2013

Architect / Engineer Design Guide

The Department of Health & Human Services
Indian Health Service
Office of Environmental Health & Engineering
Division of Engineering Services

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Preface

Changes in this edition

The 2013 Indian Health Service Architect/Engineer (A/E) Design Guide provides updates on Codes and Standards, Sustainability Requirements and Construction Contract Administration.

This edition of the A/E Design guide provides guidance for Owner's Project Requirements, Basis of Design documentation, and both Fundamental and Enhanced Commissioning requirements.

This revision also provides direction for Housing (Staff Quarters) projects and the minimum project requirements administered by Tribes or other Governmental Agencies.

Building Information Modeling (BIM)

Building Information Modeling (BIM) touches every aspect of design, and creates a new perspective to the development and management of design documents. Numerous changes have been made to this guide to incorporate the BIM process with document generation, concept development, design submittals and Contractor and Owner presentations.

The Design BIM model will greatly enhance the production of visualization and presentation tools throughout the design process, helping to highlight and resolve critical conflicts and better communicate user issues before construction begins.

The foundation for transitioning from AutoCAD to a Design BIM model is the use of Autodesk Revit, which the Indian Health Service sees as the architectural design standard. These new draft requirements are intended to facilitate the transition to BIM and provide significant benefits to project design while minimizing additional efforts by the designers.

POR space allocation, medical equipment information, and material and equipment schedules will now be captured in a common database linked to the Design BIM model through a Construction Operations Building Information Exchange (COBie) data structure that can feed details to a maintenance management system.

History

The guide is a living document with a broad user base that will continue to build on the efforts in place to address current policy, practice, and lessons learned through design and construction activities throughout the IHS that strive to expand and enhance the availability of healthcare services through facilities construction projects.

Organization

This Guide is orgainized to follow the anticipated progression of design. Each of the specific design submittal sections are stand alone chapters; definitions and abbreviations sections are provided at the end of the document. Submittal sections are organized to highlight specific requirements with drawings and other documents broken out by engineering discipline.

Layout

The document is formatted in a code style layout similar to current healthcare and life safety codes. Throughout the document there are highlighted *blue box* sections providing additional explanatory detail requirements.

Use of guide

The document is presented in anticipation of direct federal construction managed by the IHS, and includes requirements and nomenclature that are generally familiar throughout the Indian Health Service. Definitions that have a specific organizational meaning are included along with a comprehensive list of abbreviations.

New minimum submittal requirements have been incorporated in this Guide for project design work which is to be administered directly by others (for the benefit of the Government).

Electronic Distribution

This document, along with any electronic attachments or supplemental information, is available through the DES Document Access Portal at http://www.des.ihs.gov/index.cfm?module=dap.

Error and Change Submittal

Notification of errors or proposed changes should be forwarded to AEDesignGuide@ihs.gov for consideration.

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1 Introduction

Use of this A/E Design Guide is a requirement for the design of Indian Health Service (IHS) health care facility construction projects. The intent of the design guide is to capture current federal, departmental and IHS requirements, policies and best-practice. This A/E Design Guide provides guidance for the development of design documents, specifications, and other contract documents, architectural and engineering design features, submittals, and supplemental information. Modifications to the A/E Design Guide requirements for specific projects will be addressed in their respective Scopes of Work and other contract documents as appropriate.

For other users this guide provides a benchmark that can be utilized directly by reference or as a basis for good management practices for the administration of A/E services for health care design projects. Tribes using this guide should incorporate it in its entirety or consider developing an addenda list to highlight any proposed changes to the A/E Guide when referenced as a contract requirement for Public Law 93-638 agreements with the IHS.

The A/E Guide defines the minimum requirements for each submittal in the production pre-design, concept design, schematic design, design development, and construction documents for Indian Health Service construction projects. The design requirements are defined by the scope of work, the design criteria, and the program of requirements, including templates developed under the IHS Health System Planning, HSP, program.

This guideline is designed to give the A/E an understanding of what is required and what must be completed before the final construction documents are approved. This guideline does not relieve the A/E firm from their professional responsibility to produce a correct, complete, and fully coordinated set of construction documents in accordance with the standard industry practices and government criteria.

2 Responsibilities of the A/E

2.1 General Responsibilities

2.1.1 Quality

The A/E is responsible for the professional quality, technical accuracy, and coordination of all designs, drawings, specifications, and other contracted services.

2.1.2 Reviews and Approvals

(1) The A/E's work shall be subject to the Government's oversight, direction, control, review and approval.

(2) Government reviews are to assure all programs, statutory and regulatory provisions are included or met. The review is not intended to indicate a complete or detailed check of all documents, calculations, codes, etc. It does not relieve the A/E of any responsibility for checking its own work; verifying existing conditions; complying with the codes, standards, and the Program Of Requirements (POR); and producing a complete coordinated set of documents.

(3) Reviews and approvals will be provided by Governmental Agencies on a standardized comment form provided by the Project Officer. All review comments will be coordinated through the DES Project Officer for submission to the A/E. The review comment form, with the A/E's responses, will be incorporated in the design documents before work on the next design phase submittal begins.

2.1.3 A/E Project Manager

The A/E shall designate a project manager who shall be familiar with the requirements in the A/E contract, performance schedule, Scope Of Work (SOW), and this A/E guide.

The project manager is responsible for reviewing the IHS DES Lessons Learned Program for relevant issues to be considered in developing the design.

The project manager will provide necessary design guidance for the successful completion of this work and coordinate with the government.

2.1.4 BIM

It is the A/E's responsibility to coordinate the BIM process and the BIM design model throughout the design team including clash detection and drawing generation.

The BIM design model will be the principal construction delivery tool. Design information from all disciplines such as architectural, civil, structural, HVAC, plumbing, electrical, fire protection, special systems design, medical equipment information, and all system specifications will be integrated within the BIM design model.

The generated COBie database is to be closely coordinated with the design model and is expected to contain all generally available system information and scheduled equipment details.

2.1.5 Document Distribution

The A/E shall distribute documents as required in the contract.

2.1.6 Scope Changes

Any proposed deviation from the project SOW must be reviewed with the Project Officer and approved by the Contracting Officer (CO) before any action can take place. When major changes in the SOW are required,

Box 2a - Design Within Funding Limitations

The contract clause FAR 52.236-22 Design Within Funding Limitations is, with limited exceptions, required in all Federal design contracts and requires the A/E to accomplish the design so that a construction contract can be awarded at or below the estimated construction cost listed in the clause.

The clause also requires prompt notice to the Government if the A/E determines that the design requirements cannot be met within the budget. Such notices should be made as soon as the problem is identified and not wait for the next design submittal. Otherwise, the A/E is expected to continuously monitor the budget and adjust the design as necessary so that accurate construction cost estimates submitted for each design phase do not exceed the limit stated in the contract or task order.

the CO according to the changes clause of the contract will negotiate appropriate contract modifications with the A/E. During the progress of the work, if minor changes within the general project scope are required, the A/E will make the adjustments when directed by the CO.

2.1.7 Document Ownership

All drawings, designs, specifications, cost estimates, notes, computer-aided design (CAD) files, BIM design model files and data, design calculations, and other related work shall become Government property.

2.1.8 Errors and Negligent Performance

The A/E shall correct or revise any errors, omissions, or deficiencies in designs, drawings, specifications, estimates, and other services without additional compensation. The A/E shall remain liable in accordance with applicable laws for all damage caused by the A/E or its consultants, negligent performance of any of the services furnished under the A/E's contract, or failure to comply with any applicable legal or contractual obligations.

Design errors or omissions or other failures that constitute negligent performance or breach of a contractual obligation, resulting in damages or extra cost to the Government will be evaluated for potential A/E financial liability. If the Government determines the A/E is liable for any such deficiency, the CO will notify the A/E. Any damages or extra costs incurred by the Government resulting from any such deficiency will be actively pursued.

It is understood that the BIM design model is the basis of generating drawings, however; contract drawings shall be based on the signed sheets submitted and marked as final construction drawings.

2.1.9 Public Disclosure

The A/E shall make no public disclosure of pending construction contracts without written consent of the CO.

2.2 Design Record

During the design phase the owner and the A/E shall develop and update two separate documents, which constitute the Design Record, the Owner's Project Requirements (OPR) and the corresponding Basis of Design (BOD). Both the OPR and the BOD are reviewed and evaluated during the develoment of commissioning requirements, and together, drive the critical design decisions and priorities for the project.

OPR and BOD documentation provide the parties involved with the building, at each respective stage, an improved understanding of the building systems and assemblies to better perform their respective responsibilities regarding the design, construction, or operation of the building.

Specifically, the OPR and BOD:

- Help ensure that all participants involved in project planning are clear in communicating their requirements and needs to designers and contractors.
- Help the designer and contractor understand what they are tasked with achieving.
- Provide identification and evaluation mechanisms that can help resolve design issues.
- Provide criteria from which each design submittal can be validated.
- Provide clear acceptance criteria allowing performance to be verified during construction.
- Empower facility staff and maintenance contractors to make more informed decisions regarding equipment operations, maintenance, and replacement by retaining the original intent of systems and assemblies, until requirements change.
- Give designers and constructors access to complete original design and performance information facilitating more efficient and properly integrated planning and construction of renovations and additions.

2.3 General Design Requirements

In all design projects, the *Guidelines for Design and Construction of Health Care Facilities* is the primary source of design criteria for health care facilities, *NFPA 101: Life Safety Code*, shall be used for determining and maintaining life safety requirements for all occupancies in new and existing buildings.

2.3.1 Site Investigation

It is the A/E's responsibility to visit the site, inspect the location of the work, become acquainted with all local conditions, verify and identify existing conditions, review existing drawings, and consult with the Project Officer and facility personnel.

The A/E shall conduct a detailed geotechnical investigation. The geotechnical investigation shall explore, analyze, and document subsurface conditions at the project site to provide the A/E with conclusions and

recommendations for the design and construction of the facility.

2.3.2 Codes, Standards, and Guidelines

The design shall conform to the **latest published edition** (unless explicedly stated otherwise) of the following nationally recognized codes, standards and guidelines:

(1) *National Fire Codes* (with the exception of *NFPA 5000 – Building Construction and Safety Code*), as published by the National Fire Protection Association shall be used exclusively for determining and maintaining life safety requirements for all occupancies in the new and existing facilities. If a conflict should arise between the *National Fire Codes* (NFC) and any other model codes on an issue of life safety, the NFC shall take precedence.

(2) *International Building Code* (IBC) as published by the International Code Council unless another model building code is specified in the contract. The International Residential Code (IRC) will be used as it applies to staff quarters.

(3) *Guidelines for Design and Construction of Health Care Facilities* as published by the American Institute of Architects and the Facility Guidelines Institute.

(4) Guidance from the Center for Medicare and Medicaid Service (CMMS) and organizations with "deemed" status to act on their behalf, specifically, the Comprehensive Accreditation Manuals, as published by The Joint Commission for the following, as appropriate for the project occupancy:

- *Hospitals: the Official Handbook* (CAMH)
- *Critical Access Hospitals* (CAMCAH)
- *Ambulatory Care* (CAMAC)

(5) *The ADA Accessibility Guidelines* (ADAAG) as published by the Access Board.

(6) National Historic Preservation Act, 36 CFR 68.

(7) The Clean Water Act, section 402, National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Construction Activities.

(8) EPAct, Energy Policy Act of 2005

(9) Energy Independence and Security Act (EISA) of 2007

(10) Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act - EPA 841-B-09-001

(10) Radon Gas – Indoor Radon Abatement Act (IRAA) and/or state/local indoor radon requirements, including the *Technical Handbook for Environmental Health and Engineering*, Volume III, Part 21-2.4 - Radon Control and Mitigation, whichever is more stringent.

(11) Energy Conservation Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings and New Federal Low-Rise Residential Buildings - 10 CFR Parts 433, 434, and 435.

(12) ASHRAE/IESNA 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.

(13) International Energy Conservation Code (IECC) as published by the International Code Council.

(14) ASME Boiler and Pressure Vessel Code, Section II.

(15) ASHRAE 62.1 - 2010 Ventilation & Acceptable Indoor Air Quality.

(16) ANSI/ASHRAE/ASHE 170 - 2008, Ventilation of Health Care Facilities.

(17) ASHRAE 62.2 - 2010 Ventilation & Acceptable Indoor Air Quality in Low-Rise Residential Buildings.

(18) Referenced *IHS Technical Handbook* reference sections.

(19) National Council for Radiation Protection and Measurement (NCRP) Reports #145 (*Radiation Protection in Dentistry*) and #147 (*Structural Shielding Design for Medical X-Ray Imaging Facilities*).

(20) ASCE 31-03 Seismic Evaluation of Existing Buildings.

(21) ICSSC RP-6 Standards of Seismic Safety for Existing Federally Owned or Leased Buildings, 2002.

(22) ASHRAE Standard 111-2008 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

(23) All applicable IEEE Standards.

(24) All applicable UL Standards.

(25) All applicable Telecommunications Industry Association/Electrical Industries Alliance (TIA/ETA) Standards.

(26) American National Standards Institute (ANSI) / American Society of Mechanical Engineers(ASME) A17.1 - 2007, Safety Code for Elevators and Escalators.

(27) ASHRAE Guideline 0-2005, The Commissioning Process

(28) ASHRAE Guideline 12-2000 - Minimizing the Risk of Legionellosis Associated with Building Water Systems.

(29) Guidance for Protecting Building Environments from Airborne Chemical Biological or Radiological Attacks (CDC)

These requirements are considered the minimum necessary to comply with PL 100-678. More restrictive requirements may be established should they be required by a state and/or local Authority Having Jurisdiction (AHJ) or by IHS. It is the practice of IHS to comply with state, local, or tribal codes and ordinances whenever feasible.

2.3.2.1 BIM related standards.

These standards are highlighted for review and general reference rather than to add specific requirements not otherwise identified within this Guide.

(1) NBIMS-US: National BIM standard

(2) COBie: Construction Operation Building information exchange in spread sheet format by the buildingSMART alliance

(3) IFC: Industry Foundation Class

(4) LCie: Life Cycle information exchange by the BuildingSMART alliance

(5) NCS: National CAD Standard

2.3.3 Code Conflicts

When more than one code, standard, or guideline covers the same field, the jurisdiction for the project will determine the code, standard, or guideline to be utilized. Where there is a conflict between the required NFPA codes and another code, standard, or guideline, NFPA Codes shall govern unless determined otherwise by the AHJ. Conflicts between code requirements shall be documented and copies submitted to the AHJ for consideration.

2.3.4 Unique Conditions

Problems arising from unique project conditions shall be resolved through sound design practices and recognized standards and submitted for the record to the AHJ.

The Centers for Medicare and Medicaid Services (CMMS) adopts a specific edition of the NFPA 101, Life Safety Code (currently the 2000 edition) for healthcare accreditation compliance. CMS allows for deviations from the adopted edition of NFPA 101 provided that all of the requirements of that edition are met. Designers shall give due consideration for the specific edition of NFPA 101 adopted by CMMS and provide narrative of any specific conflicts within the design from the use of the most current edition of NFPA 101.

2.3.5 Deviations

When deviations from the criteria and standards are required to meet special conditions or concerns, determinations shall be the responsibility of the AHJ.

2.4 Building Information Modeling (BIM)

The A/E shall utilize BIM throughout the design process, and shall integrate all disciplines into the central BIM documents and design model.

(1) The design team shall assign an individual to the role of design team BIM manager. This individual shall have sufficient BIM experience for the size and complexity of the project and shall have relevant proficiency in the proposed BIM authoring and coordination software. The BIM manager can be the A/E project manager or other identified individual with designated responsibility on the A/E team. This individual shall serve as the main point of contact with the owner and the design team for BIM related issues.

(2) All major design technical disciplines/trades (architecture, civil, structural, MEP, cost estimator, etc.) shall assign an individual to the role of lead BIM coordinator for their work with the entire design team.

(3) All BIM documents shall be drafted, edited and shared using AutoDesk Revit.

(4) All disciplines on the A/E team shall draft their design documents through the same central Revit file. Any independent drawings will require specific approval and shall be included with an integration plan.

(5) At a minimum, BIM shall be used for the development of the **design model**, for **clash**

detection and coordination, **energy modeling**, generation of **material and equipment schedules**, along with the creation of a **COBie database** integrating the model and schedules.

(6) Extended use of the design model is encouraged for the development of the design, presentation, and management of data.

- Design visualizations for communication, functional analysis, and constructability
- Daylighting evaluation
- Medical equipment planning
- Communication of construction scheduling and sequencing

2.5 Sustainability

The A/E shall integrate sustainable design principles into the design addressing site development, energy performance, water conservation, indoor environmental quality, and the reduction of the environmental impact of materials.

The A/E is responsible for evaluating energy consumption benchmarks and designing to meet reduction requirements.

2.6 Life Cycle Cost Analysis

The A/E shall utilize Life Cycle Cost analysis where called for in the scope of work, where needed to justify critical decisions regarding capital expenditures, and to demonstrate long-term savings in operation and maintenance costs.

The A/E shall follow standard procedures for preparing and presenting this information, as outlined in this A/E Design Guide.

The A/E is responsible for the technical accuracy of all life cycle cost estimates, and shall not be compensated for additional work as a result of insufficient effort in conducting previous life cycle cost analyses.

2.7 Value Engineering

The A/E shall use value engineering principles throughout the design phase of the project, thereby making efficient and effective use of the construction and operational budgets.

Depending on the size of a project, DES may require a formal value engineering (VE) study. This determination shall be made prior to award of the A/E contract.

Critical decisions regarding mechanical systems and components, architectural elements, site configuration, etc. shall be made through a comprehensive VE evaluation, and shall include life cycle cost principles as part of the analysis. Consideration shall be made so as to make efficient and effective use of the construction and operational budgets.

2.8 Commissioning

Commissioning of building systems shall be incorporated into the design and construction of new health care facilities.

Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent.

Commissioning should be performed in accordance with the Building Commissioning Association's standards or ASHRAE Guideline 0.

The commissioning process shall begin no later than the design development phase and continue through the one-year warranty period.

2.9 Metric

The A/E shall consider the use of International System of Units (SI) in the design of new construction projects.

The Project Manager will approve the unit system.

If metric is utilized:

(1) All measurements shall be in Hard Metric format, using rounded and rational metric units.

(2) Dual measurements utilizing SI and inch-pound units shall not be permitted.

(3) Design calculations shall be in metric.

(4) Show quantities of air in metric units for each run or branch. This will aid the testing, adjusting, and balancing contractor in setting the dampers or balancing cocks to the proper quantities.

(5) Refer to ASTM E621, Standard Practice for the Use of Metric (SI) Units in Building Design and Construction, for preferred symbols and standard conventions.

(6) Additional information concerning the use of metric may be found in the IHS Technical Handbook.

3 Submittals Preparation

3.1 Drawings

3.1.1 Format

(1) Sheet size: Within a single project, all contract drawings shall be uniform in size. Standard sheet size is A1.

(2) Match Lines. Plans requiring division onto more than one sheet shall be provided with match lines. These shall be cross-referenced on each sheet.

(3) Key Plan. Projects requiring more than one sheet for each plan shall include a key plan on each plan sheet. The key plan shall show the location of the partial plan in relation to the whole plan. The key plan shall be located near the title block and oriented to match the plan. All partial plans shall be oriented the same direction on the sheets.

(4) Standard Details. Reference details that are typical and apply to the specific project are to be incorporated into the drawings by computer-aided design (CAD) equipment. However, such standard details must be applicable to the specific project.

3.1.2 Quality of Drawings

All drawings submitted for review shall represent the best professional quality of graphic presentation. Drawings shall be legible, accurate, and properly coordinated. If, in the Government's opinion, the quality of the drawings does not meet these requirements, the drawings will not be accepted.

3.1.3 Placement of Drawings on Sheets

Drawings shall be arranged on sheets with economical use of space, without crowding or overlapping, and shall be legible at half size, A3.

3.1.4 Floor Plans

One or more floor plans may be placed on a single sheet depending on the size of the project. If the entire project is shown on one sheet or if the plans and elevations are drawn on the same sheet, the plans should be placed at the bottom of the sheet.

3.1.5 Elevations and Sections

Several elevations and sections may be placed on one sheet as long as they remain legible. When more than one sheet is used, the elevation showing the main entrance should be placed on the first sheet.

All details, elevations and sections shall be identified including the drawing number where the detail, elevation or section is taken along with the drawing number where the section, detail or elevation is drawn.

3.1.6 Scales

Scales shall be appropriately selected to clearly depict all aspects of the required work. Conventional Scales shall be placed under the title of each Plan, Elevation Detail, etc. Graphic scales including every scale used on the sheet shall be located at the lower right hand corner of each sheet.

3.1.7 Floor Plans Name of Spaces

On the floor plan in the center of each space, the name and number for the space should appear and be underlined. If the space is too small for space name and number, they should be placed in a clear area outside the space with an arrow pointing to the space. On mechanical and electrical floor plans, names may be omitted from the spaces to allow clarity of utility systems. Names should then be placed in schedules located adjacent to the plans.

3.1.8 Space Identification Numbers

Unique identification numbers shall be assigned in the schematic design phase. All design spaces shall be identified with a departmental identifier and sequential POR number.

No space number shall be duplicated (i.e., PC-01 where 11 is for the Primary Care Nursing department and 01 is the first room/space in the POR space allocation list for the Primary Care Nursing department. Also, PH-01 where PH is the Pharmacy department and 01 is the first room/space listed in the POR space allocation list for the Pharmacy department.)

This numbering system will be replaced with "the Facility Room Numbers" after the design development phase documents are approved.

On the project record drawings provide a conversion sheet that labels the facility final room numbers as reflected on the General Contractor's or Construction Manager's "as-built" drawings.

3.1.9 Facility Room Numbers

(1) All room/spaces shall be numbered with a floor identifier, a corridor/departmental identifier, and

a sequential room number, or other approved numbering system. The first digit or letter indicates the floor level (B10l, 1101, 2101, P101, etc.), the second digit indicating the corridor or department, and the third indicating a sequential room number.

(2) All rooms with access to a building or departmental corridor shall only have a numerical identifier. Rooms accessed through another room shall have an alpha character appended to the main room number (for a patient bedroom numbered 1101 the interior bathroom would be 1101a.)

(3) Room numbering shall follow a logical progression promoting wayfinding on each floor. Space numbers shall be assigned to stairs, elevators, dumbwaiters, escalators, and major duct shafts. The same space number shall be repeated on each floor (Stair No. 1, Elevator No. 1, etc.).

(4) Room numbers shall not be assigned until after the floor plan is fixed (after the design development phase is approved).

(5) No room number shall be duplicated.

3.1.10 Drawing Media

Drawing guidance provided is primarily for generating traditional AutoCAD files, such as layering schemes and xrefs, are is not entirely consistent in the generation of a BIM based design model with Revit. CAD requirements are intended to provide structure as applicable.

(1) Working drawings shall be printed in both full and half-size in the quantity identified in the SOW and submitted in PDF together with required paper submittals.

(2) Final drawings shall be submitted in source AutoCad DWG format along with PDF of the stamped drawings and specifications. All schedules within the drawings shall also be provided in a separate editable file.

The included files shall be capable of being loaded by the approved version of AutoCAD without any modifications to the standard installation.

Layer designation shall conform to the AIA Guidelines included in the National CAD Standard.

For each drawing sheet a similarly named single file shall be provided, including all externally referenced files (xrefs), base plan drawings, fonts, plot styles, and graphics associated with the production of the final hard copy drawing set.

3.1.11 Title Blocks and Borders

Title Block: The DES standard title block shall be used.

Provide last name in the “Drawn by” and “Checked by” lines, rather than initials.

3.1.12 Drawing Title

Each drawing (floor plan, roof plan, elevation, section, detail, etc.) shall have a title. All site, floor, and roof plans shall have a project North Arrow.

3.1.13 Abbreviations and Symbols

Legends for abbreviations and symbols shall be included in the construction documents and shall be provided for each discipline separately, such as architectural, civil, HVAC, DDC controls, fire protection system, plumbing, electrical, fire alarm system, nurse call/paging/security system, etc.

3.1.14 General Notes and Key Notes

All general sheet notes and keynotes placed on a drawing sheet shall be edited and apply to that sheet.

3.1.15 Quality Control Review

The A/E shall perform a quality control review of all drawings before each submittal. Reviews for technical accuracy, coordination of work within each discipline, coordination of work among disciplines, and coordination between drawings and specifications shall be included.

3.1.16 Drawing Numbers

The standard drawing numbering system is as follows (optional drawing numbering systems may be submitted to DES for approval):

Civil (Site)	C-1, C-2, etc.
Landscaping	L-1, L-2, etc.
Architectural	A-1, A-2, etc.
Structural	S- 1, S-2, etc.
Mechanical	M-1, M-2, etc.
Plumbing	P-1, P-2, etc.
Medical Equipment	EQ-1, EQ-2, etc.
Fire Protection	FP-1, FP-2, etc.
Electrical	E-1, E-2, etc.
Fire Alarm Control	FA-1, FA-2, etc.
Life Safety Plan	LS-1, LS-2, etc.

Design intent furnishings plan FFE-1, FFE-2, etc.

Lightning protection system and electrical distribution grounding LP-1, LP-2, etc.

Special systems (telephone, data, nurse call, security, paging, etc.) SP-1, SP-2, etc.

Demolition: annotate trade-specific sheets with discipline, for example for mechanical drawings: DM-1, DM-2

3.1.17 A/E Certification and Signatures

The design of architectural, civil, structural, mechanical, electrical, or other engineering features of the work shall be accomplished, reviewed and approved by registered professional architects and engineers. The architects and engineers shall be registered to practice their respective disciplines in a state, the District of Columbia, or an outlying area of the United States.

The title and/or index sheet shall be signed and sealed by a registered professional architect or engineer of the A/E firm having the contract with DES. The specifications and each drawing, other than the title and/or index sheet, shall be signed and sealed by the registered professional architect or engineer in charge of the work depicted on that drawing. Drawings prepared by a consultant to the prime A/E shall be signed and sealed by the consultant. Final drawings at full size shall bear original signatures and seals.

3.1.18 Record BIM Design *as-built* Model

The A/E shall prepare and certify record drawings from information that has been provided as "as-built" by the General Contractor (GC) or Construction Manager (CM) for the project.

Record drawings shall be prepared by the A/E to reflect on-site changes the GC or CM has noted in the red-line drawings. They are to be compiled as a set of on-site changes made during the construction process including equipment schedules.

The BIM design as-built record model shall reflect any changes during construction and will be the basis for generating final record drawings.

The contractor will continue to provide 'red-line' markups of the construction contract drawings.

There may be potential for the construction contractor to directly manage as-built record tracking during construction with the BIM design model.

A final DVD(s), or other approved transferable digital media, of the record BIM design as-built model, along with a set of record drawing prints, full size, shall be provided to the IHS Project Officer upon final approval.

3.2 Specifications

3.2.1 Format

(1) To produce written specs, the A/E shall use CSI Master Format, 2004 edition MF04, or CSI Green Format.

(2) Contract specifications shall be based upon materials and performance characteristics established by ANSI, ASTM, and the American Concrete Institute, and other federal government and national industry standards. All references shall be the latest edition.

(3) Contract specifications shall be provided in a searchable PDF. The font shall be common throughout the document with a minimum point size of 11. Hard copies of the specifications shall be printed two-sided for government review and comments. The final construction document shall be printed single-sided.

3.2.2 Boiler Plate

Boiler plate documents (contracting format and clause documents) will be provided by the government. The construction documents for each project are to be coordinated with the boiler plate by the A/E. The boiler plate includes general conditions, bidding forms, FAR and Agency provisions and clauses, and other preprinted forms and text for inclusion in the contract documents.

3.2.3 Specifications & Drawings Coordination

The contract drawings and specifications shall be

Box 3a - Registration & Licensing Requirements

In areas of moderate to very high seismic vulnerability (seismic design category "C" or greater as defined by the IBC), or any other special conditions such as permafrost or wind, state licensing and local professional registration requirements shall be followed to insure responsible and adequate system design.

If the project is for a facility that is not Government-owned, professional registration is to be in compliance with the applicable laws of the State where the project is located.

coordinated for respective functions. Specifications shall include testing, materials, referenced standards, shop drawings, descriptive literature, samples, certifications, performance requirements, descriptive characteristics, finishes, workmanship, installations, and related work.

3.2.4 Cover Sheet

The A/E shall provide covers with a DES approved design for each volume of specifications.

3.2.5 Bid Items

The A/E shall coordinate all bid items and the bid schedule with the CO.

3.2.6 Quality Control Reviews

The A/E shall perform a quality control review of all specifications before each submittal. Reviews for technical accuracy, coordination of work within each discipline, coordination of work among disciplines, and coordination between drawings and specifications shall be included.

3.2.7 Proprietary, Restrictive, or Approved Equal Specifications

(1) Whenever possible, ensure that references in specifications refer to widely recognized standards or specifications promulgated by Governments, industries, or technical societies.

(2) Trade names and proprietary systems and designations may be referenced to establish required characteristics and level of quality. Whether or not trade names are used, specifications must include a complete description or listing of all major salient features.

(3) Specifications shall be developed to ensure competitive bidding without proprietary or sole-source restrictions in accordance with FAR Part 11, except where a proprietary or sole-source procurement is approved by the CO. When identification of material or equipment by manufacturer's name, trade name, or catalog number is unavoidable, three acceptable brands should be listed and the essential physical and functional characteristics required should be set forth.

(4) When the use of a brand name is unavoidable, it shall be qualified by the words "or equal." When brand name or equal descriptions are necessary, specifications must clearly describe those salient physical, functional, or performance characteristics of the brand name item that an "equal" item must meet to satisfy the requirements.

(5) Proprietary or sole-source procurement is allowed in specific situations only if justified to and approved by the CO.

3.2.8 Selection of Materials

Selection of materials and procedures shall be based on project location, design requirements, cost analysis, and availability. Readily available material and equipment should be specified whenever possible. In no case shall materials or equipment containing components excluded by law, such as asbestos or lead paint, be selected, specified, or installed.

The North America Free Trade Agreement (NAFTA) applies to construction, alteration, and repair projects.

3.2.9 Testing

Testing shall be in accordance with the appropriate codes, standards, and general design requirements on testing, testing and balancing, and commissioning.

3.2.10 Product Submittal Details

The A/E shall include a section in the specifications that instructs the construction contractor to provide the following information in three-ring binders organized in tabbed sections. The project manual shall include the following requirements for project submittals:

(1) Record product data: One copy of each product data submittal shall be marked to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site. Also, include variations from the manufacturer's installation instructions and recommendations.

(2) Record sample submitted: Samples of material used for record purposes.

(3) Maintenance manuals: Operation and maintenance data that includes the following information:

  (a) Required written warranties and related documents together with documentation of warranty duration and verification of compliance with construction documents.

  (b) Emergency instructions

  (c) Recommended maintenance cycles

  (d) Inspection procedures

  (e) Fixture lamping schedule

(f) Spare parts list

(g) Wiring diagrams

(h) Shop drawings and product data

(i) Field test reports, such as those for testing, adjusting & balancing of HVAC system, grounding, fire alarm system, etc.

(j) Training video, such as nurse call system, fire alarm, DDC, etc.

(k) Commissioning report

(l) CMMS data for maintainable equipment

3.2.11 Utility Markings

The following color codes shall be used for utility piping and physical hazards:

(1) Piping - American National Standards Institute - A13.1, Scheme for Identification of Piping Systems

(2) Medical Gases Signage - National Fire Protection Association - 99, Health Facilities, Information and Warning Signs for Gas Systems

(3) Gas Cylinder - CGA Pamphlet C-9, Standard Color Marking of Compressed Gas Cylinders intended for Medical Use

(4) Physical Hazards - Occupational Safety and Health Act - 29 CFR 1910.144, Safety Color Code for Marking Physical Hazards

3.3 Cost Estimate

There may be potential benefits in coordinating cost estimating quantity takeoffs with the BIM design model, however it is recognized that the BIM design model may not completely address all material components and quantities required for actual construction and that it might not be widely utilized as a basis for evaluating project costs.

It is anticipated that the final BIM design model will assist potential bidders in the development and refinement of quality bids.

3.3.1 General Requirements

(1) The A/E shall design the project so that construction costs will not exceed a contractually specified dollar limit (design within funding limitation.)

If the price of construction proposed in response to a Government solicitation exceeds the construction funding limitation in the architect-engineer contract, the A/E shall be solely responsible for redesigning the project within the funding limitation.

