NEW MEDICAL CENTER
VAMC Orlando, Florida

DESIGN NARRATIVE
S-2 Schematic Design
3 November 2008

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"Forward"

Several milestones have been achieved since the last Orlando VAMC submission. The 65.9 acre land parcel was purchased September 11, 2008. Orlando VAMC groundbreaking ceremony was held October 24th, 2008. Attendees included VA Secretary James Peake, Florida Governor Charlie Crist, Congressmen Tom Feeney, John Mica, Dave Weldon, Ric Keller, Congresswoman Corrine Brown and Florida Senator Mel Martinez. The theme of this groundbreaking ceremony was honoring veterans and honoring the commitment made to care for those who have borne the battle.

This submission is also an important step in bringing inpatient beds and healthcare services closer to the 400,000 veterans in Central Florida.

To maximize the ability of the new Orlando VAMC to meet healthcare needs, six rounds of user meetings were to assist in communicating program requirements. Issues such as equipment, space requirements, functional layout, lighting and electrical requirements were discussed. Champions from various VAMCs in VISN 8 worked with each user group. Operational decisions and issues were addressed by the Orlando VAMC quadrad. The Orlando Design Steering Committee, chaired by Orlando VAMC Director Tim Liezert provided guidance and oversight to the overall process.

Tangible accomplishments of this submission include:

- Meets criteria for silver level of LEED certification
- Maximizes flexibility by using the same footprint for ICU, acute care bedrooms, and mental health patient rooms
- Incorporates family zone in all patient rooms
- Promotes healing environment with 100% single bedroom concept
- Includes space for residents and students
- Maximizes clinical adjacencies
- Separates patient and staff flow
- Gross Square Footage stayed within the total approved space plan

The VAMC design team continues to work towards achieving a medical center that promotes honoring veterans, safety, sustainable design, flexibility and staffing efficiency. We look forward to design development and each step along the journey that brings needed medical care closer to veterans in East Central Florida.

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1. PROJECT DESCRIPTION AND OUTLINE

1.1 Executive Summary

S1 DESIGN PHASE

The S1 design phase for the proposed new Veterans Hospital to be located in Orlando, Florida was completed and submitted in July 2006. During the presentation of S1 to the Veterans Administration's Senior Management and Sponsors of the project approved Concept Number Three for further development. The Joint Venture (JV) Design Team of RLF and Ellerbe Becket were then directed by the VA to commence the S2 design phase, which was started in October 2006 and completed and submitted in May, 2007.

S2 DESIGN PHASE

At the S2 VA Peer review held on June 27, 2007 the VACO indicated that specific supplemental information from the MEP disciplines would be required before the VACO would approve the S2 design phase. Per mutual agreement with the VACO, the Joint Venture of RLF and Ellerbe Becket developed a "Supplemental MEP Submission S-2 Schematic Design", dated 5 September 2007 that addressed all of the VACO stated MEP concerns. That supplemental information was sent to the VACO on September 5, 2008. Unbeknownst to the JV, the VACO did not receive the Supplemental MEP Submission. On May 12, 2008 at a meeting with Sat Gupta, the JV agreed with VACO to re-deliver a copy of the Supplemental MEP Submission to the VACO and then review the contents with VACO staff. Although the previously agreed upon information was provided, the JV was also requested by VA to provide an additional project re-submission for S2 for review by VACO. This was to include a project re-submission overview presentation to the VACO followed by separate discipline review meetings as a condition to acceptance and concluding the S2 design phase.

The re-submission of the project for an S2 review was scheduled for October 31, 2008, with a follow-up review with VACO on November 19 and 20, 2008.

Upon completion and submission of the original S2 submission in May 2007, the project site for the new hospital for the VAMC Orlando had been identified but had not yet officially been selected. However, the VA anticipated finalization of the project site selection process would occur no later than June 26, 2008, finally giving the project design team a VA owned project site to locate the design of the new Veterans Hospital in Orlando, Florida.

DD 1 INTERIM DESIGN PHASE

As a result of not having a final site, the VA decided to task the Joint Venture to begin design-development-one (DD1) on the Clinic and Hospital portion of the project, but only as on interim effort with very limited and specific deliverables. The VA directed the JV to begin the first round of DD1 User Group meetings with the applicable departments at the VAMC in Orlando. The project management strategy was to allow the project design team and the VAMC to maintain a productive project continuity; the site would be 'formalized' by the end of the first user meetings; and that would permit the Joint Venture

to move into the remaining rounds of user meetings and the rest of the DD phases. This project management strategy successfully controlled the risk of not yet having a project site, as well as the eliminating the cost and conditions of a project design shutdown.

To plan-out the first user group meetings, and since these meeting would set the pace and style for the remaining 'user' meetings, the JV Design Team met at the offices of Ellerbe Becket in Washington, D.C. with Laura Finfrock and Joe Battle of the VAMC Orlando, as well as the VA, on June 28, 2007 to develop a project schedule by sequencing major activities through this initial DD1 effort in a one-day 'mini' wall scheduling meeting.

As a result of this meeting a comprehensive work plan was established for the DD1 interim submittal that identified the User Group preparation and meetings over a timeline of 12 weeks. The goal of the User Group meetings was to further develop the medical planning required for elaborating the design of the Clinic and Hospital only while complying with S2 programmatic and functional requirements and obtaining more detailed departmental feedback.

The Joint Venture began their first round of user group meetings with the VAMC Orlando Clinic and Hospital in July 2007 and completed them in mid-August 2007. The team interviewed a total of approximately 45 Departments that represent the VAMC Orlando Clinic and Hospital portion of the project during that time period.

During the previous S2 peer review, Dr. McDonald of the VACO made a comment about the surgery-planning layout. He made known his concern about the adjacency of SPD and the OR's. This issue was a large enough potential problem for moving the design of the D and T block forward that a separate meeting was planned for September 6, 2007 at the request of the VA at the VAMC Orlando to review possible options with the VA and VAMC project stakeholders. After that meeting the JV made further recommendations to the project stakeholders on possible solutions.

The JV team was tasked by the VA to produce the following deliverables from the first round of User Group meetings for the DD1 Interim Submittal:

a. The design team's first set of DD plans after the User Group meeting;
b. Any revised site plans, elevations and 3D rendering sketches of the project;
c. An initial equipment list/information;
d. Meeting minutes from the User Group meetings;
e. An initial project schedule developed from the June 28, 2007 wall scheduling.

The submission of the above-mentioned deliverables was intended as a confirmation that the first User Group meeting effort was accomplished and was not to be construed to be a finished DD 1 product as per the VA's Program Guide, PG-18-15, Volume B. The DD1 Interim Submittal was issued September 11, 2007.

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DD1 and 2 COMBINED DESIGN PHASE

From the submission of DD1 Interim Design Phase in September 2007 until March 2008, the Design Team continued to work on site design and 3rd Floor Hospital Surgical/SPD revisions. Within this time period the VA adjusted the assumed design bid-packages twice in order to finalize direction to the Design Team on expectations for developing the design documents for the pending DD phases. The actual SA-07 Notice to Proceed for the DD Combined Design Phase was initially issued May 2008.

The Joint Venture (JV) Design Team of RLF and Ellerbe Becket were directed by the VA to commence the Combined DD design phase, which was started in March 2008 and with the intent of issuing bid packages on a phased-completion schedule, with the last DD phase being completed in January 2009.

To plan-out the DD1 and 2 Combined Design Phase the JV Design Team met at the offices of Ellerbe Becket in Washington, D.C. with Laura Finfrock and Joe Battle, Tim Lizert and Jeff Birdsong of the VAMC Orlando, as well as the VA PM, Mike Heaton, on April 22 and 23, 2008 to develop a project schedule by sequencing major activities through this DD effort in a two-day wall scheduling meeting.

During the wall scheduling meeting the key milestone dates for the Award of the project became the major constraints in developing a project schedule. It was decided and agreed upon with the VA that in order to maintain the accelerated design schedule the Design Team would need to combine the DD 1 and 2 into a singular effort identified as the DD1 and 2 Combined Design Phase above. Additionally, sub submission dates for each bid-package were developed, and agreed upon with the VA stakeholders, with the critical-path-activity of the first bid-package, for the design of site-preparation, going uninterrupted through CD's without any interim submissions.

As an adjunct to the wall scheduling at a later date, the JV also accommodated the planning for the re-submission of the S2 for review by VACO that coincided with the scheduled date of conclusion for the DD1 and 2 Combined Design Phase for bid-packages 2 and 3.

The SA-07 for the DD phase was the first time the Design Team had been issued a Design-To-Funding-Limitation. This Limitation was under the presumed budget as presented in the S1 and S2 cost estimates but never verified by the VA until the SA-07 was issued. The JV immediately notified the VA Contracting Officer by letter that was sent to the VA PM, that the project exceeded the Design-To-Funding-Limitation and within that letter the JV requested direction, as required by the VA Agreement with JV.

The VA met for the first time with the JV, at VACO, on July 31, 2008 to discuss the JV budget issue. Discussions continued through August 2008 as pertinent cost-comparison information was provided and exchanged with the VA. The VA then met with the VAMC on September 29, 2008 to present to them the budget issue. The JV attended that meeting at the VA's request.

The Design Team was directed to continue to meet with the VA regarding project cost and possible cost reductions after the submission of the DD1 and 2 Combined Design

Phase and an updated cost estimate can be developed that represents the current scope of the project.

Finally, the S2 re-submission and DD1 and 2 Combined Design Phase design represented herein continues to incorporate the "Overreaching Project Goals" as established in S1 of:

- Honoring our Veterans
- Providing patient safety
- Providing staff flexibility
- Providing functional flexibility

The ultimate success of the project is being measured against these goals. All the project VA stakeholders and Joint Venture Design Team of RLF and Ellerbe Becket **proudly** present this S2 re-submission to you and respectfully encourage your review and comment of any portion of this submission document. We also invite any in-person presentation, evaluation and discussions with reviewers of this document at their convenience.

1.2 BIM

Based on the direction from the VA at the start of the Project the JV agreed to the use of Building Information Modeling (BIM) for documentation of the project design. The software selected to produce this was Revit. Because BIM represents a new software technology that is not yet suitable for large non-BIM-trained, non co-located JV design teams on large fast-paced projects such as this project, the JV has been challenged to effectively train architects, interior designers, structural engineers, mechanical, plumbing and electrical engineers, as well as consultants in using the product. This activity has and will affect the way design documentation is provided to any client and created much inefficiency in its initial use. The actual training, though assumed in the wall scheduling to occur before the start of the DD phase, happened after the start of DD, from the months of May through July 2008, because of the scarcity and availability of certified Revit trainers and coordination of the Design Team member's availability. The entire Design Team (both JV partners and consultants) attended Revit classes on an average of 40 hours per team member. Implementation of the software for the project is not a direct extension of learning the basics or advanced subjects. Implementation requires the engagement of Revit experts to assure the databases were initiated correctly within the Design Team Revit users. Because the software is a database and everything that goes into a building is a database object - called families - the JV has developed, to-date, well over 3,000 families for use in the DD phase documentation database. The JV recommends that the VA engage the BIM software industry and determine an end use to assure that the incredible potential of the BIM database can be realized for the new Veterans Hospital located in Orlando, Florida, after the CD's Design Phase BIM models are submitted.

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1.3 Statement of Work

An initial Statement of Work was developed and provided to the VA in the S1 design phase to define the Scope of the project. The S2 design phase has elaborated on this

Statement of Work General Constraints or qualifications:

a. The Project program is based upon the DEPARTMENT OF VETERANS AFFAIRS, SPACE PLANNING PROGRAM (and) INFORMATION REPORT, for Orlando, FL and is a New (free standing) Hospital and will be a Silver certified LEED campus Project and will better the 90.1 ASHRE energy requirements by 30%.
b. The site information is based upon the assumptions provided by the VA Project Manager and is as follows:

    1. The site will be flat and approximately 1320 feet deep by 2150 feet long constituting 65 acres for development.
    2. A single major access road will be located along one side of the site.
    3. A loop road will surround the entire perimeter of the site allowing for complete internal vehicular access.
    4. New VA Anti-terrorism/Force Protection criteria will be applied to the site constituting: a security barrier/fence around the entire site, a 50 foot setback from this barrier/fence, a 50 foot setback from all parking and roads toward all occupied buildings and security vehicular gate/checkpoints will be established at all entrance/exits into the site.
    5. Three access points will be established providing a patient/visitor entrance/exit (consisting of four lanes with a landscaped median), a separate staff/service entrance/exit and an emergency relief exit to be used for unforeseen events.
    6. Approximately 17% of the site will be used for storm water retention generated by this development.
    7. A heli-stop will be added for emergency patient transfers.
    8. Parking for twenty-five hundred (2,500) cars will be provided with 75% in structured spaces and remaining in surface spaces.
    9. The main Hospital / Clinic will be a multi-floor structure along with six separate structures consisting of a Nursing Home, Domiciliary, Engineering / Warehouse, and Parking Garage connected to the main facility via protected walkways and a detached central energy plant that will serve all first and future facilities.
    10. The number of building entrances will be kept to a minimum and any cross circulation between patient and staff will be minimized.
    11. Future development space will be provided for existing facility expansion, a new separate research laboratory building and a Fisher House.
    12. A minimum of two separate utility lines for each service will be provided.
    13. Facilities will be provided for seven days of emergency operations including generators for power, storage of fuel, storage of clean water, storage of supplies and waste.

c. The project construction cost, including furniture, furnishings and major medical equipment has not been established at this submission and therefore there was no "design-to" budget until SA -07 was issued.
d. All design process; criteria and deliverables are based upon the VA PG18-15B 2006 manual.
e. As of this submission there are no unanticipated environmental impacts or regulatory reviews that would affect the project.

1.4 Project Program

The current VA authorized program is 1,158,293 GSF, which includes all buildings except the CEP, Guard Houses, and Parking Garage. Refer to Section 10 of this document and Appendix A for the details of the program and its application

1.5 Project Site

The project site, which is located at the Lake Nona development in Orlando, has been selected and purchased by the Veterans Affairs It is a 65 acres piece of property located at the southern point of the Medical/Commercial district within Lake Nona. It is bounded by 2 lane roads to the north and east, by a lake/waterway to the south and the environmental conservation area to the west. A 25' landscape/easement runs along the west and north property lines and a 16' wide utility easement along the east property line. Stormwater is offsite. A maximum height of 143' has been negotiated with G.O.A.A, Access will be from 3 points concerning to surrounding roadways. A security fence will surround the entire site following the VA Physical Security Design Manual.

1.6 Project Development

The Project Design process, criteria and deliverables are based upon the VA PG18-15B manual. There are six distinct design phases to the project: Schematics 1 (S1), Schematics 2 (S2), Design Development 1 (DD1), Design Development 2 (DD2), Construction Documents 1 (CD1) and Final Bid Documents. However, at the start of DD the VA directed the JV to combine the DD1 and DD 2 into one effort.

There are various bid packages that the project design documents will be issued as, these are currently defined as:

Package 1: Rough Grading / Main Road / Site Utilities / CEP Shell
Package 2: Chapel / CLC / RR
Package 3: Warehouse / Hospital & Clinic Foundations
Package 4: Hospital & Clinic Completion / CEP Build Out
Package 5: Parking Structures & Connectors

1.7 Project Cost Control

See the Cost Control Section ___ for project cost information.

1.8 Project Schedule

Generally speaking the current project construction milestones will include early bid packages mentioned above. A current generalized design schedule is as follows:

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Design DD1 thru Final (phased): May 2007 to March 2010
Procurement and Award (phased): February 2009 to July 2010 (to be verified)
Construction (phased): April 2009 to October 2012
The Phasing section of this narrative will elaborate on the process.

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2. ARCHITECTURAL

2.1 Architectural Description

2.1.1 Inpatient Building

The five-story Inpatient Building is organized with one mechanical floor over three levels of nursing units on top of a one-story base with a total of 136 beds. The front of the building is recessed to provide a weather protected arcade along the length of the parking lot that leads to the inpatient entrance and walk-in emergency entrance. The inpatient entrance, security, emergency department, and Veteran's Benefits Administration are located on the first level. The emergency department has three distinct entrances, one for walk-in patients, one for ambulances, and one for decontaminated patients. The ambulance entry is covered by a roof to provide weather protection to patients. Just west of the emergency department, the building covers an outdoor area for mass casualty; biological/hazardous; and decontamination area out of the weather for patient and staff. The emergency department has two direct connections to the diagnostic imaging department. The inpatient lobby is a four story space that includes a seating area, an information desk, and an area to register patients that are checking in for inpatient stays and outpatient procedures. The open space under the building is adjacent to the decontamination entrance which will provide cover and services for a large event.

The Inpatient Building contains the majority of the elevators, separated by function. Four passenger elevators, two large patient elevators, and three service elevators are provided. The Inpatient Building is connected to the Diagnostic and Treatment Building with two 2-story atriums that have common activity areas on the ground floor, waiting on the third floor and corridors on the second and fourth floors connecting the two buildings at strategic points.

The second floor is dedicated to the mental health nursing units, which are on the same level as the outpatient mental health facilities. These nursing units are also close to the emergency department for convenient admissions. Each mental health unit has 20 beds, 2 seclusion rooms, and an outdoor activity area located on the roof of the first floor. The nursing units are recessed back from the face of the building above on the north side. This setback has the potential to be built out in the future.

The third floor of the Inpatient Building contains two intensive care units on the west wing and a surgery step-down unit on the east wing. The intensive care wing includes 12 medical and cardiological beds and 12 surgical beds. The surgery step-down unit includes 24 beds. The intensive care units are adjacent to the patient elevators, the on-call suite, and a corridor that leads directly to the surgery suite. The front of the building has the waiting areas for the intensive care units and a vending area along the front of the building along the atrium window wall. The waiting areas are connected to the Diagnostic and Treatment Building with a corridor and waiting areas for outpatient procedures.

The fourth floor of the Inpatient Building contains two 24-bed nursing units for medical patients and a 10-bed hoptel unit. One public corridor connects the Inpatient Building to the administrative office level of the Diagnostic and Treatment Building.

The fifth level contains mechanical and electrical equipment penthouse. The center of the building includes a taller space than the east and west wings to accommodate fresh air and exhaust louvers.

Future expansion potential is provided by adding a new four-story wing on the south side of the Inpatient Building.

2.1.2 Diagnostic and Treatment Building

The Diagnostic and Treatment Building is a four-story structure containing all of the ancillary, diagnostic and treatment services for the inpatients accommodated in the patient tower to the south and the high volume of outpatients from the Clinical Services Building to the north. At grade level the building is virtually divided into two sections by a two level grand corridor or boulevard interconnecting entrances, lobbies and atriums of the two flanking campus unit: the Clinical Services to the north and the Inpatient Building to the south. The prominence and scale of this boulevard responds to the anticipated volume of traffic from both entrances, lobbies and the atriums between each of the buildings.

The Atrium between the Diagnostic and Treatment Building and the Clinical Services Tower is beautifully scaled to accommodate a large and bustling volume of ambulatory patients and their families. The first floor contains all of the dining areas; overflow waiting space for peak time within the adjacent medical departments and the Pharmacy. This main atrium provides access to exterior dining space and healing garden.

The two 2-story atriums between the Nursing Tower and the Diagnostic and Treatment Building are considerably smaller based upon the anticipated volume of traffic between the two functional areas. The atriums provide a strong naturally lighted focal point for anxiety relief and wayfinding. The east wing contains the Food Service, the Outpatient Pharmacy, the Canteen, Travel Office, Credit Union and Volunteers. This wing is directly linked to the warehouse loading dock and other service components.

The west wing contains Outpatient Laboratory Services, Comprehensive Diagnostic Imaging (Radiology, Fluoroscopy, Mammography, Ultrasound, Nuclear Medicine, PET Scan, CAT Scan and MRI). Each of the imaging specialties flanks the primary internal corridor linking directly to the Emergency Department and the inpatient elevators from the patient floors. Comprehensive diagnostic imaging also has a direct link to mobile technology units to the west of this department. Radiation Oncology is located at this level with internal and external access. Non-Invasive Cardiology is also located at this level between the Emergency Department and the Imaging Services with direct patient access from the boulevard, and inpatient access from the adjacent inpatient nursing units. Both the East and West wings are planned for horizontal expansion at grade and vertical expansion on the roof areas above.

