and type of lighting fixtures for functional areas, both interior and exterior in accordance with design criteria as required in Architectural and Engineering Instructions.

1.9.1.4. Power Describe provisions for motor control, standby electric power, grounding, cathodic protection, and lightning protection as applicable. Indicate voltage drop of service entrance and voltage drop basis for feeders and circuits.

1.9.1.5. Hazardous Classification. Provide a description of the physical limits of each hazardous area and the class, division, and group of equipment and wiring. Discuss special fixtures for hazardous areas.

1.9.1.6. Energy Conservation. Discuss energy conservation measures, such as task lighting and selection of the most efficient type of light fixture. Indicate type of emergency lighting system to be provided.

1.9.1.7. Power Supply. Discuss ,electrical characteristics of power supply to base, or portion thereof involved, including circuit interrupting requirements and voltage regulations. State adequacy of the existing power supply at the point of take-off. If power source is inadequate, state measures proposed to correct the deficiency. If new power source or local generation is required, discuss the various schemes and submit cost comparisons.

1.9.1.8. Distribution. Discuss basis for selection of primary and secondary distribution voltage, and of overhead or underground construction. Indicate characteristics and standards of design for overhead or underground line. Include a justification for underground line

1.9.1.9. Fire Alarm. Discuss proposed fire alarm system and means for transmission of signal (if applicable).

1.9.1.10. Signal Systems. Discuss signal systems, i.e.: Program clock, MATV, communications, central sound systems, intrusion detection, etc. (if applicable).

1.9.1.11. Telephone Systems. Discuss the Telephone Systems requirements, i.e., telephone instruments/switching equipment, and inside (and outside) wiring, etc.

1.9.1.12. System Control. Discuss special control , i.e., generator paralleling,. switch gear remote control, telemetering, central supervisory control (if applicable).

1.9.1.13. Grounding. Discuss special grounding, i.e., electronic labs, security communications areas, data processing (if applicable).

1.9.1.14. Hospital Designs. Discuss hospital criteria per NFPA, and TM 5-838-2 (if applicable).

1.9.1.15. Seismic Considerations. Statement of support and anchorage design for electrical equipment in seismic areas shall be in accordance with TM 5-809-10.

1.9.1.16. Raised Floor Systems. When raised floor systems are required, state that all stanchions will be made electrically continuous for computer noise with 1 #1/0 BC brought from one point on the stanchions to a computer ground bar located within the raised floor areas. Bond this computer ground bar with 1 C1/0 BC to the service entrance ground bus.

1.9.1.17. TEMPEST/EMP Shielding. State the frequency spectrum of the installed equipment to be afforded TEMPEST/EMP protection. Maximum spectrum/attenuation requirements for TEMPEST shall be: IAW DM4-805-4.

Coordinate shielded wall systems with architectural and mechanical designers.

1.9.2. Drawings.

1.9.2.1. Electrical Site Plan. Provide electrical site plan separate from civil site plan including power and communication service lines to the building and exterior location of proposed electrical equipment.

1.9.2.2. Electrical Equipment. Provide power plan showing location of major pieces of electrical equipment such as transformers, switchgear, motor control center, panel boards, communication equipment, power outlets, etc.

1.9.2.3. One-Line Diagrams. Provide one line diagram for the following systems (if applicable):

1.9.2.3.1. Electrical

1.9.2.3.2. Telephone/communications

1.9.2.3.3. Fire Alarm

1.9.2.3.4. Signal System (Intrusion Detection, MATV, etc.)

1.9.2.4. Lighting. Provide lighting plan and lighting fixture schedule (show lighting switch locations including type e.g., single pole, 3-way, etc.).