These additional services shall be performed at no increase in price to the government. If the cost of proposed construction is affected by events beyond the A/E's reasonable control, such as an increase in material costs which could not have been anticipated, or an undue delay by the Government in issuing a construction solicitation, the firm shall not be obligated to redesign at no cost to the Government.

To ensure that the planned design does not exceed project funding, the A/E shall submit accurate cost estimates. The final cost estimate will be used to evaluate bids, plan negotiations, and serve as a guide in establishing a schedule of payments.

The estimate shall be summarized to reflect the bid schedule.

(2) Cost estimates shall address general conditions, utility and site development, demolition, including removal and disposal of hazardous materials, building costs, fixed equipment, and construction management. Direct costs, such as labor, material, equipment rentals, etc., should be shown separately from indirect costs, including overheads, profit, bonds, State and Tribal taxes, insurance, TERO fees, etc.

(3) Each cost estimate submittal shall contain at least one summary estimate and one detail estimate for each building and facility as required. All cost estimates shall be developed based on the submitted specification format.

(4) The cost estimates shall be summarized to provide discreet costs for each physical structure; costs shall be grouped by building.

(5) Cost estimates shall be prepared using MS Excel, or provided in an exported file format fully compatible with the current version of Excel.

(6) Cost estimates prepared by the A/E at any project submittal are proprietary and shall not be released outside the Government.

3.3.2 Cost Estimate Detail

(1) Cost Estimate Narrative. As a part of the submission of cost estimates at all submission phases, the A/E shall provide a brief narrative description of the methodology used in the development of the estimate, including any factors that may have a significant impact on the estimate and the sources of data used in the estimate. If

Box 3b - Cost Estimate Pricing

A detailed estimate shall be developed for each facility or system in the estimate summary. The detailed estimate shall be a breakdown of all items of work required to construct the facility or system. Avoid lump sum pricing. Where lump sum pricing is unavoidable, establish a basis for the assumption of the price. The unit price for each item of work shall be broken into labor, equipment, and materials.

The price for labor shall be the basic cost of labor plus fringe benefits including travel pay, overtime, insurance and taxes. Labor wage rates shall be developed using applicable DOL labor rates. The A/E shall estimate the number of labor-hours required for each item of work and apply the cost per labor hour to the total labor hours required for each facility or system.

The unit price for materials shall be current catalogue prices or prices quoted from a supplier and will be documented. Items of work which are normally subcontracted shall be estimated as stated above plus an allowance (percentage) for subcontractor overhead and profit. The subcontractor total will then be included in the direct cost to the prime contractor. Costs for labor, materials, equipment, and subcontractor items shall be individually totaled and then added together for each facility system. Allowances (percentages) for prime contractor overhead and profit shall be added to arrive at a total facility or system cost.

Equipment costs may be included in each item or at the end of the estimate at the A/E's option. Where there are significant equipment hours, the equipment costs will show number of work hours with an appropriate operating rate. Operator cost will be shown separately.

The unit prices shall be exclusive of overhead and profit. Apply all state and local taxes as appropriate for the locale. TERO fees shall be shown as separate items. Overhead and profit shall be shown as separate items.

The cost of construction shall be escalated to the mid-point of construction considering award of a construction contract 6 months after completion of design.

estimating software is used to produce the estimate, provide summary details of the software.

(2) Pre-Design/Concepts Estimate. This is a lump sum budget estimate; cost is per square foot.

(3) Schematic Design Estimate. This estimate shall be based on schematic design sketches and documents and shall include the major components (i.e., site, building, and fixed equipment).

(4) Design Development Estimate. This estimate shall be based on design development drawings and documents and shall be prepared using the cost of major project components (i.e., site, building, plumbing, heating and air conditioning, electrical, outside utilities, fixed and movable equipment).

(5) 65 and 95 Percent Construction Document Estimates. These estimates shall be based on intermediate construction drawings and documents. It shall be prepared from quantity takeoffs by CSI format for the complete project. The estimate shall be divided into the standard divisions including taxes (such as state & tribal), bonds, insurance and other fees, and Contractor overhead & profits. It should be recognized that the cost breakdown for any features shall be commensurate with the design status. Lump sum and allowances prices are to be avoided. Special feature costs incorporated in the facility design are to be included in the estimate as separate line items.

(6) Final Construction Documents Estimate. This estimate shall be based on the final construction documents. Unit prices or Assemblies prices shall be avoided. If assembly price is used then the detail of each assembly price shall be provided. This estimate will be considered the "Government Estimate" after it has been reviewed and accepted by DES. The estimate shall provide detailed labor and material cost of each item.

3.4 Sustainability Reports

3.4.1 General Requirements

(1) The A/E shall provide sustainability reports with each design submittal. These reports shall accompany the current OPR and BOD, and include a narrative section, providing commentary and analysis for each of the *Guiding Principles (5.2)*. This report shall identify ongoing issues including, but not limited to: individuals/entities involved, local/regional considerations, feasibility and cost considerations, time constraints, and cultural priorities.

(2) The A/E shall establish a list of milestones, specific to achieving a sustainable design certification (U.S. Green Building Council, Green Building Initiative, etc.).

(3) The A/E shall register the project with the certifying entity during the concepts phase of the project, and shall provide online access to members of the Project Leadership Team as requested by the Project Officer, but shall at a minimum include the Project Officer and the Sustainability Coordinator. The A/E shall provide all design submittals to the certifying entity in a timely fashion, and shall upload the necessary documents to the online template.

(4) Reports shall include an updated matrix, including all credits specific to the certifying entity selected including a summary of each design/construction credit, a brief narrative of the requirements pertaining to each credit, identification of person(s) responsible for achieving the credit, an assessment of the likelihood of achieving the credit (i.e. "likely", "possible", or "unlikely"), status of credit-specific submittals to the certifying entity, and a narrative explaining the actions currently being taken by the A/E to pursue the credit further.

(5) The sustainability report shall include an active updated cost matrix, identifying the cost premiums associated with each credit being pursued. A cost premium is costs incurred to the project by virtue of each sustainability credit being pursued, and shall not include costs associated with the project in the absence of a sustainability certification. In some cases, a lump sum cost for each credit is sufficient; where additional cost data is requested by the Contracting Officer, the A/E shall provide the necessary detailed costs.

(6) As part of the preliminary sustainability report, complete the DHHS Sustainable Buildings Plan Exhibit II.B.1 *Sustainable Buildings Checklist for Projects*. This checklist will be submitted by IHS to the Department of Health and Human Services as part of the funding agreement. For subsequent sustainability reports, update as needed to reflect the changes in the process.

3.4.2 Final Sustainability Report

The final Sustainability Report shall be submitted with the Final Construction Documents as part of the final Basis of Design. This report shall contain the following:

(1) An updated status of all credits pursued, including approval status from the certifying entity.

(2) A list of pending design credits, containing a narrative of the outstanding issues and including a summary of actions currently being taken to resolve these issues. For any pending design credits, the Construction Contract Administrator shall be responsible to manage the administration of said credits until a final decision has been made by the certifying authority.

(3) A summary of anticipated construction credits, including a full description of requirements to be completed during the construction phase. For each construction-related credit the A/E shall provide a description of related drawings and specifications, person(s) responsible for compliance of each construction credit, and a narrative of additional stipulations if needed. Responsibility for managing the completion of said credits shall be that of the Construction Contract Administrator.

(4) For any credits not fully approved at the time of the final sustainability report, provide narrative of all outstanding issues, as a pretext for the Construction Contract Administrator to finalize approval.

(5) A final cost summary, calculating the anticipated cost premium for the full array of sustainability requirements.

3.4.3 Projected Consumption

Include narrative discussion along with projected baseline utility consumption calculations of the baseline versus actual design for energy and water use by type for the facility. Energy and water consumption shall meet the sustainability requirements in Chapter 5.

3.5 BIM Reports

3.5.1 BIM Management / Execution Plan

The BIM management and execution plan identifies key individuals within the design team responsible for coordinating the electronic model together with their roles and responsibilities, and will outline the overall plan for incorporating the following BIM elements into the design process.

(1) Design model management by the A/E and design team

(2) Clash detection coordination

(3) Energy analysis

(4) Cost estimating

(5) Specifications

(6) COBie data integration

3.5.2 Clash Detection Reports

Provided at each design deliverable phase beginning

with schematics, the clash detection report will highlight and summarize results from a critical evaluation of coordination conflicts from BIM clash analysis.

3.6 Facility User Manual

(1) Prior to project completion, the A/E shall prepare a user manual that will explain how the new health facility is intended to be operated. The manual shall address the use or functional organization of the health facility and explain how to use the health facility in plain language. Major considerations in planning, layout, and design are highlighted. Significant design features, cultural aspects, major pieces of equipment, and potentials for flexibility and expansion are to be made clear.

(2) The manual is intended for all staff members working within the health facility. Since the informational needs will vary among staff, the manual will provide information on the functions and systems at different levels of detail. The manual also needs to be flexible for both its day-to-day use and for the addition of updated material as it is developed.

(3) The manual shall include, but not be limited to the following topics: introduction/executive summary; an overview of the facility design and operational concept; building circulation/individual department review; HVAC systems; plumbing systems; electrical systems; fire protection systems; communication systems; site design; energy conservation; code conformance/waivers; signage/ way finding; and any supplemental information.

The facility user manual is not intended to be an excerpt of the operations and maintenance manual. For building systems it should present the intended strategy of operations that guides specific equipment sequences.

(4) For Staff Quarters / Housing projects:

Tenant user manual. The manual shall address the intent of relevant design features, provide energy savings tips, and provide information on basic maintenance of mechanical systems and equipment.

Provide indexing and placeholders within the Tenant user manual for operation and maintenance data provided during construction.

4 General Requirements for Submittals

4.1 General Requirements

Submittals shall be derived from, or linked to, the BIM design model and will form the foundation for generating all drawings, specifications, cost estimates, engineering studies, etc.

The current BIM design model shall be submitted at each design phase for review.

It is intended that the BIM design model shall be interoperable with generally available analytic tools that communicate with Revit or COBie standards for evaluating building envelope, orientation, daylighting, energy consumption, life cycle cost analysis, renewable energy strategies, building energy analysis, and sustainability.

Construction documents shall be coordinated with all furnishings, equipment, and communication systems.

(1) All submittals shall be provided in PDF, in addition to the hard copies required in the scope of work.

(2) Provide large-scale drawings of showers, toilet rooms, laboratories, utility corridors, mechanical rooms, and all other areas that are too congested to be clearly understood at a smaller scale.

(3) Coordinate all drawings with other disciplines, such as site utilities, reflected ceiling plans and duct plans. Coordinate service requirements with the civil engineer. Provide the comment "Coordinate with architectural drawings for detailed information" on all drawings.

(4) Equipment such as meters, piping, and valves to be furnished and installed by the utility company shall be shown and identified on the drawings. Delineate the division of work between the utility companies or Government and the construction contractor.

(5) Furnish load data and information on equipment capacities. If the design is based on the use of existing equipment, demonstrate the adequacy of the existing equipment.

(6) Provide 3-D views, not to scale, when clarity is required.

4.1.1 Government Review Comments

(1) At the completion of each phase, the A/E shall submit the required materials and documents for review. Reviews shall be for overall design concept and adherence to the POR and previously approved submissions. After receiving a complete submittal, including the "Certified Submittal Checklist" (refer to appendix 1) and verification by the Project Officer that the submission is complete, the review period will start. Written comments will be returned to the A/E as stipulated in the A/E contract.

(2) The Government review is not intended to provide a complete or detailed check of all drawings. It does not in any way relieve the A/E of the responsibility for checking all work; verifying compliance with codes, standards, and POR; and producing a complete, coordinated set of documents.

(3) After review of any submittal the CO may require changes to the drawings. The A/E shall make these changes before completion of the next submittal.

(4) The A/E shall submit a written response to the Government review comments after each submittal. The response shall address each comment. Comments requiring additional details, sections, notes, or cross-references to make the drawings more understandable shall be incorporated. If for any reason the A/E believes that a comment cannot be complied with, the A/E shall explain this in a written response.

(5) The A/E shall not proceed to the next phase until written approval or approval contingent upon the noted changes is received from the CO.

Box 4a - Submittal Stages and Reviews

The number of submittal stages and the number of copies required for each submittal are specified in the A/E contract or the A/E task order. All resubmissions of drawings, specifications, and cost estimates shall include a completed review comment form as shown in the Appendix.

4.2 Design Record

4.2.1 Overview

The Owner's Project Requirements (OPR) and Basis of Design (BOD) are two separate documents generated during the early design phases and are updated accordingly as the design progresses. Both the OPR

and the BOD are reviewed and evaluated throughout the Commissioning process, and are the primary drivers for gauging the successes and failures of the facility design and construction process.

These two documents are collectively referred to as the "Design Record." When properly developed, updated, reviewed and utilized the Design Record is the primary driver for ensuring the owner's needs are communicated and addressed by the designer at the appropriate design stages. The Design Record allows for accurate prioritization of design objectives while fulfilling the critical performance standards within the constraints that exist with each project.

4.2.2 Owner's Project Requirements

The Owner's Project Requirements (OPR) has been often referred to as "Design Intent" or "Project Intent". According to ASHRAE, *Design intent (OPR) defines the benchmark by which the success of a project is judged*.

The A/E shall prepare the original OPR and shall update it at the end of each design phase submittal. The initial OPR shall be the product of a workshop to be held at the pre-design phase with owner's representatives (such as Project Officer, Contracting Officer, O&M personnel, and designers.)

The initial OPR should follow the format and procedure outlined in Appendix A5. The format for the OPR outline shall be in accordance with ASHRAE Guideline 0 – 2005, Informative Annex J. This annex contains 29 qualitative objectives, identified in the same appendix; these objectives are cross-referenced with planning and early design documents, available to the A/E. As the design advances, each of the qualitative objectives is expanded to include the level of detail commensurate with the design phase.

Owner's project requirements include the objectives of the owner, and define measurable criteria to achieve each objective. Each owner's objective shall be stated qualitatively, with quantitative performance metrics.

The OPR should provide essential requirements to meet the needs of all stakeholders, including the medial staff, CEO, Operation & Maintenance staff, project manager, IHS Area officers, IT staff, security staff, etc.

If the project requires commissioning, the Commissioning Authority (CxA) shall review all performance criteria developed in the OPR and the BOD by the A/E firm beginning at the Design Development Phase to prepare building systems functional testing procedures. The CxA shall consult with the Owner and the A/E firm to revise the OPR as necessary to adequately track the elements that are integral to the commissioning process.

4.2.3 Basis of Design

The Basis of Design (BOD) document provides fundamental design premises and decision-making processes, which form the essential design choices made to meet the Owner's Project Requirements (OPR). This document should capture the fundamental methods, calculations, narratives, and deliberations that are required to achieve a satisfactory design. According to ASHRAE, *the Construction Documents detail "how" the Owner's Project Requirements will be physically achieved. The Basis of Design captures important information linking the "what" and "how."*

The BOD is compiled by designers (using design narratives and other submittals from the various disciplines), and is updated with each design phase submittal to incorporate all of the relevant design decisions and objectives, and shall be approved by the Owner and meet the requirements of the Commissioning Authority. During the design development and construction documents design phases, the BOD should be updated by the A/E firm including engineers, specialists, and other consultants who provide the design decisions for their respective disciplines. Typical Basis of Design details should include information as identified in Appendix A5.

The Basis of Design consists of two sections: design narrative and design rationale. For each design narrative there is a corresponding design rationale.

4.2.3.1 Design Narrative

The design narrative provides discussion points of all objective elements listed in the OPR. It outlines the means and techniques the designer intends to use for each OPR requirement and associated performance criteria.

With each design phase the design narrative shall be updated to add the level of detail corresponding to the phase of design.

The OPR and BOD are meant to be companion documents; the A/E shall utilize a numbering system within the BOD so that it can be cross-referenced with the corresponding OPR.

4.2.3.2 Design Rationale

The design rationale is the collection of assumptions, conventions, norms, and premises used for calculations, assembly selections, configurations, and design schemes

used to comply with the owner's project requirements.

The design rationale should include the following:

- Rationale for selecting a particular assembly or system. This should include a discussion of other options considered and why the particular assembly or system was chosen over other options.
- Performance criteria assumptions for each assembly or system; including:
  - Assumptions for calculations
  - Limitations and restrictions
  - Facility ambient condition (Climatic, geologic, structural, and other)
  - Design procedures and tools (e.g. software) used
  - Assumptions behind facility operations (including level of sophistication in controls, interdependencies between systems, availability of specialty support, etc.)
- Discussion of exceptions to, and interpretations of, codes and standards
- Specific codes, standards and guidelines considered for design of the facility.
- A summary of owner policies, owner directives, handbooks, or guidelines that were used considerably.

4.2.4 Developing and Updating the Design Record

The level of detail in the design record should progress from general information during schematic design to specific and detailed data during the CD phase(s). There should be an apparent flow of information from the Owner's Project Requirements to the Basis of Design, and eventually to the Drawing and Specifications. Table 4.2.4 shows the required benchmarks and level of detail throughout the design submittal phases:

Project Phase	Issues Addressed
Programming	Project Funding Obtained, POR Completed, A/E Selected
Pre-Design	Workshop to establish initial Owner's Project Requirements
Concepts	Finalize initial OPR Provide Initial Basis of Design
Schematic	Update OPR, Hire CxA CxA shall review the OPR and provide recommendations to the Owner and the A/E firm for any changes required in the OPR Update BOD to address any changes in the OPR. If commissioning is not required for the project, the A/E shall update the OPR
Design Development	Expand OPR to incorporate critical performance criteria Provide Cx Plan Update BOD to address OPR updates
Construction Documents	Finalize OPR to incorporate all updates from DD, include performance metrics in Cx Plan Finalize BOD, Incorporate into Facility User's Manual
Construction	Perform Functional Performance Tests per Cx Plan and OPR Finalize Cx Process

Table 4.2.4 – Developing the Design Record

At each design phase submittal, the A/E firm updates the BOD with more detail and accuracy from the latest OPR, and supplements each document with any additional performance criteria that the owner and/or CxA may have added since the last design submittal. With each design update, the owner with the consultation of the CxA reviews the design record and updates the OPR to add or revise elements contained in the document.

The completed design record should be included with the construction documents as part of the bid package, as a vital source of information. Updates to the design record shall be continued throughout construction as the commissioning process reaches the functional performance testing. Finally, after the owner takes beneficial occupancy of the facility the design record shall be updated before it is turned over to the owner, including the maintenance staff.

4.2.5 Design Record and Commissioning

The Design Record is essential to the Commissioning process, and the updates to the OPR and BOD are

integral to the Cx plan and Cx report. The scope of the Design Record, however transcends the Commissioning Process.

There are many qualitative requirements that do not necessarily belong in a Cx plan. Some examples might include pedestrian pavement, aesthetic appeal, parking, accessibility, etc. Therefore the scope of the Design Record must not be limited to Cx items only.

4.3 Documents and Drawings

Documents and drawings are to be generated from the BIM design model incorporating all features of the design as it progresses in development.

Object modeling within the BIM design model by engineering disciplines shall be of sufficient detail to generate submittal drawings as called for within the requirements chapters.

For highlighted areas identified by clash analysis additional scaled object presentation is required with sufficient detail to evaluate and resolve the specific issue and to provide clarity for construction.

Many of the required documents are considered Basis of Design data, and should be submitted as part of the updated BOD document for each design submittal.

4.3.1 Architectural

(1) Provide drawings to delineate the site plan, each floor plan, exterior and interior elevations, ceiling plan(s), roof plan, building and wall sections, and details necessary to describe the installation and / or placement of materials and components of each construction assembly.

(2) Provide a narrative code analysis, including, but not limited to the following features (if conflicts exist between NFPA 101 and the model building code, provide a description of the conflict, including the resolution):

(a) building occupancy

(b) multiple occupancies

(c) construction type

(d) height and area limitations

(e) means of egress

(1) components

(2) occupant load and capacity

(3) occupant loads

(4) number of exits

(5) dead-end corridors

(6) common path of travel

(7) travel distance to exits

(8) exit discharge

(f) protection of vertical openings

(g) protection of hazardous areas

(h) interior finishes

(i) fire and smoke detection, alarm, and notification

(j) automatic sprinkler systems

(k) corridor construction

(l) smoke compartments and smoke barriers

(m) fire resistant rated separations

(3) Provide a Life Safety Code Plan within the drawings identifying in tabular format the Life Safety Code and model building code features discussed in the narrative code analysis. Graphically indicating the following features on a floor plan sheet:

(a) location of multiple occupancies (if any)

(b) suites (location, size, and occupant load)

(c) means of egress

(1) components

(2) horizontal exits

(3) dead-end corridors

(4) common paths of travel

(5) longest travel distances to exits

(6) exit discharge to public way

(d) automatic sprinkler systems

(e) smoke compartments and smoke barriers

(f) fire resistant rated separations

(4) Record Drawings. The A/E shall, prepare and certify record drawings from information that has been provided in as-built red line drawings by the General Contractor (GC) or Construction Manager (CM) for the project.

(5) Space Comparison Report. The comparison process begins in the concept phase of design, with submission of a space comparison report.

4.3.2 Civil

(1) Provide a separate drawing for each of the following with a drawing scale of 1:250 or as acceptable to the Project Officer:

(a) Site location map

(b) Site Topography and Demolition Plan, including location and instructions for identified hazardous materials.

(c) Site development plan

(d) Erosion control plan, for use in application for National Pollution Discharge Elimination System (NPDES) phase II permit; the construction contractor and/or owner will be responsible for filing the Notice Of Intent (NOI) and Notice Of Termination (NOT).

(e) Site grading and drainage plan

(f) Site Utilities Plan (domestic water, exterior fire protection, sanitary sewer and gas, etc., as appropriate)

(g) Legal description

(2) Provide the following documents:

(a) Fire hydrant flow test results with flow rates, static pressures, and residual pressures for existing hydrants within close proximity of the site. The local jurisdiction shall be notified and a letter secured indicating that the local system is adequate to handle the proposed loads; both in terms of pressure/flow relationships as well as fire suppression storage. If the existing water system is not large enough to handle the proposed loads then the design should include an upgrade that has been coordinated with all concerns. The cost estimate shall include the necessary costs to upgrade and extend the system to the site.

(b) Size and capacity of all pumped or gravity sewers. The local jurisdiction shall be notified and a letter secured indicating that the local system is adequate to handle the proposed additional loads. If the existing infrastructure, including sewerage and treatment/disposal is insufficient to handle the proposed loads then the design should include an upgrade that has been coordinated with all concerns. Refer to the Site Selection Evaluation Report (SSER) for requirements on upgrading the system. The cost estimate shall include the necessary costs to upgrade and extend the system to the site.

(c) Sizing of all tanks and service lines to buildings.

(d) NPDES permit application and related correspondence.

(3) Geotechnical Investigation Report

The detailed geotechnical investigation report shall include at a minimum:

(a) Soil conditions.

(b) Recommended design for soil percolation rates at the surface and approximately three feet deep.

(c) Seasonal Groundwater elevations for both wet and dry periods.

(d) Research historical locations of any springs or creeks relevant to the site.

(e) Location and type of rock identified through site borings.

(f) Estimated rock elevations throughout the site.

(g) Recommendations for excavation, trenching, and backfill.

(h) Appropriate foundation types for the new structures.

(i) Design criteria for the recommended foundation types.

(j) Site grading and excavation including criteria for fill quality and compaction.

(k) Subgrade preparation.

(l) Lateral pressures for design of retaining walls.

(m) Site seismicity and hazards.

(n) Construction considerations and potential construction problems.

(o) Suitability of on-site excavation to be used as fill.

(p) Pavement section recommendations: conventional asphalt, concrete and porous concrete and asphalt.

Recommendations regarding the number of borings required to obtain the above information shall be determined by the A/E.

4.3.3 Structural

(1) Provide a separate drawing for each of the following when the drawing scale is 1:100 or less.

(a) General structural notes, including design criteria, and abbreviations sheet: Sheet shall include all design loads and other information pertinent to structural design in accordance with Section 1603 CONSTRUCTION DOCUMENTS of the IBC.

(b) The statement of special inspections required by Section 1705 of the IBC shall be included with the General Structural Notes; a note should be included requiring the Contractor to provide timely notification when the work is to be performed, and to make the work available for inspection.

(c) Foundation/Slab-on-Grade Plan. Plans for concrete slabs on grade shall identify all equipment isolation pads, housekeeping pads, sumps, vaults, trench drains, and depressions for tile or other equipment. Plans shall also include a layout for all construction and control joints.

(c) Framing plan (floors and roof)

(d) Elevations

(e) Sections and details

(f) Schedules

4.3.4 Mechanical

4.3.4.1 Mechanical Drawings

Provide a separate drawing for each of the following when the drawing scale is 1:100 or less.

(1) Demolition (including location and instructions for identified hazardous materials)

(2) Ductwork

(3) Piping (other than process piping)

(4) Process piping, including:

(a) Chilled water supply & return (CHWS & CHWR)

(b) Cooling tower water supply & return (CWS & CWR)

(c) Heating system water supply & return (HWS & HWR)

(d) Steam and condensate (S&C)

(5) Plumbing (domestic water, waste, vent, gases, vacuum, compressed air, etc.)

(6) Fire protection, including:

(a) Fire and smoke damper

(b) Smoke detector, heat sensor

(c) Fire alarm control panel and annunciation panel

(d) Fire alarm pull station

(e) Fire alarm (strobe light & alarm)

(f) Fire extinguisher

(g) Fire hydrant

(h) Back flow preventer

(7) Special systems, including:

(a) Medical gas

(b) Dental air and vacuum

(c) Nitrous oxide

(8) Provide riser diagrams for all systems including ductwork, domestic water, steam, heating and/or chilled water, waste, drainage, vent, fire standpipe, and process piping. Each component shown on a riser shall also be shown in plan view. Provide cross-identification.

(9) Control sequences for all systems shall be included.

(10) Schedules for all equipment shall be shown on the drawings.

4.3.4.2 Mechanical Documents

(1) Provide fixture unit factors for water, waste, and vent.

(2) Furnish equipment piping hookups and details for installation of special systems such as engine-generator sets, unit heaters, and steam for sterilizers, deionized water, and gases (air, oxygen, nitrous oxide, nitrogen, etc.) Provide sizing of all tanks and service lines to and within buildings for gases and liquids such as propane, natural gas, fuel oil, oxygen, and water.

4.3.5 Electrical

4.3.5.1 Electrical Drawings

Provide a separate drawing for each of the following when the drawing scale is 1:100 or less.

(1) Demolition

(2) Power

(3) Grounding system, including:

(a) Building grounding system

(b) Lightning protection grounding system

(c) Telecommunications/data grounding system

(4) Lighting

(5) Special systems, including:

(a) Information Technology, IT, communications, public address systems, and data systems – all telephone and data outlet location and typical conduit with pull wire or pull cord details.

(b) Nurse call system – location of all call system outlet and required equipment.

(c) Security system

(6) Advanced metering system

(7) Renewable energy systems

4.3.5.2 Electrical Documents

(1) Identify all circuits with panel and branch designation. Circuits requiring two or three-pole protection shall be clearly identified in the panel schedules. All wiring shall be easy to follow on the drawings and easy to identify the branch circuit or home run for each device or circuit and the related panel and circuit number or switch leg.

Provide a minimum of 20 percent future load connection capacity on each panel. Identify grounded conductors, graphically or in schedules, similar to phase or neutral conductors. Do not rely on separate notes or specifications to identify these conductors.

(2) Provide larger scale drawings and/or elevations of electrical equipment layout on pads and in electrical rooms when appropriate for legibility.

(3) Show interrupting capacities for switchboards, motor control centers, and panel boards. In panel board schedule, separately identify each special single-pole load and each multi-pole load.

(4) Provide riser diagrams (block diagram will not be accepted) for all systems. Provide a one-line diagram of the incoming service and the secondary distribution system. When necessary show, in plan view, each component shown on the riser or the one-line diagrams. Provide cross-identification.

(5) Show and identify the equipment to be furnished and installed by the utility company. Delineate the division of work between the utility company (or Government) and the construction contractor. Coordinate with the local utility.

(6) Identify load requirements (kW, volts, phase) for each outlet such as motor, heating device, or special equipment on the equipment schedules.

4.4 Medical Equipment and Furnishings Planning

The A/E is responsible for identifying and coordinating installation, use, and functional requirements impacting design for all group I, II, III, special equipment, and furnishings that are anticipated to make the facility fully functional as intended.

4.5 Special Systems

4.5.1 Security

(1) Security issues that affect the design shall be coordinated with the DES Project Officer and the end users of the facility. Special attention must be paid to the design of the pharmacy, emergency department, medical storage areas, IT equipment rooms, and patient records storage, to ensure that an appropriate level of security is attained for these areas.

(2) When required, personal identity verification (PIV) card readers and their associated systems shall comply with the requirements that are detailed in the National Institute of Standards and Technology (NIST) Special Publication 800-96 “PIV Card to Reader Interoperability Guidelines.”

(3) The concepts of Crime Prevention Through Environmental Design (CPTED) should be incorporated in the design of facilities.

4.5.2 IT Systems

Telecommunication & Data System requirements shall be closely coordinated with the facility users to provide and address the following information:

(1) Type of telephone equipment and fiber optic cable for data and telephone systems

(2) LAN (Local Area Network) and WAN (Wide Area Network) requirements

(3) Wi-Fi wireless system requirements

(4) Voice Over IP (VoIP) system information

(5) DS3 line, T1 line and copper cable requirements

(6) Data drops requirements, 4-port or 2-port (RJ11 or RJ45 port) for:

- Medical Equipment data drop requirements
- Dental room data drops location
- FAX machine, Copier machine, data drops locations
- Data drops for TV equipment

(7) Single or Multimode fiber cable for data drop requirements

(8) MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) room's equipment (servers, racks, UPS) location and clear space requirements for maintenance

(9) UPS requirements for MDF room and/or IDF room

(10) Quadruplex receptacles location in MDF & IDF rooms

(11) Dedicated A/C unit with humidity control requirements

(12) Emergency backup power requirements

4.5.3 Heliport

When specifically required in the POR the A/E shall include the design of a heliport.

The heliport design shall meet the requirements of the Federal Aviation Administration (FAA) Advisory Circular 150/5390. The design recommendations relevant to developing a hospital heliport are found in Chapter 4 of this Circular.

FAA approval is required prior to constructing the heliport. The A/E shall submit all required applications to the Regional FAA Office before the final design submittal.

4.6 Calculations

Furnish calculations to support each design phase. Calculations are to be a progressive refinement of the basic design until the final submittal. Most (if not all) calculations are considered as part of the Basis of Design and should be included, if not directly, referenced with each BOD update.

4.6.1 General Requirements

(1) All design calculations shall be in the unit system approved by the project manager, consistent for both drawings and calculations.

(2) Calculation sheets shall identify all decisions, data sources, codes, etc., necessary to complete the understanding of the computations.

(3) Calculation sheets shall have a minimum 25 mm binding border with the remaining borders at least 10 mm wide. Nothing shall be written in these borders.

(4) Each sheet shall be identified by the project name, date, and page number.

(5) All lettering shall be legible and all reproductions complete.

(6) When industry-specific software is used, provide information on the software to explain the input and output parameters so that the results can be easily understood.

(7) Bind the final calculation submittal. Include catalog information for all equipment proposed for the job. Bind all drawings into correlated sets. All equipment proposed shall have three manufacturers that can meet the specified requirements.

(8) Code Analysis. Provide a written analysis stating which codes are used in the design of the facility to ensure compliance with each applicable code.

4.6.2 Civil

Civil calculations are to include all paving systems, exterior drainage and utility systems, retaining walls, equipment selection information, exterior fire protection systems, pre/post-development runoff conditions, stormwater detention and treatment, traffic flow analysis and sanitary sewerage. Provide sketches, diagrams, and calculations as per the following:

(1) For paving systems, provide geotechnical data, coupled with soil bearing data to determine base, subbase, and subgrade soil conditions for establishing appropriate site preparation and pavement thicknesses. Cite methodology for thickness and material selection.

(2) Stormwater drainage calculations shall include initial assumptions and parameters for establishing design storm data, coupled with USGS storm data (i.e. Frequency-Intensity-Duration curves, isopluvial maps, etc.) Provide site runoff simulation, showing methodology and calculations. Using this data, provide sizing of storm drain piping for all reaches of proposed stormwater discharge system. Analyze storm water systems to which the project is tributary to ensure compatibility. Consider the impacts of impoundment if short recurrence intervals are used.