The second floor of the west wing contains the Clinical Laboratory Services with direct internal linkage to outpatient laboratory services/specimen collection at the Ground Floor by dedicated stair and dumbwaiter. The clinical lab is connected internally with a pneumatic tube station to the inpatient building and clinical services. The frozen section lab is located on the third floor near surgery with a dedicated stair to the second floor lab. The combined Pulmonary Medicine, Neurology and Sleep Lab are located adjacent to the Laboratory and the atrium.

The second floor west wing contains the Main Pharmacy which also links directly to the Outpatient Pharmacy at Ground floor by dedicated stair, dumbwaiter and pneumatic tube. MAS Services, Occupational Health, Respiratory Therapy, Union and Telephone Operators are also located in this wing.

All of these services connect directly to both Inpatient and Outpatient facilities by bridging the adjoining atriums to the north and south. The balcony level of the boulevard interconnects all three buildings providing appropriate linkage between the Mental Health clinics and the Inpatient Mental Health units in the Inpatient Building.

The third floor contains both Inpatient and Outpatient Surgery and all other related invasive services, such as Invasive Cardiology, Digestive Diseases and Pulmonary Medicine. The only other department on this level is the Supply Processing & Distribution Department. Peripheral circulation enables staff and equipment passage between all three buildings. It should be noted that all patient access to and from the suite comes from the Inpatient Tower with registration at the first floor and delegated waiting for both patients and families at the third floor adjacent to the Surgical Suite.

The fourth floor is primarily an administrative floor. West of the main north-south corridor are located Personnel, Fiscal, the Nursing Service Administration, the Medical Service Administration, and at the west face of the building, the Director's Suite. Personnel is located immediately adjacent to the large Atrium for ease of access for potential employees. Nursing Admin and Medical Admin are located in the center of the space. Fiscal is located on the south side of the Director's Suite. The Director's Suite has west-facing windows.

East of the north-south corridor is located the Information Resource Management Service. The computer room is internal to the department, with offices and support spaces surrounding it. A primary expansion zone is located on the roof to the east of Information Resource Management Service.

2.1.3 Outpatient and Atrium Building

With its location centered between the two parking garages, the atrium portion of the Clinic building will serve as the main entrance to the facility. From the west parking garage a patient will have immediate access to an information desk. Central Registration, kiosk check-in, and public elevators. The atrium provides a direct route northward to the outpatient wings and a direct route southward to the amenities, support services, the Diagnostics & Treatment Building, and to the Inpatient Building beyond.

The Outpatient Building is comprised of four occupied levels with a top story mechanical and electrical penthouse. The entrance into this building will function as a ceremonial entrance into the medical facility as visitors to the VA Orlando Medical Center will park at and enter from the west parking garage side. Each of the two wings of the Outpatient Building are connected by a bridge across the atrium into Diagnostic & Treatment Building. Most of the area of the building is occupied by the clinic modules of Primary and Specialty Care, and those fourteen modules set the parameters of the building structure to accommodate typical dimensions of exam and support space throughout which would allow expansion of the modular concept in the future.

The flow concept is based on the division of the outpatient program into two straight wings such that a patient or visitor entering centrally from the atrium, would not be faced with a long distance or encumbered trek to the reception points of the clinics. Each of the two wings also includes another pair of elevators approximately 2/3 of the way down the corridor to improve both patient and staff flow within the facility.

The first three levels of the outpatient building are wholly patient-focused. The first floor accommodates Dialysis (in order to provide the most direct, unencumbered route for those often severely ill patients from covered parking in the garage), Audiology (in order to efficiently accommodate the hefty audio booths which required recessed slab installation), six of the clinic modules, Central Registration, and the Canteen dining area. The second level houses the Eye Clinic, the Mental Health outpatient group (situated on the same floor with the Mental Health Inpatient Units on the other side of the Medical Center), four more of the clinic modules, and Chemotherapy. The third floor occupants are Dental Clinic (on a floor with easy access to SPD on which they are highly dependent), Prosthetics and Rehab Medicine (close to the bridge to the garage), and three more of the clinic modules (those which are the most procedural among the modules).

The top level accommodates both staff and patient services, including the last of the clinic modules, the Library, Education, Research, and Media services. This level has the capacity in the future to be renovated into more clinic modules and expanded outward onto the roofs of lower portions of the building.

2.1.4 Community Living Center (CLC) and Chapel

The one story Community Living Center is located to the south of the site on the main loop road. The main entry is located off the loop road directly across from the Hospital main surface parking. A service entry is located off the loop road, centrally located with in the campus. The campus is composed of five structures, an administrative building and four residential nursing units all connected to one another by enclosed corridors.

The administrative building is composed of three areas. The central portion contains the primary entry with an administrative office area, multipurpose/dining area and a rehabilitation/recreation area. The administrative area and common use areas are separated by a large open courtyard which provides additional recreation areas and natural day lighting to the common areas. The building services area and a loading dock with storage areas flank either side of the central portion and are accessed by central

corridors. This administrative building is connected to the four residences by enclosed corridors.

Each of the four community living residences is divided into two wings each wing housing 15 single bedrooms, providing a total of 120 bedrooms. The two bedroom wings are gathered around a central commons area with a sub-nursing station, sitting room, kitchen facility and support spaces. The central common spaces open into and provide access to an outside courtyard with both covered patio area and an open landscaped courtyard, mechanical, electrical and communication spaces are located in each of the four community living residence.

The Chapel is a stand alone building located at the south end of the site, on axis with the main hospital/clinic building, along the lake adjacent to the CLC. It is primarily a one story structure with a double height volume in the nave.

The chapel supports multi-denominational services and has the flexibility for non-denominational functions. Housed within the chapel building are the chaplain's office, secretary, nave, sacristy, Chapel of Repose, public restrooms and spaces for mechanical, electrical and communications that support the chapel only.

2.1.5 Domiciliary

The four-story Domiciliary is organized with two levels of patient rooms on top of a floor of multi-use space for the compensated work therapy program on top of a wide common area base. The main entrance, reception, administration, common areas, and building support areas are located on the first level. An outdoor recreation area will include a covered pavilion, grille and dining areas basketball court, volleyball court, horseshoe pit, and low ropes course.

The second floor is dedicated to the compensated work therapy program. It contains a computer training area, training rooms, offices and support areas.

The third floor of the Domiciliary contains 32 beds in 15 two-bed rooms and 2 one-bed rooms.

The fourth floor of the Domiciliary contains 28 beds in 14 two-bed rooms. The multi-living unit is located on this level.

The main mechanical equipment room and electrical equipment room are located on the first and second level to keep the upper roof clear for future expansion. This building is design for future vertical expansion.

2.1.6 Warehouse/Engineering

The Warehouse is a separate building located to the east of the Diagnostic & Treatment Building. A future expansion zone is retained between the two buildings. Trucks are kept at a safe distance from the main buildings but the supplies can move directly to the buildings through two connecting corridors and a tunnel connection. The Warehouse has evolved into a combined-use building containing Warehouse, Engineering, Environmental Management Services, Acquisition Administration, and Medical

Administration Service components. Food Service deliveries will move directly through the Warehouse to the Dietetics department. Several other departments have storage areas in the warehousing portion of the building.

The first floor of the Warehouse contains the shipping and receiving docks, part of the service yard area, with warehousing storage directly adjacent. The intended stacking height is five pallets high. Some areas of the storage will be kept separated and secure. Also located adjacent to the dock is the linen service area. Currently the concept is to use laundry delivered from another location. Clean linen will be off-loaded from trucks and delivered into the building by an enclosed automated delivery system through the tunnel. Soiled linen will be returned by the same enclosed containers and loaded onto the trucks. Also located on the main floor are the Engineering shops with their supporting Tool Crib.

On the second floor are located the offices for Engineering, Environmental Management Services and Acquisition Administration. The Reproduction Room handles large scale printing and copying from this location. The toilets, lockers, and lounge on this level serve the warehousing, engineering, and environmental management staffs. There is an electrical and mechanical penthouse above a portion of the offices. Adjacent to the service yard will be the oxygen farm

2.1.7 Central Energy Plant

The central energy plant building is currently located at the northeast corner of the project site across the loop road. The building is a multi volume high-bay structure divided into two separate areas housing the main electrical services and the main mechanical services for the campus. Various service yards containing fuel tanks, etc. are located around the building with access off the main loop road. There is a water tower adjacent to the CEP to the north and cooling towers are located on the roof of the mechanical portion of the building.

2.1.8 Parking Garages

The parking garages are seven story structures containing 1,200 spaces in each of two structures for a total of 2,400 spaces for patients, visitors and staff. The parking garages flank the atrium structure. The western parking garage will serve patients and visitors while the eastern garage will serve mainly staff.

The visitor/patient entrance is located to the west connecting with the perimeter road.. The staff entrance is located to the east near the main staff entrance located at the east portion of the site. For both garages vehicular ramps are located near the entrance of the structure providing a constant slope.. No parking occurs on any sloped areas of any garage.

Stairs and elevators along with convenience toilets are located within each structure near the entrance points to the Atrium. Secondary entrance points leading to the southern portion of the atrium are intended for cardkey access or general exiting only. Within the parking deck, light courts are cut out of the center of each floor along it's length allowing natural light into the structure softening the illumination transition

between the outdoor daylight and deep shade that will be present within the garages. These light wells also provide opportunities for tall landscaping features to border the vehicular ramps.

Along the north and sough facades of each structure, full height ornamental metal screening will be provided to prevent "hop-overs".

2.1.9 Guard Houses

The guard house structures are one story buildings with covered vehicular drive-throughs located at the north end and south end of the property at the staff and patient/visitor entry points. These guard houses contain a small office for several security guards along with toilets and engineering support spaces to monitor property access. These facilities will normally be open for through traffic with the ability to screen and clear vehicles accessing the property during heightened security times. Each of these structures will have a visitor access window and associated parking for security vehicles and personal vehicles seeking site access/clearance when required.

2.2 Enlarged Plans

2.2.1 Inpatient Building

The enlarged room plans for the Inpatient Building include typical patient rooms for the intensive care room, acute care room, and the mental health care room. All of the rooms are organized with toilet rooms along the corridor side that they will be full of daylight and the family areas will be a little roomier. All of the rooms are the same width, so that they may be adapted to other uses in the future with the least amount of disruption possible. All of the patient rooms on all of the units will be handicapped accessible.

2.2.2 Outpatient Building

A typical exam room from a clinic module is included at enlarged scale and illustrates the concept of a two-sided exam room. Patients and those accompanying them will enter always from the public side, and only staff will enter from and exit to the private side.

The public side of the room lies on a semi-public corridor in which a patient has already progressed through the barrier door separating this side from the public waiting areas and main corridors. This side of the clinic module includes the exam room support spaces, such as clean and soiled utilities, and consultant offices, such as those for Pharmacists, Dietitians, and Social Workers, The private side includes the shared and private work areas of the medical staff.

Within a typical exam room, we will accommodate three sitting people, including a medical provider, a patient, and a patient's accompanying visitor. The room can accommodate one of them on a stroller and another in a wheelchair, though it would be tight in this size room. In order to allow the provider a comfortable position to face the other two people, the work desk will be retractable / extendable, and the computer monitor will swivel and extend so that any provider may locate it in a comfortable position for the task as hand, including patient interviews and discussions. In order to increase the open area to accommodate the stroller, a wheelchair, and mobile medical

equipment, we will limit the extent of casework to that which can accommodate a handwashing sink with a cabinet above.

2.2.3 Domiciliary

The enlarged room plans for the Domiciliary include four different types of patient rooms, a typical two-bed room with a shared toilet room, a handicapped accessible two-bed room with a shared toilet room, a single patient room, and a multiple living unit. All of the rooms are organized around toilet rooms along the corridor side of the rooms so that the patient areas will be full of daylight.

2.2.4 Community Living Center (CLC)

The enlarged room plan for the Community Living Center are designed as an acuity adaptable room that can accommodate patients requiring more critical care and those with special needs such as bariatric and dementia patients. Each room is designed for a single occupant with their own toilet room including sink and shower. The toilet rooms are located along the central corridor wall allowing for better acoustical privacy within the bedroom and more access to natural day lighting from the exterior.

Each room will be equipped with medical gases which are configured to allow for multiple bed arrangements and equipped with overhead lift tracks going from the bed area directly into the bathroom to the toilet. Each bedroom has built-in wardrobes, storage and a desk unit along with a flat screen television with adjustable brackets for best viewing. A full height bay window is provided along the exterior wall allowing access to able and disabled patients. All of the patient rooms in all of the units will be handicapped accessible.

2.3 Elevations

2.3.1 Inpatient Building

The Inpatient Building is the portion of the Hospital / Clinic building located at the southern end of the complex. The building is composed of two four story wings sitting on top of a one story diagnostic & treatment platform containing the main inpatient entrance, security, the Veteran's Benefits Administration and emergency department. The engineering services are contained on the uppermost story beneath a folded panel clad in metallic panels framing the entire facade to create a monumental façade and front face for the complex. The patient rooms located on either side of the building are primarily clad in glass held in precast frames. The folded metallic panel is bisected by curved overroof structure that sweeps through the Hospital-Clinic complex beginning and ending at either entrance acting as a wayfinding device and containing the engineering services for the main complex.

2.3.2 Diagnostic & Treatment

The Diagnostic & Treatment Building is the central portion of the Hospital-Clinic complex composed of a large singular block on four levels topped by a sweeping overroof connecting both mall entrances. A penthouse contains the engineering services on the roof level. The facades are primarily shallow precast frames with glass insets. Visually

the folded plate roof is composed of metallic panels. Beneath the exposed edge of this folded plate form mechanical louvers are inset which serve the mechanical systems housed on the fifth level. The large roof areas of the building most visible to public and staff will be basic green roof systems.

2.3.3 Outpatient and Atrium Building

The Outpatient Building is the northern portion of the Hospital-Clinic complex composed of two five story wings running east-west flanking the secondary entrance. At the joint between the two wings are four soaring columns grouped in pairs and framing the entrance. The glass and precast wings angle out toward the outpatient entrance creating a dynamic entry point and aiding in wayfinding through the complex. The southern façade contains waiting areas contained in precast panels jutting out from the façade face at angles allowing space for full height glazing between them. The east and west and north elevations are composed of precast panels with glazing in shallow recesses

The atrium space located between this building and the diagnostic and treatment block contains the main dining area, coffee bar and central registration. The facades are entirely of glass on either side held by an interior concrete framed structure. A central garden area, open to the sky, allows daylight and views of greenery to infiltrate the space.

2.3.4 Community Living Center (CLC) and Chapel

The Community Living Center is composed of five one story structures each with low and high roof elements with an alternating rhythm of facades. The finish materials of cementious planking, stone and stucco create a neighborhood of home–like structures. A cement tiled high pitched roof will be used to define common, vaulted interior spaces and low flat roofs of varying height will provide a residential scale to the bedroom wings. Courtyards with both covered and landscaped will provide exterior spaces. Sun screen shading devices will be used on connecting corridors and at the residents' rooms to reduce solar heat gain and glare.

The Chapel uses the same material vocabulary as the rest of the buildings on the campus, but closely relates to the more residential CLC. The single story portion is primarily a combination of stucco and stone veneer. The two story volume has two full height precast and glass mosaic walls on the east and west walls allowing natural light to fill the space during the day and act as a lantern during the night to the surrounding hardscaped areas. The roof on the single story portion is flat and the two story volume is pitched with concrete tiles.

2.3.5 Domiciliary

The building exterior is predominantly precast concrete cladding to have an appearance compatible with the hospital. The bedroom floors, 3rd and 4th, have large horizontal windows for maximum daylighting while maintaining privacy. The office windows on the 2nd floor have a lower sill height, creating a demarcation in the four story portion of the

building. The long side of the building with the most windows will be oriented to the north and the windows to the south side will be equipped with sun shading devices.

The roof over the one story portion of the building has a tilted and raised roof section to provide daylight to the inner informal activity area. The one story portion with north-facing glass brings light into the activity areas along that face of the building.

The roof over the one story portion of the building will have a green roof.

2.3.6 Warehouse

The exterior of the warehouse will be clad predominately in precast concrete and metal panels to be visually compatible with the hospital. The south end of the building which contains the shops on the first floor and offices on the second floor has a large glass area to allow maximum of daylight for energy savings. The north end has a large glass area for daylighting for the warehouse storage space. The south facing glass will be shaded to control excessive heat build-up. There will be precast panels below the glass in both the offices and shops to protect the glass from damage.

2.3.7 Central Energy Plant

The central energy plant contains the main electrical and mechanical engineering services for the entire complex on one level. The exterior fenestration will be composed of stucco over tilt-up concrete construction with stainless steel fabric panels hung on a steel frame.

2.3.8 Parking Garage

The parking deck is a seven level structure composed of precast and cast-in-place columns. The fenestration is a combination of precast architectural panels and stainless steel fabric panels. Ornamental metal railings will be used along the perimeter edges and at the internal light courts as a safety device to deter "hop-overs".

2.3.9 Guard Houses

The guard house structures will be composed of precast and metal panels matching the main Hospital / Clinic building and providing a frame for the Hospital / Clinic building.

2.4 Building Sections

2.4.1 Inpatient Building

The Inpatient Building is composed of four occupied floors every 20'-8" vertically with an interstitial floor at 9'-0" at each level in addition to a mechanical penthouse at the roof level. A six story space will be provided at the front of the building at the main entrance reducing down to a one story height corridor leading south to a two story lobby space connected to the diagnostic & treatment block.

2.4.2 Diagnostic & Treatment

The Diagnostic & Treatment Building is composed of four occupied floors at 20'-8" vertically with an interstitial floor at 9'-0" at each level in addition to a mechanical

penthouse at the roof level. Capacity for vertical expansion will be provided at the eastern and western end of this structure.

2.4.3 Clinic Building

The Outpatient Building is composed of four occupied floors at 20'-8" with an interstitial floor at each level in addition to a mechanical penthouse at the roof level. The Clinic building is split into two wings joined by a three story tall atrium leading out into a full height atrium connecting the remainder of the Hospital / Clinic complex.

2.4.4 Community Living Center (CLC)

The Community Living Center is composed of five buildings each a one story structure with both high pitched roofs over double height commons areas and low roofs over administrative and living areas.

2.4.5 Chapel

The chapel will have double height spaces as well.

2.4.6 Domiciliary

The Domiciliary is a four story structure with no interstitial space.

2.4.7 Warehouse

The Warehouse facility contains a one story main warehouse and a two story engineering building combined. The Warehouse portion is on one level in a high-bay structure (double height) matching the height of the two story engineering building. An underground material tunnel is provided in the Warehouse connecting to the main Hospital-Clinic building.

2.4.8 Central Energy Plant

The central energy plant is a one story high bay structure.

2.4.9 Parking Garage

The parking deck is a seven story structure with parking on all levels. Light courts are cut through the center of the structure along the vehicular ramps. Elevators and stair nodes are located along the north face at the ends closest to the atrium.

2.4.10 Guard Houses

The guard houses are a one story structure with a one and half story height vehicle canopy crossing the road.

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November 3, 2008

3. AUTOMATIC TRANSPORTATION

3.1 Transport Narrative

This report outlines the vertical transportation system requirements to serve the proposed new VA Orlando Medical Center project in Orlando, Florida.

Background and facility program assumptions.

The Department of Veterans Affairs CARES Commission is in the process of developing a new replacement hospital for the VAMC Hospital in Orlando, Florida.

The space needs for the total facilities on the new campus totals 1.158 million square feet.