(3) Provide a hydraulic analysis as a basis for determining flows and pressures at all critical nodes throughout the potable water system. Simulate fire flows to establish a worst-case scenario in sizing of pipes and pumps, if necessary.

Provide calculations and/or manufacturer data to support selection of piping materials and schedules. Include pump and system curves.

(4) For site stormwater management purposes, provide calculations to establish pre-development runoff conditions, coupled with post-development runoff. Include proposed onsite stormwater detention facilities where needed, and support their sizing using approved methods. Include stormwater runoff quality in the sizing and configuration of treatment facilities. State selected best management practices (BMPs) in the design narrative.

(5) Provide a design narrative to support the sizing, and configuration of all sanitary sewerage. Include flow simulation models, if necessary. Use open channel flow simulation to support all slopes and diameters of pipes. If lift stations are required, provide all calculations to support the pump sizes, discharge pipe diameters, wet well sizing, float settings, emergency storage, etc.

(6) Where retaining walls are required on the site, provide calculations to establish wall thicknesses, material selection, drainage system, footing dimensions and configuration, etc.

4.6.3 Structural

Structural calculations shall be indexed, with a table of contents provided for major sections. Structural calculations shall show computations for all loads, and combinations of loads used for the design. Sketches used to calculate loading conditions for wind and seismic, and for connection design, shall be furnished. Calculations are to include all structural elements, and a key drawing/sketch is to be provided indicating member locations.

4.6.4 Mechanical

Mechanical calculations are to include all systems and all equipment selection information about HVAC, plumbing, fire protection, and other special systems. Furnish rough sketches used to calculate duct and piping system layouts and sizing. Duct systems shall include supply, return, exhaust, and special systems. Piping systems shall include: domestic cold and hot water, waste and vent, heating water, chilled water, ethylene glycol solutions, oxygen, vacuum, compressed air, refrigerant gas, nitrogen, and other special systems.

(1) Block load calculations shall be made for both heat loss and gain. The block loads shall be used to determine the size of the primary heating and cooling units for the building or the facility. Block loads are to determine at what time the maximum loads occur and the quantity of these loads.

(2) Provide individual cooling, heating, and ventilation requirements for rooms. Include suggested equipment to meet these loads.

(3) The total of all the room loads will usually exceed the cooling block load for refrigerant equipment. Room or terminal unit loads are used for room or zone unit sizing.

(4) The calculations shall include riser diagrams, room layouts, pump and fan curves, equipment data, pipe and duct sizing, tank capacities, and all pertinent data and sketches to completely clarify the design intent.

4.6.5 Electrical

For electrical calculations, provide the following:

(1) Illuminance calculations for lighting.

(2) Load calculations including overcurrent, voltage drop, short circuit and ground fault considerations. (In both preliminary and final load calculations, indicate connected loads and demand factors for each load category.)

(3) Obtain available short circuit voltage and current data from local power company and include the information with the load calculations.

4.7 Life Cycle Cost (LCC) Analysis

(1) The A/E shall assure that the cost data is adequate and accurate. LCC analysis reports shall be submitted no later than two weeks prior to the design review in order to provide the Government sufficient time to review the parameters and findings prior to making any critical decisions.

(2) Life cycle cost analyses shall include, but not be limited to the following: a summary of alternatives being compared, cost data (including capital cost, O&M, salvage value and replacement cost), frequency of replacement, discount rates, inflation rates, savings to investment ratio (SIR), discounted payback period (DPP), discounting conventions, period of analysis, start/base years, and assumptions.

(3) The A/E shall have the latitude to utilize independent LCCA software, however the analysis must be presented in a format that is easily readable, with the parameters clearly stipulated in each report.

An acceptable model for LCC analysis is the US Army Corps of Engineer's ECONPACK.

(4) The parameters for Life Cycle Cost Analysis are summarized below:

(a) Primary versus Secondary Analysis. Primary analysis will be used when a status quo alternative is available. Secondary analysis will be used when a requirement is not currently being met (no status quo available). In primary analysis, the objective is to demonstrate economic justification for replacing the status quo. In secondary analysis, LCCA is conducted in order to demonstrate the most economically viable alternative.

(b) Project Viability. For primary analyzed systems alternatives to be considered viable, the savings to investment ratio (SIR) should be 1.5 or greater, and the discounted payback period (DPP) should be in the single digits. Where economic viability cannot be demonstrated, additional justification is required.

(c) Discount Rate. The real interest rates shall be used for the discount rate in LCCA. Appendix C of OMB Circular A-94 provides current real interest rates used for discounting real (constant dollars) flows for effective cost analysis.

(d) Objective. Economic analysis objectives will be stated in clear, concise, unbiased, and quantitative terms.

(e) Discounting Conventions. For all costs, use middle-of-year (M-O-Y) convention, and for residual values use end-of-year (E-O-Y) convention.

(f) Period of Analysis. Usually 25 years + lead time (design and construction time). In the case of renewable energy systems a 40 year payback analysis shall be used.

(g) Start/Base Years. Must be the first year funds included in the analysis are to be expended on the project (or system).

(h) Constant Dollars. Should be a constant dollar analysis, using the real discount rate (i.e. no inflated numbers).

(i) Salvage Value Calculations. For new construction, assume the physical life is 40 years, the method is straight-line, the begin year is the first year after the facility is completed, discounting convention is E-O-Y, and constant dollars are applied. For renovation projects, assume the life of the system is 25 years, and hold all other parameters the same as in new construction.

(j) Wash Costs. Costs that are equal (magnitude/cost and timing/same year) across all alternatives can be excluded from the life cycle cost report because they do not affect the alternative selection. Discuss all wash costs in the Assumptions section.

(k) Assumptions. Should contain information such as the sources of the discount rates, residual/salvage calculation parameters, important data concerning the project, assumptions concerning the scope of the project, local conditions, ordinances, etc. Cost assumptions must be clearly specified and should include; construction, installed equipment other than building equipment, operation (including utilities) and maintenance (including potential modifications and component/equipment restorations/replacements), component or facility failures, and facility downtime, all based on center's operational experience. All wash costs are also to be discussed.

(l) Utilities Cost. Normally 10-15% lower for new construction vs. renovation; however, each situation should be assessed individually.

(m) Source and Derivation of Costs. Emphasis is required for this most critical part of the analysis and it must be checked for accuracy and logic. An "audit" trail and explanation for each cost must be provided in the analysis; for example: Utilities - Includes all water, sewer, gas and electric costs associated with the project and from where and how the costs were derived. All costs associated with the life-cycle of each alternative must be included unless it is a wash cost, see discussion of wash costs above.

(n) Non-Monetary Benefits. Should be discussed, if applicable.

(o) Savings. Total present value of savings will be determined for primary analysis and discussed in Results and Recommendations section.

(p) Results and Recommendations, or Discussion. A recommendation with justification should be provided. Although the primary criterion for selecting an alternative is least cost (i.e., lowest net present value), an alternative that is not least cost may be selected based on other factors.

(q) Cost Sensitivity Analysis. Must be performed by varying initial investment cost and all of the associated costs (all of the alternative's costs) of the selected project alternative up and down by at least 25%, and keep the next closest alternative constant; do not vary any of its costs.

(r) Discount Rate Sensitivity. Must be performed by applying to all alternatives, and vary the rate up 10.0% and down by at least 1.0%.

(s) Where There is Only One Feasible Option. Must contain the project objective, a description and listing of the alternatives considered, and a recommendation; this must be completed, even though a full-blown analysis is not necessary.

(t) Additional Paragraph. Should contain one of the following sets of statements in the first paragraph of the results and recommendations:

- An economic analysis has been prepared and utilized in evaluating this project. This project or system is the most cost-effective method to satisfy the requirement. Use when a full economic analysis is prepared, and the least cost alternative was selected.
- Alternative methods of meeting this requirement have been explored during project development. This project or system is the only feasible option to meet the requirement. Use when there is only one viable alternative available due to non-monetary reasons.
- An economic analysis has been prepared and utilized in evaluating this project or system. This project or system is the best method to satisfy the requirement. Use when a full economic analysis has been prepared but the alternative selected was not based on least cost, but on non-monetary issues.

4.8 Value Engineering

4.8.1 Requirements

(1) The VE study shall be conducted at the conclusion of the schematic design phase and prior to commencement of the design development phase. In certain circumstances, additional VE studies may be needed during other design phases.

(2) The A/E shall brief the VE team about the project requirements and design concepts, provide electronic access to the BIM design model, provide copies of design documents to the VE team, and review and comment on the VE team's recommendations.

(3) The A/E shall modify the design documents to incorporate all accepted VE recommendations at no additional cost to the government.

(4) The VE team shall be lead by a certified value specialist (CVS) registered with the Society of American Value Engineers (SAVE). VE team members are required to have, at a minimum, experience in health care and must have participated in related VE studies previously. All disciplines applicable to the project at each phase shall be represented on the team.

(5) The VE study shall be conducted independently from the A/E contract. Under no circumstances shall the A/E be a team member for the VE study. This condition shall apply even should the VE study be conducted through a subcontract to the A/E. The A/E's only involvement in the study shall be to provide information to the VE team and to attend the oral presentation.

(6) The VE team shall give an oral presentation of the VE study results at the end of the study.

(7) Further VE study reporting requirements are identified in the Technical Handbook for Environmental Health and Engineering, volume III, chapter 23-3 Value Engineering. The standards for conducting value engineering study are provided by SAVE International.

4.8.2 Value Engineering Report Contents

The VE study report shall contain the following:

(1) A summary of the functional analysis phase, including:

(a) A list of critical functions

(b) A functional analysis system technique (FAST)

diagram.

(c) A cost-function worksheet, and

(d) A value index for all critical functions.

(2) A summary of the creativity phase, including a list of all ideas discussed, whether accepted by the value engineering team, or not. If a significant concept was rejected by the VE team, the reasons shall be provided in the findings of the report.

(3) In conjunction with all submitted VE proposals, a T-chart shall be submitted, consisting of two columns: 1) advantages, and 2) disadvantages. Where disadvantages can be overcome, a third column shall be included, to present concepts to mitigate them.

(4) Prepare an idea selection worksheet, consisting of weighted evaluation criteria in each row, and concepts in each column. For each concept, multiply the relative weight factor for each evaluation criteria, and sum the raw scores. Then, divide the summary score by the estimated cost to obtain a value ratio for each concept.

(5) A description of differences between the existing and proposed design, comparison of the advantages and disadvantages of each, justification when an item's function is altered, and changes affecting system or facility requirements. This may include but is not limited to sketches, calculations, models, etc.

(6) Lists and analyses of design criteria or specifications that must change if the VE study item is accepted.

(7) A separate detailed estimate of the impact on project costs for each VE study item. A description and estimate of costs the government may incur in implementing the VE study item, such as design change costs and test and evaluation costs.

(8) A prediction of any effects the proposed changes have on life-cycle costs and energy savings. All cost comparisons shall use a 30-year building life as a guideline. The discount rate shall be based on the real interest rates on treasury bonds, as presented by OMB Circular A-94.

(9) The effect the VE study item will have on the design or construction schedule.

(10) All cost analyses shall use the current dollar or present worth approach. If other methods or assumptions are used, proper justification shall be included with the VE study.

4.9 Commissioning

4.9.1 Overview

Commissioning is a quality assurance process that oversees the coordination and interoperability of complicated building systems. The process of commissioning ensures that building systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the Basis of Design.

The commissioning process shall begin no later than the Design Development phase and continue through the one year warranty period. The scope of commissioning activities depends on the construction cost and total programmed space, as shown in Table 4.9.1.

Commissioning (Cx) shall be performed by a Commissioning Authority (CxA) but requires the involvement of a Commissioning Team. Early involvement of the CxA includes confirming the Owner's Project Requirements, developing a commissioning plan, and reviewing design documents to administer the coordination of building systems Cx activities and for construction planning.

	Total Programmed Space (GSF)		
Construction Cost ($M)	Under 20k	20k to 50k	Over 50k
Under $10M	None	Fundamental	Fundamental
Over $10M	Fundamental	Fundamental	Enhanced

Table 4.9.1 – Minimum Commissioning Requirements

4.9.2 Commissioning Authority

The CxA shall be engaged in the project no later than the Design Development phase. The CxA must be independent of the project design and construction work. In other words the CxA cannot be part of the design team or be hired by the construction contractor. When the CxA is provided directly by IHS through direct employment or contract; the A/E shall provide support for all CxA activities described. Generally for projects over $10M, the CxA is provided by subcontract through the A/E's contract. In this scenario the A/E shall assume all responsibility for CxA activities and responsibilities described herein.

The CxA shall be a "Certified Commissioning Professional" by the Building Commissioning Association (BCxA) or shall demonstrate an equivalent certification. In addition, the CxA shall demonstrate a minimum of two commissioning projects for a similar

building size and occupancy type, e.g. outpatient health care, etc.

Responsibilities of the CxA include, but are not limited to the following:

- Review and confirm that the Owner Project Requirements (OPR) are reflected in the Basis Of Design (BOD)
- Preparation of the Commissioning Plan
- Review Basis of Design to confirm the building systems' performance and operation
- Scheduling and conducting all meetings, required by the commissioning plan, and recording and distributing meeting minutes.
- Coordinating inspection and testing of all interacting building systems, e.g. life safety, fire alarm, air-handling, emergency generator, and electrical grounding.
- Review/define maintenance staff training requirements
- Provide the format for documenting all building systems/assemblies, prefunctional checklists, and functional performance testing requirements.
- Noting conditions of construction in conflict or different than the contract construction documents which may prevent commissioning activities from being completed.

The CxA shall be responsible for developing the requirements for the building systems commissioning plan during design, and documenting all requirements to be completed by the construction contractor during construction to ensure that building systems function in compliance with criteria set forth in the Contract Construction Documents for the project. The Commissioning Plan shall combine all system narratives, Owner's Project Requirements, Basis of Design, assumptions, training requirements, and calculations for all systems into a single manual.

4.9.3 Fundamental vs. Enhanced Commissioning

The A/E shall employ commissioning practices tailored to the size and complexity of the building and its system components in order to verify performance of building systems/assemblies and to ensure that project design requirements are met. In general terms, new facilities under 50,000 GSF require fundamental commissioning whereas new facilities over 50,000 GSF require enhanced commissioning. The Contracting Officer has the discretion to determine exceptions to this rule. The details of fundamental vs. enhanced commissioning (as defined by the U.S. Green Building Council) are as follows:

4.9.3.1 Fundamental Commissioning

- CxA must have experience in at least 2 projects
- CxA must be independent of the design and construction teams; may be on A/E staff (but not on the design team); reports directly to the owner
- CxA may be on design team if under 50,000 SF
- CxA reviews Owner's Project Requirements
- A/E or CxA to develop and incorporate Cx Requirements in CDs (for HVAC/R, Lighting, Domestic Hot Water, and Renewable Systems)
- A/E or CxA to develop and implement Cx Plan
- A/E or CxA to verify performance of Commissioned systems
- A/E or CxA to complete a summary Cx Report
- Cx HVAC/R (mechanical and passive), Lighting, Domestic Hot Water, and Renewable Systems

4.9.3.2 Enhanced Commissioning

- CxA must be designated during the Design Development (DD) phase
- CxA must be independent of the design team
- CxA must not be an A/E employee, though he/she may be a subcontractor
- CxA must not be employed by, or subcontracted through the construction contractor (or construction manager)
- CxA must perform at least 1 Cx Design Review of project requirements, Basis of Design, and CDs, prior to mid-CD Phase
- CxA must subsequently backcheck review comments
- CxA reviews contractor submittals
- A/E or CxA to develop systems manual
- A/E or CxA to verify training completed
- CxA must review building operation with the O&M staff within 10 months after substantial completion.

4.9.4 Commissioning Plan

The Commissioning Plan shall be generated at the Design Development phase as a separate submittal.

The Commissioning Plan shall be updated at each Construction Documents phase and shall be provided to IHS for review.

The Commissioning Plan shall follow the basic structure provided in ASHRAE Guideline 0, Informative Annex G. The basic structure of this guideline is such that each phase of the plan has its own section detailing which activities will be accomplished, defines responsible persons/entities, and details how each task will be performed. The intent of this format is for the Commissioning Plan to become the Final Commissioning Process Report at the end of the project by filling in the results as the project progresses.

4.9.5 Commissioning Team

The specifications shall define the "commissioning team." The team should consist of the following, as appropriate:

- Owner: represented by the CO or Project Officer
- O&M Staff: Facilities Manager
- Commissioning Authority: qualified person, company, or agency (government official or consultant)
- The A/E Firm: Project Manager (Architect), Mechanical Engineer, Electrical Engineer
- Construction Contractor or Construction Manager:
    - Project Superintendent
    - Mechanical and Electrical Subcontractors
    - Controls Subcontractors
    - Equipment Vendors (e.g. boiler, chiller, emergency generator, Automatic Transfer Switchgear (ATS), etc.)
    - Testing Adjusting & Balancing Contractor
- Additional Team Members, as deemed necessary

The commissioning team shall implement the commissioning process through coordinated action. Members of the team shall meet as necessary to execute and coordinate interrelated activities. All members of the Cx team shall report all Cx activities directly to the Cx Authority.

4.9.6 Design Phase Services

During the Design Phase the Owner's Project Requirements are incorporated into construction documents. The Basis of Design is refined to convey the assumptions made in developing all design decisions, intended to meet the criteria in the Owner's Project Requirements. During this phase facility systems and assemblies are identified and documented. The Commissioning Plan is expanded to include the details of Construction and Occupancy and Operations Phase activities.

The intent of the CxA requirements during design phase include but are not limited to:

(1) Verifying the Basis of Design document with the Owner Project Requirements

(2) Develop Commissioning Process requirements (scope and budget)for inclusion in the Construction Documents.

(3) Develop draft Construction Checklists.

(4) Updating the Commissioning Plan to include Construction and Occupancy and Operations Phase Commissioning Process activities.

(5) Develop the scope and format of the project Systems Manual.

(6) Define training program requirements.

(7) Perform commissioning-focused design review.

(8) Integrate the Design Phase Commissioning Process activities and coordinate individual equipment specifications with the Commissioning Specification.

The A/E Project Manager with the consultation of the CxA shall provide construction specifications dedicated to building systems commissioning, which will address the various building systems to be commissioned. The level of detail in the specifications shall be commensurate with the design phase. For a typical list of building systems and assemblies to be included in the Cx plan refer to Appendix A6.

4.9.7 Construction Phase Services

During construction the CxA shall oversee Construction Contractor activities as they relate to the overall commissioning process. All Cx documents generated during or before the design phase shall be updated as needed to fulfill the objectives of the Cx process. These documents include: Basis of Design, Owner's Project Requirements, Commissioning Plan, and Project Systems Manual.

During this phase the CxA shall perform all requisite

prefunctional and functional performance testing and shall arrange for all team members to participate as needed. All test results shall be documented, and additional testing shall be conducted as deemed necessary by the CxA through procedures defined in the Cx Plan.

A fundamental part of Construction Phase Commissioning is the training of maintenance staff. The CxA shall coordinate the various contractors, subcontractors, manufacturer representatives and specialists' efforts to adequately train O&M staff to the satisfaction of the requirements stated in the Cx Plan. All training efforts shall be coordinated through the Project Officer.

For a comprehensive list of Cx activities to be included in IHS construction refer to Appendix A6.2, "Commissioning Activities - Construction Phase".

4.9.8 Occupancy and Operations Phase Commissioning Process Activities

During the Occupancy and Operations Phase, the Cx Team works to verify the ongoing compliance with the Owner's Project Requirements. Essential team members during the Occupancy and Operations Phase include Owner's representatives (Project Officer and O&M staff), the CxA, design professionals, contractors & sub-contractors, and Project Manager.

Deferred testing as identified during the Construction Phase shall be conducted during this phase. The CxA shall utilize appropriate means to simulate operating conditions, i.e. seasonal or occupational.

A detailed list of Cx Team responsibilities and activities during the Occupancy and Operations Phase is given in ASHRAE Guideline 0, Appendix G, "Commissioning Services – Occupancy and Operations Phase."

4.9.9 Commissioning Closeout

Commissioning activities shall be considered complete after all outstanding issues have been resolved following the one-year warranty inspection. The CxA shall continue to coordinate residual testing, inspection and training, and shall report to the Owner until all remaining matters of concern are addressed to the satisfaction of the Owner.

5 Sustainability

The purpose of these sustainability requirements is to ensure that IHS facilities are designed and constructed in a manner that enhances indoor environmental quality for users while reducing the production and consumption of greenhouse gases, and disposal of construction material.

The A/E shall be responsible for implementing the following sustainable design features, activities, and certifications within the project. Sustainability related responsibilities shall continue into the construction phase when required by the contract.

5.1 General Requirements

It is the intent of the IHS to make every reasonable and rational effort to meet these requirements. In the event the A/E concludes that implementation of specific sustainability requirements is not feasible (in that doing so creates major negative impacts on the project, including major overall cost increases, major operational feasibility issues, major technology application issues, etc.) a detailed rationale for limiting the use of the specific sustainability feature in question shall be submitted in writing to the Project Officer for consideration by the IHS. Such rationale shall include discussion of the significant negative impacts to the project.

Cost comparisons and evaluations used in supporting the non-inclusion of required sustainability features must show an overwhelming life cycle rationale. Such exclusions shall not be implemented unless specifically approved by the Project Officer.

The term "LEED" is generally used in this document when discussing Sustainable Design Certification. For projects pursuing Green Globes certification, the term "LEED" herein shall be replaced with "Green Globes." In this scenario, references to specific LEED credits and certification levels shall be replaced with references to similar Green Globes credits and certification levels in the contract.

(1) The A/E shall be responsible for designing to achieve sustainable design certification and for implementing within the design the following Guiding Principles found in the *Federal Leadership on High Performance and Sustainable Buildings Memorandum of Understanding*:

- Employ Integrated Design Principles
- Optimize Energy Performance
- Protect and Conserve Water
- Enhance Indoor Environmental Quality
- Reduce Environmental Impact of Materials

(2) Sustainable design features, activities and certifications are part of overall Federal policy to minimize adverse environmental impacts and ensure the environmental compatibility of Federal facilities.

5.2 Guiding Principles

The A/E shall be responsible for achieving sustainable design certification and implementing the following Guiding Principles:

(1) Employ Integrated Design Principles (Integrated Design, Commissioning)

(2) Optimize Energy Performance (Energy Efficiency, Onsite Renewable Energy, Measurement and Verification, Benchmarking)

(3) Protect and Conserve Water (Indoor Water, Outdoor Water, Storm Water Runoff, Process Water, Water-Efficient Products)

(4) Enhance Indoor Environmental Quality (Ventilation & Thermal Comfort, Moisture Control, Daylighting, Low-Emitting Materials, Protect IAQ during Construction, Environmental Tobacco Smoke Control)

(5) Reduce Environmental Impact of Materials (Recycled Content, Biobased Content, Environmentally Preferable Products, Waste and Materials Management, Ozone Depleting Compounds)

5.3 Documentation

(1) The A/E shall evaluate status of the Guiding Principles and *Leadership in Energy and Environmental Design* (LEED) certification continuously throughout the design process providing written Sustainable Design Status Reports with each design submittal. Reports shall include an updated LEED checklist along with narrative confirmations of which goals and credits have been achieved and which are at risk. Recommended solutions to goals and credits at risk shall also be provided.

(2) The A/E shall provide detailed estimates with each design submittal identifying costs associated with implementation of Sustainability. These estimates are intended to identify specific costs related to design features, design activities, and construction activities that would otherwise not have been included in the project.

5.4 Sustainable Design Certification

(1) The A/E shall design the project to obtain LEED certification from the U.S. Green Building Council.

Projects with an estimated construction cost of less than $10 million may alternatively obtain a third-party Green Globes or National Association of Home Builders (NAHB) certification when explicitly stated as such in the contract. In this scenario, references herein to specific LEED credits and certification levels shall be replaced with references to similar Green Globes or NAHB credits and certification levels.

(2) The A/E shall be responsible for the coordination of LEED certification into the design.

Box 5a - Sustainability References

Requirements of this section are based upon the following documents:

1 Energy Policy Act of 2005

2 Federal Leadership on High Performance and Sustainable Buildings Memorandum of Understanding with various signature dates in 2006

3 HHS Policy for Sustainable and High Performance Buildings dated September 8, 2006

4 10 CFR Parts 433 and 435, Energy Efficiency Design Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings and New Federal Low-Rise Residential Buildings (Final Rule) dated August 10, 2011

5 Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management dated January 26, 2007

6 EISA 2007, Energy Independence and Security Act of 2007

7 Executive Order 13514 - Federal Leadership in Environmental, Energy and Economic Performance

Coordination of design includes project registration, preparation of all documentation necessary to achieve certification, submittal of documentation to the certifying organization, and incorporation of certification requirements into the construction documents.

The A/E is responsibe to identify all construction-related LEED credits at the final submittal for further tracking and management during construction.

Tracking of construction related credits will be the responsibility of the A/E only as part of a Construction Contract Administration (CCA) contract.

(3) LEED Silver certification is required (Green Globes Level 2 is comparable). Higher levels of certification are desirable and encouraged when cost effective to do so. At a minimum, LEED Gold certification shall be used as a target in order to create a buffer to ensure LEED Silver certification is achieved.

(4) The specific version of LEED rating system to be utilized will be approved by the PM. Specific credits identified in the following paragraphs reference LEED v3 for New Construction (2009). These references shall be modified accordingly should another version be utilized.

(5) The A/E shall evaluate all LEED credits to determine the feasibility of implementing each credit into the design, and make recommendations regarding which credits to pursue for certification. Evaluation shall include consideration of initial and life cycle cost impacts.

5.5 Implementing Guiding Principles

Specific LEED credits identified in the following paragraphs are required.

5.5.1 Employ Integrated Design Principles

(1) Integrated Project Team

- The A/E shall designate a specific LEED Accredited Professional (LEED AP BD+C for healthcare projects or LEED AP Homes for staff quarters) to participate on an IHS led Integrated Project Team (IPT) focused on implementing the sustainable design Guiding Principles into the project design.
- The IPT will conduct a concept phase sustainable design charette. The charette shall

be led by the A/E's LEED AP and may be combined with other design meetings or may be an independent exercise as identified in the contract.

- Sustainable design performance goals shall be established during the concept phase sustainable design charette. Performance goals shall include siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and LEED certification. Performance goals shall take into consideration all stages of the building's life cycle including deconstruction.
- Additional sustainable design meetings will be conducted throughout the design process to evaluate the status of and revise performance goals as necessary. Such meetings may be combined with other design meetings or may be an independent exercise.

(2) Commissioning - Provide building system commissioning services. Building system commissioning services shall meet the requirements of *LEED EA Prerequisite 1 – Fundamental Commissioning of the Building Energy Systems* and *LEED EA Credit 3 – Enhanced Commissioning (if required, see Table 4.9.1)*.

5.5.2 Optimize Energy Performance

Incorporate energy simulation modeling activities from the BIM design model so that changes to the design will be incorporated into the energy model in real-time.

(1) Energy Efficiency (Health Care Facilities)

- Design to achieve energy consumption level 30% or greater below the ASHRAE 90.1-2010 baseline.
- If a 30% reduction in energy consumption is not feasible, lower reductions may be considered when approved by the Project Officer. In such circumstances, energy consumption reduction levels shall be targeted at 5% intervals (i.e. 25%, 20%, 15%, etc.) until the maximum feasible energy reduction level is achieved. In no case may energy consumption levels exceed the ASHRAE 90.1 baseline.
- Energy consumption calculation shall include space heating, space cooling, ventilation, service water heating, lighting, laboratory fume hoods, kitchen ventilation systems, and all other energy consuming systems with the exception of receptacle and process loads.
- Energy consumption and baseline levels shall be calculated in accordance with ASHRAE 90.1-2007, Appendix G, Performance Rating Method. The ASHRAE Performance Rating Formula in paragraph G1.2 shall be modified as follows:

  % improvement = 100 x (baseline consumption - proposed consumption) / (baseline consumption - receptacle and process loads)

(2) Energy Efficiency (Staff Quarters that are three stories or less, above grade)

- Design to achieve energy consumption level 30% or greater below the ICC International Energy Conservation Code (IECC), 2009 baseline.
- If a 30% reduction in energy consumption is not feasible, lower reductions may be considered when approved by the Project Officer. In such circumstances, energy consumption reduction levels shall be targeted at 5% intervals (i.e. 25%, 20%, 15%, etc.) until the maximum feasible energy reduction level is achieved. In no case may energy consumption levels exceed the IECC baseline.
- Energy consumption calculation shall include space heating, space cooling, and domestic water heating.

(3) Energy Star Rating - Design to earn the U.S. EPA Energy Star.

(4) Solar Hot Water Heating - Evaluate the feasibility of constructing a solar hot water heating system capable of delivering at least 30% of the hot water demand. Feasibility shall be based upon the available budget and life-cycle cost (using a 40-yr payback analysis). Incorporate the largest capacity feasible solar hot water heating system into the design.

(5) On-Site Renewable Energy - Evaluate the feasibility of constructing an on-site renewable energy system capable of providing at least 7.5% of the annual electrical load. The A/E shall include a separate line item in the budget, dedicated to renewable energy systems. The size and scope of the renewable energy system(s) shall be determined through a cost feasibility analysis. Feasibility shall be based on the allotted budget, and a life-cycle cost analysis using a 40-yr payback calculation.

If it is not feasible to provide renewable energy systems providing at least 7.5 percent of the annual electrical load, the maximum capacity feasible system shall be incorporated into the project.

(6) Measurement and Verification

- Include the design of an advanced metering system within plans and specifications.
- Advanced metering systems shall, at a minimum, measure hourly consumption of electricity and report data on a daily basis.
- Additional guidance for advanced metering systems may be found in chapter 72-3 of the IHS Technical Handbook.

(7) Benchmarking - Establish energy benchmarking tool using Energy Star® Portfolio Manager. Train O&M staff to collect and record energy consumption data through the end of the first year of occupancy. Following the one-year warranty inspection, provide a report comparing actual energy performance data with energy design targets.

Box 5b - Construction - Related LEED Credits

LEED credits include design and construction credits. In pursuing a LEED certification the applicant must comply with the requirements attached to the construction credits sought in the original application. The A/E's involvement during construction is conditional on the requirements in the contract, therefore these credits must be identified by the A/E and included in the drawings and specifications for proper execution during construction. A list of all possible construction-related credits in LEED v3 is provided here:

- SSp1 Construction Activity Pollution Prevention
- SS5.1 Site Development – Protect or Restore Habitat
- SS7.1 Heat Island Effect – Non-roof
- EAp1 Fundamental Commissioning of Building Energy Systems
- EA3 Enhanced Commissioning
- EA5 Measurement and Verification
- EA6 Green Power
- MR1.1-1.2 Building Reuse
- MR2 Construction Waste Management
- MR3 Materials Reuse
- MR4 Recycled Content
- MR5 Regional Materials
- MR6 Rapidly Renewable Materials
- MR7 Certified Wood
- EQ3 Construction IAQ Management Plan
- EQ4 Low-Emitting Materials
- IDx Innovation in Design (conditional)
- RPx Regional Priority Credits (conditional)

5.5.3 Protect and Conserve Water

(1) Indoor Water - Design to achieve 20% reduction, relative to the EPAct 1992 standard (see LEED WE Prerequisite 1).

Efforts to achieve higher reductions per *LEED WE Credit 3 - Water User Reduction (30-40%)* are encouraged, but not required.

Metering of process water is required. This includes cooling towers and boilers, if using an open-loop system.

The use of harvested rainwater, treated wastewater, and air conditioner condensate should be considered and used where feasible for nonpotable use and potable use where permitted.

(2) Outdoor Water - The use of potable water for landscaping is not permitted. Design to earn *LEED WE Credit 1 - Water Efficient Landscaping (4 points - 100% Reduction).*

(3) Water-Efficient Products. Specify EPA's WaterSense-labeled products or other water conserving products, where available. Facilitate selection of irrigation contractors who are certified through a WaterSense labeled program.

5.5.4 Enhanced Indoor Environmental Quality

(1) Ventilation and Thermal Comfort. Design to comply with ASHRAE Standard 55-2004. Design to earn *LEED IEQ Credit 7.1 - Thermal Comfort: Design.* Design to meet or exceed the minimum ventilation requirements identified in ASHRAE 62.1 - 2007 for applicable building occupancies and ASHRAE 170 for healthcare occupancies.

(2) Moisture Control. Implement a moisture control strategy within the design to control moisture flows (rain penetration and groundwater entry) and condensation to prevent building damage and mold contamination.

(3) Daylighting

- Achieve a minimum daylight factor of 2 percent (excluding all direct sunlight penetration) in 75 percent of all space occupied for critical visual tasks.
- Provide automatic dimming controls or accessible manual lighting controls, and daylight glare controls.

(4) Low-Emitting Materials

Specify materials and products with low pollutant emissions, including composite wood products, adhesives, sealants, interior paints and finishes, carpet systems, and furnishings.

- Specify all adhesives and sealants to meet the requirements of *LEED IEQ Credit 4.1 - Low-Emitting Materials: Adhesives & Sealants*.
- Specify all interior paints and coatings to meet the requirements of *LEED IEQ Credit 4.2 - Low-Emitting Materials: Paints & Coatings*.
- Specify all carpet systems to meet the requirements of *LEED IEQ Credit 4.3 – Low-Emitting Materials: Carpet Systems*.

(5) Protect Indoor Air Quality During Construction

Follow the recommended approach of the Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction, 2007. After construction and prior to occupancy, conduct a minimum 72-hour flush-out with maximum outdoor air consistent with achieving relative humidity no greater than 60 percent. After occupancy, continue flush-out as necessary to minimize exposure to contaminants from new building materials.

- Design to earn *LEED IEQ Credits 3.1 and 3.2 - Construction Indoor Air Quality Management Plan (3.1: During Construction, 3.2: Before Occupancy).*

5.5.5 Reduced Environmental Impact of Materials

(1) Recycled Content

For EPA designated products, specify products that meet or exceed EPA recycled content recommendations. For other products, specify materials with cycled content when practicable. If EPA-designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction. EPA designated products may be found in the EPA Comprehensive Procurement Guidelines.

- Design to earn *LEED MR Credit 4.1 - Recycled Content 10% (post-consumer + ½ pre-consumer).*

(2) Biobased Content

For USDA designated products, specify products with the highest content level per USDA's biobased content recommendations.

For other products, specify biobased products made from rapidly renewable resources and certified sustainable wood products.

If these designated products meet performance requirements and are available at a reasonable cost, a preference for purchasing them shall be included in all solicitations relevant to construction in the building. USDA's biobased product designations and biobased content recommendations are available on USDA's BioPreferred web site at <www.usda.gov/biopreferred>.

- Design to earn *LEED MR Credit 4 - Recycled Content (1 point: 10%).*
- Design to earn *LEED MR Credit 7 - Certified Wood.*

(3) Environmentally Preferable Products - Use products that have a lesser or reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose.

For recommendations, consult the Federal Green Construction Guide at <www.wbdg.org/design/greenspec.php>

(4) Waste and Materials Management - Incorporate adequate space, equipment, and transport accommodations for recycling in the building design. During a project's planning stage, identify local recycling and salvage operations that could process site-related construction and demolition materials. During construction, recycle or salvage at least 50 percent of the non-hazardous construction, demolition and land clearing materials, excluding soil, where markets or onsite recycling opportunities exist. Provide salvage, reuse and recycling services for waste generated from major renovations, where markets or onsite recycling opportunities exist.

- Design to earn *LEED MR Credit 2 –*

Construction Waste Management: (1 point: Divert 50% from Disposal.)

(5) Ozone-Depleting Compounds - Eliminate the use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts..

- Design to earn *LEED EA Credit 4 - Enhanced Refrigerant Management.*

5.6 Supplementary Sustainability Measures

The following design measures are significant, and high priority to IHS. However no statutory requirements are affiliated with them. During design these measures will be considered during each review phase, but compliance with the targets is not mandatory.

5.6.1 Acoustics

Apply sound design principles so as to achieve desirable acoustic environments, which are consistent with other indoor environmental quality goals.

5.6.2 Building System Controls

Building system controls, properly selected, calibrated, tested, and commissioned, are central to achieving optimal energy performance.

Provide updated information on the status of the building system controls with each Sustainable Design Status Report and Basis of Design..

5.6.3 Siting

Proper siting is essential to various sustainability principles, including integrated design, stormwater management, energy efficiency, daylighting and ventilation. As part of each Sustainable Design Status Report, provide written narrative, detailing the usage of the site in the context of sustainability principles. Where tradeoffs are evident, provide a discussion of the evaluation process in determining relative advantages and disadvantages. Engage the Integrated Project Team in critical decisions relating to site.

5.6.4 Greenhouse Gas

Inasmuch as greenhouse gas production is an important metric relating to the design, provide calculations, estimating the production of greenhouse gases during construction, and after occupancy on an annual basis. Calculations shall be based on source energy usage, and shall account for the various sources of electricity generation from the utility. Estimated energy savings (as compared to ASHRAE 90.1-2007) shall be converted to reductions in greenhouse gas production.

5.6.5 Fossil Fuel Reduction

Fossil Fuel Reduction is being targeted in federal construction, by virtue of legislation passed in 2007. However, the final rule has not yet been established by DOE, thus at the time of publication of this guide, there is no requirement. However, every effort should be made to document the efforts to reduce Fossil Fuel consumption in federal buildings.

Provide calculations, updated with each sustainable design status report, to include design energy usage intensity (EUI), separated for fossil-fuels, and by occupancy type.

Present this data so as to compare design EUI with Commercial Buildings Energy Consumption Survey

Box 5c - ASHRAE Advanced Energy Design Guide for Large Hospitals

The 2012 Edition of the ASHRAE Advanced Energy Design Guide for Large Hospitals – 50% Energy Savings contains a summary of recommended energy savings measures sufficient to achieve 50% energy savings, compared against the ASHRAE 90.1-2007 baseline. Although this guide is not perfectly applicable to all IHS construction it contains prescriptive requirements, which are specific to each climate zone.

Strict adherence to this guide is likely to achieve significant energy savings, and may be sufficient to comply with the 30% reduction mandated in 10 CFR 433. Nevertheless, full compliance requires the development of an energy simulation model, benchmarking, and measurement for the first full year of occupancy.

The prescriptive requirements contained in the Advanced Energy Design Guide are built on sound principles and practices, including building envelope design, fenestration placement and sizing, infiltration control, recirculation and heat recovery, control of solar heat gain, etc. The IHS recommends the application of this Guide to the maximum extent practicable as a means for determining which design enhancements will most effectively achieve the necessary energy reduction.

(CBECS), or, for residential projects, the Residential Energy Consumption Survey (RECS) data from the Energy Information Agency. This effort shall be limited to design activities only; verification of this data shall not be the responsibility of the A/E.

The following tables are extracted from the Federal Register, Vol. 75, No. 199 (http://www.gpo.gov/fdsys/pkg/FR-2010-10-15/pdf/FR-2010-10-15.pdf):

Healthcare and Supporting Buildings			
Building Type	CBECS Baseline	FY 2012-2014 (55% Reduction)	FY 2015-2019 (65% Reduction
	(kBtu/SF/yr)		
Healthcare (Inpatient)	313	141	109
Healthcare (Outpatient)	148	67	52
Office	160	72	56
Public Assembly	125	56	44
Warehouse and Storage	66	30	23

Table 5.6.5.1 Maximum energy usage intensity targets for achieving fossil fuel reduction requirements

Housing			
Building Type	RECS Baseline	FY 2012-2014 (55% Reduction)	FY 2015-2019 (65% Reduction
	(kBtu/SF/yr)		
Single Family Detached	59	27	21
Single Family Attached	66	30	23
Multi-Family in 2-4 Unit Buildings	105	47	37
Multi Family in 5 or more Unit Buildings	94	42	33
Manufactured Homes	115	52	40

Table 5.6.5.2 Maximum energy usage intensity targets for achieving fossil fuel reduction requirements for Housing

6 Pre-Design Submittal

This phase includes the review and evaluation of all of the project planning and development leading to the concepts phase.

6.1 Requirements

6.1.1 Program Verification

Review and compare the PJD, POR, SSER, SOW, sustainability requirements, contract, and environmental criteria (Categorical Exclusion, Environmental Assessment or Environmental Impact Statement), provided with the contract documents by the CO. Summarize the review in a written report, and list all questions and unresolved issues.

6.1.2 Preliminary Owner's Project Requirements

Conduct a workshop with Owner's representatives, for the purpose of drafting a preliminary OPR document. Representatives of the owner may include but shall not be limited to the following: Service Unit Chief Executive Officer, facility maintenance staff, key clinical staff (doctors, dentists, nurses, etc.), IHS Area Office staff, Project Manager (Division of Engineering Services), Contracting Officer, and Tribal representatives. The preliminary OPR shall be founded on the elements provided in Appendix A5.

A/E shall prepare a preliminary OPR after the workshop for review and approval.

6.1.3 Site Analysis

Prepare a rough sketch to show the character of the site and the surrounding area. The sketch shall show all observations, site conditions, and environmental issues that will affect the project development.

Box 6a - Topographic Survey

Prepare the site analysis using the site survey and a local land map, city map, county map, and/or United States Geological Survey map, as required. Show general topographic survey information such as boundaries, grades, roads, walks, water features, structures, tree masses, major utility lines, including electrical, communications, data and cable TV, and property lines.

Prepare additional sketches or overlays, at a scale of 1:200 or smaller, to show conditions outside the survey area that will affect or be affected by the project development.

As part of the pre-design site analysis, provide information on the existing potable water and wastewater collection and treatment systems at the proposed site including locations and narrative review of potential project impacts from the available capacity serving the site.

Provide following information as minimum:

(1) Domestic water & fire water systems.

- Existing Pipe size and piping material.
- Available existing water flow and water pressure.
- Available existing Fire water flow.
- Provide documentation, from the local Fire Department, identifying existing and planned response equipment, connection, signal, access, or other special requirements, along with the general fighting strategy anticipated to serve the site.

(2) Sanitary sewer system

- Existing pipe size.
- Anticipated total sanitary sewer flow.
- Capacity of existing piping and treatment for the anticipated additional flow.

(3) Site Drainage

- Observed stormwater runoff characteristics, including infiltration capacity, erosion, receiving waters, etc.

(4) Site Electrical

- Anticipated infrastructure for interconnection with the utility
- Proximity to site/potential impacts to patients/visitors/staff
- Correspondence with Utility for connection agreement

(5) Natural Gas

- Availability/Capacity to serve site
- Correspondence with Utility for connection agreement

(6) Data/Telephone/Cable TV

- Utility/Utilities providing service
- Correspondence/connection agreements.

6.1.4 Geotechnical Study

Review the preliminary geotechnical investigation report provided by the government to prepare the initial recommendations on potential foundation systems.

The final selection of building foundation system shall be based on the detailed geotechnical investigation performed by the A/E.

6.1.5 BIM project management plan

Provide a BIM management and execution plan.

6.1.6 Pre-Design Survey Report

Review and document existing conditions to establish the basis for work during the design stages. Report all findings regarding the conditions of the existing structures or systems in a format that can be reproduced readily.

6.1.7 Record Drawings

Obtain and verify available Record Drawings or other drawings of existing structures related to the anticipated design effort.

(1) Investigate and document the condition of existing structures during the field survey. Review available environmental survey documents including asbestos inspections, lead paint and hazardous materials surveys.

(2) Provide summary of any observed discrepancies from record drawings and include photographs if needed.

6.1.8 Results

Provide pre-design submittal results in a bound booklet with a tab for each of the sections.

Refer to Appendix A1 for submittal checklist.

7 Concepts Submittal

The purpose of concepts is to investigate alternative organizations, site layouts, and building massing arrangements. The building concepts are to show the most desirable general organization of the project, both internally and on the site.

7.1 Requirements

The A/E shall perform the following:

(1) Conduct work sessions with IHS and the facility staff to develop a level of understanding of the site, the program, sustainability requirements, and departmental concerns. During the work sessions, note specific concerns, discuss the interdepartmental relationships, and review the site constraints, PJD and POR. The overall facility should be sensitive to and reflect the tribal culture.

(2) Update the preliminary OPR based on the Owner review comments along with refined details developed during worksessions.

(3) Conduct a sustainable design charette, identifying project specific goals in compliance with sustainability requirements.

(4) Evaluate the feasibility of constructing an on-site renewable energy system capable of providing 7.5% of the annual electrical load. Provide a written feasibility analysis (using a 40-yr payback) including recommendations for implementation.

(5) Evaluate the feasibility of constructing a solar hot water heating system capable of delivering 30% of the hot water demand. Provide a written feasibility analysis (using a 40-yr payback) including recommendations for implementation.

(6) Examine alternative schemes for site layouts. The alternatives should include major site features such as site contour layouts, other buildings and structures, building entrances, recreational areas, yards, walks, drives, loading dock, emergency drop-off, emergency entrance, fuel storage tanks, staff and visitor parking, etc. Each site layout scheme shall be incorporated into a basic BIM design model, which at a minimum will provide the reviewer access to a virtual 3D model of each scheme. Unless directed otherwise, develop three schemes.

Box 7a - NEPA

The National Environmental Policy Act (NEPA) requires all government agencies to obtain environmental clearance prior to beginning a project. The IHS Area Office typically performs this function during the planning phase of a project. If conditions permit, a categorical exclusion is sufficient clearance.

Where additional clearance is required, IHS provides an Environmental Assessment (EA) and/or an Environmental Impact Statement (EIS). The A/E is responsible for compliance with all environmental laws relating to the site, and shall obtain all clearance documents early in the design process in order to meet all requirements, and to be aware of any sensitive environmental issues.

NEPA requires clearance in the following areas: Wetlands/Water Resources (Corps of Engineers Section 404 Permit), Floodplains Executive Order 11988, Endangered Species Act of 1973 as amended, Historic Preservation Act of 1966 (with related acts and executive orders), Wild and Scenic Rivers Act, Coastal Zone Management Act, Wilderness Act, Farmland Protection Act, Safe Drinking Water Act, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

(7) Incorporate conceptual design activities with the site planning. Examine the facility building plan and massing arrangement alternatives. Space planning shall be done at departmental level. Identify alternatives for foundation, structural, and mechanical systems and their impact on architectural features. Show alternatives for foundations, framing, and building system distribution spaces in simple wall and building sections.

(8) Provide a topographic survey of the existing project site in such detail as necessary to be used for the analysis of site layout including, but not limited to: property boundaries, site boundaries, topographic features (surface contours and spot elevations for surface features), observed drainage features, existing infrastructure (potable and fire water, sanitary and storm sewer, natural gas, etc.), protected areas, easements, right-of-ways, and any

other information affecting the use of the site for the desired development.

All topographic information shall be incorporated into the BIM design model.

Show the locations of boring logs, test wells, and/or percolation test pits.

Identify sanitary sewer tie-in connection point, and coordinate with local utility company.

Identify natural gas tie-in connection point, and coordinate with local utility company.

Show location of existing utility services including electrical, communications, data and any cable TV, prospective connection methods, and access routes.

(9) Verify and document local utility system capacity for domestic and fire water, sanitary sewer, and natural gas.

Verify domestic water demands and calculate fire flow for the facility incorporating input from all relevant disciplines with consideration for community storage capacity, and local fire response requirements specific to the site. Consider storage requirements for both life safety and structure protection. If sufficient capacity is not available, provide design concepts for additional requirements to address predicted demands.

Provide documentation from each utility verifying capacity in current system to handle additional demand from the proposed interconnection. Where capacity upgrades are needed, provide status report between interested stakeholders.

(10) Provide the results of a geotechnical survey of the site, including information required to analyze the site and provide a basis for design of the building foundation systems, pavements, retaining walls, slope stabilization requirements, stormwater detention ponds, roads and walks.

(11) Develop three schemes. Present at least three well developed plans and alternative concepts with distinct alternative general plan features, one for each site layout.

Schemes shall include 3-D drawings to give clients an understanding of form and massing of buildings. Featured perspectives should also accompany schemes.

Provide supporting alternative sub concepts for framing, vertical development, mechanical systems, and electrical systems.

Provide preliminary cost data, including operation and maintenance cost implications for each alternative presented. Concepts shall include at least one single-story, and one multi-story plan when practical.

Provide the following for all schemes:

(a) Interdepartmental proximity diagrams (“scaled blocks”)

(b) Functional diagrams

(c) Locations and types of building access

(d) Building massing drawings including site development and prominent site features incorporated into the BIM design model

(e) Other drawings as directed

(f) Space comparison reports

(g) Cost estimates (including life cycle cost analysis where appropriate to justify greater capital expenditures)

(h) Life safety code analysis

(i) Narrative on energy reduction goals, including issues and benefits related to each scheme and orientation

For Staff Quarters / Housing projects provide alternative massing schemes. Include narrative of the relative advantages and disadvantages of single-story vs. multi-story, basements vs. crawlspaces vs. slab-on-grade, etc.

(12) Provide a summary report on the sustainable design charette, together with a sustainable design status report that addresses all schemes.

(13) Provide a brief written analysis of all planning and systems concepts and recommend a general overall approach for the schematic design phase. Carefully consider consequences for all major building service systems.

(14) Incorporate comments from the concepts review and provide a record drawing of the final site layout and building organization and massing plan as a separate submittal.

(15) Provide the initial Basis of Design document using the preliminary Owner’s Project Requirements document established during the pre-design phase. This document shall be numbered to reference the same elements used in the OPR document.

Refer to Appendix A1 for submittal checklist.

8 Schematic Design Submittal

The purpose of the schematic design is to establish the size, shape, general construction, framing system and building envelope, site configuration (including access roads, driveways, walkways, utilities, drainage), general mechanical and electrical systems, and room-by-room layout. This submittal represents approximately 10 percent of the design phase.

8.1 Requirements

The A/E shall perform the following:

(1) Integrate all preceding design efforts and all design-related special studies.

(2) Conduct work sessions with IHS and the client staff to review the type of spaces, interdepartmental relationships, and circulation within the departments developed during the concepts phase.

The A/E is encouraged to utilize the BIM design model to provide users with a greater understanding of form and function of spaces and the selected scheme.

(3) Refine the approved conceptual design. Establish the preferred building scheme, integrating a workable structure. Develop the floor plan to include all rooms listed in the POR including non-template spaces. Define all general assemblies, materials, and floor plans to show all walls with double lines. Show general building dimensions (horizontal and vertical).

(4) Verify capacity of scheme to accommodate all supporting systems and equipment. Establish general concepts of type, location, and distribution of mechanical and electrical systems.

(5) Develop the site plan sufficient to demonstrate layout and functionality of all critical systems, including (proposed and existing) underground utilities, site drainage, onsite stormwater detention, access roadways, parking lots, storage tanks, overhead or underground power configuration, significant site grading modifications, and retaining walls. Site plans shall contain sufficient detail to convey the Owner's Project Requirements. Include an evaluation of the anticipated traffic issues, sufficient to recommend whether a traffic study will be necessary.

(6) Provide the following:

(a) Updated space comparison report

(b) Provide the completed geotechnical report and the basis for design of the building foundation systems, retaining walls, erosion control practices, stormwater detention ponds, roadways, walkways, underground utilities, underground utilities, and other site improvements.

(c) Updated sustainable design status report including baseline energy consumption and renewable energy system information.

(d) Owner's Project Requirements/Basis of Design documentation, updated to reflect all design changes and emerging priorities.

(e) Preliminary calculations for civil, structural, mechanical, and electrical systems (included within the Basis of Design documentation).

(f) Updated cost estimate

(g) Clash detection report

(h) Updated life safety code analysis

(i) Outline for the technical specifications

(j) Drawings

(k) Other Documents called for in 8.1.2

(l) Value Engineering Study

Refer to Appendix A1 for submittal checklist.

8.1.1 Drawings

(1) From the current BIM design model, provide two or more exterior views from prominent approach points along with interior views for all key architectural element public spaces.

(2) Note the name or function, space identification number, and the net area in each individual room or space.

(3) Verify that adequate space has been provided for mechanical equipment, IT systems, data/telecom, janitors closets, and electrical equipment on floor plans.

Box 8a - Program and Space Accounting

Program and space allocations authorized in the POR are closely scrutinized. Deviations require significant review and approval. Generally, additional project dollars are not available and modifications will need to be reconciled within the approved project budget.

The overall building gross space is fixed and cannot be increased without a POR amendment.

Individual and departmental spaces can deviate from the listed POR allocation by +/- 10% to accommodate actual program services defined during design and to make accommodations for building configuration without any overall increase to the building gross.

(4) Verify that each space in the POR space schedule and POR functional diagram are shown on the drawings.

(5) Coordinated with the space comparison report, provide POR space floor plans that graphically highlight all POR spaces at the departmental level showing actual space, POR space, and percent deviation for each department. All spaces shall be accounted for on the plan, including building circulation & envelope, major mechanical, and non-POR spaces and be generated from within the BIM design model and presented as a space programing schedule within the model.

(6) Show significant life safety features, including all smoke and fire-rated walls in a life safety plan

(7) Show all anticipated furnishings and medical equipment in a layout plan.

(8) Show entrances, circulation areas, stairs, elevators, mechanical equipment space, electrical equipment, toilet rooms, stacks, and wire closets.

(9) Show typical window arrangement and exterior materials.

(10) Show all required smoke and/or fire partitions on the floor plans.

(11) Designate the floor that is approximately on the same level as the main entrance as the "first floor." If the site slopes downward from the main entrance area, and one or more secondary entrances are below the first floor, designate that level the "ground floor." Floors below grade are to be designated as "basements."

(12) Indicate planned or possible future building expansions by dotted outlines on the plans and elevations. They shall be noted with the words "future expansion."

(13) The schematic drawings should indicate space for all major mechanical requirements including space for the maintenance and operation of the equipment including: chillers, boilers with exhaust, chilled and hot water system pumps, control panels for equipment, fire pump with controllers, domestic hot water system tank and pumps, medical gas system equipment, oxygen tank location, etc.

(14) Indicate location of major equipment and required maintenance space per NEC including switchgear with main disconnect, panels, transformers, generator, ATS, communication panel, data/telecommunication system equipment servers, UPS with clear maintanance space in the MDF/IDF room, PV system control panels, ect.

(15) Provide plans, elevations, and building sections at 1:100 minimum. Provide typical wall sections at a larger scale.

(16) Provide a site plan, floor plans, a roof plan, elevations, and longitudinal and transverse sections.

(17) Provide sections through the building in both the longitudinal and transverse direction. All major rooms are to be shown and labeled (abbreviated if necessary), with floor-to-floor dimensions noted.

(18) Provide one-line electrical diagram (block diagram will not be accepted) including all three-phase equipment, 3-pole circuit breaker size, conduit/wire size, and metering device (Voltmeter, ammeter, Watt-hour meter).

(19) Provide primary side of the main transformer wiring detail. Provide main transformer concrete pad size, primary side conduit size and location in accordance with the local utility company requirements.

8.1.2 Other Documents

All design requirements for each discipline shall be included in the submitted Basis of Design Documentation, and shall be provided in the format prescribed in Section 4.2.3 and Appendix A5.

8.1.2.1 Architectural

(1) Provide life safety code analysis.

(2) Medical equipment summary. Provide a room by room tabular list of all anticipated group I, II, III, and special purpose equipment, as projected in the

HSP, including estimated cost by item. This initial equipment listing will be the basis of developing detailed equipment lists with users during design development.

(3) Provide a security system drawing based on the specific security assessment in the PJD/POR document. Minimum requirements for the security drawing:

(a) Electronic Lock on the doors on all Exit doors, all Pharmacy area doors, and all medical records storage doors etc.

(b) Card reader as on all IT-rooms doors

(c) Camera - Interior locations such as Waiting areas, Pharmacy areas etc.

(d) Camera - Exterior locations such as all entrance doors and government vehicle parking areas.

For device locations where specific equipment is not known anticipate a junction box, empty conduit and pull string for future use.

8.1.2.2 Civil

(1) Provide a basis of design of all underground piping. In addition to proposed horizontal layouts on the site plan, provide preliminary calculations for sizing these pipes. Include preliminary placement of main potable water valves, water meters, fire protection system water flow requirements, existing water supply (utility) system information, integrated cross-connection control plan (in consultation with mechanical sub-consultants and CxA), hydrants, manholes, cleanouts, and other appurtenances. Also, cite all Standards and codes used as a basis for the design, and include critical details regarding the systems (i.e. gravity versus pressurized sewer, ductile iron versus PVC water main, etc.).

(2) Show preliminary layouts for all proposed walkways, and driveways.

(3) Provide a preliminary stormwater analysis, including a narrative regarding erosion control and permitting requirements. The stormwater analysis shall be based on state or local standards and shall evaluate the 2, 5, 10, 50, and 100-year storm event. Follow procedures outlined in the Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act, wherein the site is designed to retain the 95th percentile rainfall event (24-hr period). Include a narrative summary of probable Best Management Practices (BMPs) for implementing a stormwater pollution prevention plan during construction, and Low Impact Development (LID) practices for minimizing runoff after development.

Provide an estimate of pre-development runoff based on existing site hydrology using the storm event intervals of 2, 5, 10, 50, and 100-year intervals. Provide an estimate of post-development runoff using the same intervals for design storm events. Ensure that post-development runoff does not exceed pre-development runoff. Properly size stormwater piping and appurtenances consistent with local AHJ requirements, or as local site conditions require.

Identify the agencies which have jurisdiction over the NPDES permit and the individuals/ entities who will submit the Notice of Intent (NOI) under said permit. Provide narrative regarding the development of a Stormwater Pollution Prevention Plan (SWPPP) as part of the permitting requirements.

(4) Submit a traffic code analysis narrative. Identify local codes and regulations, which may impact the layout and configuration of all site access roads. Include correspondence with tribal, city, county, or state authorities, to validate your analysis.

(5) Identify special site features, which merit additional studies. These include, but are not limited to loading docks, retaining walls, bridges, ground-

Box 8b - Project Budget, Space, and Program Reconciliation

The schematic design phase concludes with a detailed review of the project design for conformance with the program and space allocations authorized in the POR.

To ensure that the estimated project cost remains closely coordinated with anticipated construction funding as the design moves forward, the project design, scope, proposed value engineering initiatives, including sustainability features, will all be considered to reconcile the estimated project cost with the project budget.

From this review specific direction will be provided to the A/E identifying issues that will be incorporated or modified into the subsequent phases of design.

Generally, additional project dollars are not available.

Program deviations will be closely scrutinized and will require an amendment to the POR.

source heat pump wells, special drainage structures, etc.

Provide a narrative, which identifies design standards to be used as a basis for these features. Where appropriate, include relevant data from the geotechnical report to identify issues of concern.

(6) Potable and fire water piping distribution systems

Provide hydraulic model output of proposed water distribution system during normal conditions and during fire event.

Indicate size of required site piping (valves, air release valves, fire hydrants, etc.).

Provide all calculations and assumptions for potable water storage tank requirements, onsite chlorination, or other special systems.

(7) Sanitary sewer collection systems

Provide hydraulic model output for proposed collection system during peak flows to show that proposed collection system will function as designed with no overflows or surcharged conditions.

Determine size and location lift stations that will be required to handle anticipated sewage flows and indicate sanitary sewer collection system pipe sizes, slopes for pipe sizes, manhole sizes, depths, etc.

(8) For Staff Quarters projects, provide narrative on lot layout and sizing. Include a discussion regarding the advantages / disadvantages of large versus smaller lots. Provide analysis regarding the type of landscaping to be used. Identify areas where site slopes may be a concern and discuss methods to facilitate drainage and minimize impacts from lot-to-lot drainage.

8.1.2.3 Structural

(1) Provide a description and economic comparison of foundation systems based on recommendations in the geotechnical report. Description shall include a summary of advantages and disadvantages of each system.

(2) Provide an economic comparison of at least three structural framing systems for each area of the building that has distinct framing requirements. Comparison shall consider requirements for use, occupancy and fire protection requirements.

8.1.2.4 Mechanical

(1) Submit an economic analysis of at least three HVAC mechanical systems. At least one alternative shall utilize renewable technology, e.g., ground source heat pump system, etc.

Provide narrative of each HVAC mechanical system including diagram/sketches, required equipment, piping, controls, and cost estimates of each system with sufficient detail to evaluate options. Include performance of the building envelope insulation.

Discuss the pros and cons of each system including system contribution in meeting required building energy reduction goals.

Provide justification and analysis of the mechanical system selected compared to other systems.

Evaluate comparative costs and include recommendations for fuels for heating. Include an economic analysis for a snow-melting system if required.

The economic analysis shall be performed for measuring Life Cycle Cost of the building system in accordance with applicable codes and standards (such as ASTM E917).

The analysis shall be approved and the type of system selected before the design development stage.

(2) Provide a psychrometric analysis for air handling systems. See appendix A7 for an example.

8.1.2.5 Electrical

(1) Provide an early building electrical load analysis based on Watt/m^2 basis for each category of load such as lighting, receptacles, miscellaneous equipment, and HVAC equipment. Provide copy of design analysis with support document or identify per NEC article.

(2) Provide lightning protection requirement calculation in accordance with NFPA 780.

8.2 Value Engineering Study

The A/E shall facilitate the timely completion of the VE study by providing all requisite design documents to the independent VE firm. As part of the schematic design submittal, the A/E shall include a narrative as to the status of the pending VE Study, shall include VE activities in the design schedules, and shall inform IHS of any developments.

9 Design Development Submittal

The purpose of the Design Development (DD) submittal is to describe the size and character of the project in detail from the owner's point of view and confirm that all engineering requirements can be accommodated in the final design. This submittal constitutes approximately 35 percent of the design phase.

9.1 Requirements

The A/E shall perform the following services:

(1) Integrate all preceding design efforts and all design-related special studies.

(2) Begin to integrate commissioning requirements into the design.

(3) Refine the approved schematic design documents. All interior and exterior systems and materials that the medical staff and patients will use, encounter, see, hear, or are dependent upon for their safety, must be identified.

(4) Conduct work sessions with DES and the client staff. Specifically,

(a) Meet with the client staff to develop detailed locations and connections for all related Group I and Group II equipment, telephone equipment, computers, printers, copiers/fax machines. Determine the layout of cabinet elevations (doors, drawers, heights, shelves, etc.), function of door hardware, finishes, location of power and communication requirements, location and type of lighting, refine room and departmental circulation, etc.

Identify potential locations and quantities of voice/data outlets throughout the facility. Discuss the possibility of digital health care delivery and medical records, radiology, pharmacy, and dental departments.

(b) Confer with appropriate client staff to develop keying and room numbering strategies.

(c) Meet with designated representatives for final approval of each area or department before completing the DD submittal.

(5) Implement the design development with accepted value engineering proposals and sustainability requirements.

(6) Provide all design specialty services needed for a complete facility design including radiation shielding, dietary services equiment, trash disposal, medical gas storage and dispensing systems, dental equipment, and all storage and internal transportation devices.

(7) Provide the following:

(a) Updated space comparison report

(b) Updated sustainable design status report including a tabulation of all LEED credits being pursued, likelihood of earning each credit, calculations using USGBC templates (if applicable), narrative for each credit including latest updated information, and a calculation of cost premiums associated with each credit being pursued. The report shall also include a feasibility analysis for solar water heating (as stipulated by EISA 2007), and an updated feasibility analysis of the renewable energy options.

(c) Projected energy usage report with calculations

(d) Comissioning plan including items similar to Appendix A6 developed from ASHRAE Guideline 0

(e) Updated Owner's Project Requirements/Basis of Design documents

(f) Updated calculations

(g) Updated medical equipment summary

(h) Updated cost estimate

(i) Clash detection report

(j) Narrative summary of VE changes implemented in the design

(k) Project draft specifications, including division 0 and 1, in developmental draft form

(l) Drawings

(m) Other Documents called for in 9.1.2

Refer to Appendix A1 for submittal checklist.

9.1.1 Drawings

BIM design model is the basis of generating drawings.

9.1.1.1 Architectural

From the current BIM design model, provide two or more exterior views from prominent approach points along with interior views for all key architectural element public spaces.

Provide general and detailed floor plans, exterior elevations, and major building sections at 1:100. Provide all major types of wall sections at a larger scale. Revise architectural floor plans and interior elevations at 1:50.

(1) Areas of potential future expansion shall be indicated by dotted outlines on the plans and elevations, and marked with the words "future expansion."

(2) Floor plans. Floor plans shall have the following note: "BASED ON PROGRAM OF REQUIREMENTS DATED _____ AND ON SCHEMATIC DRAWINGS APPROVED_____." Floor plans shall indicate wall thicknesses, door swings, and door sizes.

(3) Each room or space shall be identified by name (abbreviated when necessary) and number.