3.1.1 The Individual Facilities On Campus Included

a) A 134-bed inpatient wing including 22 ICU beds, 48 medical beds, 24 Surgical beds and 40 Mental Health beds; 4 levels plus interstitial levels.

b) Patient Care service facility including major diagnostic and treatment services, support services and administration.

c) An Outpatient Clinic wing of approximately 370,000 building gross square feet (BGSF) to handle approximately 675,000 annual patient visits.

d) A sub level tunnel connects the Hospital and Outpatient Clinic with the Warehouse for horizontal materials handling distribution.

e) A 120-bed CLC facility consisting of a main activity building and four single story housing buildings.

f) A 60 bed four-story Domiciliary facility.

g) A Warehouse connected via tunnel to the Hospital and Clinic and at grade. Note: The CLC and Domiciliary will each have there own loading dock to receive materials from the main warehouse.

h) Parking Garages

i) Central Energy Plant

3.2 Facility Plan Organization & Distribution Systems

The main Hospital and Clinic facility is a low profile 4 story building that has a large floor plate requiring special attention to the horizontal distances and potential cross traffic between patient and materials distribution. In order to reduce such potential cross traffic, a sub-grade tunnel is proposed.

An Automated Guided Vehicle (AGV) System is proposed to automatically transport materials handling carts via the tunnel from the Warehouse to the individual patient care levels in the main Hospital, and the Clinic facilities. The CLC and the Domiciliary will be serviced directly from the warehouse via over-the-road trucks.

The AGV System will automatically transport bulk scheduled deliveries such as supply carts, food carts, waste cart removal, etc.

A 6" Pneumatic Tube system will be provided for small item demand request transport throughout the patient care facilities. The CLC will also have pneumatic tube service directly to each care unit.

The main Hospital and Clinic will incorporate the VA Building System with interstitial space between each occupied floor level. The floor-to-floor distance is 20'-8".

3.3 Materials Distribution Operating Concepts

Loading Dock – The main loading dock is designed as a single point for receipt of all deliveries to the campus.

General Supplies – All vendor deliveries will be received at the main Warehouse loading docks. At this point, palletized items will be broken down and properly posted.

Note: all pallets will be discarded at this point. No pallets will be allowed beyond the Warehouse area.

The majority of supplies will be automatically transported to individual departments on carts that are configured to interface with the AGV system.

Direct Deliveries – Direct deliveries will be discouraged and kept to a minimum. Fed Ex, UPS and similar deliveries will be received at the loading dock and distributed to the end user by VA materials management staff.

Sterile Supplies – Medical supplies will be loaded on carts and dispatched from the Warehouse receiving area directly to the SPD department located on the third level (surgical department level).

A surgical case cart system will be implemented. Surgical supplies will be joined with the sterile packs, placed in surgical case carts ready for transport horizontally to the surgical suite. Most surgical case carts scheduled for the next day surgical cases along with back-up supply items will be transported to the surgical suite the evening before.

Medication Receiving – Pharmaceutical vendors will deliver Medications directly to the main pharmacy located on the second level. Vendors will use the dedicated SPD elevators to access the second level.

An automated dispensing system (ADM or PYXIS) will be utilized for dispensing medication and controlled drugs at the patient care units.

IV solutions will be stored within the Warehouse and dispensed directly to the patient care units or to the pharmacy for IV additives.

Linen Distribution – Soiled linen will be processed at an offsite laundry and clean linen will be delivered daily to the Hospital.

Bulk linen carts will be received directly at the clean linen staging room located within the main warehouse. Unit linen carts will be made up within the linen staging room prior to being transported to the patient care units.

A linen cart exchange system will be utilized for linen distribution within the Hospital, CLC and Domiciliary.

Linen exchange carts will be configured to interface with the AGV system for delivery within the hospital. The CLC and Domiciliary linen will be transported via over-the-road truck. Soiled linen will be transported via truck back to the warehouse for laundry contractor pickup.

Most linen transport will occur on the night shift automatically via the AGV system. Also the carts will have drop shelves so that the carts can be used for soiled linen collection and return via the AGV system to the loading dock.

Linen carts will be transported to the CLC and Domiciliary manually.

Food Distribution – Food product vendors will make deliveries to the main loading docks and transported to the nutrition department through the Warehouse.

Patient tray carts will hold 24 patient trays. Patient tray carts will be configured to interface with the AGV system.

Patient tray carts will be assembled in the Nutrition department and transported to the nursing units via the AGV system. Soiled trays will be returned to the nutrition cart washing area after each meal.

Food for CLC patients will be prepared and manually transported to the facility in bulk

Waste Handling – General and regulated waste materials will be properly contained. placed in carts and transported on the AGV system to the waste center at the main loading dock.

At this point, the waste will be separated into recyclable categories prior to being hauled away from the site by an outside contractor.

Medical waste will be place in red plastic bags, than placed in red carts and handled separately from other trash.

Food garbage will be processed through a garbage pulper disposer within the dietary department.

3.4 Traffic Study

Elevator Performance Criteria

The performance criteria used for this study is the culmination of the results of studies performed in hundreds of medical facilities ranging from freestanding outpatient facilities to 1,000-bed general medical and surgical hospitals. These studies encompassed facilities that were operated by governmental and private sponsorship.

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Given the impact of the estimated patient load and the intensive level of care required, the elevators in this facility must be capable of compliance with the following criteria:

Passenger (Public) Elevators

Average Interval (seconds) 30 to 35 seconds

Handling Capacity Over 14%

(% of assigned elevator population)

Patient/Service Elevators

Average Interval (seconds) Under 50

Handling Capacity 100%

(% of required 5-minute vehicular movement)

The elevator calculations and subsequent analysis are based on anticipated "elevator populations" that were developed from the base information provided by the Hospital.

3.5 Proposed Elevator Systems

This traffic analysis has been based on the functional and space program and the conceptual plans that were developed by RLF/Ellerbe Becket Architects.

The passenger vertical traffic requirements in the facility basically will be pedestrian (visitors and staff) in nature.

There will be some vehicular traffic such as wheelchairs encountered during the day particularly within the Clinic.

A significant volume of service and materials traffic is anticipated in the new Hospital and Clinic facilities.

Development of separate patient/service elevator systems and lobbies to prevent the co-mingling of patient/materials traffic and the public is desired.

In the analysis of vehicular traffic needs for the proposed facility, proper, effective patient care is of primary concern. It is imperative that a sufficient number of elevators be provided in the new facilities to meet the transport needs of patients and material delivery requirements. Elevator systems must be capable of supporting on-time deliveries of patient meals, patient supplies, medications, equipment and prompt, immediate transportation of patients for treatment and diagnostic care.

Patient/service movement, to be effective, should be separated from other types of traffic in a dedicated patient/service elevator system. Proper infection control precludes the mixing of patient and general passenger traffic. In addition to these environmental concerns, the psychological needs of the patient in transit can be better addressed when a dedicated patient vertical transportation system is provided. Use of a dedicated system will isolate and protect very ill patients transported to treatment areas and patients traveling to and from surgery from the public.

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Staff movement will distribute itself between the patient/service and passenger groups of elevators.

3.6 Elevator Recommendation Summary (See Elevator Core Locations)

Passenger Elevators - P1 (Hospital)

For the 4 active levels of the inpatient wing, we propose a four-car geared electric traction elevator system consisting of four – 4,000-pound passenger cars and will have a rated speed of 350 FPM. Based on the building design layout, it should be assumed that most staff members will use the passenger elevators when not assisting patients or transporting patients in wheelchairs or on gurneys.

Passenger Elevators – P2 (Clinic)

For the 4 active levels of the Clinic wing, we propose a five-car geared electric traction elevator system consisting of five – 4,000-pound passenger cars and will have a rated speed of 350 FPM.

Passenger Elevators – P3 (Clinic)

For the 4 active levels of the Clinic west wing, we propose a two-car geared electric traction elevator system consisting of two – 4,000-pound passenger cars and will have a rated speed of 350 FPM.

Passenger Elevators – P4 (Clinic)

For the 4 active levels of the Clinic east wing, we propose a two-car geared electric traction elevator system consisting of two – 4,000-pound passenger cars and will have a rated speed of 350 FPM.

Passenger Elevators – P5 (Clinic / Hospital)

For the four active levels, we propose two geared electric 4000 pound traction elevator at a rated speed of 350 FPM located between the Diagnostic Treatment Building and the Clinic to transport staff between these two facilities without utilizing the Clinic/passenger elevators.

Passenger Elevators – P6 (Warehouse)

We propose a single 3500 pound hydraulic elevator at a rated speed of 1250 FPM to transport staff to the second level of the Warehouse.

Passenger Elevators – P7 (Parking Garage)

For each parking garage, we propose two 4,000-pound electric traction elevators in each parking garage and will have a rated speed of 350 FPM.

Passenger Elevators – P8 (Domiciliary)

For the Domiciliary, we propose 3 two-car geared electric traction elevator systems consisting of two – 4,000-pound passenger cars and will have a rated speed of 250 FPM.

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Patient Trauma Elevators - T1 (Hospital)

We propose two-9000-pound Trauma elevator that will transport critical patients with a number of patient care team members. This elevator will service all 4 levels and will be rated at 350 FPM. These elevators are very important in transporting trauma and surgical patients from the ER and operating room to the ICU units.

Materials Distribution System (AGV System)

For bulk scheduled cart supply and waste cart transport, we recommend the use of an Automatic Guided Vehicle System (AGV) be used to automatically transport carts efficiently throughout the main patient care facilities. In order to move carts over the long horizontal distances, a dedicated tunnel below grade will connect the Warehouse to the Hospital / Clinic facilities. It is planned that the CLC will have access via the AGV system at grade level. It is planned that the CLC will have access via the AGV system at grade level.

Materials Handling Elevators S1

We propose two 4500-pound materials handling elevators for the AGV System located within the Warehouse that will access the below grade tunnel. These hydraulic type elevators will go two levels and will have a rated speed of 125 FPM. The primary purpose of these elevators is to transport materials and waste from/to the Warehouse. These elevators will be designed to accommodate the automatic guided vehicle system (AGVS).

Materials Handling Elevators S2

We propose two 4500-pound materials handling elevators for the AGV System located within the Hospital that will access the SPD department on the third level and extend down to access the tunnel. These electric traction type elevators will go four levels and will have a rated speed of 350 FPM. The primary purpose of these elevators is to transport materials and waste from/to the SPD department. These elevators will be designed to accommodate the automatic guided vehicle system (AGVS).

Materials Handling Elevators S3

We propose three 6000-pound materials handling elevators, two for the AGV System and one for equipment transport. These elevators will be geared electric traction type and will have a rated speed of 350 FPM. These elevators will service all levels including the tunnel level. The primary purpose of these elevators is to transport materials, equipment and waste from/to support services, including dietary, to/from the patient care units. These elevators will be designed to accommodate the automatic guided vehicle system (AGVS) and have capabilities for service limited staff transport.

Materials Handling Elevators S4 & S5

We propose two 4500-pound materials handling elevators, two for the AGV System located on the East and West sides of the Clinic. These elevators will be geared electric traction type and will have a rated speed of 350 FPM. These elevators will service all

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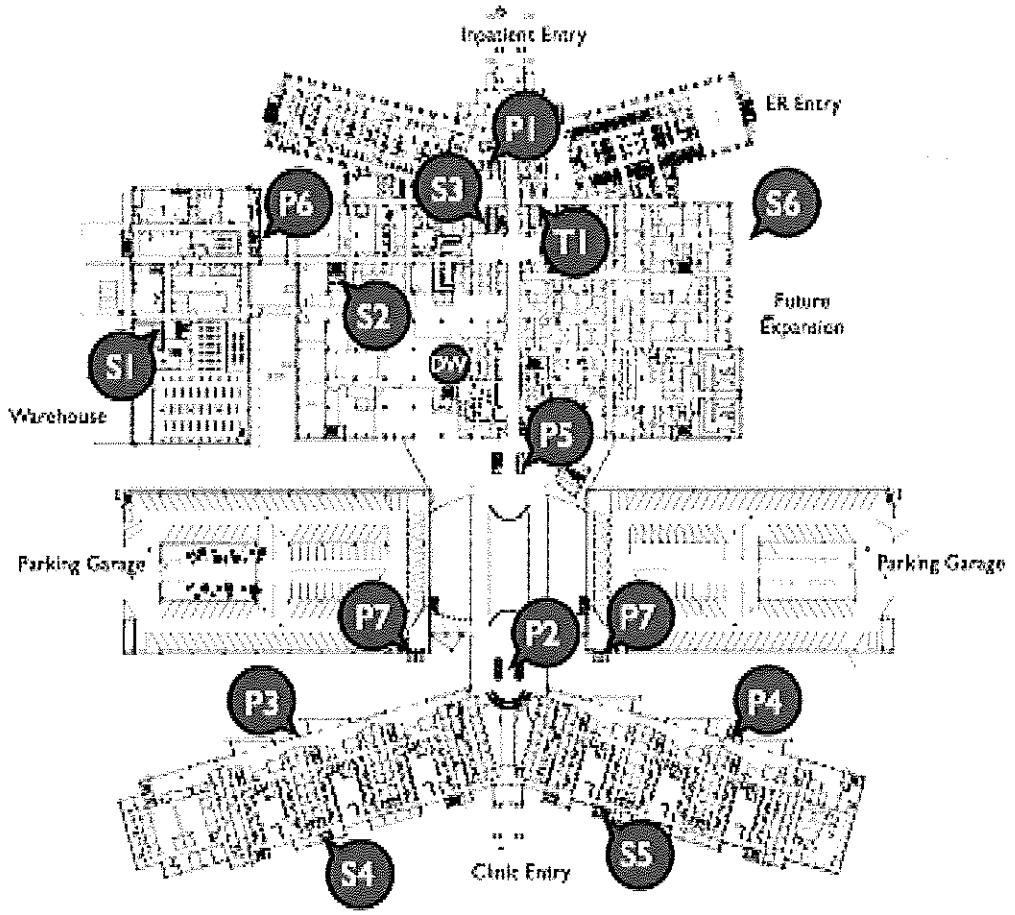
levels including the tunnel level. The primary purpose of these elevators is to transport materials, equipment and waste from/to the patient care clinics. These elevators will be designed to accommodate the automatic guided vehicle system (AGVS) and have capabilities for service limited staff transport.

Materials Handling Elevator S6 (Future)

We propose a service elevator to be located in the future addition that will service the east zone in the future. This future elevator would be a 6,000 pound elevator that will service all levels including the tunnel.



Elevator Core Locations

Dumbwaiter DW

We propose Two Dumbwaiters. A dumbwaiter is recommended to transport medications between the main; inpatient pharmacy on the second level to the outpatient pharmacy on the ground level. A dedicated dumbwaiter between these two areas would serve control medication transport requirements very well. A second dumbwaiter is recommended to transport Lab specimens between surgery and the main Lab. We recommend a 30" x 30" car for both services.

Pneumatic Tube System

A 6" pneumatic tube system will be provided for rapid demand response transport throughout the hospital, clinic and the CLC.

3.7 Vertical Transportation Preliminary Budget Costs

Budget costs estimated at this stage of the design process are conservative since not all of the design criteria have been fully established. The estimates below do not include general contractor's markup nor do they include escalation beyond today's market. The cost estimates will be refined as the design process continues.

Hospital	
Inpatient Wing	
4 Passenger Elevators (4 Stops)	$1,000,000.
2 Trauma Elevators (4 Stops)	$800,000.
1 Service Elevator (6 Stops)	$360,000.
2 AGV Materials Handling Elevators (5 stops)	$550,000.
D&T Zone	
2 AGV Materials Handling Elevators (4 stops)	$424,000.
2 Dumbwaiters for pharmacy & Lab (2 stops)	$100,000.
Clinic	
4 Passenger Elevators (4 Stops)	$1,000,000.
2 Passenger Elevators, East Side (4 Stops)	$500,000.
2 Passenger Elevators West Side (4 Stops)	$500,000.
2 Passenger staff elevators (4 Stops)	$550,000.
AGV Materials Handling Elevator East Side (5 stops)	$550,000.
1 AGV Materials Handling Elevator West Side (5 stops)	$550,000.
Warehouse	

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2 AGV Materials Handling Elevator (2 stops)	$110,000.
1 Passenger Elevator (2 stops)	$75,000.
Domiciliary	
2 Passenger Elevators (4 Stops)	$250,000.
Parking Garage	
2 Passenger Elevators, East Side (4 Stops)	$250,000.
2 Passenger Elevators, West Side (4 Stops)	$250,000.
6" Pneumatic Tube System (53 stations)	$1,325,000.
AGV System (base System + 20 vehicles)	$3,000,000.
Total	$12,144,000..

3.8 Inpatient Wing Elevators

Passenger Elevator Calculations

Passenger traffic demand will amount to 10% of the hospital population in a 5-min period. This population, for elevator purposes, should be based on a minimum of 3 people per bed and adjusted to reflect expected staffing in the facility.

The characteristic hospital traffic is a combination of both two-way and inter-floor traffic. Calculations are based on a two-way traffic approach.

Critical traffic periods occur at a number of times during the day. One of the most important periods occurs at about 3:00 p.m. When hospital nursing staffs are in shifts and a coincidental visitor peak may occur.

Given:

138 beds initially plus 72 beds future addition equals 206 total beds
4 floors
21 ft. average floor to floor heights

Handling Capacity:

Passenger traffic: 206 beds x 3 people per bed = 618 x 14% = 86.5 people per 5 min.

A passenger elevator has a 5 min. handling capacity of 10 persons.

Assume: 10 passengers up and 10 passengers down.

Elevator speed 350 fpm

Probable stops 10 passengers, 3 floors =2.9 stops up x 0.7 = 2 stops down.

Time to run up, per stop: 3 floors x 21 ft/ 2.9 stops = 22.8 ft. rise per stop.
22.8ft. = 7.2 sec.

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Time to run down, per stop: 3 x 21 / 2 = 33 ft. down per stop
33 ft. = 8.5 sec.

Elevator performance calculations:

Standing time

Lobby time 10 in and 10 out	=	18.0 sec.
Transfer time, up stops (2.9 x 2)	=	5.8 sec.
Door time, up stops (2.9 +1 x 5.3)	=	20.7 sec.
Transfer time, down stops (2 x 4)	=	8.0 sec.
Door time, down stops (2 x 5.3)	=	10.6 sec.
Total Standing time	=	63.1 sec.
Inefficiency factor, 15%	=	9.5 sec.
Sub Total		72.6 sec.

Running time

Run up (2.9 x 7.2 sec)	=	20.9 sec.
Run down (2 x 8.5 sec)	=	17.0 sec.
Total Round trip time	=	110.5 sec.
Handling Capacity = ((10+10) x 300) / 414	=	14.5 people
49.7 / 14.5	=	3.42 or 4 elevators

Average Interval

110.5 sec/ 2 eevators	=	55.3 sec.
110.5 sec/ 4 elevators	=	27.6 sec.
110.5 sec/ 3 elevators	=	36.8 sec.

For this condition, 4 passenger elevators are recommended based on the average interval time required between 30-35 sec.

Patient Service Elevator Calculations

Critical vehicular traffic reaches a peak at about 8:30 to 9:00 a.m. when patients are transferred for diagnostic and treatment procedures, the cleanup from the morning meal is in progress, supplies are transferred, and maintenance activities are in full swing.

Given:

138 beds initially plus 72 beds future addition equals 206 total beds.
4 floors
21 ft average floor to floor heights

Assume:

4 vehicles per 100 beds = 5.5 vehicles per 5 min.

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Elevator speed 350 fpm
5'-0" two speed center opening doors

Elevator performance

Standing time:

Time to load vehicles	=	15.0	sec.
Run one-half building height (average trip)			
4/2 x 22 = 44 ft x 60 = 2640 /350 fpm	=	7.5	sec.
Unload vehicle	=	15.0	sec.
Run return	=	7.5	sec.
Door time, down stops (2 x 6)	=	12.0	sec.
Average trip time	=	57.0	sec.

Handling Capacity:

206 beds / 57 sec. = 3.6 vehicles per elevator per 5 min.

4 vehicles per 5 min. / 3.6 = 1.1 or 2 elevators

For this condition, 2 Patient Service elevators are required for patient transport.