(4) Materials of all partitions shall be indicated by either symbol or note to agree with those materials described in the supporting data.

(5) Floor plans shall include section lines showing locations of longitudinal and transverse sections.

(6) Precisely locate and size vertical structural members and rough size horizontal members to assure there are no conflicts with other systems.

(7) Show all anticipated furnishings and medical equipment in a layout plan. Utilize as a background base for mechanical and electrical coordination, including room names and numbers.

(8) Show all required smoke and/or fire partitions on the floor plans.

(9) Show significant life safety features, including all smoke and fire-rated walls in a life safety plan. This plan will be developed to facilitate fire egress placards and assist with Joint Commission surveys.

(10) Elevations. Provide elevations with the major features and materials noted directly on the elevations. This shall be in generalities such as brick, stone, granite, architectural cast concrete, bronze, aluminum, etc. Terminology and materials must agree with the supporting data submitted.

(11) Longitudinal and Transverse Sections. Provide at least one longitudinal and one transverse section through the major portions of the building. All major rooms exposed by the section shall be shown and identified by name. Complete floor-to-floor dimensions from the lowest floor to the roof shall be given. Ceiling heights throughout the building shall be indicated.

(12) Wall Sections. Provide one wall section cut on a line through windows and another on a line through the wall proper. A partial elevation and plan section shall be on the same sheet at the same scale. This is required for all substantial variations in wall design. The purpose of these sections is to delineate the fundamental concepts of the proposed exterior wall design.

(13) Design of special areas. Provide preliminary design sketches, including 1:50 scale plans, interior elevations, reflected ceiling plans of lobbies, auditoriums, kitchens, laboratories, and other areas which are to be given special architectural treatment. Floor plans at 1:50 scale shall be started during this phase. They shall show casework and equipment layouts. Provide 3-D views to convey spatial and equipment layout to users.

9.1.1.2 Civil

Site Plan and Civil Engineering Elements: Provide a well-articulated site plan showing the location and size of the facility and facility-support systems. The following note shall appear on the site plan: "BASED ON TOPOGRAPHIC SURVEY DATED _____." The following shall be submitted as supplemental to the site plan:

(1) Site and Grading Plans. These plans must show the entire site, and must establish the grading and project limits. Provide elevation contours (existing and proposed, using a 2-ft contour interval.) Also include surface features, which will be removed, or existing buildings to be demolished.

(2) Roadways, Parking Lots, and Pedestrian Paving. All proposed access roads and parking lots shall be shown in plan view. Layouts for all curbs will also be required.

Provide horizontal and vertical layout, including pavement materials, subgrade preparation, pavement thicknesses, and finishes. Reconcile

Basis of Design with Geotechnical Report. Provide narrative regarding site access and coordination, including staging and site control.

(3) Site Drainage. Include all proposed site drainage features. This shall include: drainage paths, surface drains, storm drain manholes, roof and foundation drains, storm sewer layouts, on-site detention, and discharge.

(4) Water/Sewer. Show all proposed water and sewer utilities; provide this information in plan view, and profile views where site conditions merit such detail.

(5) Other Utilities. All other site utilities shall be included in the site plan. These utilities shall be shown with sufficient detail to confirm appropriate layout and configuration in relation to other site features. Examples of other utilities include: underground gas lines, steam lines, hot/chilled water, underground electric, TV, telephone, T1, etc. Refer to the appropriate specialty section for additional requirements.

9.1.1.3 Structural

(1) Drawings shall include general structural notes, design criteria, foundation plan, floor and roof framing plans, and typical sections. Schedules and typical details should also be included.

Drawings shall be grouped as follows:

- General structural notes
- Abbreviations
- Plan view - Foundation plan, floor and roof structural plans with coordination of all mechanical equipment, duct, piping, and roof opening plans
- Elevations

(2) Identify sizes, weights and locations of mechanical, electrical, and other equipment, which will be supported by the structure.

9.1.1.4 Mechanical

(1) Plumbing. Show location and size of existing utilities and service connections to building(s), the arrangement of all major equipment, and the plumbing layout of typical toilet rooms including drainage and venting systems. Provide schematic diagrams that show completed drainage, venting, and water systems. Include process services, if any.

(2) Heating. Provide the preliminary layout and description of outside distribution systems from central plant, if utilized. Include the location and size of any existing mains and building connections, and the location and arrangement of all major heating equipment.

(3) Complete single-line piping diagrams of all heating systems and equipment for the entire building. Diagrams shall include air conditioning and heating coils, perimeter heating systems, and special heating for stairways, lobbies, entrances, garages, etc.

(4) Provide a listing of control points (analog & digital) for all major mechanical equipment in the Direct Digital Control (DDC) system such as chillers, cooling towers, boilers, pumps (chilled and hot water), booster pumps, medical gas equipment, AHUs, VAV boxes, exhaust fans, etc..

(5) Complete equipment and piping diagram with heat balance calculations for process hot water system and steam generating system.

(6) Air Conditioning - Particular attention should be given to insure that the layouts suit the modular space arrangement for the building (Provide the following information).

(a) Location and arrangement of all major equipment

(b) Single-line layout of ventilating and air conditioning ductwork, for supply, return and exhaust, to indicate number of zones, type of system (i.e., high or low pressure, multi-zone, etc.) and extent of each system. Elevator machine room ventilation shall be included.

(c) Sequence of operation and schematic temperature control diagrams.

(d) Air outlet locations, for supply, return and exhaust, for typical areas.

(e) Location of cooling tower including a method for screening from view.

(f) VAV boxes with T-stat locations

(7) Kitchen exhaust system details.

(8) Medical and Dental gas piping and equipment details.

(9) Fire Sprinkler system including back-flow preventer, main header with zone piping, fire flow switch and tamper valves, fire pump layout with controller.

9.1.1.5 Electrical

(1) Plans shall show space assignment, size and outline of any new, existing or planned future fixed major electrical equipment, including service entrance, transformers, main switchgear, generators, fuel oil or gas tanks, transfer switches, branch panels, FACP, etc., in support of the basic distribution.

(2) Provide lighting layout plan for all areas, including interior, exterior, and parking. Show all emergency and exit lighting. Include preliminary lighting fixture schedule.

(3) Provide electrical plan with location of all medical equipment that required electrical connection. Provide equipment list in tabular form with voltage, phase and ampacity requirements.

(4) Where the occupancy is required by code or criteria to have fire detection and alarm system devices, provide a preliminary layout plan. Provide the location of all fire/smoke damper motor location

(5) Provide preliminary one-line power distribution diagram with major equipment such as utility's transformer, Main Distribution Panel (MDP) surge protector devices, generator and all Automatic Transfer Switch (ATS) and panel boards.

(6) Identify and show location and space for of any proposed telephone and Local Area Network (LAN)/ fileserver equipment, including switch location and any racks and/or backboards.

(7) Show general receptacle layout including any proposed special receptacles such as hospital grade, Ground Fault Circuit Interrupter (GFCI) etc. All general receptacles must be 20 amp 125 volt unless the special equipment it serves requires higher capacity.

(8) Show location and size of existing electric/power lines and service connections into the building.

(9) Electrical and telecom/data support spaces shall be accounted for within the 12% space allowance for major mechanical space as detailed in the POR.

- Electrical distribution room spaces should show access spaces in front of all electrical equipment accordance with National Electric Code (NEC) (front and top). Provide large scale electrical room drawing and identified required space for all electrical equipment (Panel, transformer (ATS) Motor Control Center (MCC) switchgear etc.).
- Telecom/data distribution rooms shall be sized per Telecommunication Industries Association/ Electronic Industries Alliance (TIA/EIA) standard 569B considering additional space for housing telecom/data equipment.

(10) Provide detail Lighting Plan including different type of light fixtures schedule, and emergency "EXIT" fixtures location.

9.1.2 Other Documents

All design requirements for each discipline shall be included in the submitted Basis of Design Documentation, and shall be provided in the format prescribed in Section 4.2.3 and Appendix A5.

9.1.2.1 Architectural

(1) Perspective Sketch. Provide perspective sketches (minimum of three external views) showing the desired appearance of the building in its surrounding environment.

Perspective views are now called for elsewhere with every design submittal phase as a by-product of generating the BIM design model. The perspective sketch called for here is intended to become the basis for record design artwork depicting the future construction.

9.1.2.2 Civil

(1) Provide preliminary design parameters for paving systems, including subgrade preparation, subbase materials and thickness, paving materials, drainage systems, thickness of pavement, etc. In the analysis, include walkways as well as driveways, loading docks and parking areas.

(2) Provide a comprehensive stormwater analysis, including a narrative regarding erosion control and permitting requirements. The stormwater analysis shall establish pre-development and post-development conditions in terms of site runoff, and shall be based on state or local standards. Design rationale shall evaluate the 2, 5, 10, 50, and 100-year storm event. Ensure that post-development runoff does not exceed pre-development runoff. Properly size stormwater piping and appurtenances consistent with local AHJ requirements, or as local site conditions require.

Follow procedures outlined in the *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security*

Act, wherein the site is designed to retain the 95th percentile rainfall event (24-hr period). Include a narrative summary of probable Best Management Practices (BMPs) for implementing a stormwater pollution prevention plan during construction, and Low Impact Development (LID) practices for minimizing runoff after development.

Identify the agencies which have jurisdiction over the NPDES permit and the individuals/entities who will submit the NOI under said permit. Provide a schedule designating permit activities, time frames, and individuals responsible for each event. For catch basins and storm sewer designs, provide calculations sufficient to justify pipe diameters based on a 10-year storm frequency for one hour, or according to local code, whichever is more stringent. For stormwater impoundment, provide sizing calculations to substantiate design, and incorporate relevant data from the geotechnical evaluation. Provide narrative regarding the development of a SWPPP as part of the permitting requirements.

(3) Expand on the traffic code analysis from the schematic submittal by providing calculations to identify critical traffic control elements, and confirm proper sizing of all traffic corridors and placement of signage.

9.1.2.3 Structural

(1) Narrative discussing basis of design; explanation of framing system used, lateral force resisting system, and load paths.

(2) Calculations shall identify live and dead loads, and computations of loads on the building system. Calculations for major structural elements preliminary sizes should also be included.

9.1.2.4 Mechanical

(1) If the health care facility requires rooms to have specific pressurization relationships or airflow requirements, then provide a listing of all rooms and indication of the airflow direction in or out of the rooms.

(2) Develop a list of rooms, used for clinical purposes, and provide the total air changes per hour and pressurization relationships for these rooms.

(3) Heating. Provide design narratives including design temperature (indoor and outdoor) per ASHRAE fundamental book, total outdoor-air requirements, heating load calculation for each room, including walls, roof, windows, and infiltration load, and the total heating load, including outdoor-air ventilation load, for entire buildings. Narratives shall also address the domestic water heating load and also the summer/winter process heating, such as kitchen and other equipment, load for the boiler. Refer to FGI/AIA Guidelines and ASHRAE Standard 62.1 and ASHRAE Standard 62.2 for outdoor air recommendations.

(4) Air Conditioning. Provide design narratives including design temperature (indoor and outdoor) per ASHRAE fundamental book, total outdoor-air requirements, air-conditioning load calculation for each room, including walls, roof, windows, and infiltration load, and the total air-conditioning load, including outdoor-air ventilation load, for entire building for the peak time of day. Refer to FGI/AIA Guidelines and ASHRAE Standard 62.1 and ASHRAE Standard 62.2 for outdoor air recommendations.

(5) Provide an economic analysis to show comparative costs and recommendations for refrigeration plant. An economic justification should be provided if a high-velocity duct distribution system is proposed.

(6) Provide preliminary calculations for determining sizes and types of plumbing, HVAC equipment, process equipment, and systems.

9.1.2.5 Electrical

(1) Provide a general description of the electrical service including proposed voltage and phase, service feed, primary or secondary, and service type (overhead or lateral).

Box 9a - Use of Copper

The following items shall be of copper material:

- Conductor - phase, neutral and ground
- Motor winding
- Transformer winding
- Panel board bus bars - phase, neutral and ground (may be silver plated on main switchboard)
- Automatic Transfer Switch - phase, neutral, and ground (may be silver plated)
- The building grounding system rod

(2) Provide a description of general interior and exterior lighting systems, indicating types of lighting intensities. Submit catalogue cuts for each major type of fixture proposed.

(3) Provide a list of medical equipment required for the project that requires electrical connection. Show proposed voltage, phase and ampacity.

(4) Provide calculations to establish the sizing of major electrical components and equipment.

(5) Provide building electrical load calculations including lighting, medical equipment, HVAC, receptacles, and other loads in accordance with IEEE, NFPA/NEC. Include specific code reference for specific calculation assumptions.

(6) Provide a building electrical system load analysis including normal power and an emergency power systems. Electrical load calculation shall include load information for lighting, receptacles, HVAC, mechanical, fixed medical equipment, alarms, communication/data loads and other equipment.

For medical facilities, provide an essential electrical system function listing for every room and space as recommended by NFPA 99, Appendix C-3.3.

(7) Provide lightning protection calculations in accordance with NFPA 780.

(8) Provide preliminary short circuit analysis. Address electrical system grounding approach and propose a method of installation for this system.

(9) Provide all proposed electrical schedules, tables, calculation methods, forms, etc. Includes samples such as lighting calculation format, fixture schedule form, panel schedule form, electrical legend, final calculation format, voltage drop calculations format, transformer schedule form, and motor control schedule form.

(10) Provide electrical power system selective coordination study requirements for both normal and emergency power.

(11) Provide electrical system details for special systems including nurse call, security, heliport, paging, master time, data/telephone/TV, or other included systems.

10 Construction Documents Overview

The construction document (CD) drawings and related documents are submitted for review and approval in three phases. Each phase requires a separate submittal package.

- 65 percent construction documents
- 95 percent construction documents
- Final construction documents

10.1 Requirements

The following components are required for each stage of the construction documents:

10.1.1 Overview of Drawings

Each sheet of drawings must show the name, number, and location of the project. Required drawings include:

- cover and index sheets
- site survey and soil borings data.
- site utilities
- site work
- landscaping and planting drawings
- architectural floor and roof plans (a separate plan must be drawn for each floor, basement, mezzanine, and penthouse level.)
- exterior elevations
- longitudinal and transverse building sections
- reflected ceiling plans
- architectural schedules (finish, door, window, etc.)
- exterior and interior details
- life safety plan
- furnishings and medical equipment plan
- structural drawings, schedules, and details
- mechanical drawings, schedules, and details
- electrical drawings, schedules, and details
- additional drawings (e.g., demolition, kitchen equipment, etc.) as warranted by the project. Provide 3-D views, not to scale, when clarity is required.

10.1.2 Specific Requirements

(1) Plans. If floor plans are drawn at 1:100 scale, detailed 1:50 scale plans are required to show spaces that need special architectural treatment.

(2) Toilets. If floor plans are at 1:100 scale or smaller, additional toilet plans shall be furnished at 1:50 scale to indicate fixture enclosure location and provide other necessary information. Provide toilet room elevations.

(3) Stairs. Stairs shall be laid out fully at 1:50 scale. All dimensions and necessary enlarged details shall be provided.

(4) Hazardous Materials. The location of any hazardous material (e.g. asbestos) identified by preliminary inspection shall be noted, with appropriate instructions, on drawings related to any portion of the construction that might disturb the material, unless the material will be removed prior to that phase of construction.

(5) Cover Sheet and Index. A cover sheet and an index sheet of the same size as the drawings must be provided. The A/E shall provide covers with an DES approved design for the drawings and specifications. All drawings shall be listed by number, title, and in numerical sequence. Titles and numbers listed in the index must be identical to those shown in each title block.

(6) Topographic Survey. This survey, when required, shall be inserted as the first drawing following the index sheet.

10.1.3 Elevations and Sections

Interior elevations are generally submitted at 1:50 scale.

(1) The extent of each building material used shall be indicated clearly on the elevations.

(2) Cutting plane for longitudinal and transverse Sections: A plane shall be chosen which cuts through the most important spaces and reveals the maximum number of different construction conditions. In addition to complete sections, provide other partial sections needed for clarity. The planes through which the longitudinal and transverse sections have been taken shall be indicated on the related floor plans.

(3) Exterior details: Provide all details necessary to explain fully the exterior architectural work and how it connects to the structural work. Head, jamb and sill details of exterior door and window openings are required as well as exterior wall sections at openings and between openings. Other necessary architectural features shall also be detailed.

(4) Wall sections: Complete wall sections of all unique conditions are required. They shall show each type of wall construction from the top member to the lowest floor level, including the footing.

(5) Anchor details for stone, brick, and other masonry shall be checked for structural adequacy by structural engineers.

(6) Sections shall be developed to the extent necessary to show roofing and flashing details under all conditions.

10.1.4 Details

Details shall be drawn at a scale sufficient to indicate the desired arrangement of materials. Standard details may be used as an integral part of the drawings; however, they must be tailored to fit the specific project. In case of differences between small and large-scale drawings, the large-scale drawings shall govern.

All details shall be appropriately cross-referenced as well as back-referenced to the plans. When a large scale drawing of a major element is made, it shall be referenced on the floor plans.

Portions of interior plans and elevations may need to be enlarged to 1:20, 1:10, or 1:5 scale to indicate the contract requirements adequately. Window and doorframe details shall be drawn at 1:10 or 1:5 scale.

10.1.5 Clash Detection and Coordination

For identified areas of potential clash provide modeling of the anticipated equipment and required clearances, including maintenance accessibility, to assist in resolving clash issues.

Provide typical details to show space coordination in ceiling areas, particularly in the corridor area, for maintenance and access of equipment, components, piping, ducts etc. including, but not limited to:

- electrical conduit for lights and power supply
- fire alarm conduit/wiring
- special system - voice/data cable tray, nurse call system cable
- light fixtures
- HVAC system piping - chilled water/Hot water supply and return piping
- HVAC system control valves and accessibility to the valves
- piping - medical air, oxygen, nitrous oxide, dental air, vacuum, domestic hot/cold water, sprinkler system, etc.
- supply and return duct work
- damper and accessibility to the damper

10.1.6 Schedules

Since the construction contract clauses of the specifications state that schedules on drawings shall take precedence over any conflicting notations on the drawings, it is important that schedules be accurately prepared to ensure that the desired finishes and materials are obtained.

All identified and required schedules are to be generated within the BIM design model.

The following schedules shall be provided:

- POR space program schedule
- medical equipment schedule
- interior finish schedule
- interior and exterior color schedule
- door schedule
- window schedule
- equipment schedule, and
- schedules to supplement detail drawings

10.1.7 Materials

A materials legend showing cross hatching examples and corresponding materials shall be provided. On areas of drawings where cross-hatching is needed to indicate materials, only enough area to show the type and extent of the material need be crosshatched. Where cross-hatching is used to indicate the extent or scope of new work, as opposed to existing work, the entire area of the new work shall be crosshatched.

10.1.8 General Notes

General notes for each category of drawings shall be placed on the first sheet of each series, preferably above the title block. These notes should be clear and concise. They may be referred to on other sheets in the same

or other series as necessary without repetition. They should complement the drawings and specifications.

Notes shall be directed only to the general contractor. The A/E shall not place any notation or statement on the drawings indicating or designating portions of the work to be done by a specific subcontractor or trade.

10.1.9 Consistency of Nomenclature

In order to guard against conflicts over ambiguous terms and statements, the terms used on drawings and in specifications shall be identical. The A/E shall refer to the POR and design data for proper terms for rooms, spaces or portions of structures.

10.1.10 Coordination of Construction Documents

All construction documents shall be coordinated to ensure coverage and to eliminate contradictions between architectural, civil, structural, mechanical, and electrical drawings and specifications.

10.1.11 Accessibility of Mechanical and Electrical Equipment

The A/E shall ensure that the design is coordinated to provide code required clearance around all machines and equipment for the installation and removal of parts. Door or window openings, removable panels, corridor sizes and locations, and floor or roof load capacities shall be designed so that equipment can be removed without structural changes to the building.

11 CD Submittal 65 Percent

The purpose of the 65% Construction Documents Submittal is to transition the Design Development Submittal into detailed and coordinated plans and specifications sufficient to enter into a contract for construction. The submittal is intended to demonstrate that the plans and specifications are being developed in a manner that is consistent with project requirements, project budget, project schedule, design record, previous submittals, reviews, discussions, and decisions.

11.1 Requirements

The A/E shall integrate all preceding design efforts and all design-related special studies.

The 65 percent construction documents shall be developed in accordance with the approved design development submittal, the approved POR, and the written comments made during the design development review.

Drawings and specifications must define the size, configuration, materials, and complexity of construction, the type and quantity of all medical equipment, and the scope and complexity of all systems. Provide major groups of construction details, schedules and diagrams, and a written report on building construction costs and energy budget status. Identify all systems for which performance specifications are being considered.

Provide the following:

(1) Updated space comparison report

(2) Updated medical equipment summary

(3) Updated sustainable design status report

(4) Updated projected energy usage report with calculations

(5) Updated commissioning plan including completed specifications for commissioning coordinated with the construction contract specifications

(6) Updated Owner's Project Requirements/Basis of Design documentation

(7) Updated cost estimate

(8) Clash detection report

(9) Preliminary Specifications

Specifications shall be prepared by the A/E to substantiate form, arrangement, and procedures for development of all sections.

The preliminary specifications shall include all technical sections prepared with headings that illustrate broad scope contents along with draft non-technical specifications (Division 1 and 0). Specifications shall be complete, edited for project, and in final format.

(10) Drawings

(11) Other Documents called for in 11.1.2

Refer to appendix A1 for submittal checklist.

11.1.1 Drawings

BIM design model is the basis of generating drawings.

Drawings shall be at final working drawing scale. Each detail, section or elevation shall be identified by a title. All drawings submitted shall be identified by a drawing number, date, and identification of submittal.

Drawings not specifically required to be completed at this stage but are required to prepare a detailed cost estimate, may be submitted in a partially complete state.

If demolition is necessary, provide demolition plans clearly identifying magnitude, scope and phasing of demolition.

11.1.1.1 Architectural

From the current BIM design model, provide two or more exterior views from prominent approach points along with interior views for all key architectural element public spaces.

(1) Floor Plans. A plan of each floor level at 1:100 scale is required. Plans shall be complete, showing materials, dimensions, room names and numbers, finishes, ceiling heights, door types, materials and sizes, and any fire retardant walls, partitions and doors. Those areas which are complex and/or require fixed furniture or equipment layout shall be drawn at 1:50 scale.

(2) Show significant life safety features, including all smoke and fire-rated walls in a life safety plan. This plan will be developed to facilitate fire egress placards and assist with Joint Commission surveys.

(3) Roof Plans.

(a) A complete roof plan, including details of

flashings and drains, is required. Roofs shall be sloped at not less than 21 mm per m. Patterns of slope to drains shall be shown on the roof plan. Elevations showing high and low points on the roof shall be included on the drawings.

(b) Location of all mechanical equipment such as AHU's, exhaust fans, roof drains, roof vents, and condensing unit as shown in the mechanical drawings.

(4) Elevations and Sections. A complete elevation of each side of the building, at least one complete longitudinal section, and one complete transverse section through the building are required. The elevations and sections shall include notes to indicate materials that are specified.

(5) Exterior Wall Details.

(a) A typical wall section for each type of wall construction is required. Wall sections must be complete and show materials, dimensions, structural bonding and anchoring systems, windows, doors, louvers (as shown in the mechanical plan), and flashings.

(b) If architectural cast concrete (stone) panels are used, all reinforcing required for a typical panel shall be indicated.

(c) Provide 1:5 scale details of all anchors required to secure the exterior facing to the structure, and of the header, jamb, and sill conditions for all openings in exterior walls.

(6) Interior Details. Interior elevations are required for those spaces that require fixed furniture or equipment, or where elevations are necessary to show the extent of wall material. Elevations shall be drawn at 1:50 scale and shall indicate the design, materials, and major dimensions.

(a) Partial floor plans at 1:50 scale shall be provided to explain interior elevations or to provide information on equipment layout, floor materials, patterning, etc.

(b) Reflected ceiling plans shall show the extent of materials and the coordination of architectural, mechanical, and electrical items.

(c) Explanatory sections at 1:20, 1:10, or 1:5 scale should be included where necessary to show the design of an element.

(d) The drawings shall show all necessary details for the special areas shown on the DD design. There shall be sufficient detail to allow approval by the agency.

(7) Elevators, Escalators, Dumbwaiters and Materials Handling Equipment.

(a) Plans at 1:50 scale of elevators showing floors served, typical floors in blind portions of hoistway, if any, elevator pits, secondary levels, and machine rooms having access. Plans shall include platform size, counterweight space, door space, and clearance dimensions.

(b) Sections at 1:50 scale through elevator hoistways, pits, secondary levels, and machine rooms. Show runby dimensions.

(c) Details showing elevator hoistway vents when serving four or more floors.

(d) Details of trolley beams, trap doors, or other provisions for removal of components of elevator equipment from elevator machine rooms.

(e) Details of supports for elevator machine beams. Elevator dead end hitch beams, and escalator trusses, elevator machine and hitch beams shall rest on their support beams rather than frame into the support beams.

(f) Elevations of elevator entrances at typical and nontypical floors. Show signal fixtures, elevation of elevator starters, indicator and control panels.

(g) Details of special elevator cabs and special hoistway entrances where applicable.

(h) Plans and sections showing clearances at 1:50 for escalators, dumbwaiters, adjustable loading ramps, scales, and conveyors.

(i) Diagrammatic layout of materials handling systems.

(j) Details at appropriate scale of power-operated doors (pedestrian and vehicular), control systems, and space for door operators.

(8) Schedules. It is crucial that schedules be closely coordinated with the project specifications and that the nomenclature be identical. The following schedules are required and shall be shown on the drawing:

(a) Interior Finish Schedule. List every material that is exposed in each space, including unfinished walls or undersides of structural

slabs. The word "exposed" shall not be used. Instead, use the name of the material. For each space, this schedule shall identify the room number, room name, substrate, material and finish of floor, base, each wall (i.e., north, east, south, and west), ceiling, ceiling height, and space for remarks.

(b) Interior and Exterior Color Schedule. Place on the last sheet in the series of schedule sheets. This schedule shall identify the room name, number, material, color, and other pertinent information. Colors, textures, and finishes of specific manufacturers may be used in this schedule or the finish schedule. A note shall be included stating that a manufacturer's name is not intended to limit competition.

(c) Door Schedule. Include all doors by door number and room number, frame material and detail, door material and elevation, size of door, glazing, other openings and hardware set. The schedule shall refer to detail drawings of jamb and head conditions.

(d) Window Schedule. Indicate all window sizes, location of operating units, and type of glazing used in each window.

11.1.1.2 Civil

(1) Demolition and Site Clearing. All existing surface features which will be removed shall be identified on the site plan. The requirements for demolition and removal shall be added for consideration of the review team. Where partial removal of a surface feature applies (i.e. portions of a grove of trees, existing building foundations, existing site utilities, etc.), sufficient detail shall be provided to specify the boundaries for removal, and the conditions for transitioning to new construction.

(2) Site and Grading Plans. These plans must show the entire site, and must establish the grading and project limits. Relevant features on adjacent sites must also be included to establish a basis for assimilating the site (i.e. connecting roads, water/sewer, storm drainage, housing, parks, rivers, lakes, etc.) Where practical, the building on the site plan should be oriented the same as the floor plans so that the entrance faces the same side of the sheet on all plans.

(3) Roadways and Parking Lots. All proposed access roads and parking lots shall be shown in plan view, and include profiles and section views of all parking areas. Layouts for all curbs will be required, including appropriate details.

(4) Site Drainage. All proposed site drainage features are required at this submittal. This shall include: finish contours, crowning, drainage paths, area drains, catch basins, storm drain manholes, roof and foundation drains, storm sewer layouts, on-site detention/retention facilities, and outlet structures.

(5) Cut and Fill. All finish grading shall be submitted with the drawing set. This shall include: finish contours, existing contours, spot elevations, cut banks, retaining walls, section views, and cut/fill balancing calculations (included on the same sheet). If cut and fill cannot be balanced, the site plan shall include information regarding borrow areas, and/or disposal sites.

(6) Water/Sewer. All proposed underground utilities shall be included with the site plan, and shall be shown both in plan view, as well as in profile. Gravity sewer profiles shall include all rim and invert elevations, as well as pipe slopes.

The site plan shall include all tie-in locations for domestic water, fire water (if separate), and sanitary sewer piping to the utility system piping. Details shall include, but shall not be limited to: manholes, valve boxes, cleanouts, thrust blocks, water/sewer connections, water/sewer crossings, vaults, lift stations, booster pump stations, water storage tanks, building connections, etc.

(7) Other Utilities. Where applicable, additional site utilities shall be included in the site plan. These utilities shall be shown with sufficient detail to confirm appropriate layout and configuration in relation to other site features. Examples of other utilities include: underground gas lines, steam lines, hot/chilled water, underground electric, TV, telephone, T1, etc. Refer to the appropriate specialty section for additional requirements.

(8) Landscaping. The A/E is responsible for providing a landscaping plan coordinated with sustainability requirements and other site plans (civil, architectural and site-electrical).

11.1.1.3 Structural

Provide drawings sufficiently complete to describe the total structural design. Include major sections and connection details.

(1) General Structural Notes should be mostly complete, identifying all materials and special

instructions to the contractor

(2) Abbreviations and Standard Details should be mostly complete

(3) Plan Views should show all framing members and columns, and indicate the member sizes.

(4) Elevations (when required) will show all vertical bracing members, drag struts and connections

(5) Sections and Details shall be referenced from structural plans and elevations, and shall be grouped according to the plan view where referenced. Referencing sections and details in Architectural drawings are to be avoided.

(6) Schedules

11.1.1.4 Mechanical

All system details, equipment piping hookup details, piping riser diagrams, controls and equipment schedules shall be shown. In addition to the drawings, calculations and specifications, the following shall be included:

(1) Heating.

(a) Layouts of mechanical room including boilers, chiller, generator, pumps, tanks, AHU's, etc. and other rooms containing maintenance clearances, and main piping.

(b) Provide hot water piping and equipment, including boilers, pumps, VAV box reheat coils, AHU coils, etc. on floor plans. Include heating system flow diagrams, riser diagrams, and control diagrams for heating system and major equipment indicating the contemplated design.

(c) Layout of underground heat distribution system in details indicating contemplated design.

(d) Layout of engine generator sets in details permitting evaluation of contemplated design with regard to fuel, air, exhaust and electrical systems.

(2) Plumbing

(a) Layouts of typical toilet rooms and location of all plumbing equipment in mechanical equipment rooms.

(b) Layouts of special spaces such as elevator machine rooms.

(c) Typical riser diagrams for water, soil, waste, and vent piping.

(d) System and supply piping layout for all standpipe systems and sprinkler systems showing hazards and zoning.

(e) Layout of all fuel systems such as propane, natural gas, fuel oils, and/or solid fuels showing locations of storage tanks or other storage areas, all safety and fire precautions.

(f) Layouts of all medical and nonmedical gas and other systems such as: oxygen, nitrous oxide, compressed air, vacuum, nitrogen, etc., and other systems including softened water, deionized water, laboratory water, non-potable water, feed water, ethylene glycol solutions and associated feed piping, tanks and other appurtenances as required.

(3) Air Conditioning

(a) Building air flow system balance diagram, including supply, return and exhaust air flow, and chilled water and hot water systems balance diagram. Provide on the drawing and not in the calculations.

(b) Preliminary sequence of operation and automatic temperature control diagram with major control equipment (controller) for boiler, chiller, AHUs, pumps, exhaust fans and connection to monitor the building fire alarm system.

(c) Double line ductwork layout including mechanical room, boiler room and typical corridor areas at ductwork crossings.

(d) Equipment room layouts developed to the extent of showing clearances for access and showing trolley beams provided for maintenance.

(e) Floor plans including chilled water piping with all associated equipment.

(4) Fire Protection System

(a) Includes piping for fire hydrants, fire department connection location, backflow preventer, etc.

(b) Provide the following Information on the fire protection plan.

- Available water pressure
- Minimum water density per occupancy classification
- Maximum protection area per sprinkler head

(5) Building Automation System (BAS)

Provide one line diagram which includes the following:

- controller for HVAC equipment, such as AHU, chiller, boiler, VAV box, pumps, VFD, and cooling tower
- type of all alarms, total number of points and any additional points for future use
- type of communication system, such as backnet and other third party hardware to communicate with HVAC equipment
- type of computer and printer, RS-232 port etc., including web base access
- energy usage information on the panel, such as water flow, gas flow, electrical kWH, etc.
- life safety alarms, including fire alarm signal from the Fire Alarm Control Panel (FACP) along with signal and communication details for the local fire department

(6) Preliminary riser diagrams and equipment schedules.