Note: Two large trauma elevators (Megivators) will be required to transport patients between Surgery and the Emergency department.

3.9 Clinic Building Requirements

Clinic Passenger Elevator Calculations

Even though the parking garage is connected to the Clinic facility on three levels, it is assumed that in elevated security levels all patients will enter the Clinic Building on the ground level before accessing the elevators for transport to the clinics on the upper levels.

Given:

Projected Outpatient Clinic visits = 675,000 annually.
4 floors
21 ft average floor to floor heights

Elevator utilization annually = 675,000 patent clinic visits

Daily elevator use

Clinic operations - 260 days per year, 5 days per week

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675,000 annual patient visits / 260 days per year = 2,596 daily visits.
2,596 x 10% = 259.6 or 260 people in 5 min.

A passenger elevator has a 5 min. handling capacity of 10 patient visits.

Assumptions:

10 passengers up and 10 passengers down
Elevator speed 350 fpm
4,000 pound elevators
48" two speed center opening doors

Probable stops 10 passengers, 3 floors = 2.95 up x 0.7 = 2 stops down

Time to run up, per stop:
3 floors x 21 ft / 2.95 stops = 22.4 ft. rise per stop
22.4 ft = 7.2 sec.

Time to run down, per stop: 3 floors x 21 ft / 2 = 33 ft. down per stop

33 ft = 8.5 sec.

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Elevator performance calculations:

Standing time

Lobby time 10 in and 10 out	=	18.0 sec.
Transfer time, up stops (2.9 x 2)	=	5.8 sec.
Door time, up stops (2.9 +1 x 5.3)	=	20.7 sec.
Transfer time, down stops (2 x 4)	=	8.0 sec.
Door time, down stops (2 x 5.3)	=	10.6 sec.
Total Standing time	=	63.1 sec.
Inefficiency factor, 15%	=	9.47 sec.
Total Standing Time	=	74.57 sec.

Running time

Run up (2.9 x 7.2 sec)	=	20.9 sec.
Run down (2 x 8.5 sec)	=	17.0 sec.
Total Round trip time	=	112.5 sec.

Handling Capacity = ((10+10) x 300) / 112.5 = 53.3 people
260 / 53.2 = 4.9 or 5 elevators

Average Interval 112.5 sec/ 5 elevators = 22.5 sec.

For this condition, 5 Clinic Passenger Elevators are required.

Floor Plate Layout and Elevator Locations

Elevator grouping and location – It is essential to position the elevators in locations that permit a maximum walking distance of 200' from the furthest point to an elevator.

Therefore we recommend a group of four elevators placed in the center of the Clinic and a group of two elevators places on each side of the Clinic.

Note: refer to Elevator Plans in appendix

Escalator Consideration

Consideration was given to the concept of utilizing an escalator at the Clinic lobby to quickly transport ambulant patients, staff and visitors between levels. The following calculations were analyzed to evaluate the benefit of an escalator at this location.

Escalator Calculations

Given:

Annual Clinic Visits – 675,000 visits
The Clinic facility operating hours will be one shift 5 days per week or 260 days per year

675,000/ 260 = 2,596 visits / day
2,596 / 8 =324.5 or 325 patient visits / hour

Assume each patient visit is accommodated by at least one family member.
325 patients x 2 = 650 people per hour.

Since the 4th level will be essentially education facilities and the first level will not require any vertical transport, the patient visits that will impact vertical transportation will be for services on the second and third levels.

Assume 2/3 of the patient visits will be for visits to the second and third levels.

2/3 x 650 = 433 people per hour.

Assume that 15% of these patients will definitely require vertical transport via elevators per hour.

433 x 15% = 65

433 – 65 = 368 people per hour

Potentially 368 people could be capable of using the escalator system.

Because of the location of the cafeteria and the access to the parking garage, it can be assumed that 200 additional people (or staff) per hour could use the escalator for vertical transport during the peak hour.

Thus, 368 + 200 = 568 people movements on the peak hour or
568 / 60 = 9.5 movements / min

An escalator moves 168 people / 5 min @ 90'/ min. or 33 people per min.

An escalator could handle 3.5 times the peak movements anticipated.

Therefore, an escalator is not an appropriate application for this condition and is not recommended.

3.10 Elevator Type & Description

The Passenger elevators considered for this facility have a capacity of 4,000 pounds. The standard platform for this capacity is 8'-0" wide by 6'2" deep. This platform will provide a net clear inside area of 6'-8" wide by 5'-4" deep. The entrances are located along the 7'-0" side and measure 4'-0" wide by 7'-0" high. The entrances are two-speed, center-opening. We recommend that a 12' wide lobby be provided for waiting passengers.

The Patient Trauma elevators considered for this facility will have a capacity of 9,000 pounds. This elevator will be used to transport critically ill patients that require a number of specialists to accompany the patient while in transport. The platform size for this elevator is 7'-9" wide by 11'-5" deep. The elevator entrance is 5'-0" center-opening doors.

The Materials handling elevators considered for this facility will have a capacity of 4,500 pounds. These elevators will be used as a service elevator to transport supplies and waste carts from/to the loading dock down to/from the ground level Warehouse and food

service department. The platform size for this elevator is 6'-0"wide by 7'-9 1/2" deep. The elevator entrance needs to be a minimum of 4'-0" wide.

Elevator Controls

Passenger Elevators

The passenger elevator groups will have electric traction hoisting equipment with variable voltage, variable frequency alternating current control systems.

Patient Trauma Elevators

The patient trauma elevators will have electric traction hoisting equipment with variable voltage, variable frequency alternating current control systems.

Operation

All elevators will have microprocessor operational controllers.

Each of the groups of passenger cars and patient trauma cars will have a group automatic operational system designed specifically for hospital use.

Standby (Emergency) Power

Each elevator system will be provided with standby power operation that will automatically return the elevators to the main landing, one elevator at a time, when the normal power supply is lost. The last elevator in each bank to arrive will remain in full service.

3.11 Outline Elevator Specifications

Elevator Equipment

Comply with the latest edition of the ASME A17.1 Safety Code for Elevators and Escalators, State of Florida Regulations, and ADA.

Passenger Elevators (Hospital / Clinic)

Quantity – Four (4)
Type – passenger – electric traction
Capacity – 4000 pounds
Speed - 350 FPM
Travel in feet – 88'
Number of landings -4 @ Lobby through 4
Number of openings – 4 in line
Front - all
Rear - none

Operation - two car group automatic operation- micro -processor
Control - variable voltage - variable frequency A/C

Platform - 8'-0" wide x 6'-2" deep

Net inside cab - 7'-8" wide x 5'-5" deep

Guide rails - steel tees at sides
Roller guides - 6 roller type
Buffers - oil
Cab - $25,000.00 allowance
Cab door size – 4'-0"" wide x 7'-0" high, center opening
Hoistway door size - same as car
Door operation - single speed, center opening - 2.5 FPS

- Fixtures and signals
- Two car operating panels
- Digital car position indicator
- Digital hall position indicator at first floor
- Hall lanterns at each floor
- Vandal resistant illuminated pushbuttons
- ADA accessories

Machine type - geared traction - overhead
Communication - ADA in car and fireman per code

Trauma Elevators

Quantity - Two (2)
Type - service – electric traction
Capacity - 9000 pounds
Speed - 350 FPM
Travel in feet 88'
Number of landings - 4
Number of openings - 4

- Front All
  Rear - none
- Operation — micro-processor

Control - variable voltage variable frequency A/C
Platform - 7'-9" wide x 11'-5" deep
Net inside cab - 7'-5" wide x 10'-6" deep
Guide rails - steel tees at sides
Roller guides - 6 roller type
Buffers - oil
Cab - $25,000.00 allowance
Cab door size –5'-0"" wide x 7'-0" high, two speed, side opening, double sided
Hoistway door size - same as car
Door operation – Side Slide Opening - 2.5 FPS
Fixtures and signals

- Two car operating panels
- Digital car indicator
- Digital hall position indicator at first floor

- Hall lanterns at each floor
- Vandal resistant illuminated pushbuttons
- ADA accessories

Machine type - geared traction - straight overhead
Communication - ADA in car and fireman per code

Materials Handling Elevators

Quantity – Nine (_9_) 7 electric traction & 2 hydraulic
Type – Service – electric traction/ hydraulic
Capacity – 4500 pounds
Speed - 350 FPM
Travel in feet – 88'
Number of landings -5
Number of openings – 5
Front - 5
Rear - 0
Operation - micro -processor
Control - variable voltage - variable frequency A/C
Net inside cab - 5'-8" wide x 7'-9 1/2" deep
Guide rails - steel tees at sides
Roller guides - 6 roller type
Buffers - oil
Cab - $20,000.00 allowance
Cab door size - 4'-0" wide x 7'-0" high, center opening
Hoistway door size - same as car
Door operation - single speed, center opening - 2.5 FPS

- Fixtures and signals
- Two car operating panels
- Digital car position indicator
- Digital hall position indicator at first floor
- Hall lanterns at each floor
- Vandal resistant illuminated pushbuttons
- ADA accessories

Machine type - geared traction - overhead
Communication - ADA in car and fireman per code

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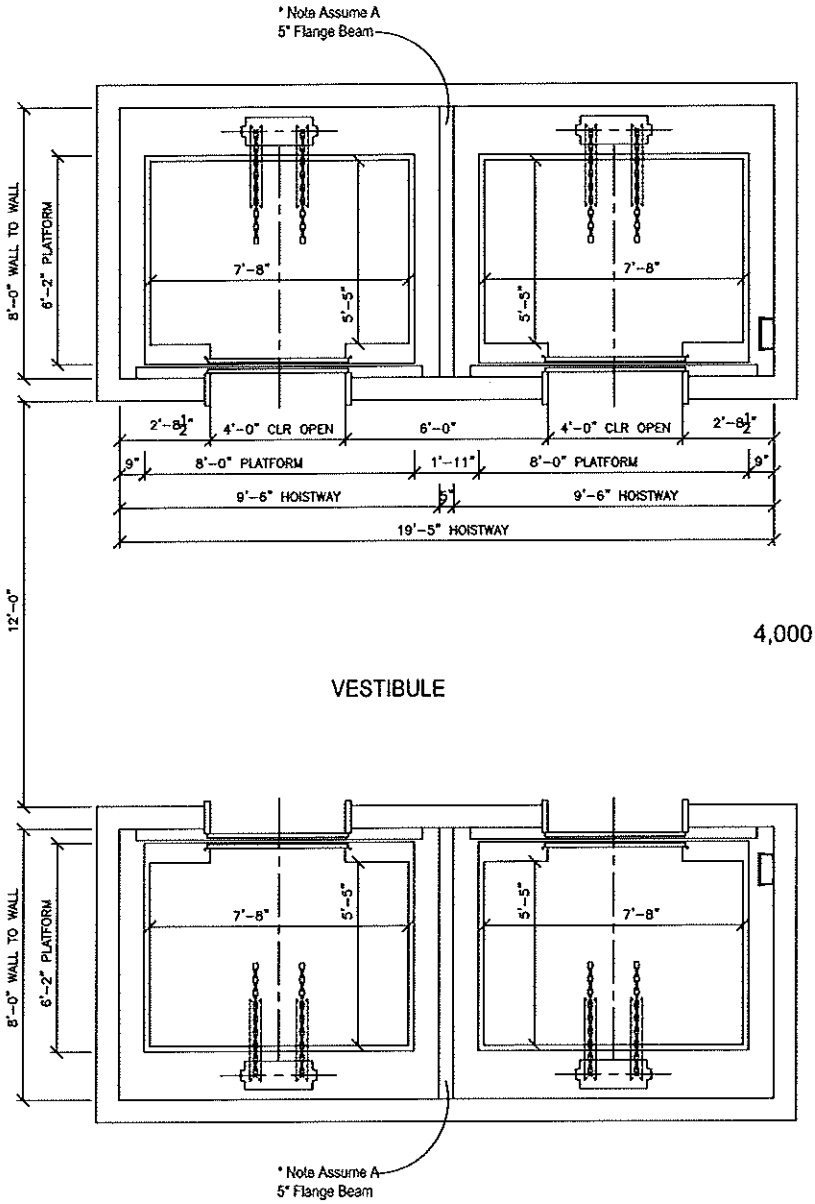

4,000 Lbs Electric Traction
Passenger Elevators
Single Sided
Hoistway Plan

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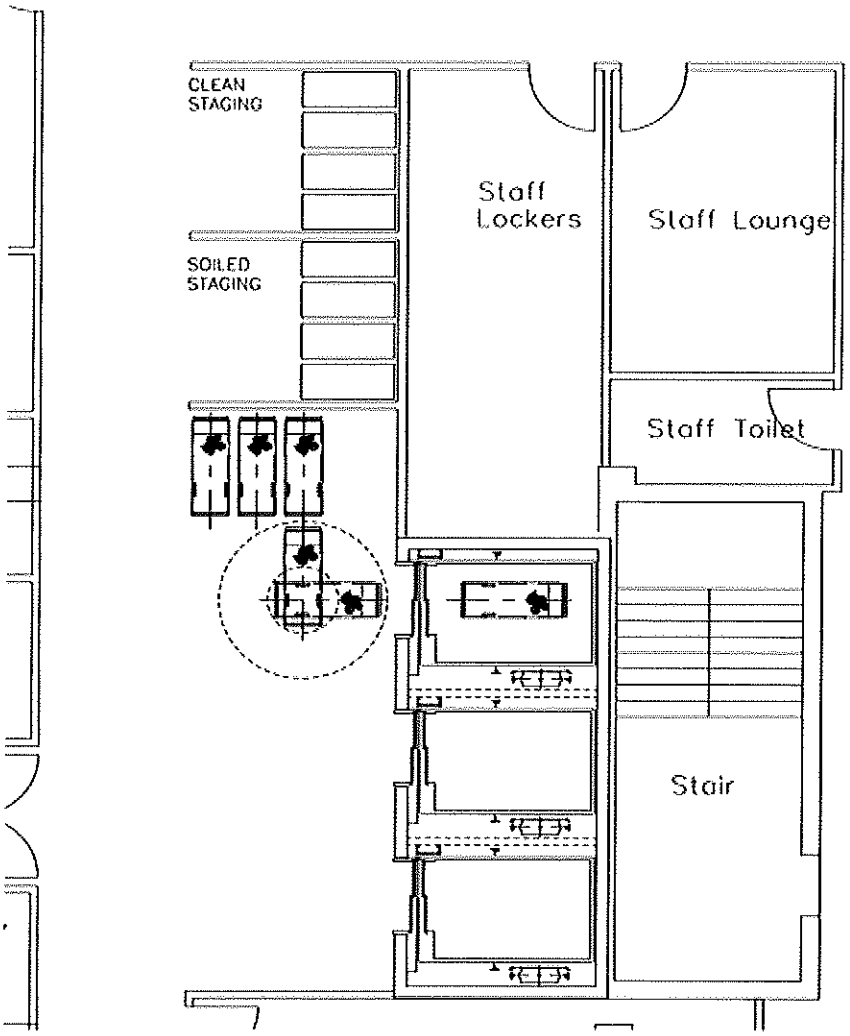

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AGV System Circulation

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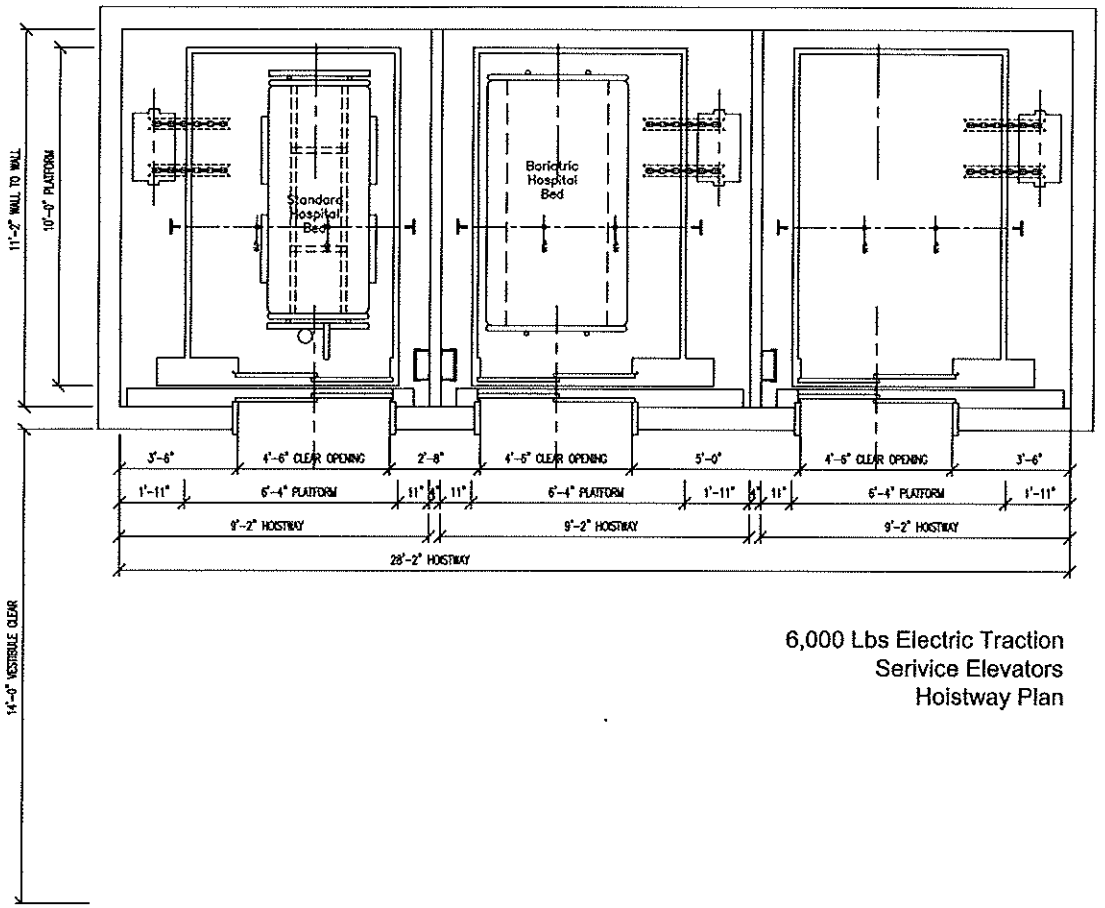

6,000 Lbs Electric Traction
Serivice Elevators
Hoistway Plan

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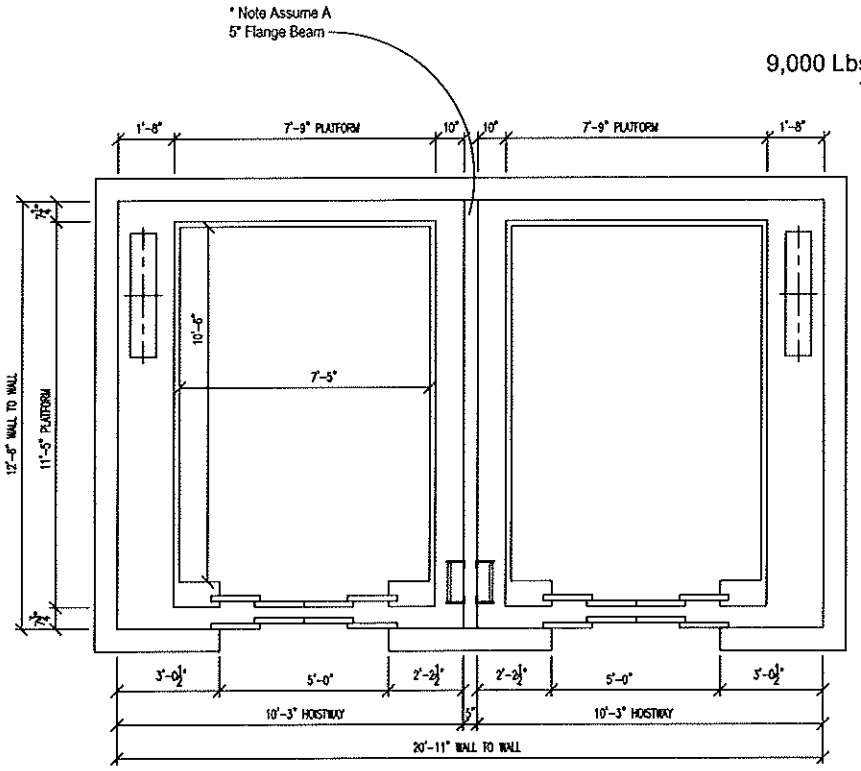

9,000 Lbs Electric Traction
Trauma Elevators
Hoistway Plan

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3.12 Pneumatic Tube System

3.12.1 Introduction

The new VA Medical Center Orlando Hospital should incorporate a 6" pneumatic tube system. There will be 53 stations located throughout the new Hospital and Clinic and with minimal service to the CLC.

Specific station placement, routing and zoning will be determined during the finalization of the schematic plans.

At this time it is envisioned that at least 6 blower zones will be required.

3.12.2 General System Description

Type: Computer controlled material transport system consisting of a control center, stations, transfer units, blowers, carriers, transmission piping and associated wiring.

Size: Six-inch round tubing provides capability to transport items in high impact resistant thermoplastic carriers.

Zones: Groups of stations configured into a zone. Zoning allows carrier in transit within each zone simultaneously. Zones are interconnected to enable stations in a zone to send carriers to stations in other zones.

Capacity: System to consist of multiple zones to handle high carrier traffic and expansion capability.

3.12.3 Standard Station

Recessed stations will be located in patient care areas for sending and receiving carriers.

Recessed station will consist of a control panel, dispatcher, receiving bin, and a minimum storage rack capacity of four carriers.

Carriers will travel at a speed of approximately 20 to 25 feet per second. Carriers arriving at a station are slowed by an air cushion to minimize impact and sound.

An optical carrier sensor identifies the arrival and dispatch of carriers.

3.12.4 Carriers

Molded high impact resistant thermoplastic – transparent for recognition of carrier contents.

Full side-opening carriers with self-closing latches.

Symmetrical that allowing unit to be dispatched from either end.

Overall outside carrier dimensions - 5-3/4" diameter x 16" long.

Clear inside dimensions – 4-1/2" diameter over central 8-1/2" long, tapering to 2" square in each end.

Useable inside length is 15-5/8"

Empty carrier weight – 2-1/4 lb

Standard payload – 7 lb maximum

Removable padded liners for containing and cushioning breakable and sensitive materials.

3.12.5 Transfer Units

Transfer units located at branching points direct the route of a carrier from a single tube at one end to any one of two or four selectable tubes at the other end.

An optical sensor detects the passage of a carrier.

Drive mechanism – electromechanical

Power requirements – 105 to 125 VAC, 60 Hz, single phase, 3A

Control requirements - 4-conductor cable, #18, AWG stranded, 5 VDC maximum open circuit voltage, and 200 amp maximum short circuit current.

Environmental requirements:

- Operating temperature - 0 to 120 F
- Relative Humidity - 0 to 90%
- Storage temperature - -20 to 180 F
- Maximum system vacuum or pressure - 4 psig
- Positioning time - Typically 2 seconds (3 seconds maximum)

Heat output - Approx 130 BTU/hr.

3.12.6 Blower

Regenerative type centrifugal blower provides the vacuum that moves carriers through the system.

Power requirements – 105 to 125 VAC, 60 Hz, 1 phase, 5.4A

Full load amperage – 208/230/460 VAC, 50/60 Hz, 3-phase 24/25/12.5A

Control requirements – 4-conductor cable, #18 AWG stranded, 5 VDC maximum open circuit voltage, 200 amp maximum short circuit current

Maximum vacuum/pressure (at 5000 ft) – 3-1/2 psig

Maximum output (at zero pressure and 5000 ft) – 330 SCFM

Environmental requirements

- Operating temperature - 0 to 120 F
- Storage temperature - 20 to 180 F
- Relative humidity - 0 to 90%
- Maximum operating RPM - 3500

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- Weight without sound package - 395 lbs
- Weight with sound package - 530 lbs
- Heat output - 8000 BTU/hr
- Sound levels in open area
  Open area - 72 db
  Mounted above ceiling - 61 to 66dbA

3.12.7 System Control Center

Control center will consist of a PC computer with color monitor, 104 key "AT" style keyboard, printer, standby power supply, and a wall-mounted cabinet containing individual zone control units.

Software will enable user to perform multiple tasks without affecting pneumatic tube system operations.

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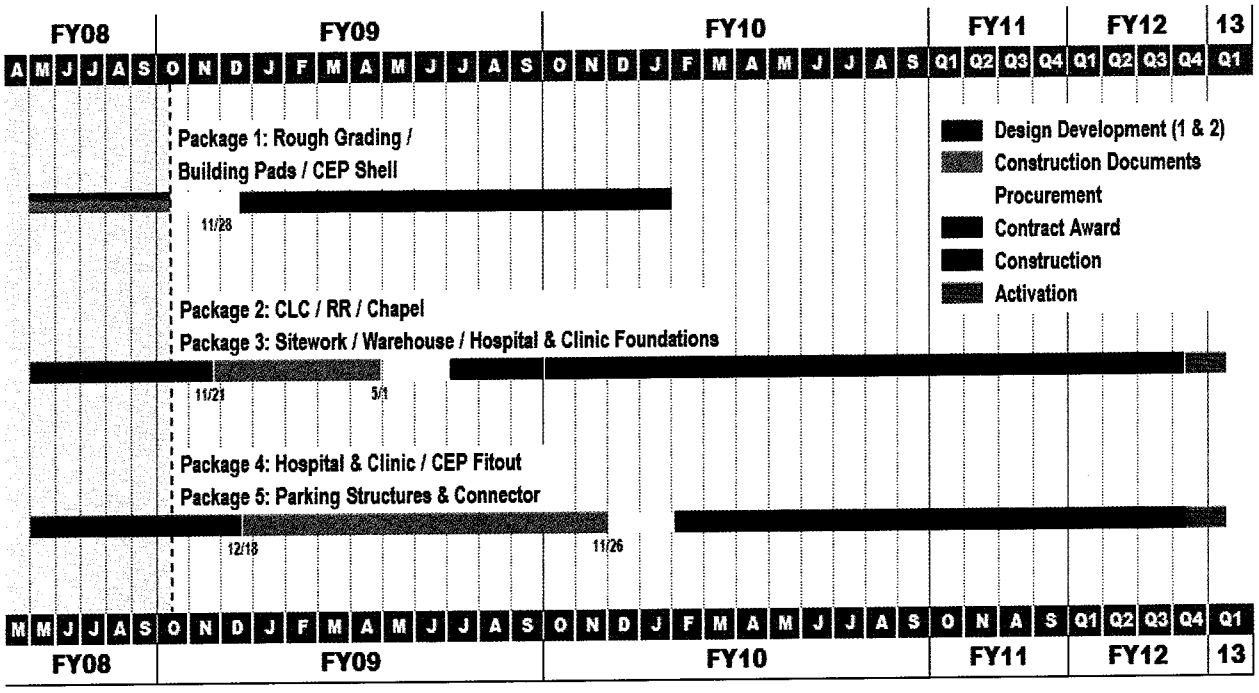
4. CRITICAL PATH METHOD (CPM)

4.1 Phasing Description

Two major factors drive the phasing plan for the construction of the facilities: 1) Funding, 2) Site Access / Logistics.

The funding driven construction packages have been revised somewhat from the S2 submission. This has resulted in the program schedule pictured below. The phasing of the structures accommodates a reasonable logistical progression of work generally from the southernmost end of the site, working toward the entrance, as will be illustrated in the next section.



4.2 Phasing Plans

A schematic of the anticipated direction of construction progress is pictured on the following page. Phase 1 rough grading and foundations work will start at the Central Energy Plant (CEP) in the Northeast corner of the site. That is followed by the Phase 2 RR, Chapel and CLC buildings at the southern extreme. Phase 3 includes the foundations for the Hospital and Clinic, and construction of the Warehouse. Phase 4 completes the Hospital, Clinic and CEP. Phase 5 includes the Parking Garages and Connectors, and all remaining site and security work.

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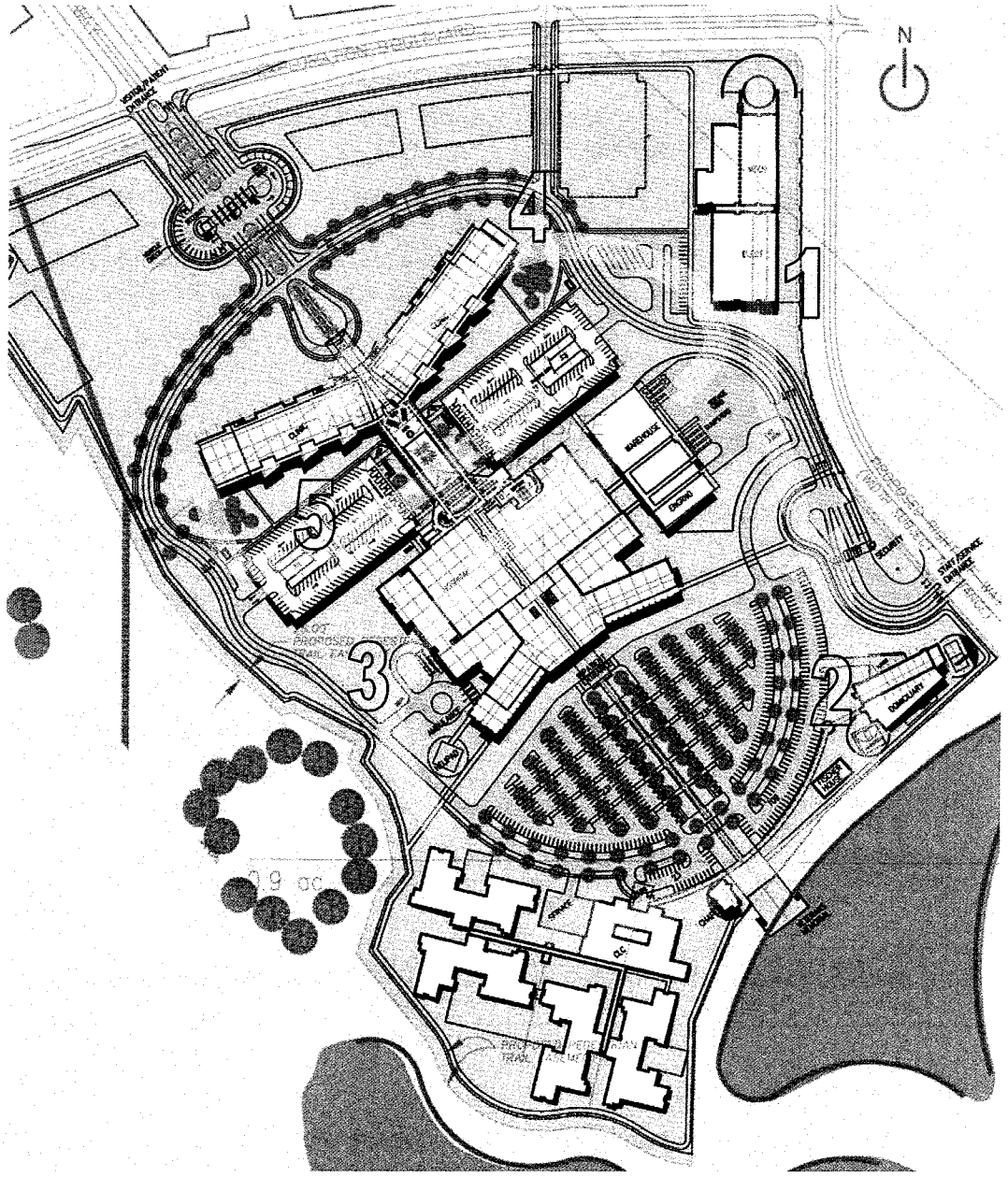

4.3 Phasing Diagrams

A detailed arrow diagram representation of the above phasing plan is set forth in Drawing CPM-1.

4.4 Additional Phasing Requirements

Not at this time.

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5. ELECTRICAL

5.1 Electrical Design Criteria

NFPA 20 - 2007	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 70 - 2008	National Electrical Code
NFPA 72 – 2007	National Fire Alarm Code
NFPA 99 - 2005	Health Care Facilities
NFPA 101 - 2006	Life Safety Code
NFPA 110 – 2005	Standards For Emergency and Standby Power Systems
NFPA 780 - 1997	Lightning Protection Code
ANSI C2	National Electrical Safety Code
EIA 232-F	Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange
TIA/EIA-526-7	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA/EIA-526-14A	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plants
TIA/EIA-568-B.1	Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
TIA/EIA-568-B.1-1	Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 1 – Minimum 4-Pair UTP and 4-Pair ScTP Patch Cable Bend Radius
TIA/EIA-568-B.2	Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted Pair Cabling Components
TIA/EIA-568-B.3	Optical Fiber Cabling Components Standard
TIA/EIA-569A	Commercial Building Standard for Tele-communications Pathways and Spaces
TIA/EIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
TIA/EIA-607	Grounding and Bonding Requirements for the Telecommunications Infrastructure of Commercial Buildings
TIA/EIA-758	Customer-Owned Outside Plant Telecommunications Cabling Standard
TIA/EIA-758-1	Customer-Owned Outside Plant Telecommunications Cabling Standard. Addendum No. 1 to TIA/EIA-758

VA Design Guide and Technical Guides

Fire Protection Design Manual Department of Veteran Affairs

November 3, 2008

VA Hospital Building System Research Study Report

Florida Americans with Disabilities Accessibility Implementation Act (October 1993) as described in Accessibility Requirements Manual, Department of Community Affairs (January 1, 1990)

Florida Building Code (2004)

In addition to the codes and standards listed above, the referenced codes and standards listed in the architectural section also apply.

5.2 Electrical Design Approach (Hospital)

5.2.1 Power Distribution

Six 1500/2000KVA (AA/FA), 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Hospital from Utility power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as indicated. The substations will be located in dedicated rooms. Main and branch circuit breakers will be electronic trip type with LSIG trip functions. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

Five 1500/2000KVA (AA/FA), 12,470V-480/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Hospital from emergency power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as indicated. The substations will be located in dedicated rooms. All circuit breakers will be electronic trip type with LSI trip functions. Ground fault alarm only will be provided on the main circuit breakers. Each substation will be served by two separate feeders from the paralleling switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. Two levels of ground fault protection will be provided on the normal system only, first level on the main and second level on the distribution breakers. A multifunction digital meter that indicates true RMS values will be provided on each main and distribution circuit breaker of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures.

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Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms, except panels serving the operating rooms will be located within the operating room. Isolation type panels will be provided in each operating room. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction except panelboards located in operating room shall be flush mounted. A minimum of one electrical room will be located at approximately 150 feet on center. Electrical rooms will be vertically aligned up through the building. Electrical rooms will be vertically aligned up through the building and located to limit horizontal runs to a maximum of 75 feet. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

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Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be hospital grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plate will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior conductors will be installed in metallic raceway (EMT) up to the interstitial space where they will then be routed through metallic wire-way with hinged covers to the electrical room from which they are served. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 3/4 inch. Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab. PVC conduit shall not be used to serve patient care areas.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system.

All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Two levels of ground fault circuit protection will be provided on the normal distribution switchboards, one on the main and one on each branch. A minimum six-cycle separation between the main and branch ground fault devices will be maintained. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator. The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, articles 250 and 517. The emergency generators will be grounded as separately derived system (neutral and ground bonded together). The equipment grounding busses of the normal and essential branch circuit panel-boards serving the same individual patient vicinity will be bonded together with a #10 AWG insulated copper conductor.

The VA Hospital Building System (VAHBS) concept will be used for this Building. Vertical distribution for the electrical systems shall be routed through the service bays of the building. Horizontal distribution will be routed from the service bays through the service zone (interstitial space) to the branch electrical and communications rooms within the functional zones. The electrical rooms within the functional zones will be located to comply with the requirements of the VAHBS.

A complete electrical power monitoring system will be provided to monitor and record load profiles, power quality, historical trending, alarming, etc. for each feeder in the building. The system shall use the building's Ethernet network for communication and transmission of data. All power information shall be collected, stored and managed by a server that will reside in the Central Energy Plant communication room. Anyone with the appropriate password shall be able to access the power monitoring system from any PC connected to the building's network or via the internet.

5.2.2 Lighting

Lighting will conform to VA Design Guidelines and IES lighting levels as design values. The lighting energy density will conform to ASHRAE/IESNA standard 90.1-2004. All fluorescent and HID lighting operation at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Offices, laboratories and other areas with a large number of personal computer workstations will have low glare and low brightness fixtures such as indirect fixtures. Conference rooms will be provided with dimmable fluorescent fixtures. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial fixtures with wire guards. Compact fluorescent down lighting fixtures and other special lighting fixtures will be used in areas where greater attention must be given to the aesthetics. Interior lighting fixtures will be supported from the structure and will not be supported from suspended ceiling systems, although the fixtures will be mechanically fastened to the ceiling grid system. HID and

incandescent fixtures will only be used in special areas or for architectural design reasons.

25 percent of the general lighting in the operating rooms, emergency treatment rooms and any other room with invasive procedures will be provided with 90 minute battery backup for general illumination which will operate without interruption during periods of normal and emergency power lapse. Fluorescent fixtures with battery backup will be provided in the generator room, generator control switchgear room, telephone switch room, communications closets, electrical rooms and the computer room. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277v. Switches will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent dimming switches shall be modular, full-wave, solid state units with continuously adjustable slide and on/off switch. Units shall have audible and electromagnetic noise filters and shall be compatible with the ballasts, which they control.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 75. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens. Edge lit exit signs will be used in high profile areas for aesthetic purposes.

Automatic lighting controls will be provided in all circulation corridors and areas with an abundance of natural light such as clearstory spaces and offices located on exterior walls. The lighting control system shall be a complete networked system consisting of control panels, wiring, and components with the following features: Smart application specific controllers, daylight harvesting control, manual switch override of automated system functions and web-enabled controls. Manual switch controls will be used in the "in-patient" corridors of the facility, the switches will be located at the nurses stations and labeled appropriately.

5.2.3 Lightning Protection

A complete lightning protection system will be provided for the Hospital in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground

rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used on the parapet walls.

5.2.4 Voice/Data Distribution System (Structured Cabling System)

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

Combination voice and data outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit stubbed out into the wire way system located in the interstitial space.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms and will be routed through open wire way in the interstitial space. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Backbone distribution will consist of multi-pair (100 pair minimum) category 3 copper riser cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the Hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. Each communications room will be approximately 10 feet x 12 feet minimum, and will serve approximately 10,000 square feet of functional floor area in accordance with TIA/EIA-569-A. Communications rooms will be vertically aligned in multistory areas of the building. Six 4 inch conduit risers will be provided between each vertically aligned communication room on adjacent floors. All communications rooms will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual. The grounding system will consist of a Telecommunications Main Ground Busbar (TMGB) located in the telephone switch room, and Telecommunications Grounding Busbar (TGB) located in each telecommunications room. A Telecommunications Grounding Backbone Conductor (TGBC) will be provided to interconnect the TMGB and the TGB's. A separate TGBC will be provided from the TMGB for each group of stacked telecommunications closets. The TGB in each telecommunications closet will be bonded to the TGBC. A #3/0 AWG copper grounding conductor (minimum) will be provided to bond the TMGB to the facility's earth ground.

The telephone switch and instruments will be provided by the VA, funded by the project. It is estimated that approximately 3000 lines will be required to serve the campus. A dedicated 1,500 square foot room will be provided adjacent to the main computer room in the Hospital to house the telephone system equipment. The telephone equipment room will be provided with a raised computer room type floor. All other buildings on the campus will be served from the telephone switch located in the Hospital.