11.1.1.5 Electrical

(1) Provide complete drawing (s) showing interior lighting system including lighting controls, and circuit number with panel identification, light fixture schedules (lamp and ballast information), and energy saving light fixture information.

Provide lighting power density (LPD) table for each room and compare with ASHRAE 90.1-2010 LPD requirements.

Provide catalogue cutsheet for each type of light fixture proposed for project design.

(2) Provide detailed site plan showing power service, site power distribution, communications and cable service, if any, and site lighting. Identify the location of an electrical utility company's connection point, and an electrical utility transformer and metering locations. Delineate between utility service work and construction contractor's work.

(3) Provide detailed power plans for all areas including any switchgear, transformers, generators, panels, medical and other equipment and receptacles. Show panel and circuit designations (home runs).

(4) Provide detailed special system plans showing layout of communication and signal pathways and devices, fire detection and alarm devices, including FACP, smoke detectors, duct detectors, horns/strobes, manual pull stations, etc., and other signal systems, such as nurse call, etc.

(5) Detailed one-line diagram shall include all connected 3-phase equipment, all panel boards, and feeder conduit and conductor sizes. The panel schedules shall show a minimum of 65% completed branch circuits in each panel. The panel schedule shall show all overload protection, voltage, phase, Ampere Interrupting Capacity (AIC) Main Circuit Breaker/Main Lugs Only (MCB/MLO) neutral size, connected load and demand load for both normal and essential power.

Provide power protection coordination calculations and requirements on a one-line electrical power diagram.

(6) Provide lightning protection design and show all system grounding and equipment grounding and bonding details. Provide the location of all grounding rods on the floor plan and detail showing how to access these rods in future for checking ground connections continuity and testing.

11.1.2 Other Documents

All design requirements for each discipline shall be included in the submitted Basis of Design Documentation, and shall be provided in the format prescribed in Section 4.2.3 and Appendix A5.

11.1.2.1 Architectural Documents

(1) Rendered Perspective. The rendering may be produced using traditional artistic methods or with computer aided design rendering tools. The original color rendering and three color copies will be required.

(a) Medium. Rendering shall be in color suitable for photographic reproduction. The environment of the building as it actually exists or will exist after completion of construction shall be portrayed. Emphasis shall be given to the building instead of its surroundings.

(b) Scale and Materials Indication. Human figures, familiar to the culture and place of the project location and client, shall be placed at or near the main entrance to understand the scale of the building. The extent to which materials are indicated may be left to the A/E's judgment

(c) The rendering shall be a minimum of 500 x 400

mm exclusive of mat. It shall be provided with mat, frame, and non-reflective glass.

The exterior perspective rendering shall have a matted overall dimension of 762 x 508 mm with a framed dimension of 787 x 583 mm, mounted under anit-glare glass surrounded by a good quality 25 mm minimum flat top black metal frame.

(2) Interior perspective sketch. A preliminary line perspective depicting a proposed typical interior view perspective shall be submitted.

The interior perspective sketch will clearly define the proposed interior materials and overall quality of the major public interior spaces. An eye-level perspective of the main public lobby/waiting area, reception desk, and major pedestrian circulation routes are the preferred perspective views.

(3) Preliminary color boards: Color boards for two unique color schemes shall be submitted in a standard 280 x 215 mm three ring binder.

The schemes shall be coordinated with elevations for the exterior and by room names and numbers shown on the architectural floor plans for the interior. Materials and colors shall be labeled by manufacturer, source, and product description for color and pattern purposes.

Samples will be presented of all major building interior and exterior finishes. Foldouts may be up to 838 x 647 mm as long as they refold within the standard binder configuration. Actual material samples shall be displayed showing color, texture, pattern, finish, thickness, etc., for all appearance related items where choice exists. These samples shall be large enough to indicate true patterns. Samples shall be organized by color schemes with a separate sample group for each scheme.

11.1.2.2 Civil Documents

(1) Provide a status report concerning all site-related permit activities. Include a summary of all permits, pending or approved. For pending permit activities, include an estimated date for permit approval, and add narrative for pending activities, and persons responsible for completion.

(2) Provide design calculations of all major civil elements subject to final review. Present calculations and related narratives in detail consistent to the level of design.

11.1.2.3 Structural Documents

Provide design calculations of all major structural elements consistent to the level of design. Present calculations consistent with the level of design, including connections and collector elements as appropriate.

11.1.2.4 Mechanical Documents

Provide calculations, riser diagrams, and special systems including medical gases.

Provide load calculations for sizing of air handling units, pumps, chillers, and boilers.

11.1.2.5 Electrical Documents

Provide the following:

(1) Separate detailed lighting calculations with fixture manufacturer cut sheets, unless isometrics are shown on drawings. All fluorescent lamps shall comply with EPA's TCLP (toxic characteristic leaching procedure) for lowest Mercury content.

(2) Detailed load calculations, short circuit calculations, voltage drops based on drawings. Where used, provide detailed emergency power total load calculations for sizing of generator(s) and transfer switch(es).

Include load calculations for renewable energy systems or other special systems incorporated into the project.

Provide a revised list of all the medical equipment, if any is required, 1-phase or 3-phase, for the project that require electrical connection.

(3) Provide arc flash calculations per IEEE 1584 for arc flash protection of building staff responsible for electrical maintenance.

12 CD Submittal 95 Percent

When the contract documents are nearly 100 percent complete, they are submitted to the agency for review. This includes all architectural and engineering drawings and specifications necessary for bidding and required calculations. All components shall be accurate and coordinated among disciplines.

Details shall be incorporated on the drawings.

12.1 Requirements

Provide the following:

(1) Updated space comparison report

(2) Final medical equipment summary

(3) Updated sustainable design status report

(4) Final projected energy usage report including a complete energy model analysis for the proposed building together with a baseline model (per ASHRAE 90.1 - 2007, Appendix G).

This report shall contain a summary of projected energy savings in terms of both energy consumption (expressed in MMBtus) and energy cost (separated by fuel type).

The report shall include a summary of energy-saving systems implemented in the design, including any on-site renewable energy systems, and shall include a life cycle cost analysis to justify cost premiums.

(5) Updated building commissioning plan

(6) Updated Owner's Project Requirements/Basis of Design documentation

(7) Facility user manual

(8) Updated cost estimate

(9) Final clash detection report and summary

(10) Statements of special inspections for both wind and seismic requirements, where required by IBC chapter 17

(11) Complete specifications, including non-technical divisions 0 and 1, shall be prepared for submittal to the CO. Specifications shall be complete, edited for the project, and in final format.

(12) Drawings

(13) Other Documents

Refer to appendix A1 for submittal checklist.

12.1.1 Drawings

BIM design model is the basis of generating drawings.

12.1.1.1 Architectural Drawings

Drawings complete including two or more exterior views from prominent approach points along with interior views for all key architectural element public spaces.

12.1.1.2 Civil Drawings

Provide completed design drawings sufficient for site development activities. Final documents shall include a site map, erosion control plan, grading plan, paving and drainage plan, site layout details, utility plan, detailed civil details sheets, and all other drawings necessary for a complete site design package.

12.1.1.3 Structural Drawings

Provide completed design drawings sufficient for fabrication, construction and erection of the entire structural system.

Annotate all structural columns with grid locator for consistent use in reference during fabrication and construction.

12.1.1.4 Mechanical Drawings

Complete drawings for all mechanical systems including:

- Domestic water system isometric plan with all connected equipment
- Ductwork diagram (supply, return, and exhaust)
- Chilled water and hot water system piping plan with all connected equipment
- Equipment location plan showing roof mounted equipment with maintenance access
- Mechanical (HVAC) system, medical gas system, plumbing system equipment schedules
- Equipment control diagrams with sequence of operations and control points requirement
- Generator fuel system piping and control plan
- Kitchen exhaust system plan with fire protection system requirements

- Fire sprinkler system plans with details and system operation requirements

12.1.1.5 Electrical Drawings

(1) Complete drawings (light and power distribution), equipment schedules, and panel schedules. Complete lightning protection drawing including equipment grounding and bonding details.

(2) Complete one-line diagram with minimum cross wiring. Differentiate between single-phase, dual-phase and three-phase equipment, including Over Current Protection Device (OCPD) size for panel board, transformer, motors, such as exhaust fans, AHU's and condensing units. No block diagram will be accepted.

(3) Main Electrical room layout in large scale showing maintenance space around equipment.

12.1.2 Other Documents

12.1.2.1 Architectural Documents

(1) Rendered perspectives of prominent interior architectural spaces. Renderings may be produced using traditional artistic methods or with computer aided design rendering tools. The original color renderings and three color copies will be required.

(a) Medium. Renderings shall be in color suitable for photographic reproduction.

(b) Scale and materials indication. Human figures, familiar to the culture and place of the project location and client. The extent to which materials are indicated may be left to the A/E's judgment

(c) The renderings shall be an appropriate size to communicate the architect's vision to the client users.

The interior perspective rendering shall have a matted overall dimension of 762 x 508 mm with a framed dimension of 787 x 583 mm, mounted under antiglare glass surrounded by a good quality 25 mm minimum flat top black metal frame.

(2) Final Color Boards. All changes resulting from the review of the preliminary color boards shall be incorporated in the Final CD submittal. This submittal shall be complete with all originally approved and new materials presented in a single revised package.

(3) Prepare a wayfinding plan within the BIM design model detailing signage to route users throughout the facility. Provide sample signage design for the indicated locations with recommended size, placement and layout together with a typical room number placard layout design. Prepare layout and details for all exterior signs to route users to services throughout the campus, include details for building mounted and monumental signage. Provide a construction sign layout.

12.1.2.2 Civil Documents

Provide an updated narrative regarding the status of all associated permits to construct the project. Provide additional design rationale (if needed) based on previous design review comments and updates to the related sections of the OPR.

12.1.2.3 Structural Documents

Provide complete narrative describing design methods, assumptions, theories and technical formulas employed in design solutions.

12.1.2.4 Mechanical Documents

(1) Provide a bound summary of proposed equipment selection including model number, pump curves, and fan curves with selections indicated.

(2) Provide final load calculations for heating, cooling, and ventilating, including individual room loads.

12.1.2.5 Electrical Documents

Provide completed building total connected load and demand load calculations, including future demand. Complete emergency power load calculation for sizing the generator.

Provide electrical power selective coordination study.

12.1.2.6 Maintainable Equipment Summary

Provide a tabular summary of all anticipated maintainable equipment.

Provide a COBie database of all anticipated maintainable equipment linked to the BIM design model.

Where equipment has been specifically identified as the basis of design include identified features from drawing schedules. Other maintainable equipment provided by the contract shall be identified and referenced with a specific equipment tag number.

Include project specification requirements for contractor to provide extracted O&M details for all maintainable equipment including:

- relevant equipment data for replacement or service
- part details for typical service replacement items
- specific tasks and frequencies (weekly, monthly, quarterly, semi-annually, and annually, as required) for performing regular preventive maintenance as identified within the approved O&M documents.

The final approved data shall be provided in a format that is importable to the selected Computerized Maintenance Management System, CMMS, agreed to by the project manager, or entered by the contractor directly into the installed CMMS.

13 Final CD Submittal

All written government review comments shall be resolved and incorporated. The updated drawings and specifications will become the final construction documents. These documents shall be signed, sealed, and dated by the professional architect or engineer with respect to the specific field of registration.

13.1 Requirements

Provide the following:

(1) Final space comparison report

(2) Permitting status summary

(3) Final sustainable design status report

(4) Final projected energy use report including energy and water consumption baseline and design projections separated by fuel type and water usage

(5) Final building commissioning plan including the maintainable equipment summary

(6) Final Owner's Project Requirements/Basis of Design documentation

(7) Formally concluded project review comment file

(8) Copies of all other reports and studies required by this contract

(9) Final facility user manual

(10) Final cost estimate

(11) Final BIM design model and COBie database

(12) Final project construction specifications

(13) Final construction documents

(14) Draft bid support documents, including:

- bid form
- statement of work
- general conditions requirements

Refer to appendix A1 for submittal checklist.

14 Construction Contract Administration

14.1 General Requirements

This chapter summarizes the responsibilities associated with the administration of a contract for construction of an IHS facility.

The primary role of the Construction Contract Administrator (CCA) is to observe the construction work and advise the IHS Project Officer of the progress and quality of the work, and its conformance with the Contract Documents. The CCA is responsible for the impartial, comprehensive and timely administration of all project related documentation and information, and to represent the Government in all project meetings and other field matters relating to the project's construction. The CCA will make regular, periodic visits to the project site to record observations and report to IHS Project Officer the status of project completion, quality of workmanship and compliance with the Contract Documents. The CCA shall also coordinate oversight of all sustainable features, activities and certifications identified in paragraph 14.3.7 with the Construction Contractor.

The CCA Team shall include, but not be limited to, the following members: Architect (Project Manager), Engineers (Civil, Structural, Mechanical, Plumbing and Electrical), and the Commissioning Authority.

In the event the CCA does not represent the A/E firm responsible for completing the project's Construction Documents, the CCA and their consultants shall:

- meet the requirements of Section 3.1.17;
- meet the Sustainability responsibilities of the A/E as identified in Section 5.4 and 5.5.
- fulfill the responsibilities of the design A/E firm to clarify and convey contract document information as necessary.

Construction Contract Administration Services (CCAS) are specific to the oversight and management of a project, and include specific deliverables identified in the project's scope. The following is a list of CCAS contract required project services and deliverables to be accomplished by the CCA.

14.2 Pre-construction Phase Services

The CCA shall assist the Contracting Officer in establishing protocols for processing construction-related requests, inspection procedures, pay request handling, site conditions, and any other conditions specific to the contract.

If the Contracting Officer determines a Pre-Construction meeting is to be held, the CCA shall attend and participate. The CCA shall record the Minutes of the Pre-Construction Meeting and a written copy of those minutes within 5 days of that meeting. The purpose of the Pre-Construction meeting shall be identified in Division 1 [General Requirements] of the Contract Documents.

14.3 Construction Phase Services

In order to ensure real-time communication of construction progress, the CCA shall provide the IHS Project Officer and the Construction Contractor with real-time access to the CCA's Internet Site (e.g. FTP, Sharepoint, etc.). That site shall contain all current and relevant project information, including, but not limited to, daily construction reports, Requests For Information (RFI), Architect's Supplemental Instructions (ASI), Change Order Proposals, minutes from construction progress meetings, pay requests, updated BIM, and contract documents/details, etc.

14.3.1 Construction Progress Site Meetings

The CCA shall visit the IHS facility's construction site at periodic intervals as described within the CCAS contract. Such site visits are intended for the CCA to inspect the construction progress and certify the extent of construction completion, evaluate the quality of the work, and endeavor to guard the Owner against defects and deficiencies in the execution of this work. The CCA is responsible for determining if the work is being performed in accordance with the construction contract documents, including (but not limited to) the Owner's Project Requirements, the project's Basis of Design, and the Commissioning Plan.

Construction Progress meetings should generally coincide with the CCA's monthly site visits (according to the schedule identified in the CCAS contract requirements). The purpose of these meetings is to communicate inspections' findings, discuss pending change orders, RFIs, material submittals and ASIs, evaluate payment requests, ascertain overall progress against the construction schedule, oversee updating of as-built documentation, and incorporate participation of

all parties as necessary to resolve construction issues.

All site visits by the CCA shall result in the production of various deliverables by the CCA, including (but not limited to): site visit reports, review and approval of the construction contractor's pay application, commissioning reports, sustainability updates, monthly inspection report summaries, review of the construction contractor's redline drawings (to be used as the basis of future as-built drawings preparation), documentation of known deviations from the construction documents, and updated construction schedules.

The CCA shall submit construction progress reports to the IHS Project Officer within seven (7) calendar days of the construction progress site meeting. The report shall include, at a minimum but not limited to, a summary of the following:

- Current status and evaluation of the overall project's percentage of completion
- Progress milestones achieved during the previous 30 day period, and progress milestones scheduled for the following 30 day period
- List and Status of all RFIs, ASIs and Submittals
- Summary of change orders including related adjustments to construction schedule and cost
- Narrative of problems, accomplishments and recommendations specific to the project at the time of the latest inspection
- Progress payment recommendations, based on a review of the construction contractor's pay request and progress chart
- Progress photos of the work. Provide photos as required to generally represent the overall progress of the work

14.3.2 Submittal Review

The CCA shall review required Construction Contractor submittals, including shop drawings, product data, and samples for compliance with construction documents and for conformance with the design concept expressed in the construction documents. The CCA shall review submittals according to the approved submitted schedule established in Division 1 of the Contract Documents.

The CCA shall review other contractor submittals including inspection and testing reports, and operation and maintenance manuals for compliance with construction documents. Other possible documents for review include: facility user manual, design submittals, sample finishes and mock-ups.

The CCA shall recommend to the Project Officer, in writing, an appropriate action on all Contractor submittals. Recommendations may include "Approved," "Approved as Noted," "Disapproved," or "Re-submit." Re-submittals are considered a routine element of the submittal and approval process. No additional compensation shall be provided for routine re-submittal response.

The CCA shall maintain a record of and copies of all contractor submittals and responses and shall keep the log up to date on a weekly basis, and make that record available to the Project Officer for review.

14.3.3 Request for Information (RFI)

The Construction Contractor may prepare and submit requests for information requesting clarification about the construction documents. RFI's shall include a written statement describing the clarification requested and indicate specific related drawings, specifications and/or other contract documents. Additional explanatory sketches may be provided. The CCA shall validate, review and prepare responses to all RFIs, and shall make timely recommendations for action on RFI items to the Project Officer and the contractor (as required by the CCA's contract). RFI Responses from the CCA shall include narratives, supplemental drawings and specifications as necessary to provide clarification. The CCA Contractor shall provide timely RFI responses to both the IHS Project Officer and the Construction Contractor.

The CCA shall maintain a separate and complete log of all RFIs, including record copies of all RFIs and responses. The CCA shall update the RFI log on a weekly basis, and make that record available to the Project Officer for review. If an RFI leads to a Change Order, that information shall be reflected in the RFI log.

In the event the RFI response does not provide sufficient detail to adequately clarify the contract documents, or if completion of the RFI will lead to additional work outside the Construction Contract's Scope of Work, the CCA should provide all required drawings/details/specifications to complete the required work, along with a cost estimate, to the Project Officer.

14.3.4 Architect's Supplemental Instruction (ASI)

Contract Documents' supplemental instructions from the CCA clarify ambiguities, provide detail the contractor cannot readily ascertain from the drawings, and/or make minor changes based upon field conditions. An ASI will not increase the contract value or extend the contract time.

If deemed necessary, the CCA shall prepare and issue an ASI to the Construction Contractor to provide minor changes or additional information which may not be included in the contract documents. The CCA shall prepare the responses to all ASIs, and shall timely notify the Project Officer.

The CCA shall maintain a separate and complete log of all ASIs, including record copies of all ASI's and responses. The CCA shall update the ASI log on a weekly basis, and make that record available to the Project Officer for review.

14.3.5 Change Order Proposals

The Construction Contractor may submit a Change Order Proposal in the event that changes in the scope of the project are needed due to differing site conditions, design deficiencies, etc. All Change Order Proposals shall be submitted in writing, and shall include a narrative of the proposed changes, preliminary markups of existing drawings, attached contract documents, and so forth.

In some cases the Owner may initiate a Change Order, which may be prepared by the CCA at the request of the Project Officer. In these instances the CCA shall provide technical assistance to the extent required in order to complete the owner-directed change.

In the process of evaluating a Change Order Proposal the CCA shall conduct initial cost negotiations with the Construction Contractor, using contemporary cost data specific to the history and characteristics of the construction project. After initial cost negotiations and evaluation of the proposal, the CCA shall issue a recommendation to the Project Officer for review, response and (if appropriate) final approval by the Contracting Officer. In no case shall the CCA issue approval of any Change Order Proposals.

The CCA shall maintain a separate and complete log of all Proposed and Approved Change Orders, including record copies of all Change Orders and supporting documentation. The CCA shall update the Change Order log on a weekly basis, and make that record available to the Project Officer for review.

14.3.6 Value Engineering Proposals

A Construction Contractor may submit a Value Engineering Change Proposal (VECP) under the Value Engineering provisions of the Federal Acquisition Regulations (FAR) that, through a change in a project's plans, designs, or specifications as defined in the contract documents, would lower the project's life-cycle cost to the Government. If such a submittal is received the CCA shall provide an initial review of the proposal for preliminary determination of its potential and value. The proposal shall then be communicated to the Project Officer for additional review, and, if appropriate, shall be submitted to the Contracting Officer for review, response and (if appropriate) final approval.

14.3.7 Sustainability Certification

IHS construction projects whose construction costs exceed $10 Million require a third-party's sustainability certification (typically a LEED certification). Pursuit of a third-party sustainability certification is an administrative process that requires pro-active efforts, frequent reporting, and coordination and follow-up with the parties involved. While the majority of the design credits sought for sustainability certification are earned during the design phase, some construction credits require tracking throughout the construction process. The pursuit of LEED construction credits requires documentation and reporting to the U.S. Green Building Council (USGBC) in order to receive final LEED certification of the facility.

Construction-related LEED credits identified in the contract documents are required to be met and incorporated into the project's LEED submittal. Certification by a third party (USGBC) is used to document compliance with IHS criteria. The CCA shall coordinate efforts to identify IHS sustainability requirements with the Project Officer.

The CCA shall oversee and be responsible for the review, coordination and resolution of all issues related to the design and construction sustainability credits identified in the Construction Documents and in Chapter 5 of the IHS A/E Design Guide. The CCA shall coordinate all Sustainable Certification activities with the Project Officer, the Construction Contractor and the designated third party Certifying Authority (USGBC), and take responsibility for submitting all construction related credits required information to the USGBC to achieve LEED certification as required per contract documents.

At the end of the project the CCA shall prepare a summary of the Sustainability certification process, including a full report of the status of each credit pursued during design and construction. For credits rejected by the third-party certifying authority (USGBC), the CCA shall report on the deficiencies that led to the loss of each potential credit. For credits requiring additional follow-up, the CCA shall perform the requisite tasks to complete certification process in accordance with the USGBC requirements.

14.3.8 Commissioning Services

The CCA shall be responsible for coordinating all required Construction Phase Commissioning Services with the Project Officer, the Commissioning Authority (CxA), the A/E, the Construction Contractor, and the USGBC. The CCA shall be familiar with the design phase commissioning services outlined in chapters 2.8 and 4.9.

See Appendix A6.2, "Commissioning Activities - Construction Phase" for specific Construction Phase Commissioning Service responsibilities.

The Commissioning Team shall consist of the following: CxA, Project Officer, CCA, Design A/E and their appropriate consultants, Facility Manager, O&M staff, Prime Construction Contractor and appropriate Subcontractors.

In the event any system cannot be commissioned due to change in Season, the CCA is responsible for completing the system-commissioning requirement during the next season. For example, if installation of the chilled water system is completed during the winter season, the system's commissioning shall be completed during the following summer.

14.4 Project Close-Out Services

Construction contract administration culminates in Project Close-out and includes activities involved with the orderly transfer of the completed project from the Construction Contractor to the Government. The process starts with the systems' start-up and commissioning process, and ends when the Government makes the Final Payment to the Construction Contractor.

A Close-out Conference may be arranged by the Contracting Officer prior to Substantial Completion to review Contract Document requirements for project Close-out.

The IHS Contracting Officer shall oversee coordination and completion of the following procedures in closing out the project:

(1) Review of the Construction Contractor's Contract and the project's Construction Documents - particularly Division 1 (General Requirements) - to determine any additional contractual administrative and procedural requirements related to Project Close-out;

(2) Completion of Equipment/System Commissioning (Testing/Start-Up/Demonstration) by the Commissioning Authority, and Delivery of Operations & Maintenance materials by the Construction Contractor;

(3) Following an independent inspection of the work (or a designated portion of the work) by the Construction Contractor, the Construction Contractor shall prepare a comprehensive list of incomplete items (Initial Punch List) and submit a Notice of Substantial Completion to the Contracting Officer and the CCA;

(4) Once the CCA determines the Construction Contractor has sufficiently completed construction to allow use of the work (or a designated portion of the work), the CCA shall schedule and conduct an inspection with the Contracting Officer to verify the project's completion in accordance with the Construction Contract Documents and certify the work permits occupancy for the intended use, then amending the Punch List as necessary;

(5) Once the CCA verifies Punch List items have been sufficiently addressed to allow occupancy, Close-out submittals have been processed, and Equipment/System Commissioning completed, the CCA shall complete and certify the Certificate of Substantial Completion and assemble two (2) copies of the following project record documents, and submit them to the Project Officer / Contracting Officer:

- Facility User Manual
- Final Owner Project Requirements (OPR) document
- Final Basis of Design (BOD)
- Testing, Adjusting, and Balancing Report
- Pre-functional checklists
- Functional performance test reports
- Grounding system Master Label certificate
- Medical Gas (Oxygen piping) system certificate
- Equipment Warranties and Guarantees
- Training documents
- CADD and hard copies of Record Construction Contract Documents
- Certified As-Built drawings including local utility connections, specifications, and general data
- Fire Alarm system monitoring locations
- Certificate of Occupancy (issued by the

Authority Having Jurisdiction)

- Operation and Maintenance Manuals for Equipment/Systems
- Release of Liens, Inspection Certificates, Consent of Surety
- Written recommendation of Retainage to be withheld from the Construction Contractor until Final Completion of deficiencies (punch list items)
- Transfer of responsibilities for utilities, maintenance and security
- Verification all other conditions of the Construction Contract have been met or satisfied
- Construction Contractor submits notice of Final Completion to CCA
- IHS Project Officer inspects project to verify final completion
- CCA processes the Final Application for Payment from the Construction Contractor and any remaining closeout submittals

14.4.1 Final Documents: Record Drawings / As-Built Documents / BIM

Following project completion and closeout, the Construction Contractor will be responsible for preparing Final Red-Line drawings showing all changes to the Construction Documents which occurred during construction, and delivering those Red-Line drawings to the Contracting Officer. To the maximum extent feasible, the CCA shall review red-line drawing information throughout the construction progress and discuss preparation of these documents during each construction progress meeting.

Following receipt of the Final Red-Line drawings from the Contracting Officer, the CCA shall prepare and submit to the Government all Record Drawings and specifications, including updated mechanical equipment schedules and all significant changes in the work made during construction. The CCA shall submit hard (printed) and digital copies (in AutoCAD .dwg format) of both the Final Record / As-Built drawings and the post-construction Building Information Model (BIM) for integration with Computerized Maintenance Management System (CMMS) requirements. The CCA shall coordinate with the local utility companies to show existing and new utility easements and right-of-ways.

14.5 Post-Occupancy Services

14.5.1 Warranty Inspection

The CCA shall be responsible for coordinating all required Warranty Phase Services with the Project Officer, the Construction Contractor, the USGBC and the CCA's engineering consultant(s).

The CCA shall be familiar with the Owner's Project Requirements and project's original design phase documents at the time of the Warranty Inspection.

The CCA shall coordinate participation in the Warranty Inspection during the ninth (9th) month of the warranty period. Following the Warranty Inspection, the CCA shall compile a list of deficiencies in a formal, written report, to be submitted to the Contracting Officer within 7 days following completion of the Warranty Inspection.

Definitions

Authority Having Jurisdiction (AHJ): The Division of Engineering Services is the AHJ responsible for implementing and enforcing codes and standards on new construction projects for IHS owned facilities.

Building Information Modeling (BIM): Digital technology to establish a computable representation of all physical and functional characteristics of a facility and its related project / life-cycle information, that is intended to be a repository of information for the facility owner / operator to use and maintain throughout the life-cycle of the facility.

Charrette: Refers to an intense period of design activity typically focused on a targeted set of goals. The word charrette may refer to any collaborative session in which a group of designers drafts a solution to a design problem. While the structure of a charrette varies, depending on the design problem and the individuals in the group, charrettes often take place in multiple sessions in which the group divides into sub-groups. Each sub-group then presents its work to the full group as material for future dialogue. Such charrettes serve as a way of quickly generating a design solution while integrating the aptitudes and interests of a diverse group of people. Compare this term with workshop.

Clash detection: A process that allows efficient inspection, identification, and reporting of interferences and coordination conflicts within the BIM design model between various solid objects including necessary clearances for access.

Crime Prevention Through Environmental Design (CPTED) is a multi-disciplinary approach to deterring criminal behavior through environmental design. CPTED strategies rely upon the ability to influence offender decisions that precede criminal acts.

Construction Operations Building Information Exchange (COBie) database: Common data format for exchanging detail object information within the BIM design model to other programs such as energy modeling, daylighting, property asset management, and CMMS.

Contracting Officer (CO): An employee of the Government with the authority to bind the Government legally by signing a contractual instrument.

Equipment:

Group I: Fixed, built-in, attached, and installed equipment normally included in the construction contract.

Group II: Major moveable equipment – items having a useful life of 5 years or more. Moveable equipment does not require attachment to the building or utility service, other than provided by an electrical plug or quick disconnect fitting. Examples include chairs, beds, bassinets, desks, computers and printers, network file servers, typewriters, system furniture, sphygmomanometers, microscopes, centrifuges, portable whirlpool units, exercise bars, refrigerators, and linen carts.

Group III: Minor moveable equipment – items having a useful life of less than 5 years. These items are of relatively small cost and size and lend themselves to on-site storage for replacement of lost or worn out equipment. Examples include linens, blankets, gowns, washbasins, bedpans, pipettes, surgical instruments, silverware, and chinaware.

Special Purpose Equipment: Group I, II, or III technical, medical, or scientific equipment needed to operate a laboratory, a hospital, a clinic, a clinical research patient care unit, an animal care facility, or equipment which is specific to a single purpose and not generally suitable for other purposes. Examples of such equipment include incubators, electric ovens, sterilizers, vacuum and pressure pumps, centrifuges, water baths, casework, sinks, shelves, patient headboards, workbenches for microscopes, and moveable apparatus for laboratory animals. Special-purpose equipment may be classified as either fixed or moveable equipment.

Final Acceptance: In cases of design and construction contracts, final acceptance is the act of the Government, represented by the contracting officer, which approves specific services rendered as complete performance of a contract, effectively transfering the risk of loss from the contractor to the owner. Final acceptance is conclusive except in cases where there are latent defects, fraud, gross mistakes amounting to fraud, or any right of the Government under warranties.

Joint Commission (formerly JCAHO): The Joint Commission, until 2007 the Joint Commission on Accreditation of Healthcare Organizations (JCAHO,

Abbreviations

AABC: American Air Balancing Council

ACI: American Concrete Institute

ADA: Americans with Disabilities Act

ADAAG: Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities

A/E: Architect/Engineer. The design and/or technical consulting firm engaged for professional architectural and/or engineering services.

AHJ: Authority Having Jurisdiction

AHU: Air-Handling Unit (but not all mixing or air flow control boxes)

AIA: American Institute of Architects

AIC: Air Interrupting Capacity

ANSI: American National Standards Institute

ASI: Architect's Supplemental Instruction

ASME: American Society of Mechanical Engineers

ASCE: American Society of Civil Engineers

ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers

ASTM: American Society for Testing and Materials

ATS: Automatic Transfer Switch

BAS: Building Automation System

BCxA: Building Commissioning Association

BIM: Building Information Model

BGA: Building Gross Area

BMPs: Best Management Practices

BOCA: Building Officials and Code Administrators International, Inc.

BOD: Basis Of Design

CAD: Computer-Aided Design

CADD: Computer-Aided Design and Drafting

CAD Layers: American Institute of Architects CAD Layer Guidelines

CAMH: Comprehensive Accredition Manual Hospitals: the Official Handbook

CAMAC: Comprehensive Accreditation Manual - Ambulatory Care

CAMCAH: Comprehensive Accredition Manual Critical Access Hospitals

CBECS: Commercial Buildings Energy Consumption Survey

CCA/CCAS: Construction Contract Administration/ Construction Contract Administration Services

CD: Construction Documents (includes drawings and specifications)

CDC: Centers for Disease Control

CEO: Chief Executive Officer (formerly SUD-Service Unit Director)

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act

CHWR: Chilled Water Return

CHWS: Chilled Water Supply

CM: Construction Manager

CMMS: Computerized Maintenance Management System

CO: Contracting Officer

COBie: Construction Building Information Exchange. From the Building Smart Alliance

CSI: Construction Specifications Institute

CVS: Certified Value Specialist

CWA: As amended in 1977, commonly known as the Clean Water Act

CWR: Cooling Water Return

CWS: Cooling Water Supply

Cx: Commissioning

CxA: Commissioning Authority

DD: Design Development

DDC: Direct Digital Control

DFO: Division of Facilities Operations

DFPC: Division of Facilities Planning and Construction

DGA: Departmental Gross Area

DHHS: Department of Health and Human Services

DHHSAR: Department of Health and Human Services Acquisition Regulations

DNA: Departmental Net Area

DoE: Department of Energy

DPP: Discounted Payback Period

DWG: Drawing format for AutoCAD Files

EA: Environmental Assessment

EIS: Environmental Impact Statement

EISA: Energy Independence and Security Act of 2007

EO: Executive Order

E-O-Y: End Of Year

EPA: Environmental Protection Agency

EPAct: The Energy Policy Act of 1992

EUI: Energy Usage Intensity

DDC: Direct Digital Control

DES: Division of Engineering Services

DES-D: Division of Engineering Services - Dallas

DES-S: Division of Engineering Services - Seattle

EMCS: Energy Management Control System

FAA: Federal Aviation Administration

FACP: Fire Alarm Control Panel

FAR: Federal Acquisition Regulations

FAST: Functional Analysis System Technique

FFE: Furniture, Fixtures, and Equipment

FGA: Floor Gross Area

FGI: Facility Guidelines Institute

FY: Fiscal Year

GC: General Contractor

GFCI: Ground Fault Circuit Interupter

GSF: Gross Square Feet

HFPM: Health Facility Planning Manual

HSP: Health System Planning

HVAC: Heating Ventilation and Air-Conditioning

HVAC/R: Heating, Ventilation, Air Conditioning, and Refrigeration

IBC: International Building Code (formerly UBC)

IFC: Industry Foundation Class

ICSSC: Interagency Committee on Seismic Safety in Construction

IECC: International Energy Conservation Code

IEEE: Institute for Electrical and Electronic Engineers

IESNA: Illuminating Engineering Society of North America

IEQ: Indoor Environmental Quality

IHS: Indian Health Service

IHSAR : Indian Health Service Acquisition Regulation

IPT: Integrated Project Team

IRAA: Indoor Radon Abatement Act

IRC: International Residential Code

IT: Information Technology

LAN: Local Area Network

LCC/LCCA: Life Cycle Cost/Life Cycle Cost Analysis

LCie: Life Cycle information exchange by BuildingSMART

LEED: Leadership in Energy and Environmental Design

LID: Low Impact Development

LPD: Lighting Power Density

LPI: The Lightning Protection Institute

LSC: Life Safety Code (NFPA 101)

M&I: Maintenance and Improvement

M&M: Medicare / Medicaid

MCB/MLO: Main Circuit Breaker/Main Lugs Only

MDP: Main Distribution Panel

MEP: Mechanical, Electrical and Plumbing

MeV: Mega Electron Volts

M-O-Y: Middle Of Year

NAFTA: North American Free Trade Agreement

NAHB: National Association of Home Builders

NBC: National Building Code

NBIMS: National BIM Standard-US

NCS: National CAD Standard

NEBB: National Environmental Balancing Bureau

NEC: National Electrical Code

NEMA: National Electrical Manufacturers Association

NESC: National Electrical Safety Code

NEPA: National Environmental Policy Act

NETA: InterNational Electrical Testing Association

NFC: National Fire Code

NFPA: National Fire Protection Association

NIH: National Institutes of Health

NIST: National Institute for Standards and Technology (Formerly NBS National Bureau of Standards)

NOI: Notice of Intent

NOT: Notice Of Termination

NPDES: National Pollution Discharge Elimination System

NRCP: National Council on Radiation Protection and Measurement

NSF: National Sanitation Foundation

O & M: Operation and Maintenance

OCPD: Over Current Protection Device

OEHE: Office of Environmental Health and Engineering

OMB: Office of Management and Budget

OPH: Office of Public Health

OPR: Owner's Project Requirements

OSHA: Occupational Safety and Health Administration

PD: Pre-Design

PDF: Portable Document Format

PECI: Portland Energy Conservation, Inc.

PIV: Personal Identity Verification

PJD: Program Justification Document

PJDQ: Program Justification Document for Staff Quarters

PM: Project Manager for the Architect/Engineer.

POR: Program of Requirements

PORQ: Program of Requirements for Staff Quarters

PSD: Project Summary Document (Similar to a POR, used for smaller projects.)

RFI: Request for Information

RECS: Residential Energy Consumption Survey

S&C: Steam & Condensate

SAVE: Society of American Value Engineers

SBCCI: Southern Building Code Congress International, Inc.

SD: Schematic Design

SI: International System of Units

SIR: Savings to Investment Ratio

SOW: Scope of Work

SPie: Specificers' Properties Information Exchange. From the Building Smart Alliance

SSBC: Southern Standard Building Code

SSER: Site Selection and Evaluation Report

STC : Sound Transmission Coefficient

SU: Service Unit, usually a hospital, clinic, or care facility operated by Indian Health Services

SWPPP: Stormwater Pollution Prevention Plan

TAB: Testing, Adjusting, and Balancing

TCLP: Toxic Characteristic Leaching Procedure

TERO: Tribal Employment Rights Office

TIA/EIA: Eelecommunications Industry Association/ Electrical Industries Alliance

UBC: Uniform Building Code, now IBC

UFAS: Uniform Federal Accessibility Standards

UL: Underwriters Laboratories, Inc.

USDA: United States Department of Agriculture

USGBC: United States Green Building Council

USGS: US Geological Survey

VAV: Variable Air Volume

VE: Value Engineering

VECP: Value Engineering Change Proposal

VFD: Variable Frequency Drive

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Appendix

1

Submittal Checklists

project name

Pre-Design

planset date

Submittal Checklist

6.1 Requirements

6.1.1 Program Verification

[ ] Review Planning Documents and provide written report including unresolved issues.

6.1.2 Preliminary Owner's Project Requirements document

[ ] Conduct a workshop with Owner's representatives.

[ ] Provide preliminary Owner's Project Requirements document.

6.1.3 Site Analysis

[ ] Prepare a preliminary site map, showing observations, site conditions, and environmental issues consequential to the project development.

[ ] Provide information on potable & fire water systems, sanitary sewer, site drainage, site electrical, natural gas, and data/telephone/cable TV.

6.1.4 Geotechnical Study

[ ] Review preliminary geotechnical report.

6.1.4 BIM Management/Execution Plan

[ ] Provide BIM Management/Execution Plan.

6.1.6 Pre-Design Survey Report

[ ] Provide pre-design survey report; review/document existing conditions; report findings of condition of existing structure or systems.

6.1.7 Record Drawings

[ ] Investigate and document the condition of existing structures. Review available environmental survey documents.

[ ] Provide summary of any observed discrepancies from record drawings; include photographs if needed.

6.1.8 Results

[ ] Provide all pre-design submittals in a bound and tabbed booklet.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____

(signature) (date)

_____

(print name and title)

project name

Concepts

planset date

Submittal Checklist

7.1 Requirements

Key Activities

[ ] 7.1(1) Conduct work sessions with IHS and client.
[ ] 7.1(3) Conduct a sustainable design charette.
[ ] 7.1(6) Develop three schemes.

Deliverables

[ ] 7.1(2) Update preliminary OPR baesd on worksessions.
[ ] 7.1(4) Evaluate feasibility of onsite renewable energy systems.
[ ] 7.1(5) Evaluate feasibility of solar hot water system.
[ ] 7.1(7) Incorporate design activities with site planning. Identify alternatives for foundation, structure, and mechanical systems.
[ ] 7.1(8) Provide preliminary topographic survey and incorporate into BIM.
[ ] 7.1(9) Verify local utility system capacity; calculate fire flow and provide preliminary design features if needed. Provide documentation from each utility verifying capacity.
[ ] 7.1(10) Incorporate geotechnical study into the Basis of Design for foundation systems, retaining walls, slope stabilization, stormwater detention, roads, and walks.
[ ] 7.1(11) Provide preliminary cost data for each design alternative.
[ ] 7.1(12) Provide report on sustainability design charette and sustainability status.
[ ] 7.1(15) Provide initial BOD, update OPR from Pre-Design.

Post Concepts Submittal Requirements

Activities

[ ] 7.1(14) Incorporate comments from submittal review to produce final concept.

Deliverables

[ ] 7.1(14) Provide record drawing of final site layout.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____
(signature) (date)

_____
(print name and title)

project name

Schematic Design

planset date

Submittal Checklist

8.1 Requirements

Key Activities

[ ]	8.1(2)	Conduct work sessions to review spaces, interdepartmental relationships, and circulation.
[ ]	8.1(3)	Refine approved conceptual design; approve building scheme; develop floor plan to incorporate all POR spaces.
[ ]	8.1(4)	Verify scheme to accommodate all supporting systems and equipment; establish general concepts of mechanical and electrical systems.
[ ]	8.1(6)l	Commission Value Engineering Study.

Deliverables

[ ]	8.1(5)	Develop site plan to demonstrate layout/functionality of utilities, roadways, parking lots, grading, etc. Perform perfunctory traffic analysis.
[ ]	8.1(6)a	Updated space comparison report.
[ ]	8.1(6)b	Geotechnical report (complete).
[ ]	8.1(6)c	Updated sustainable design report.
[ ]	8.1(6)d	Updated OPR/BOD.
[ ]	8.1(6)e	Preliminary calculations (submitted in BOD).
[ ]	8.1(6)f	Updated cost estimate.
[ ]	8.1(6)g	Clash Detection Report.
[ ]	8.1(6)h	Updated Life Safety Code Analysis.
[ ]	8.1(6)i	Outline Technical Specifications.
[ ]	8.1(6)j	Drawings.
[ ]	8.1(6)k	Provide other documents called for in 8.1.2 as part of the BOD.
[ ]	8.2	Narrative status of the Value Engineering Study.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____

(signature) (date)

_____

(print name and title)

project name

Design Development

planset date

Submittal Checklist

9.2 Requirements

Key Activities

[ ]	9.1(2)	Begin to integrate Commissioning requirements into the design.
[ ]	9.1(3)	Refine approved schematic design documents; identify all exterior and interior systems.
[ ]	9.1.(4)a	Meet with client staff to develop locations for all Group I & II Equipment. Also discuss cabinets, lighting, medical records, etc.
[ ]	9.1.(4)b	Develop keying and room numbering scheme.
[ ]	9.1.(4)c	Meet with departments for final approval of each area or department.
[ ]	9.1.(5)	Implement accepted value engineering proposals and sustainability requirements.
[ ]	9.1.(6)	Provide all design specialty services; e.g. radiation shielding, dietary, trash disposal, security, etc.

Deliverables

[ ]	9.1(7)a	Updated space comparison report.
[ ]	9.1(7)b	Updated sustainable design report.
[ ]	9.1(7)c	Projected energy use report with calculations (in BOD).
[ ]	9.1(7)d	Building Commissioning Plan.
[ ]	9.1(7)e	Updated OPR/BOD.
[ ]	9.1(7)f	Updated calculations (in BOD).
[ ]	9.1(7)g	Updated medical equipment summary.
[ ]	9.1(7)h	Updated cost estimate.
[ ]	9.1(7)i	Clash detection report.
[ ]	9.1(7)j	Narrative summary of Value Engineering changes implemented in the design.
[ ]	9.1(7)k	Draft specifications.
[ ]	9.1(7)l	Drawings.
[ ]	9.1(7)m	Provide other documents called for in 9.1.2 as part of the BOD.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____

(signature) (date)

_____

(print name and title)

project name

65 Percent CD

planset date

Submittal Checklist

11.2 Requirements

Deliverables

[ ] 11.1(1) Updated space comparison report.
[ ] 11.1(2) Updated medical equipment summary.
[ ] 11.1(3) Updated sustainable design report.
[ ] 11.1(4) Updated projected energy use report with calculations (in BOD).
[ ] 11.1(5) Updated Commissioning Plan.
[ ] 11.1(6) Updated OPR/BOD.
[ ] 11.1(7) Updated cost estimate.
[ ] 11.1(8) Updated clash detection report.
[ ] 11.1(9) Preliminary specifications.
[ ] 11.1(10) Drawings.
[ ] 11.1(11) Provide other documents called for in 11.1.2 as part of the BOD.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____
(signature) (date)

_____
(print name and title)

project name

95 Percent CD

planset date

Submittal Checklist

12.2 Requirements

Deliverables

[ ] 12.1(1) Updated space comparison report.
[ ] 12.1(2) Final medical equipment summary.
[ ] 12.1(3) Updated sustainable design report.
[ ] 12.1(4) Final projected energy use report in BOD.
[ ] 12.1(5) Updated Commissioning Plan.
[ ] 12.1(6) Updated OPR/BOD with final calculations.
[ ] 12.1(7) Facility User Manual.
[ ] 12.1(8) Updated cost estimate.
[ ] 12.1(9) Final clash detection report and summary.
[ ] 12.1(10) Complete structural narrative (per IBC Ch 17).
[ ] 12.1(11) Compete specifications.
[ ] 12.1(12) Drawings.
[ ] 12.1(13) Provide other documents called from in 12.1.2 as part of the BOD.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____
(signature) (date)

_____
(print name and title)

project name

Final CD

planset date

Submittal Checklist

13.2 Requirements

Deliverables

[ ] 13.1(1) Final space comparison report.
[ ] 13.1(2) Permitting status summary.
[ ] 13.1(3) Final sustainable design status report.
[ ] 13.1(4) Final projected energy use report including energy and water consumption baseline, etc.
[ ] 13.1(5) Final Commissioning Plan including maintainable equipment summary.
[ ] 13.1(6) Final OPR/BOD
[ ] 13.1(7) Provide formally concluded project review comment file.
[ ] 13.1(8) Provide copies of other reports and studies required by contract.
[ ] 13.1(9) Provide final facility user manual.
[ ] 13.1(10) Provide final cost estimate.
[ ] 13.1(11) Provide final BIM design model and COBie database.
[ ] 13.1(12) Provide complete Project Specifications.
[ ] 13.1(13) Provide complete construction documents.
[ ] 13.1(14) Provide draft bid support documents.

A/E project manager certifies that the above indicated requirements have been completed as required.

_____ _____
(signature) (date)

_____
(print name and title)

Appendix

2

Submittal Guidance for Projects Administered by Tribal or Others for IHS Review

A2 Submittal Guidance for Projects Administered by Tribal or Others for IHS Review

IHS construction often includes PL 93-638 (Indian Self-Determination Act) contracts. In these arrangements with the government, the Tribe has the authority to manage the project independently, with only marginal involvement from the federal government. In recognition of this fact, this appendix provides a reduced list of submittals deemed to be essential for federal government review during the design and construction of the project.

For 638 projects, Joint Venture Agreements, Small Ambulatory Program Projects, and Youth Regional Treatment Centers the required design submittals are consolidated to three phases:

1) Planning/Concepts Phase,

2) Design Advancement Phase, and

3) Construction Documents phase.

Specific requirements for each design phase are included here, and contain references to the applicable chapter within the A/E Design Guide.

Phase I – Planning/Concepts Phase	
7.1(9)	Documentation from each utility verifying capacity; if capacity is not sufficient provide design concepts for additional requirements
7.1(11)	Building organization and massing schemes (recommended)
7.1(12)	Sustainable Design Charette Summary (recommended)
7.1(13)	Written analysis of planning and concepts with suggested approach for schematics
8.1(6)a	Space comparison report
8.1(6)b	Geotechnical report
8.1(6)c	Sustainable design status report
8.1(6)d	Owner's Project Requirements, OPR / Basis Of Design, BOD documentation
8.1(6)f	Cost estimate
8.1(6)g	Clash detection report
8.1(6)h	Life safety code analysis
8.1.1	Drawings
8.1.2.1(2)	Medical equipment summary
8.1.2.1(3)	Security system drawing
8.2	Narrative status on VE study

Phase II – Design Advancement Phase	
8.1(6)i	Outline technical specifications
9.1(7)j	Narrative summary of VE changes implemented in the design
9.1.2.4	(1,2) Room pressurization relationship and airflow summary
9.1.2.5(3)	Electrical needs for medical equipment listing. Also include mechanical needs (i.e. heat load, ventilation, etc.)
11.1(1)	Updated space comparison report
11.1(3)	Updated sustainable design status report
11.1(4)	Updated projected energy usage report with calculations (per 3.5.2)

Phase II – Design Advancement Phase	
11.1(5)	Building commissioning plan
11.1(7)	Updated cost estimate
11.1(8)	Clash detection report
11.1(10)	Drawings

Phase III – Construction Documents Phase	
11.1.2.1(1)	Architectural building perspective rendering
11.1.2.2(1)	Civil narrative report on the status of all site related permit activities
11.1.2.5(3)	Arc flash analysis
12.1.2.1(3)	Signage and wayfinding plan
12.1.2.5	Electrical power selective coordination study
12.1.2.6	Maintainable equipment summary
13.1(1)	Final space comparison report
13.1(2)	Permitting status summary
13.1(3)	Final sustainable design status report
13.1(4)	Final energy and water consumption projections
13.1(5)	Final building commissioning plan including the maintainable equipment summary
13.1(8)	Record copy of other reports and studies required by the contract (e.g. archaeological discovery/ study, outstanding NEPA issues, etc.)
13.1(9)	Final facility user manual
13.1(10)	Final cost estimate
13.1(12,13)	Complete construction documents including final technical specifications

Appendix

3

Housing Submittals

A3 Housing Submittals

The following is a list of submittals essential for federal government review during the design of Staff Quarters projects. Specific requirements for each design phase are included here, and contain references to the applicable chapter in the A/E Design Guide.

The required design submittals are consolidated to four phases:

1) Site Planning and Development
2) Housing Details
3) Design Advancement
4) Construction Documents

Specific requirements for each design phase are included here, and contain references to the applicable chapter within the A/E Design Guide.

Phase I – Site Planning and Development	
7.1(9)	Documentation from each utility verifying capacity; if capacity is not sufficient provide design concepts for additional requirements
7.1(11)	Building organization and massing schemes
7.1(12)	Sustainable Design Charette Summary
8.1(6)d	Owner's Project Requirements/Basis of Design documentation
8.1(6)b	Geotechnical report including Basis of Design for all building foundation systems, retaining walls, slope stabilization requirements, stormwater detention ponds, roads and walks.
8.1(6)c	Sustainable design status report
8.1.1	Drawings
8.1.2.2(1) 8.1.2.2(6)	Sizing of all underground piping including calculations and hydraulic analysis. Provide documentation and narrative in Basis of Design documentation.
9.1.1.2(1)	Site and Grading Plans. Establish grading and project limits. Provide cut and fill calculations and discuss staging of earth-moving operations.
9.1.1.2(2)	Roadways and pedestrian paving. Provide horizontal and vertical layout, including pavement materials, subgrade preparation, pavement thicknesses, and finishes. Reconcile Basis of Design with geotechnical report. Provide narrative regarding site access and coordination, including staging and site control.
8.1.2.2(3) 9.1.2.2(2)	Comprehensive stormwater analysis, including pre-development and post-development conditions. Demonstrate in Basis of Design that post-development runoff will not exceed pre-development runoff for design storm. Provide sizing and layout of stormwater conveyance system with applicable calculations. Provide erosion control plan for application during all phases of construction and include discussion for obtaining a Construction General Permit under NPDES and prepare a SWPPP.
8.1.2.2(8)	Provide narrative on lot layout and sizing. Include a discussion regarding the advantages/disadvantages of large versus smaller lots. Provide analysis regarding the type of landscaping to be used.

Phase II – Housing Details	
7.1(4)	Evaluate the feasibility of constructing on-site renewable energy systems capable of delivering up to 7.5% of the annual electrical load. Life cycle cost analysis shall use a 40-yr payback period.
7.1(5)	Evaluate the feasibility of constructing a solar hot water heating system capable of delivering 30% of the hot water demand. Life cycle cost analysis shall use a 40-yr payback period.
7.1(6)	Examine alternatives for site layouts. Optimize solar exposure and site contours to optimize energy conservation and site drainage.
7.1(11)	Provide alternative massing schemes. Include narrative of the relative advantages and disadvantages of single-story vs. multi-story, basements vs. crawlspaces vs. slab-on-grade, etc.
3.4	Sustainability Report. Provide a preliminary list of available credits using the LEED for Homes template. Include a summary of each design/construction credit, a brief narrative of the requirements pertaining to each credit, and an assessment of the likelihood of achieving each credit (i.e. “likely”, “possible”, or “unlikely”. Identify forthcoming tasks and strategies for pursuing desired credits.
8.1(6)a	Space comparison report
8.1(6)h	Life safety code analysis
8.2	Status on VE study

Phase III – Design Advancement Phase	
8.1(5)i	Outline technical specifications
9.1(7)(j)	Narrative summary of VE changes implemented in the design
11.1(1)	Updated space comparison report
9.1(7)(e)	Updated OPR/BOD Documentation.
11.1(3)	Updated sustainable design status report
11.1(5)	Building commissioning plan
11.1(4) 5.5.2(2)	Updated projected energy usage report with calculations (per 3.4.3). Provide energy usage calculations for each building type (including duplexes, single family detached, handicapped units, apartment building, etc.) Provide an energy simulation model with electronic files available for the owner. Demonstrate compliance with 30% energy reduction requirement (compared to IECC 2009 baseline), or provide justification for reductions in energy savings measures.
11.1.1	Drawings
3.6(4)	Preliminary tenant user manual. The manual shall address the intent of relevant design features, provide energy savings tips, and provide information on basic maintenance of mechanical systems and equipment.

Phase IV – Construction Documents Phase	
11.1.2.1(1)	Architectural building perspective rendering
11.1.2.2(1)	Civil narrative report on the status of all site related permit activities
11.1.2.5(3)	Arc flash analysis
12.1.2.1(3)	Signage and wayfinding plan (site)
12.1.2.5	Electrical power selective coordination study
12.1.2.6	Maintainable equipment summary
13.1(1)	Final space comparison report
13.1(2)	Permitting status summary
13.1(3)	Final sustainable design status report
13.1(4)	Final energy and water consumption projections
13.1(5)	Final building commissioning plan including the maintainable equipment summary
13.1(6)	Updated OPR/BOD Documentation
13.1(8)	Record copy of other reports and studies required by the contract (e.g. archaeological discovery/ study, outstanding NEPA issues, etc.)
13.1(9)	Final tenant user manual
13.1(13)	Complete construction documents including final technical specifications

Appendix

4

Program and Space Accounting

A4 Program and Space Accounting

A4.1 POR Space Comparison Report

Through the various phases of a new or major renovation/expansion health care facility construction project, the space allocation provided in the approved Indian Health Service (IHS) Program of Requirements (POR) is to be compared with the actual space designed and/or constructed. The comparison process begins in the Concepts Phase of design, with the submittal of a Space Comparison Report. The last submittal of a Space Comparison Report is with the submittal of the Final Construction Documents. If any deviation occurs between the first and last submittal that exceeds 10 percent, plus or minus, an update is to be submitted at that time. Also, as part of the "Record Drawings", an update and verification is required.

A4.1.1 Report Content

The report is to be provided in two parts. The first part is to contain tables that provide a summary and a detailed backup. The specific computer programs to be used for the tables portions of this report will be determined during the Predesign Phase. The second part is to contain floor plans that delineate the various components used in the actual space comparison computations. Computer-Aided Design (CAD) is to be used in the preparation of the drawings for the Concepts Phase submittal, including the use of polylines ("P lines"), so that the net and gross areas are calculated by the computer software program.

Part I, Section A, is a summary that shows subtotals for each of the service components included in IHS health care facilities; i.e., Inpatient, Diagnostic, Ambulatory, Administrative, and Support, as applicable to the respective project. Each department within a service component will be subtotaled. For each service component and departmental subtotal, the POR net area, applicable net-to-gross factor, and gross area are to be shown. The actual spaces (designed or constructed) are to be compared with the POR spaces, with the percent of variance for both net and gross areas being shown. See Example "A" for format.

Part I, Section B, is a backup that gives a detailed breakdown for each department. This breakdown is intended to track each individual space in the POR by Criterion Number. The POR portion of the table is to provide the respective Criterion Number, the space name, quantity (number of units), unit net area, and total net area. The POR net areas for each department are to be totaled. This portion of table is to provide the actual space identification numbers (used by the designer for space identification in the early phases of the design prior to room number assignments), room numbers, unit net area, and net area. For each POR Criterion Number, the actual net areas are to be compared with POR net areas, with the variance amount being shown as well as the percent of variance and any appropriate comments. Note that a justification comment is required for any variance when the actual exceeds plus or minus 10 percent of that specified in the POR. See Example "B" for format.

Part II, is appropriate floor plans that delineate how the actual area is assigned to each department and the components that make up the building gross area. CAD drawings are to be used with "P lines" and layers reflecting net and gross areas.

A4.1.2 Basis of Computations

Measurements used in the computations shall be taken from the outside face of the exterior walls, disregarding such architectural projections as cornices, buttresses, and roof overhangs; the normal thickness of the exterior wall is included in the gross area.

Normal building overhangs, unroofed courtyards or plazas, bay windows extending outside the building line, catwalks providing access to equipment, mezzanines in the maintenance or central supply department which utilize open metal grating and are used for storage purposes only. Cooling towers, other unroofed equipment, and unfinished attics in quarters units are not counted as gross area.

A4.1.2.1 Space Net Area

1) For space net area, each actual individual space is measured from the inside face of permanent walls or common lines between spaces. No deductions are to be made for space occupied by interior partitions when it is a wall within a space used to separate functions; or baseboard heating, ventilation and air-conditioning (HVAC) units. However, deductions are to be made for all mechanical shafts passing through the space, structural columns, and

HVAC units other than baseboard type.

2) When two or more spaces are combined into a single area, the actual space is to be compared with the combined respective POR spaces.

3) When a single space is divided into two or more spaces, the actual space is to be compared with the split respective POR space.

A4.1.2.2 Department Gross Area

1) For department gross area, each actual department shall be measured from the inside face of any exterior wall, the inside face of permanent corridor (building circulation) walls, or to the inside face of walls common with an adjacent department. (Note: the entire thickness of all walls for permanent corridors are included with the measurements for the permanent corridors.) There are to be no deductions for structural elements, departmental corridors, or partitions that occur within the department. Spaces for structural columns, which have been deducted from the space net area, are to be included in the department gross area. Spaces that have been identified to be included in the calculations for floor and building gross areas are to be deducted from the department gross area measurements and calculations.

2) When a space has been approved for location in a department (recipient) other than the department (donor) for which it was programmed in the POR, the gross area for the relocated space is to be deducted from the gross area of the recipient department and reflected in the donor department for comparison with the POR space. (Noting that the gross area is what is moved, then a new net area will have to be calculated based on the conversion factor for the recipient department, if these factors are different. By moving gross areas between departments, the total building gross area is not affected.)

3) CAD "P lines" are to be used to determine the departmental gross areas. A CAD layer separate from the one used to develop the space net areas is to be used.

A4.1.2.3 Floor Gross Area.

The actual floor gross area is the sum of the items listed below:

1) Department gross areas.

2) Permanent corridors, lobbies, vestibules (other than arctic enclosures), malls, and their walls.

3) Stairwells on the first level as they occur and their walls on all levels.

4) Elevator shafts on the first level as they occur and their walls on all levels.

5) Interior walls common to more than one department.

6) Exterior walls (walls that follow the building "footprint," not including roof overhangs, cornices, pilasters, buttresses, etc., which extend beyond the exterior wall face).

A4.1.2.4 Crawl Spaces and Mechanical Penthouses

These components do not affect the building "footprint" but are included as components of the mechanical space at the percentage of area indicated below:

1) All spaces having a clear height of 2 000 mm or higher are counted as 100 percent in gross area computations.

2) All spaces having a clear height of 1 200 mm to 1 999 mm are to be counted as 50 percent in gross area computations.

3) All spaces, having a clear height of less than 1 200 mm are excluded from gross area computations.

The clear height of a crawl space is defined as the distance between the surface of the earth or finished floor and the bottom of the predominate framing members (normally the joists or trusses). It is expected that girders, pipes or ducts may protrude into this height.

A4.1.2.5 Mechanical Space.

Depending upon the size of the project, the POR will allocate up to 12 percent of the total floor gross area for mechanical space. This space can be used only as mechanical space and can not be added to other areas of the facility. If the area is not required as mechanical space, it is to be deducted from the total building gross area. The actual mechanical space is included in the total building gross area. The various components of mechanical space are to be listed in a summary backup table and compared with the programmed percent for mechanical space given in the POR. Mechanical space includes the following: The actual building gross area is the sum of the items listed below:

1) Enclosed and covered space used for major equipment such as boilers, chillers, large pumps and valves, emergency generators, storage tanks, and

large fans.

2) Rooms used for electrical switching gear, main electrical panels, main communication terminals, mechanical controls, metering of utility services, and shafts for utilities on the first level they occur and their walls on all levels.

3) Crawl Spaces and Mechanical Penthouses.

4) The gross area of stand alone mechanical spaces and mechanical penthouses are counted as part of the "gross area for mechanical space." The net area of mechanical spaces located in a building that houses more than one department is counted as part of the "gross area for mechanical space."

A4.1.2.6 Building Gross Area.

The actual building gross area is the sum of the items listed below:

1) Floor Gross Area.

2) Mechanical Space.

3) Space associated with energy efficiency, extreme climate response such as arctic enclosures, seismic concerns, and/or innovative construction techniques. (Examples are extra wall thickness for arctic conditions, seismic bracing, and double walls that are a result of placing two modular units together.)

A4.1.2.7 Components Excluded from Building Gross Area Computations, but Included in the Report

1) The following components are excluded from the building gross area. They are to be included in this report as separate line items and the actual spaces are to be reported and compared with the POR space requirements when applicable. Each of these components is to be authorized specifically for use in the project in the basic POR or a POR amendment.

   a) Equipment access walkways.

   b) Catwalks and mezzanines which utilize open metal floor grating.

   c) Interstitial space (if use of such is approved in accordance with IHS requirements).

   d) Loading Dock(s).

   e) Covered entrances.

   f) Exterior covered walkways, canopied areas, trellis-type covers and other covered but not enclosed areas.

   g) Building overhangs exceeding 1 meter in width.

   h) Parking.

   I) Uncovered outside storage areas.

   j) Helicopter ports or helicopter pads.

   k) Unroofed equipment pads.

   l) Locally specified separate traditional healing structures.

2) Crawl space having a clear height less than 1 200 mm are excluded from the building gross area and the use thereof does not require authorization before they are used in a design. They are to be included in this report as a separate line item and the actual area is to be reported.

A4.1.2.8 Components Excluded from the Report

The following components are excluded from the building gross area and from this report:

1) Building overhangs not exceeding 1 meter in width.

(2) Bay windows.

(3) Unfinished and unoccupied attics that do not have floor surfaces. Note, attics that have floor surfaces are treated as a floor and will be counted as such.