The VA Hospital Building System (VAHBS) concept will be used for this building. Vertical distribution for the communications systems shall be routed up through the stacked communications rooms. Horizontal distribution will be routed from the communications rooms through the service zone (interstitial space). All cables will be installed in metallic wire-ways within the interstitial space.

5.2.5 Nurse Call System

Audiovisual Nurse Call Systems will be provided for all areas of the in-patient portion of the facility such as patient bedrooms, operating rooms, recovery rooms, emergency rooms, etc. The audiovisual nurse call system will use voice communications and microprocessor control. The audiovisual nurse call system will be designed as a networked system. The networked system will include all departments in the building with an audiovisual Nurse Call System. The Audiovisual nurse call system will consist of patient stations, staff assist stations, staff stations, duty stations, toilet emergency stations, shower emergency stations, code blue stations, corridor dome lights, and corridor zone lights. Dome and zone lights will be wall mounted where possible. Where wall mounting is not possible, the dome and zone lights will be ceiling mounted.

A patient call station will be located in each patient bedroom. Emergency pull cord stations will be located in all patient toilets, showers and dressing rooms. Duty stations

will be located in all clean workrooms, soiled workrooms, nourishment rooms, staff lounges, patient prep/hold, decontamination, linen and medication prep rooms.

Code blue stations will be located in all patient bedrooms, operating rooms, patient hold, emergency exam and treatment rooms and x-ray rooms. Code Blue stations will not be integral with the patient stations, but will be separate stand-alone stations. All code blue calls will activate radio pagers of the emergency response team, and will also be annunciated at constantly attended location of the Hospital as directed by the VA.

Each nurse call master station will include a color touch screen monitor. Master stations will be provided at each nurse station. One hundred percent swing capability will be provided between all master stations on the same floor in the facility. Providing this swing capability will give the hospital nursing staff maximum flexibility in monitoring the needs of the patients.

The nurse call system head-end equipment will be located in the communications room within the area served. Nurse call equipment will be connected to the critical branch of the essential system.

Nurse call system wiring will be routed through the wire way in the interstitial space. Conduit will be provided from the devices up to the wire way.

5.2.6 Public Address System

A multi-channel amplified public address/radio entertainment system with a large number of low power ceiling speakers will be provided for each zone to provide uniform sound distribution at a low volume level. The system will be provided with "all call" and selective zone paging capabilities. Volume control for each zone will be located at an accessible location within that zone. Volume control for the general "all call" paging zone will be located at the head-end equipment rack. Each zone will be provided with a telephone interface module with one 4 pair category 6 UTP cable terminated on a patch panel located in the nearest communication room. Separate amplifiers will be provided for each paging zone. The public address system head-end equipment will be mounted in a lockable freestanding cabinet on the first floor within a communications room.

Access to the public address will be through the telephone system or microphones. A desk type microphone will be provided at the head end equipment rack and other rooms as directed by the VA. Keying of the microphone will activate an "all call" page that will override any zone paging. The microphone "all call" will have priority over the "all call" initiated from the telephone system. Paging zones will be provided as directed by the VA.

Combination radio entertainment (RED) speakers and PA system speakers will be provided in each Dayroom, TV Lounge, Waiting Room and other designated areas. Separate volume/selector controls will be provided at the reception desk serving the area containing the RED speakers.

The public address system speakers will operate at 70V with all wiring installed in 3/4" conduit minimum.

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5.2.7 Entertainment Television System

A complete television distribution system will be provided to serve the building. The system will include all cables and hardware as required to distribute the television signals throughout the facility. Amplifiers will be provided to produce a +6 to +12 dBmv signal level at each outlet. The system will be designed as a star topology with each television outlet connected back to the communications room with a coaxial and a 4 pair category 6 UTP cable.

Coaxial drop cables will be RG-6 quad shield and trunk cables will be RG-11 quad shield. Cables will be routed through the wire way located in the interstitial space. ¾" conduit will be extended from each outlet up to the wire way located in the interstitial space.

The program distribution source for the facility shall be the local cable television service provider (Brighthouse Networks) or satellite service as directed by the VA.

5.2.8 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the wire way located in the interstitial space. Wiring between the devices and the wire way will be installed in conduit, 3/4" minimum.

5.2.9 Intrusion Detection System

A complete intrusion detection system will be provided for the following areas: pharmacy, agent cashier, canteen retail store, canteen store rooms, canteen managers office, supply service warehouse, and other locations as defined by the VA.

The system will consist of interior space sensors, control communicators, keypad(s), batteries, audible signaling devices, and communications interface devices. The system shall consist of sensors to detect intrusion attempts. The system shall sense and respond with local and remote visible and audible signals the activation of detection sensors.

All intrusion detection system wiring shall be installed in 3/4" conduit minimum.

5.2.10 Access Control System

A complete door access control system will be provided as directed by the VA.

5.2.11 Physiological Monitoring System

The physiological monitoring system will consist of empty raceways and back boxes only. A ¾" empty conduit with pull string will be provided from each outlet location to the wire way located in the interstitial space. Back boxes will be 4 inch square x 2 1/8 inch deep with a single gang plaster ring.

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5.2.12 Wire way System

A wire way system will be provided throughout the interstitial space to route communications systems wiring with the exception of the public address system, intrusion detection system, and Fire Alarm system (these systems will be installed in metallic conduit). An open cable tray will also be provided within each communication room to manage the cables. Multiple wire ways will be provided to serve the various systems (i.e. voice/data, nurse call, television etc.) The wire way shall be sized in accordance with NFPA 70 plus 25 percent free space for cables. The wire ways shall be installed in zone S3 within the interstitial space.

5.2.13 Fire Alarm and Detection

A complete addressable voice alarm type fire alarm system will be provided to serve the facility. The system will include a main control panel located in the fire command room, remote transponder panels located throughout the building and a remote annunciator panel located at the main entrance to the building. The main control panel will be connected back to the main control panel located in the Hospital with a network connection. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical system. The system will be a voice alarm type system utilizing digital voice systems with the ability to make live announcements as well. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances and voice alarm speakers will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A. All other building's on the campus will have a fiber optic network connection back to the main fire alarm control panel located in the fire command room to allow a single point of monitoring for the entire campus.

Transponder panels will provide a signal interface between the fire alarm control panel and the individual areas of fire alarm system coverage. In addition to fire alarm control functions, the transponder shall also house the audio/visual power supplies and batteries.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72 and also at nurses stations.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 and 90A. Smoke detectors will be located in elevator machine rooms, elevator lobbies, fire alarm control panel location, transponder panel locations, patient sleeping rooms and at hold open doors in smoke walls. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

Projected beam type smoke detectors will be provided in the atrium spaces for activation of the smoke management system. The smoke management system will also have manual controls located in the fire command room.

135 degree fixed temperature heat detectors will be located in the elevator machine room and pit for elevator power shunt trip actuation. The circuit serving the shunt trip circuit breakers will be monitored by the fire alarm system.

Notification appliances will consist of wall mounted strobe units and ceiling mounted speakers. Combination wall mounted speaker/strobe units will be used in areas where ceiling mounted speakers are not practical or possible. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements. Critical care areas may be provided with strobes only.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

The fire alarm system will be interfaced with the fire pump alarm contacts per NFPA 20. These alarm signals will be automatically transmitted to the central monitoring station.

The fire alarm system will be interfaced with the kitchen hood suppression system to sound a general alarm, notify central monitoring station, disconnect fuel source supply cooking equipment and open locked egress doors.

The operation of a single fire / smoke detector, beam detector, kitchen hood extinguishing system, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at fire alarm control panel and the control functions will be initiated.

5.3 Electrical design approach (Clinic)

5.3.1 Power Distribution

Four 1500/2000KVA (AA/FA), 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Clinic from Utility power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as Indicated. The substations will be located in dedicated room(s) on the penthouse level of the Clinic. Main and branch circuit breakers will be electronic trip type with LSIG trip functions. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

Two 1500/2000KVA (AA/FA), 12,470V-480/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Clinic from

emergency power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as Indicated. The substations will be located in dedicated room(s) on the penthouse level of the Clinic. All circuit breakers will be electronic trip type with LSI trip functions. Ground fault alarm only will be provided on the main circuit breakers. Each substation will be served by two separate feeders from the paralleling switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. Two levels of ground fault protection will be provided on the normal system only, first level on the main and second level on the distribution breakers. A multifunction digital meter that indicates true RMS values will be provided on each main and distribution circuit breaker of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction except panelboards located in operating room shall be flush mounted. A minimum of one electrical room will be located in each smoke compartment on every floor. Electrical rooms will be vertically aligned up through the building and located at

approximately 150 feet on center. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be hospital grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plates will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All

interior conductors will be installed in metallic raceway (EMT) up to the interstitial space where they will then be routed through metallic wire-way with hinged covers to the electrical room from which they are served. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 3/4 inch. Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab. PVC conduit shall not be used to serve patient care areas.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Two levels of ground fault circuit protection will be provided on the normal distribution switchboards, one on the main and one on each branch. A minimum six-cycle separation between the main and branch ground fault devices will be maintained. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator. The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, articles 250 and 517. The emergency generators will be grounded as separately derived system (neutral and ground bonded together). The equipment grounding busses of the normal and essential branch circuit panel-boards serving the same individual patient vicinity will be bonded together with a #10 AWG insulated copper conductor.

The VA Hospital Building System (VAHBS) concept will be used for this Building. Vertical distribution for the electrical systems shall be routed through the service bays of the building. Horizontal distribution will be routed from the service bays through the service zone (interstitial space) to the branch electrical and communications rooms within the functional zones. The electrical rooms within the functional zones will be located to comply with the requirements of the VAHBS.

A complete electrical power monitoring system will be provided to monitor and record load profiles, power quality, historical trending, alarming, etc. for each feeder in the

building. The system shall use the building's Ethernet network for communication and transmission of data. All power information shall be collected, stored and managed by a server that will reside in the Central Energy Plant communication room. Anyone with the appropriate password shall be able to access the power monitoring system from any PC connected to the building's network or via the internet.

5.3.2 Lighting

Lighting will conform to VA Design Guidelines and IES lighting levels as design values. The lighting energy density will conform to ASHRAE/IESNA standard 90.1-2004. All fluorescent and HID lighting operation will be 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Offices, laboratories and other areas with a large number of personal computer workstations will have low glare and low brightness fixtures such as indirect fixtures. Conference rooms will be provided with dimmable fluorescent fixtures. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial strip fixtures with wire guards. Compact fluorescent down lighting fixtures and other special lighting fixtures will be used in areas where greater attention must be given to the aesthetics. Interior lighting fixtures will be supported from the structure and will not be supported from suspended ceiling systems, although the fixtures will be mechanically fastened to the ceiling grid system. HID and incandescent fixtures will only be used in special areas or for architectural design reasons.

Fluorescent fixtures with battery backup will be provided in the communications closets and electrical rooms. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent dimming switches shall be modular, full-wave, solid state units with continuously adjustable slide and on/off switch. Units shall have audible and electromagnetic noise filters and shall be compatible with the ballasts, which they control.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 82. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens. Edge lit exit signs will be used in high profile areas for aesthetic purposes.

Automatic lighting controls will be provided in all circulation corridors and areas with an abundance of natural light such as clearstory spaces and offices located on exterior walls. The lighting control system shall be a complete networked system consisting of control panels, wiring, and components with the following features: Smart application specific controllers, daylight harvesting control, manual switch override of automated system functions and web-enabled controls.

5.3.3 Lightning Protection

A complete lightning protection system will be provided for the Clinic in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used on the parapet walls.

5.3.4 Voice/Data Distribution System (Structured Cabling System)

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

Combination voice and data outlets will consist of a single gang six position, angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit stubbed out into the wire way system located in the interstitial space.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms and will be routed through open wire

way in the interstitial space. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Backbone distribution will consist of multi-pair (100 pair minimum) category 3 copper riser cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the Hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. Each communications room will be approximately 10 feet x 12 feet minimum, and will serve approximately 10,000 square feet of functional floor area in accordance with TIA/EIA-569-A. Communications rooms will be vertically aligned in multistory areas of the building. Six 4 inch conduit risers will be provided between each vertically aligned communication room on adjacent floors. All communications rooms will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual. The grounding system will consist of a Telecommunications Grounding Busbar (TGB) located in each telecommunications room. A Telecommunications Grounding Backbone Conductor (TGBC) will be provided to interconnect the TMGB and the TGB's. A separate TGBC will be provided from the TMGB for each group of stacked telecommunications closets. The TGB in each telecommunications closet will be bonded to the TGBC. A #2 AWG copper grounding conductor (minimum) will be provided to bond the TMGB to the facility's earth ground.

The VA Hospital Building System (VAHBS) concept will be used for this building. Vertical distribution for the communications systems shall be routed up through the stacked communications rooms. Horizontal distribution will be routed from the communications rooms through the service zone (interstitial space). All cables will be installed in metallic wire-ways within the interstitial space.

5.3.5 Nurse Call System

Tone Visual Nurse Call Systems will be provided for clinic spaces in the facility. The system will include emergency pull cords located in patient toilets, dressing rooms and emergency push buttons located procedure rooms and treatment rooms. A corresponding dome light will be located outside of the room containing the pull cord or

push button. Zone light annunciation will be provided at cross-corridors. Dome and zone lights will be wall mounted where possible. Where wall mounting is not possible, the dome and zone lights will be ceiling mounted. An annunciator panel will be located at each reception counter or control desk serving the area.

The nurse call system head-end equipment will be located in the communications room within the area served. Nurse call equipment will be connected to the critical branch of the essential system.

Nurse call system wiring will be routed through the wire way in the interstitial space. Conduit will be provided from the devices up to the wire way in the interstitial space.

5.3.6 Public Address System

A multi-channel amplified public address/radio entertainment system with a large number of low power ceiling speakers will be provided for each zone to provide uniform sound distribution at a low volume level. The system will be provided with "all call" and selective zone paging capabilities. Volume control for each zone will be located at an accessible location within that zone. Volume control for the general "all call" paging zone will be located at the head-end equipment rack. Each zone will be provided with a telephone interface module with one 4 pair category 6 UTP cable terminated on a patch panel located in the nearest communication room. Separate amplifiers will be provided for each paging zone. The public address system head-end equipment will be mounted in a lockable freestanding cabinet on the first floor within a communications room.

Access to the public address will be through the telephone system or microphones. A desk type microphone will be provided at the head-end equipment rack and other rooms as directed by the VA. Keying of the microphone will activate an "all call" page that will override any zone paging. The microphone "all call" will have priority over the "all call" initiated from the telephone system. Paging zones will be provided as directed by the VA.

Combination radio entertainment (RED) speakers and PA system speakers will be provided in each Dayroom, TV Lounge, Waiting Room and other designated areas. Separate volume/selector controls will be provided at the reception desk serving the area containing the RED speakers.

The public address system speakers will operate at 70V with all wiring installed in 3/4" conduit minimum.

5.3.7 Entertainment Television System

A complete television distribution system will be provided to serve the building. The system will include all cables and hardware as required to distribute the television signals throughout the facility. Amplifiers will be provided to produce a +6 to +12 dBmv signal level at each outlet. The system will be designed as a star topology with each television outlet connected back to the communications room with a coaxial drop cable and a 4 pair category 6 UTP.

Coaxial drop cables will be RG-6 quad shield and trunk cables will be RG-11 quad shield. Cables will be routed through the wire way located in the interstitial space. ¾" conduit will be extended from each outlet up to the wire way located in the interstitial space.

The program distribution source for the facility shall be the local cable television service provider or satellite service as directed by the VA.

5.3.8 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the wire way located in the interstitial space. Wiring between the devices and the wire way will be installed in conduit, 3/4" minimum.

5.3.9 Access Control System

A complete door access control system will be provided as directed by the VA.

5.3.10 Physiological Monitoring System

The physiological monitoring system will consist of empty raceways and back boxes only. A ¾" empty conduit with pull string will be provided from each outlet location to the wire way located in the interstitial space. Back boxes will be 4 inch square x 2 1/8 inch deep with a single gang plaster ring.

5.3.11 Wire way System

A wire way system will be provided throughout the interstitial space to route communications systems wiring with the exception of the public address system, intrusion detection system, and Fire Alarm system (these systems will be installed in metallic conduit). An open cable tray will also be provided within each communication room to manage the cables. Multiple wire ways will be provided to serve the various systems (i.e. voice/data, nurse call, television etc.) The wire way shall be sized in accordance with NFPA 70 plus 25 percent free space for cables. The wire ways shall be installed in zone S3 within the interstitial space.

5.3.12 Fire Alarm and Detection

A complete addressable voice alarm type fire alarm system will be provided to serve the facility. The system will include remote transponder panels located throughout the building and a remote annunciator panel located at the main entrance to the building. The remote transponder/amplifier panels will be connected back to the main control panel located in the Hospital. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical. The system will be a voice alarm type system utilizing digital voice systems with the ability to make live announcements as well. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances and voice alarm speakers will be provided in accordance with

NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A.

Transponder panels will provide a signal interface between the fire alarm control panel and the individual areas of fire alarm system coverage. In addition to fire alarm control functions, the transponder shall also house the audio/visual power supplies and batteries.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72 and also at nurses stations.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A. Smoke detectors will be located in elevator machine rooms, elevator lobbies, fire alarm control panel location, transponder panel locations, patient sleeping rooms and at hold open doors in smoke walls. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

Projected beam type smoke detectors will be provided in the atrium spaces for activation of the smoke management system. The smoke management system will also have manual controls located in the fire command room.

135 degree fixed temperature heat detectors will be located in the elevator machine room and pit for elevator power shunt trip actuation. The circuit serving the shunt trip circuit breakers will be monitored by the fire alarm system.

Notification appliances will consist of wall mounted strobe units and ceiling mounted speakers. Combination wall mounted speaker/strobe units will be used in areas where ceiling mounted speakers are not practical or possible. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

The fire alarm system will be interfaced with the fire pump alarm contacts per NFPA 20. These alarm signals will be automatically transmitted to the central monitoring station.

5.4 Electrical design approach (CLC)

5.4.1 Power Distribution

One 1500/2000KVA (AA/FA), 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substation will be provided to serve 480/277V and 208/120V loads in the CLC from Utility power. The secondary distribution will consist of a 3,000A main circuit breaker

and branch circuit breakers as Indicated. The substations will be located in a dedicated room in the building. Main and branch circuit breakers will be electronic trip type with LSIG trip functions. Substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

One 750/1000KVA (AA/FA), 12,470V-480/277V, 3 phase, 4 wire single ended unit substation will be provided to serve 480/277V and 208/120V loads in the CLC from emergency power. The secondary distribution will consist of a 1,600A main circuit breaker and branch circuit breakers as Indicated. The substation will be located in a dedicated room in the building. All circuit breakers will be electronic trip type with LSI trip functions. Ground fault alarm only will be provided on the main circuit breakers. Substation will be served by two separate feeders from the paralleling switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. Two levels of ground fault protection will be provided on the normal system only, first level on the main and second level on the distribution breakers. A multifunction digital meter that indicates true RMS values will be provided on each main section of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch

position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction. Electrical rooms will be located to limit horizontal runs to a maximum of 75 feet the rooms shall be spaced at approximately 150 feet on center. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be hospital grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are

connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plates will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior conductors will be installed in metallic raceway (EMT) up to the interstitial space where they will then be routed through metallic wire-way with hinged covers to the electrical room from which they are served. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 3/4 inch. Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab. PVC conduit shall not be used to serve patient care areas.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Two levels of ground fault circuit protection will be provided on the normal distribution switchboards, one on the main and one on each branch. A minimum six-cycle separation between the main and branch ground fault devices will be maintained. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator. The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, articles 250 and 517. The emergency generators will be grounded as separately derived system (neutral and ground bonded together). The equipment grounding busses of the normal and essential branch circuit panel-boards serving the same individual patient vicinity will be bonded together with a #10 AWG insulated copper conductor.

A complete electrical power monitoring system will be provided to monitor and record load profiles, power quality, historical trending, alarming, etc. for each feeder in the building. The system shall use the building's Ethernet network for communication and transmission of data. All power information shall be collected, stored and managed by a

server that will reside in the Central Energy Plant communication room. Anyone with the appropriate password shall be able to access the power monitoring system from any PC connected to the building's network or via the internet.

5.4.2 Lighting

Lighting will conform to VA Design Guidelines and IES with all fluorescent and HID lighting operation at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. Lighting for the CLC will be designed to provide low glare and high contrast in all areas of the building used by the residents, therefore all fixtures in these areas will be provided with some type of shielding to prevent direct view of the lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Offices and other areas with a large number of personal computer workstations will have low glare and low brightness fixtures such as indirect fixtures. Conference rooms will be provided with dimmable fluorescent fixtures. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial strip fixtures with wire guards. Compact fluorescent down lighting fixtures and other special lighting fixtures will be used in areas where greater attention must be given to the aesthetics. Interior lighting fixtures will be supported from the structure and will not be supported from suspended ceiling systems, although the fixtures will be mechanically fastened to the ceiling grid system. HID and incandescent fixtures will only be used in special areas or for architectural design reasons.

Each resident room will be provided with a reading light with controls readily accessible to the resident. A minimum of one night light fixture with controls at the room entrance will be provided in each resident's room.

Fluorescent fixtures with battery backup will be provided in the communications closets, electrical rooms and other selected fixtures throughout the facility

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent dimming switches shall be modular, full-wave, solid state units with continuously adjustable slide and on/off switch. Units shall have audible and electromagnetic noise filters and shall be compatible with the ballasts, which they control.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 82. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens. Edge lit exit signs will be used in high profile areas for aesthetic purposes.

Automatic lighting controls will be provided in all circulation corridors and areas with an abundance of natural light such as clearstory spaces and offices located on exterior walls. The lighting controls will automatically dim or shut off the corridor lighting fixtures when the natural light contribution is above a predetermined value. The lighting control system shall be a complete networked system consisting of control panels, wiring, and components with the following features: Smart application specific controllers, daylight harvesting control, manual switch override of automated system functions and web-enabled controls.

5.4.3 Lightning Protection

A complete lightning protection system will be provided for the CLC in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used.

5.4.4 Voice/Data Distribution System (Structured Cabling System)

Combination voice and data outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit stubbed out into the cable tray system located in above the finished ceiling.

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal

cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms and will be routed through cable tray system above the finished ceiling. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Interior backbone distribution will consist of multi-pair (100 pair minimum) category 3 copper riser cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A multi-pair outside plant cable will be provided from the MDF in the telephone equipment room located in the Hospital to the main communications room in the CLC for voice. A 24 strand, single mode outside plant fiber optic cable will be provided from the computer room in the Hospital to the main communications room in the CLC for data. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. Building protector modules will be provided where outside plant copper cable enters the building. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. Each communications room will be approximately 10 feet x 12 feet minimum, and will serve approximately 10,000 square feet of functional floor area in accordance with TIA/EIA-569-A. All communications rooms will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual. The grounding system will consist of a Telecommunications Main Ground Busbar (TMGB) located in the telephone switch room, and Telecommunications Grounding Busbar (TGB) located in each telecommunications room. A Telecommunications Grounding Backbone Conductor (TGBC) will be provided to interconnect the TMGB and the TGB's. The TGB in each telecommunications closet will be bonded to the TGBC. A #2 AWG copper grounding conductor (minimum) will be provided to bond the TMGB to the facility's earth ground.

5.4.5 Nurse Call System

Audiovisual Nurse Call Systems will be provided in areas of the facility such as resident bed locations, resident toilet, resident bath and shower rooms. The audiovisual nurse call system will use voice communications and microprocessor control. The audiovisual nurse call system will be designed as a networked system. The networked system will include all departments in the building with an audiovisual Nurse Call System. The Audiovisual nurse call system will consist of patient stations, staff assist stations, staff

stations, duty stations, toilet emergency stations, shower emergency stations, code blue stations, corridor dome lights, and corridor zone lights. Dome and zone lights will be wall mounted where possible. Where wall mounting is not possible, the dome and zone lights will be ceiling mounted.

A patient call station will be located in each resident bed location. Emergency pull cord stations will be located in all resident toilets, showers and bath rooms. Duty stations will be located in all staff workrooms.

Code blue stations will be located at all resident bed locations. Code Blue stations will not be integral with the patient stations, but will be separate stand-alone stations. All code blue calls will activate radio pagers of the emergency response team, and will also be annunciated at the master station.

Each nurse call master station will include a color touch screen monitor. Master stations will be provided at each nurse station. One hundred percent swing capability will be provided between all master stations in the facility. Providing this swing capability will give the nursing staff maximum flexibility in monitoring the needs of the residents.

The nurse call system head-end equipment will be located in the communications room within the area served. Nurse call equipment will be connected to the critical branch of the essential system.

Nurse call system wiring will be routed through the cable tray system above the finished ceiling. Conduit will be provided from the devices up to cable tray.

5.4.6 Public Address System

A multi-channel amplified public address/radio entertainment system with a large number of low power ceiling speakers will be provided for each zone to provide uniform sound distribution at a low volume level. The system will be provided with "all call" and selective zone paging capabilities. Volume control for each zone will be located at an accessible location within that zone. Volume control for the general "all call" paging zone will be located at the head-end equipment rack. Each zone will be provided with a telephone interface module with one 4 pair category 6 UTP cable terminated on a patch panel located in the nearest communication room. Separate amplifiers will be provided for each paging zone. The public address system head-end equipment will be mounted in a lockable freestanding cabinet on the first floor within a communications room.

Access to the public address will be through the telephone system or microphones. A desk type microphone will be provided at the head end equipment rack and other rooms as directed by the VA. Keying of the microphone will activate an "all call" page that will override any zone paging. The microphone "all call" will have priority over the "all call" initiated from the telephone system. Paging zones will be provided as directed by the VA.

The public address system speakers will operate at 70V with all wiring installed in 3/4" conduit minimum.

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5.4.7 Entertainment Television System

A complete television distribution system will be provided to serve the building. The system will include all cables and hardware as required to distribute the television signals throughout the facility. Amplifiers will be provided to produce a +6 to +12 dBmv signal level at each outlet. The system will be designed as a star topology with each television outlet connected back to the communications room with a coaxial drop cable and a 4 pair category 6 UTP cable.

Drop cables will be RG-6 quad shield and trunk cables will be RG-11 quad shield. Cables will be routed through the wire way located in the interstitial space. ¾" conduit will be extended from each outlet up to the wire way located in the interstitial space.

The program distribution source for the facility shall be the local cable television service provider or satellite service as directed by the VA.

5.4.8 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the wire way located in the interstitial space. Wiring between the devices and the wire way will be installed in conduit, 3/4" minimum.

5.4.9 Intrusion Detection System

A complete intrusion detection system will be provided for the facility as directed by the VA.

The system will consist of interior space sensors, control communicators, keypad(s), batteries, audible signaling devices, and communications interface devices. The system shall consist of sensors to detect intrusion attempts. The system shall sense and respond with local and remote visible and audible signals the activation of detection sensors.

All intrusion detection system wiring shall be installed in 3/4" conduit minimum.

5.4.10 Access Control System

A complete door access control system will be provided as directed by the VA.

5.4.11 Physiological Monitoring System

The physiological monitoring system will consist of empty raceways and back boxes only. A ¾" empty conduit with pull string will be provided from each outlet location to the wire way located in the interstitial space. Back boxes will be 4 inch square x 1 1/8 inch deep with a single gang plaster ring.

5.4.12 Cable Tray System

All cable trays will be ladder type tray 4 inches high by 12 inches wide. The cable tray system will be provided above suspended ceilings in all corridors to install

communications systems wiring with the exception of the PA system, IDS, and Fire Alarm (these systems will be installed in metallic conduit). Cable tray will also be provided in each communication closet. Corridor cable trays will be connected to cable trays in each communications closet. Conduit sleeves will be provided at all smoke walls, sleeves will be sized in a fill capacity of 50 percent and will be fire stopped after cable installation.

5.4.13 Fire Alarm and Detection

A complete addressable voice alarm type fire alarm system will be provided to serve the building. The system will a main control panel, remote transponder panels located throughout the building and a remote annunciator panel located at the main entrance to the building. The main control panel will be connected back to the main control panel with a network cable. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical. The system will be a voice alarm type system utilizing digital voice systems with the ability to make live announcements as well. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances and voice alarm speakers will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A.

Transponder panels will provide a signal interface between the fire alarm control panel and the individual areas of fire alarm system coverage. In addition to fire alarm control functions, the transponder shall also house the audio/visual power supplies and batteries.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72 and also at nurses stations.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A. Smoke detectors will be located at the fire alarm control panel location, transponder panel locations, hold open doors in smoke walls. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

The resident sleeping rooms will be equipped with an addressable, photoelectric smoke detector with an integral sounder as well as a wall mounted strobe. Upon activation of the smoke detector the integral sounder and the wall mounted strobe shall be also be activated. An addressable interface device (control module) shall be provided above the ceiling in each room to control the strobe. The strobe shall also be activated by the other initiating devices in the building except for other sleeping room smoke detectors shall activate their respective strobes only.

Notification appliances will consist of wall mounted strobe units and ceiling mounted speakers. Combination wall mounted speaker/strobe units will be used in areas where

ceiling mounted speakers are not practical or possible. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

The fire alarm system will be interfaced with the kitchen hood suppression system to sound a general alarm, notify central monitoring station, disconnect fuel source supply cooking equipment and open locked egress doors.

5.5 Electrical design approach (Domiciliary)

5.5.1 Power Distribution

One 750KVA, 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Domiciliary from utility power. The secondary distribution will consist of a 1,200A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the Domiciliary. The main circuit breaker will be electronic trip type with LSIG trip functions and branch circuit breakers will be electronic type with LSI trip function. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

One 500KVA, 12,470V-480/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Domiciliary from emergency power. The secondary distribution will consist of a 1,200A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the Domiciliary. All circuit breakers will be electronic trip type with LSI trip functions. Ground fault alarm only will be provided on the main circuit breaker. Each substation will be served by two separate feeders from the paralleling switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. One level of ground fault protection will be provided on the normal system only. A multifunction digital meter that indicates true RMS values will be provided on each main section of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70.

Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge

suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be heavy duty specification grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plate will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior conductors will be installed in metallic raceway (EMT) up to the interstitial space where they will then be routed through metallic wire-way with hinged covers to the electrical room from which they are served. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 3/4 inch. Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator.

The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, article 250.

A complete electrical power monitoring system will be provided to monitor and record load profiles, power quality, historical trending, alarming, etc. for each feeder in the building. The system shall use the building's Ethernet network for communication and transmission of data. All power information shall be collected, stored and managed by a server that will reside in the Central Energy Plant communication room. Anyone with the appropriate password shall be able to access the power monitoring system from any PC connected to the building's network or via the internet.

5.5.2 Lighting

Lighting will conform to VA Design Guidelines and IES lighting levels as design values. The lighting energy density will conform to ASHRAE/IESNA standard 90.1-2004. All fluorescent and HID lighting operation at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Offices, laboratories and other areas with a large number of personal computer workstations will have low glare and low brightness fixtures such as indirect fixtures. Conference rooms will be provided with dimmable fluorescent fixtures. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial fixtures with wire guards. Compact fluorescent down lighting fixtures and other special lighting fixtures will be used in areas where greater attention must be given to the aesthetics. Interior lighting fixtures will be supported from the structure and will not be supported from suspended ceiling systems, although the fixtures will be mechanically fastened to the ceiling grid system. HID and incandescent fixtures will only be used in special areas or for architectural design reasons.

Light fixtures as indicated will be provided with 90 minute battery backup for general illumination which will operate without interruption during periods of normal and emergency power lapse. Fluorescent fixtures with battery backup will be provided in the communications closets, electrical rooms and the mechanical room. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent dimming switches shall be modular, full-wave, solid state units with continuously adjustable slide and on/off switch. Units shall have audible and

electromagnetic noise filters and shall be compatible with the ballasts, which they control.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 75. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens. Edge lit exit signs will be used in high profile areas for aesthetic purposes.

Automatic lighting controls will be provided in all circulation corridors and areas with an abundance of natural light such as clearstory spaces and offices located on exterior walls. The lighting control system shall be a complete networked system consisting of control panels, wiring, and components with the following features: Smart application specific controllers, daylight harvesting control, manual switch override of automated system functions and web-enabled controls.

5.5.3 Lightning Protection

A complete lightning protection system will be provided for the Domiciliary in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used on the parapet walls.

5.5.4 Voice/Data Distribution System (Structured Cabling System)

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

Combination voice and data outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit stubbed out into the cable tray system located in the ceiling space.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms and will be routed through open cable tray in the ceiling space. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Backbone distribution will consist of multi-pair (100 pair minimum) category 3 copper riser cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the Hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. Each communications room will be approximately 10 feet x 12 feet minimum, and will serve approximately 10,000 square feet of functional floor area in accordance with TIA/EIA-569-A. Communications rooms will be vertically aligned in multistory areas of the building. Three 4 inch conduit risers will be provided between each vertically aligned communication room on adjacent floors. All communications rooms will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual. The grounding system will consist of a Telecommunications Main Ground Busbar (TMGB) located in the telephone switch room, and Telecommunications Grounding Busbar (TGB) located in each telecommunications room. A Telecommunications Grounding Backbone Conductor (TGBC) will be provided to interconnect the TMGB and the TGB's. A separate TGBC will be provided from the TMGB for each group of stacked telecommunications closets. The TGB in each telecommunications closet will be bonded to the TGBC. A #3/0 AWG copper grounding conductor (minimum) will be provided to bond the TMGB to the facility's earth ground.

5.5.5 Public Address System

A multi-channel amplified public address/radio entertainment system with a large number of low power ceiling speakers will be provided for each zone to provide uniform

sound distribution at a low volume level. The system will be provided with "all call" and selective zone paging capabilities. Volume control for each zone will be located at an accessible location within that zone. Volume control for the general "all call" paging zone will be located at the head-end equipment rack. Each zone will be provided with a telephone interface module with one 4 pair category 6 UTP cable terminated on a patch panel located in the nearest communication room. Separate amplifiers will be provided for each paging zone. The public address system head-end equipment will be mounted in a lockable freestanding cabinet on the first floor within a communications room.

Access to the public address will be through the telephone system or microphones. A desk type microphone will be provided at the head-end equipment rack and other rooms as directed by the VA. Keying of the microphone will activate an "all call" page that will override any zone paging. The microphone "all call" will have priority over the "all call" initiated from the telephone system. Paging zones will be provided as directed by the VA.

Combination radio entertainment (RED) speakers and PA system speakers will be provided in each Dayroom, TV Lounge, Waiting Room and other designated areas. Separate volume/selector controls will be provided at the reception desk serving the area containing the RED speakers.

The public address system speakers will operate at 70V with all wiring installed in 3/4" conduit minimum.

5.5.6 Entertainment Television System

A complete television distribution system will be provided to serve the building. The system will include all cables and hardware as required to distribute the television signals throughout the facility. Amplifiers will be provided to produce a +6 to +12 dBmv signal level at each outlet. The system will be designed as a star topology with each television outlet connected back to the communications room with a coaxial and a 4 pair category 6 UTP cable. Coaxial drop cables will be RG-6 quad shield and trunk cables will be RG-11 quad shield. Cables will be routed through the cable tray located in the ceiling space. ¾" conduit will be extended from each outlet up to the cable tray located in the ceiling space.

The program distribution source for the facility shall be the local cable television service provider (Brighthouse Networks) or satellite service as directed by the VA.

5.5.7 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the cable tray located in the ceiling space. Wiring between the devices and the cable tray will be installed in conduit, 3/4" minimum.

5.5.8 Access Control System

A complete door access control system will be provided as directed by the VA.

5.5.9 Cable Tray System

A cable tray system will be provided throughout the corridor ceiling space to route communications systems wiring with the exception of the public address system, intrusion detection system, and Fire Alarm system (these systems will be installed in metallic conduit). An open cable tray will also be provided within each communication room to manage the cables. The cable tray shall be 4" deep x 18" wide wire basket type.

5.5.10 Fire Alarm and Detection

A complete addressable voice alarm type fire alarm system will be provided to serve the facility. The system will include a main control panel located in the communications closet, remote transponder panels located throughout the building and a remote annunciator panel located at the main entrance to the building. The main control panel will be connected back to the main control panel located in the Hospital with a network connection. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical system. The system will be a voice alarm type system utilizing digital voice systems with the ability to make live announcements as well. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances and voice alarm speakers will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A. All other building's on the campus will have a fiber optic network connection back to the main fire alarm control panel located in the fire command room to allow a single point of monitoring for the entire campus.

Transponder panels will provide a signal interface between the fire alarm control panel and the individual areas of fire alarm system coverage. In addition to fire alarm control functions, the transponder shall also house the audio/visual power supplies and batteries.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A. Smoke detectors will be located in elevator machine rooms, elevator lobbies, fire alarm control panel location, transponder panel locations, and at hold open doors in smoke walls. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

The resident sleeping rooms will be equipped with an addressable, photoelectric smoke detector with an integral sounder as well as a wall mounted strobe. Upon activation of the smoke detector the integral sounder and the wall mounted strobe shall be also be activated. An addressable interface device (control module) shall be provided above the ceiling in each room to control the strobe. The strobe shall also be activated by the other initiating devices in the building except for other sleeping room smoke detectors shall activate their respective strobes only.

135 degree fixed temperature heat detectors will be located in the elevator machine room and pit for elevator power shunt trip actuation. The circuit serving the shunt trip circuit breakers will be monitored by the fire alarm system.

Notification appliances will consist of wall mounted strobe units and ceiling mounted speakers. Combination wall mounted speaker/strobe units will be used in areas where ceiling mounted speakers are not practical or possible. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements. Critical care areas may be provided with strobes only.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

The fire alarm system will be interfaced with the fire pump alarm contacts per NFPA 20. These alarm signals will be automatically transmitted to the central monitoring station.

The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at fire alarm control panel and the control functions will be initiated.

5.6 Electrical design approach (Warehouse/Engineering)

5.6.1 Power Distribution

One 1000KVA, 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substation will be provided to serve 480/277V and 208/120V loads in the Warehouse/Engineering Building from Utility power. The secondary distribution will consist of a 1,600A main circuit breaker and branch circuit breakers as indicated. The substation will be located in a dedicated room within the building. The main circuit breaker will be electronic trip type with LSIG trip functions and branch circuit breakers will be electronic type with LSI trip functions. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

One 750KVA, 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Warehouse/Engineering Building

from Emergency power. The secondary distribution will consist of a 1,600A main circuit breaker and branch circuit breakers as indicated. The substation will be located in a dedicated room within the building. The main and branch circuit breaker will be electronic trip type with LSI trip functions. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. One level of ground fault protection will be provided on the normal system main breaker only. A multifunction digital meter that indicates true RMS values will be provided on each main and distribution circuit breaker of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

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Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be heavy duty specification grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plate will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior conductors will be installed in metallic raceway (EMT. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring

located in damp or wet locations. Minimum size conduit will be 16mm (1/2 inch). Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator. The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, article 250. The emergency generators will be grounded as separately derived system (neutral and ground bonded together).

A complete electrical power monitoring system will be provided to monitor and record load profiles, power quality, historical trending, alarming, etc. for each feeder in the building. The system shall use the building's Ethernet network for communication and transmission of data. All power information shall be collected, stored and managed by a server that will reside in the Central Energy Plant communication room. Anyone with the appropriate password shall be able to access the power monitoring system from any PC connected to the building's network or via the internet.