PROJECT NAME
Project PHASE
date

Comparison of POR Space Allocation with Actual Space

Part I, Section A - Services Summary

		POR			actual			variance *gross area*	
template number	department name	net area (m^2)	net to gross factor	gross area (m^2)	net area (m^2)	net to gross factor	gross area (m^2)	difference (m^2)	%
ADDITIONAL SERVICES									
	Diabetes Prevention Program	253	1.35	342	280	1.35	378	36	11%
	DHHSA Tribal Health Services	270	1.35	365	265	1.35	358	-7	-2%
	WIC	138	1.35	186	142	1.35	192	6	3%
			1.35			1.35			
			1.35			1.35			
			1.35			1.35			
			1.35			1.35			
			1.35			1.35			
			1.35			1.35			
			1.35			1.35			
	Subtotal Additional Services	661		893	687		928	35	4%
ADMINISTRATION									
	Administration	216	1.4	302	224	1.4	314	12	4%
	Business Office	113	1.4	158	124	1.4	174	16	10%
	Health Information Management	320	1.25	400	310	1.25	388	-12	-3%
	Information Management	69	1.2	83	72	1.2	86	3	4%
	Subtotal Administration Services	718		943	730		962	19	2%
AMBULATORY SERVICES									
AU2	Audiology	64	n/a	81	64	n/a	81	0	0%
DCC14	Dental Care	462	1.5	693	462	1.5	693	0	0%
DCC16	Dental Care	500	1.5	750	500	1.5	750	0	0%
ER3	Emergency	230	1.55	357	230	1.55	357	0	0%
EC2	Eye Care	182	n/a	236	182	n/a	236	0	0%
PCP14	Primary Care	1,036	1.45	1,502	1,036	1.45	1,502	0	0%
	Specialty Care	43	1.45	62	43	1.45	62	0	0%
	Subtotal Ambulatory Services	2,517		3,681	2,517		3,681	0	0%
ANCILLARY SERVICES									
DI3	Diagnostic Imaging	314	n/a	427	314	n/a	427	0	0%
LB4	Laboratory	205	1.25	256	205	1.25	256	0	0%
PH_8	Pharmacy	354	1.2	425	354	1.2	425	0	0%
PT3	Physical Therapy	378	1.3	491	378	1.3	491	0	0%
	Respiratory Therapy		1.21			1.21			
	Surgery		1.55			1.55			
	Subtotal Ancillary Services	1,251		1,599	1,251		1,599	0	0%
BEHAVIORAL SERVICES									
	Mental Health	168	1.4	235	175	1.4	245	10	4%
	Social Work	76	1.4	106	92	1.4	129	23	22%
	Subtotal Behavioral Services	244		341	267		374	33	10%

POR space comparision example A

page 1 of 2

PROJECT NAME
Project PHASE
date

Comparison of POR Space Allocation with Actual Space

Part I, Section A - Services Summary

template number	department name	POR net area (m^2)	POR net to gross factor	POR gross area (m^2)	actual net area (m^2)	actual net to gross factor	actual gross area (m^2)	variance *gross area* difference (m^2)	variance *gross area* %
FACILITY SUPPORT									
CE1	Clinical Engineering	39	n/a	42	39	n/a	42	0	0%
FM_4	Facility Management	205	1.2	246	205	1.2	246	0	0%
	Subtotal Facility Support	244		288	244		288	0	0%
INPATIENT SERVICES									
ACB8	Acute Care	394	1.55	611	394	1.55	611	0	0%
	Intensive Care		1.41			1.41			
LD1	Labor & Delivery	228	n/a	326	228	n/a	326	0	0%
	Psychiatric Nursing		1.55			1.55			
	Subtotal Inpatient Services	622		937	622		937	0	0%
PREVENTIVE SERVICES									
	Environmental Health	149	1.4	209	160	1.4	224	15	7%
	Health Education	49	1.4	69	52	1.4	73	4	6%
	Public Health Nursing	321	1.4	449	315	1.4	441	-8	-2%
	Public Health Nutrition	47	1.4	66	49	1.4	69	3	5%
	Subtotal Preventive Services	566		792	576		806	14	2%
SUPPORT SERVICES									
DT1	Dietary	310	n/a	333	310	n/a	333	0	0%
EGC2	Education & Group Consultation	126	n/a	151	126	n/a	151	0	0%
	Education & Group Consultation	23	n/a	27	22	n/a	27	0	0%
	Employee Facilities	328	1.2	394	357	1.2	428	34	9%
HL2	Housekeeping & Linen	47	1.1	52	47	1.1	52	0	0%
	Housekeeping & Linen	16	1.1	18	17	1.1	19	1	6%
MS2	Medical Supply	99	1.24	123	99	1.24	123	0	0%
PS_4	Property & Supply	398	1.1	438	398	1.1	438	0	0%
	Public Facilities	156	1.1	172	170	1.1	187	15	9%
	Subtotal Support Services	1,193		1,373	1,236		1,424	51	4%

Building Totals							
Subtotal - Total Dept. Gross Area		10,153		10,290	137	1.4%
Department to Floor Factor[1]	20%	2,031	20%	2,058	27	1.4%
Subtotal - Total Floor Gross Area		12,184		12,348	165	1.4%
Mechanical Space[2]		1,462		1,482	20	1.4%
Total Building Gross Area		**13,646**		**13,830**	**185**	**1.4%**

[1]Department to floor factor varies based on single or multi-story.
[2]Percentage of mechanical space will very. See POR.

POR space comparision example A

page 2 of 2

PROJECT NAME
Project PHASE
date

Comparison of POR Space Allocation with Actual Space

Part I, Section B - Departmental Review

ADMINISTRATION SERVICES

				POR			actual			variance		
RFN code	space name	room number	room number	quantity of spaces	unit net area (m^2)	total net area (m^2)	quantity of spaces	unit net area (m^2)	total net area (m^2)	difference (m^2)	%	
ADMINISTRATION												
ALLG1	Alcove Staff Lounge			1	3	3	1	4	4	1	0%	
MLRM1	Mailroom			1	10	10	1	11	11	1	10%	
OFOC1	Administrative Assistant			9	6	54	9	6	54	0	0%	
OFOC1	Clerk, Quality Assurance			1	6	6	1	7	7	1	17%	
OFOC1	Employee Health Clerk			1	6	6	1	5	5	-1	-17%	2
OFOC1	Secretary/Clerk			1	6	6	1	5	5	-1	-17%	2
OFSP1	Clinical Director			1	11	11	1	12	12	1	9%	
OFSP1	Director of Nursing			1	11	11	1	10	10	-1	9%	
OFSW1	Office, Shared Work			1	6	6	1	6	6	0	0%	
OFTY1	Administrative Officer			3	9	27	3	9	27	0	0%	
OFTY1	Employee Health Supervisor			1	9	9	1	9	9	0	0%	
OFTY1	Nursing Quality Assurance			3	9	27	3	10	30	3	11%	
STSF1	Unit Supply & Filing			4	4	16	1	17	17	1	6%	
TLPS1	Toilet, Staff			1	5	5	1	6	6	1	20%	1
WRCP1	Duplicating Equip. & Supply			1	11	11	1	12	12	1	9%	
WTFN1	Waiting Area			1	8	8	1	9	9	1	13%	1
	Subtotal Administration Department net square meters					216			224		4%	
	departmental net to gross					*1.40*			*1.40*	*calculated net to gross*		
	departmental gross square meters					*302*			*314*	*actual department gross*		
BUSINESS OFFICE												
ALLG1	Alcove Staff Lounge			1	3	3	1	4	4	1	0%	
ALCP1	Duplicating Equip. & Supply			1	4	4	1	5	5	1	25%	1
ALLG1	Alcove, Staff Lounge			1	3	3	1	3	3	0	0%	
OFIN1	Registration & Interview			1	7	7	1	8	8	1	14%	1
OFOC1	Accounts and Billing			5	6	30	5	7	35	5	17%	1
OFSP1	Business Manager			1	11	11	1	12	12	1	9%	
OFSW11	Office, Shared Work			1	6	6	1	7	7	1	17%	1
OFTY1	Health Benefits Cord.			3	9	27	3	9	27	0	0%	
STSF1	Unit Supply & Filling			3	4	12	1	13	13	1	8%	
TLPS1	Toilet, Staff			1	5	5	1	5	5	0	0%	
WTGN1	Waiting			1	8	8	1	9	9	1	13%	1
	Subtotal Business Office Department net square meters					113			124		10%	
	departmental net to gross					*1.40*			*1.40*	*calculated net to gross*		
	departmental gross square meters					*158*			*174*	*actual department gross*		

POR space comparision example B

page 1 of 2

PROJECT NAME
Project PHASE
date

Comparison of POR Space Allocation with Actual Space

Part I, Section B - Departmental Review

ADMINISTRATION SERVICES

				POR			actual			variance	
RFN code	space name	room number	room number	quantity of spaces	unit net area (m^2)	total net area (m^2)	quantity of spaces	unit net area (m^2)	total net area (m^2)	difference (m^2)	%
DEPARTMENT											
	similar room detail for each department within the POR ADMINISTRATION service										
	Subtotal Department net square meters										
	departmental net to gross									*calculated net to gross*	
	departmental gross square meters									*actual department gross*	

Administration Services Totals	POR	actual
Total Department Net Area (m^2)	718	730
Total Departmental Gross Area (m^2)	943	962

[1]A justification comment is required since the actual area exceeds 10 percent of that authorized by the POR.
[2]A justification comment is not required when the 10 percent variance is less than that authorized by the POR.

POR space comparision example B

page 2 of 2

Appendix

5

Design Record

Owner's Project Requirements
Basis of Design

A5 Design Record - OPR & BOD

Owner's Project Requirements

The A/E shall draft a preliminary Basis of Design as part of the Concepts Phase submittal. This document shall follow the format laid out in the original Owner's Project Requirements. The Basis of Design shall contain two essential elements for each design feature captured in the OPR: design narrative and design rationale (see section 4.2 for clarification). With each subsequent design submittal the BOD shall be updated to capture the degree of complexity in the design, and shall address issues raised by the most recent OPR. The OPR/BOD document update process will be used to inform the Commissioning efforts at every stage.

Every requirement listed in the OPR shall be addressed in the Basis of Design. However, some design elements may not initially be captured under the general outline provided in this appendix. Therefore the following list is provided to include specific design features typically included in every IHS new construction project. To the maximum extent feasible the A/E shall incorporate these design elements under the same structure provided in the OPR.

The Owner's Project Requirements document shall consist of two fundamental elements: 1) qualitative statements, and 2) performance criteria. For each identified owner's project requirement there shall be a corresponding qualitative statement and accompanying performance criteria, which shall identify verification methods.

The establishment of the initial OPR may be combined with other design review meetings, such as the sustainability charrette, but the responsibility for drafting the initial OPR shall be that of the A/E. The following is a list of key facility requirements that constitute the fundamental elements in the preliminary OPR.

Facility Requirements		References
1	Project schedule and budget	RFP
2	Commissioning Process scope and budget	2.8, 4.9, Appendix A6, Cx Plan
3	Project documentation requirements, including format for submittals, training materials, reports, and the Facility User Manual	Chapters 3-4
4	Owner directives	PJD/POR
5	Restrictions and limitations	PJD/POR, SSER, Prelim. Geotechnical Study
6	User requirements	PJD/POR
7	Occupancy requirements and schedules	PJD/POR
8	Training requirements for Owner's personnel	Cx Plan
9	Warranty requirements	Cx Plan, 14.5.1
10	Benchmarking requirements	Cx Plan, 5.5.2(7)
11	Operation and maintenance criteria for the facility that reflect the Owner's expectations and capabilities and the realities of the facility type	Cx Plan, 6.1.2
12	Equipment and system maintainability expectations, including limitations of operating and maintenance personnel	Cx Plan, 6.1.2
13	Quality requirements for materials and construction	2.3.2, 5.5.5
14	Allowable tolerance in facility system operations	Cx Plan
15	Energy efficiency goals	5.5.2
16	Environmental and sustainability goals	Chapter 5

Facility Requirements		References
17	Community requirements	PJD/POR, SSER, NEPA Documentation
18	Adaptability for future facility changes and expansion	PJD/POR
19	Systems integration requirements, especially across disciplines	Cx Plan
20	Health, hygiene, and indoor environment requirements	PJD/POR, 5.5.4
21	Acoustical requirements	PJD/POR, 5.6.1
22	Vibration requirements	2.3.2, 5.6.1
23	Seismic requirements	2.3.2(2), 2.3.2(5), 2.3.2(19)
24	Accessibility requirements	2.3.2(5)
25	Security requirements	OEHE Technical Handbook, 4.5.1
26	Aesthetics requirements	RFP, 2.3
27	Constructability requirements	2.3
28	Communication requirements	PJD/POR
29	Applicable codes and standards	2.3.2

Basis of Design

The A/E shall draft a preliminary Basis of Design as part of the Concept Phase submittal. This document shall be directly referenced to the Owner's Project Requirements, and for each OPR element, shall provide a design narrative and a design rationale. With each subsequent design submittal the BOD shall be updated to include sufficient detail to address the level of complexity of the design, and shall be used to facilitate the Commissioning process.

Much of the following information required for the Basis of Design documentation is also listed under the requirements section for each design submittal, and is also included in Appendix A1, Submittal Checklists. Inclusion of these submittals in the Basis of Design will fulfill such requirements.

As a minimum, the following information shall be included with the Basis of Design document:

General Information

Site Information

Building Area

Site Area

Building Footprint

Landscape Area

Number of Parking Spaces

Number of Handicap Parking Spaces

Full Time Equivalent (FTE) Occupants

Occupancy Classification

Code Sheet - Applicable Codes, Standards and Guidelines

Provide list of Codes, Standards, and guidelines used for the design of the facility

Life Safety

Structural System

Plumbing system

Medical gas system

HVAC system

Energy Management (Direct Digital) Control system

Fire Protection

Energy Conservation

Renewable Energy system

Electrical Distribution system

Fire Alarm system

Nurse calls system

Architecture / Energy

Building Envelope:

Window and Skylight

Glass Type:

Location:

U-Value:

Solar Heat Gain Factor (SHGF):

Shading Coefficient:

Air Leakage:

Exterior and Interior Wall

Type of wall:

Insulation type:

Insulation R-Value:

Wall U-value:

Type of Roof:

Roof Insulation type:

Roof Insulation R-Value:

Roof U-value:

Building Energy Information

Energy saving calculation by computer program (such as Trane Trace) is acceptable.

Conditioned Floor Area

Energy Consumption per year based on Proposed Design

Energy Consumption per year based on ASHRAE 90.1-2007

Energy saved per year compare to Proposed Design

% Energy saved below Standard

Strategies to accomplish each LEED credit to receive LEED Silver certification

List of mandatory credits

List of design and construction credits

Strategies to accomplish these credits

Civil

Strategies for Building Utility system

Code requirements for each system

Potable water system

Firewater system

Sanitary sewer system

Storm water system

Erosion control practices

Correspondence with local utilities regarding capacity to meet:

Fire protection system water requirements

Sanitary sewer system load requirements

Natural Gas, Fuel Oil, Propane, etc.

Mechanical

HVAC Systems Strategies

Codes and Standards

Design Criteria

Isolation room ventilation strategies

Ceiling as return air plenum strategies

AC unit zones strategies

Building area double air- filtration strategies

Climatic Conditions

Location

Latitude

Longitude

Elevation

HVAC System Control Strategies

Facility's Design Conditions

Temperature statistics basis

Mean daily range of temperatures for each month including dry bulb and wet bulb temperatures.

Plumbing System

Strategies for potable water system design

Code reference

Water saving strategies to meet LEED credits

Strategies for Potable hot water system and energy saving

Sanitary drainage requirements, e.g. piping materials, diameters, slopes, horizontal and vertical separations, etc.

Fire Protection System

Fire water requirements, e.g. flow/pressure, duration, etc.

Occupancy Hazard classification

Fire Pump requirements

Strategies for Medical Gas system

Code requirements

Strategies and requirements for each medical gas, e.g. oxygen, nitrous oxide, etc.

Equipment Power requirements

Electrical

Building Area

Building Total Electrical Load - provide Code reference

Breakdown of electrical loads by the following designations: lighting, receptacles, HVAC equipment, medical equipment, other.

Strategies for Lighting system design

Strategies for Lighting Power Density (LPD) for typical type of rooms

Calculation of LPD in proposed design, including a comparison against ASHRAE 90.1-2007 requirements.

Strategies for Building Life Safety system design

Code requirements

Strategies for an Emergency Power design

Code requirements

Life safety power system

Critical power system

Emergency Equipment power system

Strategies for Heliport design

Heliport lighting system

Narrative interpretation of FAA requirements

Strategies for Lightning Protection and Facility Grounding system

Strategies for the Information-Technology (IT) and Telephone system

Record of user sessions including IT and telecommunication requirements. Identify tasks that will be performed by local IT staff and sequencing of these tasks in relation to construction tasks.

Code requirements

Cabling requirements per utility

MDA and IDF Room Area requirements

MDA and IDF Room's power requirements

IT-system grounding requirements

Strategies for Building Security system

Record of user sessions including issues of security. Identify sequencing of operations and tasks that will involve IHS personnel, including training.

Security Room Area requirements

Security Room's power requirements

Type of Card reader and cameras requirements

Strategies for Nurse Call's system:

Code requirements

Nurse call's system equipment

Appendix

6

Commissioning

A6 Commissioning

A6.1 Listing of Commissioning Systems and Assemblies

The following is a list of systems and affiliated assemblies to be commissioned (at a minimum) as part of the Commissioning Plan. The column on the right represents percentages of each assembly to be tested during the performance testing. Depending on the complexity and scope of the project additional items may be identified for commissioning tasks. This list is to serve as a staging point, for developing a specific list of systems and assemblies to be tested during the development of the Commissioning Plan.

List of Commisioning Systems and Assemblies		
Life Safety System		
	Fire Alarm Control Panel and Annunciator Panel	100%
	Fire Pump with Jockey Pump	100%
	Flow Switch	100%
	Fire Sprinklers	50%
	Doors with Frames Fire Rating	50%
	Exit Light Fixtures	50%
	Emergency Lighting	50%
	Smoke Detectors and sensors	50%
	Fire and Smoke Dampers	50%
	Horn/Strobe lights for fire alarm	25%
	Manual Pull Stations	25%
Building Security and Communication System		
	Nurse Call System	100%
	Infant Protection and Alarm system	100%
	Security System	100%
	Public Address System	100%
Building Automation System with Control Strategies		
	Direct Digital Control (DDC) or Building Automation System (BAS)	100%
	Energy Management Control System (EMCS)	100%
	Electrical or Pneumatic Controls	100%
Air Handling Unit System		
	Air Handling Unit including Supply and Return (or Relief) fans	100%
	Exhaust air fans	100%
	Terminal Units (or VAV boxes)	25%
	Diffusers / Grilles (Supply, Return, and Exhaust)	25%
	Ductwork (Supply, Return, Exhaust)	25%
	Chilled and Hot water pumping system	25%

Major Mechanical Systems		
	Chilled Water System including Chiller, Cooling Tower, and Pumps	100%
	Heating Hot Water System including Boiler, Fuel system and Pumps	100%
	Process System (Steam for Sterilizers, Humidifier etc.)	100%
Major Electrical Systems		
	Main Switchgear and all electrical panel boards	100%
	Emergency & Standby Generators with ATS	100%
	Arc Flash Hazard warning Signs on electrical panels	100%
	Coordination and Short Circuit Study information	100%
	Lightning Protection with Building Grounding System	100%
	Transient Voltage Surge Suppression (TVSS) System	100%
	Advanced Metering System	100%
	Renewable Energy System	100%
	Building Lighting Control system	50%
	Regular and K-type Transformers	50%
Other Systems		
Backflow Preventer		
	Potable water, Fire Sprinkler system, Chiller, Cooling Tower, and Boiler water supply	100%
Medical Gas and Dental Vacuum System		
	Oxygen System, Nitrous Oxide System, Medical Air System, Dental Air System, Dental Vacuum system, Laboratory Gas System, Air Compressor, Medical Gas System Equipment	100%
Standby Generator Fuel Gas System		100%

Medical Equipment Power Supply System		
	CT-Scanner, X-Ray and MRI equipment, UPS requirements to protect equipment	100%
Telecommunication and Television cable System		users
Building Security System		users
Medical Waste Disposal System		users

A6.2 Commissioning Activities

Construction Phase

During construction the CxA shall oversee Construction Contractor activities as they relate to the overall commissioning process. the following listing has been derived from ASHRAE Guideline 0 - *The Commissioning Process*:

(1) Conduct a Pre-Bid Conference to allow Cx Team to alert bidders to Cx Process requirements

(2) Coordinate Owner's Representatives Participation by communicating specific activities to which the Owner should have involvement. Examples include Cx team meetings, review of Cx process reports, discussions to change Owner's Project Requirements, and staff and occupant training.

(3) Update Owner's Project Requirements as needed by virtue of Owner-directed changes or design/construction process-initiated changes. Evaluate the functional impacts of value management proposals.

(4) Update the Commissioning Plan to include new or revised descriptions of Cx Process activities as conditions and circumstances may dictate. Incorporate test procedures and data forms developed during construction and renew roles and responsibilities of the Cx Team including the identification of new members. Integrate changes to the communications channels and procedures that are necessary.

(5) Conduct Pre-Construction Commissioning Process Meeting with the Cx Team early in the construction phase to establish the Owner's Project Requirements, Basis of Design, and unique contract document requirements. Establish specific roles and responsibilities of the contractors relative to the Commissioning Process activities.

(6) Verify Submittals by randomly sampling submittals to be used to focus upon the quality ad ability of the submittal to achieve the Owner's Project Requirements. If substantial deviations are encountered, additional sampling may be necessary. Included training programs for specific systems and assemblies as part of the submittal verification.

(7) Schedule Commissioning Process Activities so as to allow Cx Team members to be available for critical Cx activities. The following should be included as a minimum: Cx Team meetings, start and completion of each construction phase, key system and assembly completion and tests, training sessions, substantial completion, warranty start date, beneficial occupancy, warranty review (two months prior to end of warranty period), and lessons-learned meeting.

(8) Develop Test Procedures to define the means and methods to carry out tests that are accomplished during the construction phase. Test procedures require the following:

(a) Participants required for the test.

(b) Prerequisites for the test performance in terms of completion of systems and assemblies and acceptable completion of other activities.

(c) Step-by-step instructions to exercise the specific systems and assemblies under test. Include configuration of the system or assembly to start the test and how to restore the system to normal operation at the conclusion of the test.

(d) List of instrumentation, tools, and supplies required for the test. Include a list of participants responsible for each of the items listed.

(e) An indication, for each step of the procedure, of what observations or measurements must be recorded and the range of acceptable results.

(f) Component test procedures to verify the performance of components under a full range of actions, responses to inputs, and loads.

(g) System/assembly test procedures to verify the performance of subsystems, systems, and assemblies under a full range of operating conditions.

(h) Intersystem test procedures to verify the interactions between systems and assemblies.

(i) Owner's Project Requirements test procedures to verify that various systems and assemblies that comprise the facility deliver the intended OPRs at the point of use.

(9) Develop Test Data Records to capture test data, observations, and measurements. Include dates and times for each test, conditions under which each test was conducted, narratives to include observed performances of each test, dated signatures, etc.

(10) Commissioning Team Meetings shall be held on a consistent, periodic basis. Team members represented at the meeting must be authorized to make commitments and decisions for their respective organizations. Circulate an agenda in advance of each meeting.

(11) Accomplish Periodic Site Visits to Verify Compliance with the Owner's Project Requirements. Use statistical sampling techniques for verification of Construction Checklists and Record Documents.

(12) Test Execution comprises witnessing of tests, verification of tests or test data reports. The scope each test varies depending on the type and complexity of the test. Implement procedures for deviations encountered during testing.

(13) Verify Training within a reasonable time period of each training program. Include random sampling of trainees to informally evaluate the efficacy of the training provided for each critical system and assembly. Include verification of training to operate interdependent systems and assemblies such as fire suppression systems and annunciator panel, HVAC and DDC, etc. Review attendee sign-in sheets to verify training was delivered to all intended people.

(14) Construction Phase Commissioning Process Report shall be used for documentation of the Cx work and results accomplished during the construction phase. The Cx Phase Process Report shall contain the following:

(a) Identification of any systems or assemblies that do not perform in accordance with the OPR. If the Owner chooses to accept any such systems, the conditions shall be documented along with the environmental, health, safety, comfort, energy, and operating and maintenance cost impacts. The OPR must be updated to match the revised expectations.

(b) Evaluations of the operating condition of the systems at the time of test completion.

(c) Construction Checklist completion and verification summary.

(d) Results from the Issues Log. The description should assess the importance of the issues and estimate the value of their correction.

(e) Test procedures and data. This section should include a set of blank data forms for future use in the Continuous Commissioning Process and Re-Commissioning.

(f) Commissioning Process Progress Reports.

(g) Deferred Tests shall be listed, citing reasons such as occupancy or design weather conditions. For these deferred tests, the prerequisite conditions and estimated schedule for their completion should be included.

(h) Lessons Learned including changes that will improve the delivered project. This information shall be used to form the basis for the Final Commissioning Process Report.

(15) Verify Systems Manual Update to ensure Construction Phase Cx activities are incorporated. Materials that should be added include: test procedures/records, training plans/records, drawings, submittal review reports, updated OPR, updated BOD, updated Cx Plan, updated issues log, and Cx Process Progress Reports.

(16) Verify Update of the Basis of Design to reflect any changes to the design during the Construction Phase. Verify the changes comply with the OPR.

A6.3 Commissioning Activities *Occupancy and Operations Phase*

During the Occupancy and Operations Phase, the Cx Team works to verify the ongoing compliance with the Owner's Project Requirements. Essential team members during the Occupancy and Operations Phase include Owner's representatives, the CxA, design professionals, contractors, and construction/program/project managers.

Responsibilities of the Cx Team during the Occupancy and Operations Phase include the following:

(1) Coordinate Contractor callbacks

(2) Verify Seasonal Testing of facility systems and assemblies.

(3) Verify continuing operation and maintenance personnel training.

(4) Verify system and assembly operations meet updated Owner's Project Requirements.

(5) Verify continual updating of the Systems Manual

(6) Conduct and verify periodic performance evaluations of facility systems and assemblies.

(7) Convene lessons-learned workshop.

(8) Complete the final Cx Process Report for the project.

Systems and assemblies identified for deferred testing due to weather or occupant loading conditions shall be tested during the Operations Phase Commissioning Process activities.

Appendix

7

Supplemental and Example Material

Example Psychrometric Analysis

Crime Prevention Through Environmental Design (CPTED)

Example Psychrometric Analysis

Extracted from *Schematic Design Sumbittal for Eagle Butte Health Center*

5) Engineering Narrative - Mechanical Engineering

Psychrometric Analysis of AHU System

A psychometric chart will not be included as part of this discussion, however we will address this issue as follows:

A. As far as can be determined at this time, each air handler will have a significant enough return at all times that a mid-winter situation will provide only a modest need for heating at the air handler. Wintertime mixed air conditions will provide enough cooling air in the duct to cool all internal spaces but allow a reset of the mixed air temperature to make use of as much return air as possible (to offset the situation that during many months in order to maintain a set, say 55 deg. F. mixed air temperature, we would actually be relieving some air that could be returned to the system.) We will utilize controls to allow the mixed air temperature to rise up a little bit during extreme winter conditions so as to maximize utilization of return air.

B. However in the summertime we will have two different situations psychometrically at the air handling units. The first situation will be for normal outpatient clinical areas where we will try to achieve a summertime relative humidity of 60 – 65% in the space. This will require a leaving air temperature of 55 deg. F. off the chilled water coil. At a typical condition of approximately 15% fresh air and a design (warm) summer day, we would have the following conditions:

Outside air – 95 deg. Db/76 deg. wb
H = 40.0

Return air – 74 deg. db/64 deg. wb
h = 29.3

Mixed air at 15% fresh air on a design summer day would then be:
77 deg.db/66.5 deg. wb
h = 31.0

Leaving coil temperature would then be:
55 deg. db/54 deg. wb
h = 23.4

C. At all critical air handling unit areas, of which there will be three air handlers, the leaving air temperature off the coil will be 52 deg. F. so as to produce 50 – 60% relative humidity in patient, diagnostic, and critical healthcare areas.

There will be no specific separation between these clinical and healthcare areas except for the normal closing of doors, etc. but these will be the main conditions that we will seek to maintain.

Crime Prevention Through Environmental Design (CPTED)

Crime prevention through environmental design is a multi-disciplinary approach to deterring criminal behavior through environmental design. CPTED strategies rely upon the ability to influence offender decisions that precede criminal acts.

Strategies for the Built Environment

CPTED strategies rely upon the ability to influence offender decisions that precede criminal acts. Research into criminal behavior shows that the decision to offend or not to offend is more influenced by cues to the perceived risk of being caught than by cues to reward or ease of entry. Consistent with this research, CPTED based strategies emphasize enhancing the perceived risk of detection and apprehension.

The proper design and effective use of the built environment can reduce crime, reduce the fear of crime, and improve the quality of life. Built environment implementations of CPTED seek to dissuade offenders from committing crimes by manipulating the built environment in which those crimes proceed from or occur. The three most common built environment strategies are natural surveillance, natural access control and natural territorial reinforcement.

Natural surveillance and access control strategies limit the opportunity for crime. Territorial reinforcement promotes social control through a variety of measures.

Natural Surveillance

Natural surveillance increases the threat of apprehension by taking steps to increase the perception that people can be seen. Natural surveillance occurs by designing the placement of physical features, activities and people in such a way as to maximize visibility and foster positive social interaction among legitimate users of private and public space. Potential offenders feel increased scrutiny and limitations on their escape routes.

Place windows overlooking sidewalks and parking lots.

Leave window shades open.

Use passing vehicular traffic as a surveillance asset.

Create landscape designs that provide surveillance, especially in proximity to designated points of entry and opportunistic points of entry. Do not use landscape and building design that form hiding places for perpetrators of crime.

Use the shortest, least sight-limiting fence appropriate for the situation.

Use transparent weather vestibules at building entrances.

When creating lighting design, avoid poorly placed lights that create blind-spots for potential observers and miss critical areas. Ensure potential problem areas are well-lit: pathways, stairs, entrances/exits, parking areas, ATMs, phone kiosks, mailboxes, bus stops, children's play areas, recreation areas, pools, laundry rooms, storage areas, dumpster and recycling areas, etc.

Avoid too-bright security lighting that creates blinding glare and/or deep shadows, hindering the view for potential observers. Eyes adapt to night lighting and have trouble adjusting to severe lighting disparities. Using lower intensity lights often requires more fixtures.

Use shielded or cut-off luminaires to control glare.

Place lighting along pathways and other pedestrian-use areas at proper heights for lighting the faces of the people in the space (and to identify the faces of potential attackers).

Natural surveillance measures can be complemented by mechanical and organizational measures. For example, closed-circuit television (CCTV) cameras can be added in areas where window surveillance is unavailable.

Natural Access Control

Natural access control limits the opportunity for crime by taking steps to clearly differentiate between public space and private space. By selectively placing entrances and exits, fencing, lighting and landscape to limit access or control flow, natural access control occurs.

Use a single, clearly identifiable, point of entry

Use structures to divert persons to reception areas

Incorporate maze entrances in public restrooms. This avoids the isolation that is produced by an anteroom or double door entry system

Use low, thorny bushes beneath ground level windows.

Eliminate design features that provide access to roofs or upper levels

Use waist-level, picket-type fencing along residential property lines to control access, encourage surveillance.

Use a locking gate between front and backyards.

Use shoulder-level, open-type fencing along lateral residential property lines between side yards and extending to between back yards. They should be sufficiently unencumbered with landscaping to promote social interaction between neighbors.

Use substantial, high, closed fencing (for example, masonry) between a backyard and a public alley.

Natural access control is used to complement mechanical and operational access control measures, such as target hardening.

Natural Territorial Reinforcement

Territorial reinforcement promotes social control through increased definition of space and improved proprietary concern. An environment designed to clearly delineate private space does two things. First, it creates a sense of ownership. Owners have a vested interest and are more likely to challenge intruders or report them to the police. Second, the sense of owned space creates an environment where “strangers” or “intruders” stand out and are more easily identified.

By using buildings, fences, pavement, signs, lighting and landscape to express ownership and define public, semi-public and private space, natural territorial reinforcement occurs. Additionally, these objectives can be achieved by assignment of space to designated users in previously unassigned locations.

Maintained premises and landscaping such that it communicates an alert and active presence occupying the space.

Provide trees in residential and commercial areas. Research results indicate that, contrary to traditional views within the law enforcement community, outdoor residential spaces with more trees are seen as significantly more attractive, more safe, and more likely to be used than similar spaces without trees.

Restrict private activities to defined private areas.

Display security system signage at access points.

Placing amenities such as seating or refreshments in common areas in a commercial or institutional setting helps to attract larger numbers of desired users.

Scheduling activities in common areas increases proper use, attracts more people and increases the perception that these areas are controlled.

Territorial reinforcement measures make the normal user feel safe and make the potential offender aware of a substantial risk of apprehension or scrutiny.

Appendix

8

Selected IHS Technical Handbook Index

A8 Selected IHS Technical Handbook Index

http://www.ihs.gov/oehe/index.cfm?module=handbook

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Appendix

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List of Electronic Attachments

A9 Electronic Attachments

The following attachments may be downloaded from the DES document access portal, online at: http://www.des.ihs.gov/index.cfm?module=dap.

1. **2013 Architect / Engineer Guide**
2. **Design Comment Review Form & Instructions**
3. **DES Title Block**
4. **Example Space Accounting Reports**
5. **HHS Sustainable Buildings Checklist for Projects**

The Department of Health & Human Services
Indian Health Service
Office of Environmental Health & Engineering
Division of Engineering Services