5.6.2 Lighting

Lighting will conform to VA Design Guidelines and IES lighting levels as design values. The lighting energy density will conform to ASHRAE/IESNA standard 90.1-2004. All fluorescent and HID lighting operation at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Offices and other areas with a large number of personal computer workstations will have low glare and low brightness fixtures such as indirect fixtures. Conference rooms will be provided with dimmable fluorescent fixtures. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial fixtures with wire guards. Compact fluorescent down lighting fixtures and other special lighting fixtures will be used in areas where greater attention must be given to the aesthetics. Interior lighting fixtures will be supported from the structure and will not be supported from suspended ceiling systems, although the fixtures will be mechanically fastened to the ceiling grid system. HID and incandescent fixtures will only be used in special areas or for architectural design reasons.

Light fixtures as indicated will be provided with 90 minute battery backup for general illumination which will operate without interruption during periods of normal and emergency power lapse. Fluorescent fixtures with battery backup will be provided in the communications closets, electrical rooms and the mechanical room. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent dimming switches shall be modular, full-wave, solid state units with continuously adjustable slide and on/off switch. Units shall have audible and electromagnetic noise filters and shall be compatible with the ballasts, which they control.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 75. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens. Edge lit exit signs will be used in high profile areas for aesthetic purposes.

Automatic lighting controls will be provided in all circulation corridors and areas with an abundance of natural light such as clearstory spaces and offices located on exterior walls. The lighting control system shall be a complete networked system consisting of control panels, wiring, and components with the following features: Smart application specific controllers, daylight harvesting control, manual switch override of automated system functions and web-enabled controls.

5.6.3 Lightning Protection

A complete lightning protection system will be provided for the Warehouse/Engineering Building in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used on the parapet walls.

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5.6.4 Voice/Data Distribution System (Structured Cabling System)

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

Combination voice and data outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit stubbed out into the wire way system located in the interstitial space.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms and will be routed through open wire way in the interstitial space. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Backbone distribution will consist of multi-pair (100 pair minimum) category 3 copper riser cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the Hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. Each communications room will be 10 feet x 12 feet minimum, and will serve approximately 10,000 square feet of functional floor area in accordance with TIA/EIA-569-A.

Communications rooms will be vertically aligned in multistory areas of the building. Six 4 inch conduit risers will be provided between each vertically aligned communication room on adjacent floors. All communications rooms will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual. The grounding system will consist of a Telecommunications Main Ground Busbar (TMGB) located in the telephone switch room, and Telecommunications Grounding Busbar (TGB) located in each telecommunications room. A Telecommunications Grounding Backbone Conductor (TGBC) will be provided to interconnect the TMGB and the TGB's. A separate TGBC will be provided from the TMGB for each group of stacked telecommunications closets. The TGB in each telecommunications closet will be bonded to the TGBC. A #3/0 AWG copper grounding conductor (minimum) will be provided to bond the TMGB to the facility's earth ground.

Vertical distribution for the communications systems shall be routed up through the stacked communications rooms. Horizontal distribution will be routed from the communications rooms through the corridor ceiling space within the cables tray.

5.6.5 Public Address System

A multi-channel amplified public address/radio entertainment system with a large number of low power ceiling speakers will be provided for each zone to provide uniform sound distribution at a low volume level. The system will be provided with "all call" and selective zone paging capabilities. Volume control for each zone will be located at an accessible location within that zone. Volume control for the general "all call" paging zone will be located at the head-end equipment rack. Each zone will be provided with a telephone interface module with one 4 pair category 6 UTP cable terminated on a patch panel located in the nearest communication room. Separate amplifiers will be provided for each paging zone. The public address system head-end equipment will be mounted in a lockable freestanding cabinet on the first floor within a communications room.

Access to the public address will be through the telephone system or microphones. A desk type microphone will be provided at the head end equipment rack and other rooms as directed by the VA. Keying of the microphone will activate an "all call" page that will override any zone paging. The microphone "all call" will have priority over the "all call" initiated from the telephone system. Paging zones will be provided as directed by the VA.

Combination radio entertainment (RED) speakers and PA system speakers will be provided in each Dayroom, TV Lounge, Waiting Room and other designated areas. Separate volume/selector controls will be provided at the reception desk serving the area containing the RED speakers.

The public address system speakers will operate at 70V with all wiring installed in 3/4" conduit minimum.

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5.6.6 Entertainment Television System

A complete television distribution system will be provided to serve the building. The system will include all cables and hardware as required to distribute the television signals throughout the facility. Amplifiers will be provided to produce a +6 to +12 dBmv signal level at each outlet. The system will be designed as a star topology with each television outlet connected back to the communications room with a drop cable and each communications room connected back to the head-end equipment with a trunk cable.

Drop cables will be RG-6 quad shield and trunk cables will be RG-11 quad shield. Cables will be routed through the wire way located in the interstitial space. ¾" conduit will be extended from each outlet up to the wire way located in the interstitial space.

The program distribution source for the facility shall be the local cable television service provider (Brighthouse Networks) or satellite service as directed by the VA.

5.6.7 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the wire way located in the interstitial space. Wiring between the devices and the wire way will be installed in conduit, 3/4" minimum.

5.6.8 Intrusion Detection System

A complete intrusion detection system will be provided for the following areas: supply service warehouse, and other locations as defined by the VA.

The system will consist of interior space sensors, control communicators, keypad(s), batteries, audible signaling devices, and communications interface devices. The system shall consist of sensors to detect intrusion attempts. The system shall sense and respond with local and remote visible and audible signals the activation of detection sensors.

All intrusion detection system wiring shall be installed in 3/4" conduit minimum.

5.6.9 Access Control System

A door access control system will be provided as directed by the VA.

5.6.10 Cable Tray System

A cable tray system will be provided throughout the corridor ceiling space to route communications systems wiring with the exception of the public address system, intrusion detection system, and Fire Alarm system (these systems will be installed in metallic conduit). An open cable tray will also be provided within each communication room to manage the cables. The cable tray shall be 4" deep x 18" wide wire basket type.

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5.6.11 Fire Alarm and Detection

A complete addressable voice alarm type fire alarm system will be provided to serve the facility. The system will include a main control panel located in the communications closet, remote transponder panels located throughout the building and a remote annunciator panel located at the main entrance to the building. The main control panel will be connected back to the main control panel located in the Hospital with a network connection. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical system. The system will be a voice alarm type system utilizing digital voice systems with the ability to make live announcements as well. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances and voice alarm speakers will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A. All other building's on the campus will have a fiber optic network connection back to the main fire alarm control panel located in the fire command room to allow a single point of monitoring for the entire campus.

Transponder panels will provide a signal interface between the fire alarm control panel and the individual areas of fire alarm system coverage. In addition to fire alarm control functions, the transponder shall also house the audio/visual power supplies and batteries.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A. Smoke detectors will be located in elevator machine rooms, elevator lobbies, fire alarm control panel location, transponder panel locations, and at hold open doors in smoke walls. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

135 degree fixed temperature heat detectors will be located in the elevator machine room and pit for elevator power shunt trip actuation. The circuit serving the shunt trip circuit breakers will be monitored by the fire alarm system.

Notification appliances will consist of wall mounted strobe units and ceiling mounted speakers. Combination wall mounted speaker/strobe units will be used in areas where ceiling mounted speakers are not practical or possible. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements. Critical care areas may be provided with strobes only.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

The fire alarm system will be interfaced with the fire pump alarm contacts per NFPA 20. These alarm signals will be automatically transmitted to the central monitoring station.

The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at fire alarm control panel and the control functions will be initiated.

5.7 Electrical Design Approach (Parking Garage)

5.7.1 Power Distribution

One 1000KVA, 12,470V-480Y/277V, 3 phase, 4 wire single ended unit substations will be provided to serve 480/277V and 208/120V loads in the Parking Garage from Utility power. The secondary distribution will consist of a 1,600A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the Parking Garage. The main circuit breaker will be electronic trip type with LSIG trip functions and branch circuit breakers will be electronic type with LSI trip function. Each substation will be served by two separate feeders from the medium voltage switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

One 500KVA, 12,470V-480/277V, 3 phase, 4 wire single ended unit substation will be provided to serve 480/277V and 208/120V loads in the Parking Garage from emergency power. The secondary distribution will consist of a 800A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the Parking Garage. All circuit breakers will be electronic trip type with LSI trip functions. Ground fault alarm only will be provided on the main circuit breaker. Each substation will be served by two separate feeders from the paralleling switchgear located in the central energy plant. The primary feeders will be configured as a primary selective system.

All loads within the facility will be backed-up by the emergency power supply system as directed by the VA.

Switchboards will be freestanding type with individually mounted main circuit breaker and group mounted distribution circuit breakers. Main distribution switchboards will be front accessible only. One level of ground fault protection will be provided on the normal system only. A multifunction digital meter that indicates true RMS values will be provided on each main and distribution circuit breaker of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

All panelboards will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction. Electrical rooms will be vertically aligned up through the building. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge

suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be heavy duty specification grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plate will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior conductors will be installed in metallic raceway (EMT) up to the interstitial space where they will then be routed through metallic wire-way with hinged covers to the electrical room from which they are served. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 3/4 inch. Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits below grade and feeders routed below underground or below the floor slab.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator.

The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, article 250.

5.7.2 Lighting

Lighting will conform to VA Design Guidelines and IES lighting levels as design values. The lighting energy density will conform to ASHRAE/IESNA standard 90.1-2004. Metal halide fixtures will be used through the garage for general illumination. All lighting will operate at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial fixtures with wire guards.

Light fixtures as indicated will be provided with 90 minute battery backup for general illumination which will operate without interruption during periods of normal and emergency power lapse. Fluorescent fixtures with battery backup will be provided in the communications closets, electrical rooms and the mechanical room. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 75. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type with a red lens.

Automatic lighting controls will be provided to shut off the light fixtures around the perimeter of the garage when adequate natural light is available. The lighting control system shall consist of a lighting contactor, photocell and time clock.

5.7.3 Lightning Protection

A complete lightning protection system will be provided in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used.

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5.7.4 Voice/Data Distribution System (Structured Cabling System)

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

The system will consist of mainly "house" phones for emergency use and some voice/data outlets in selected areas. Outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured for T568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit back to the communications room.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

Backbone distribution will consist of multi-pair category 3 copper cables for voice and one 24-strand multi-mode fiber optic cable plus one 24-strand single mode fiber optic cable for data from origination point to each Telecommunications Room. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the Hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual.

The telephone switch and instruments will be provided by the VA, funded by the project.

5.7.5 Closed Circuit Television System

The closed circuit television system (CCTV) shall be complete system including CCTV cameras, video monitors coaxial cable and all other hardware required for a complete system. Cameras and monitors will be provided in locations as directed by the VA.

CCTV cables will be routed through the cable tray located in the ceiling space. Wiring between the devices and the cable tray will be installed in conduit, 3/4" minimum.

5.7.6 Fire Alarm and Detection

A complete addressable fire alarm system will be provided to serve the building. The system will control panel and a remote annunciator panel located at the main entrance to the building. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical system. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A.

Notification appliances will consist of wall mounted combination horn/strobe units. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

5.8 Electrical design approach (Central Energy Plant)

5.8.1 Power Distribution

Two 2,000KVA, 12,470V – 480Y/277V single ended unit substations will be provided to serve 480/277V and 208/120V loads in the CEP from utility power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the CEP. Main circuit breakers will be electronic trip type with LSIG trip functions and branch circuit breakers will be electronic type with LSI trip functions.

Two 2,000KVA, 12,470V – 480Y/277V single ended unit substations will be provided to serve 480/277V and 208/120V loads in the CEP from emergency power. The secondary distribution will consist of a 3,000A main circuit breaker and branch circuit breakers as required. The substation will be located in a dedicated room within the CEP. All circuit breakers will be electronic trip type with LSI trip functions. Provide ground fault alarm only on the main circuit breakers.

Three 1,500KVA, 12,470V – 4,160V single ended unit substations will be provided to serve the chillers located in the CEP. Each substation is design to serve two chillers.

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The secondary distribution will consist of a 15KV load interrupter and 5KV vacuum type circuit breakers with multifunction electronic overcurrent relays.

Two sets of 15KV switchgear will be provided to distribute utility power at 12,470V to the individual substations located within the buildings. Each switchgear lineup will consist of two main circuit breakers and normally open tie breaker. Each section will also be equipped with vacuum type branch circuit breakers with multifunction electronic overcurrent relays. The normal switchgear will be interfaced with the paralleling switchgear to enable all normal power loads to be backed –up by the engine generator sets. All of the circuit breakers will be automatically controlled by the generator paralleling switchgear.

Switchboards will be freestanding type with individually mounted main circuit breaker and individually mounted distribution circuit breakers. Both the main and distribution circuit breakers shall be draw-out type with electronic trip units. Main distribution switchboards will be front and rear accessible. Two levels of ground fault protection will be provided on the normal system only, first level on the main and second level on the distribution breakers. A multifunction digital meter that indicates true RMS values will be provided on each main and distribution circuit breaker of the switchboard. Switchboards will be located in dedicated electrical rooms with means of egress as required by NFPA 70. Transient voltage surge protection will be provided for each main on each distribution switchboard.

Substation transformers will be dry type, full vacuum cast coil with copper windings, forced air-cooling fan, temperature monitoring panel and NEMA 1 indoor enclosures. Two key interlocked primary selector switches and a load interrupter switch with current limiting fuses will be provided to serve the primary side of each transformer.

All panelboards switchgear and other electrical equipment will be located in dedicated electrical rooms. Panelboards will be surface mounted with bolt-on circuit breakers, copper bussing and dead front construction except panelboards located in operating room shall be flush mounted. No piping or other equipment foreign to the electrical room will be located in, enter or pass through such rooms.

Heavy-duty enclosed safety switches with quick make/break mechanisms. Handle will be pad lockable in the On or Off position. NEMA type 1 enclosures will be used indoors whereas NEMA type 3R enclosures will be used outdoors.

Motor controllers will be combination type controllers with field adjustable, externally operated motor circuit protectors. Controllers will be full voltage non-reversing horsepower rated magnetic starters with a 120V operating coil, 2 N.O. and 2 N.C. auxiliary contacts, solid state type over load protection, phase failure and under voltage protective relays, control transformer, pilot lights and hand-off-automatic selector switch. Solid state, reduced voltage controllers will be used on motors 50HP and larger. Red pilot light will be provided to indicate "motor running" and green pilot to indicate "motor not running" conditions. Pilot lights will be heavy-duty push-to-test type.

Thermal magnetic molded case circuit breakers will be utilized in branch circuit panelboards. Solid state, electronic trip circuit breakers will be utilized in switchboards and distribution panelboards where required for selective coordination. All circuit breakers will be fully rated for the available fault current. Series rated systems will not be used.

Transient voltage surge suppression (TVSS) will be provided on the building service mains and branch panelboards serving sensitive electronic equipment. Surge suppressors will consist of parallel metal oxide varistors (MOV's) with line-to-line, line-to-neutral, line-to-ground and neutral-to-ground protection.

Dry type transformers will be ventilated dry type with an indoor enclosure. Transformers shall be harmonic mitigating type transformers that exceed NEMA TP1-2002 requirements. Transformers shall reduce voltage distortion to less than 5% and also cancel positive and negative sequence harmonic currents. Units shall be low sound level with copper windings and 115 degree C temperature rise. Primary will be 480V, 3 phase delta connected and the secondary will be 208Y/120V, 3 phase, 4 wire. A ground buss will be provided in each electrical room for connection of grounding electrode conductors from dry type transformers. A grounding electrode conductor sized for the largest transformer in each electric room will be provided from the ground buss to the grounding electrode system.

Receptacles will be heavy duty specification grade grounding type 125V, 20A, NEMA configuration 5-20R. Ground fault circuit interrupter receptacles will be provided only at those locations required by NFPA 70. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon in finished areas. Each receptacle cover plates will be engraved to indicate the panelboard and circuit number from which it is served. Engraving will be in-filled with black paint for white cover plates and white paint for red cover plates.

All conductors will be copper with type THHN/THWN insulation unless conditions require a different type of insulation. Minimum size for branch circuits will be #12 AWG. All interior cables will be installed in metallic raceway (EMT). The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets with each other or other wiring, except at automatic transfer switches.

Electrical Metallic Tubing (EMT) will be used for all branch circuit and feeder wiring in dry locations. Rigid galvanized steel conduit will be used for branch circuit and feeder wiring located in damp or wet locations. Minimum size conduit will be 16mm (1/2 inch). Flexible metal conduit will be used to serve all vibrating equipment, except liquid-tight flexible conduit will be used in damp or wet locations. PVC conduit will not be used except for exterior underground circuits. Conduits routed below interior slab on grade will be PVC. Schedule 80 PVC shall be used for emergency system circuits and feeders routed below underground or below the floor slab.

The electrical distribution system will be designed to provide selective coordination between over current protective devices. A short-circuit and over current protective

device coordination study will be provided for the complete electrical distribution system. All equipment will be fully rated for the available short circuit current. Series rated systems will not be used.

Ground fault circuit protection will be provided in accordance with NFPA 70. Two levels of ground fault circuit protection will be provided on the normal distribution switchboards, one on the main and one on each branch. A minimum six-cycle separation between the main and branch ground fault devices will be maintained. Ground fault sensing (no tripping) with remote annunciation will be provided at the generator. The emergency system ground fault alarm annunciation will be incorporated into the generator remote alarm panel.

Grounding shall comply with NFPA 70, articles 250 and 517. The emergency generators will be grounded as separately derived system

5.8.2 Emergency Power Supply System

All loads in entire facility (i.e. Central Energy Plant, Warehouse, Domiciliary, Hospital, CLC and Parking Garage) will be connected to the emergency power supply system (EPSS). The EPSS will be classified as a Type 10, Level 1 system as defined by NFPA 110. The essential system will consist of two systems classified as "emergency" and "equipment" as defined by NFPA 70. The emergency system consists of two branches classified as the "Life Safety" branch and the "Critical" branch. Each branch of the essential system will be assigned a priority that determines the order in which the loads are connected to the generator paralleling bus and also the order in which loads would be shed from the generator paralleling bus. Priority 1 loads (Life Safety and Critical) will be connected to the emergency bus within 10 seconds from the time of normal power interruption. Equipment branch loads will be connected to the generators in delayed sequence as additional generators are paralleled to the bus. Normal power loads will be the lowest priority.

The estimated load for the entire campus is approximately 19MVA. The alternate power source will consist of (8) 2,250KW prime rated engine generator sets. Each will be a diesel engine driven, 12,470V, 3 phase, 3 wire, 60 hertz, 0.8 power factor units and will be controlled by paralleling switchgear. The engine generator sets and paralleling switchgear will be located in dedicated rooms in the CEP. Space will be provided for two additional engine generator sets. Exhaust louvers will be provided directly in front of each generator and will be sized to accommodate the removal of a generator from the building. Combustion and cooling air in the generator room will be provided by louvers located at the roof level. All louvers shall meet the Dade County Florida criteria for impact resistance. The engine generator sets will be of equal capacity and ratings with matched impedance and loss characteristics and will be designed to carry, in parallel the maximum demand load of the essential system. The engines will have critical grade type exhaust silencers which discharge through the wall directly above the discharge louvers.

A network style remote generator alarm annunciator (generator storage battery powered) will be located at a constantly attended location in the Hospital and also within

the fire command room within the Hospital. The annunciator will indicate alarm conditions of the alternate power source as indicated in NFPA 99 and 110. Single mode outside plant fiber optic cable will be utilized outside between the CEP and the Hospital building. Twisted pair network cable will be used within the building. 24VDC fiber to copper converters powered from the generator batteries will be provided at both ends of the fiber optic cable.

Automatic transfer switches (ATS's) will be located within the building that they serve. ATS's will be 4 pole (switched neutral), open transition, double throw switches, equipped with a load break by-pass isolation switch to maintain normal or emergency power while the ATS is being repaired or maintained. 3 pole transfer switches will be used to serve 3 phase 3 wire loads with no neutral. Circuit breaker type transfer switches will not be used. Priority 2 and higher equipment branch transfer switches will be equipped with a "center off" position for load shedding and programmed transition when going from the emergency to normal position. All engine start, load shed and transfer inhibit controls will be hard wired connections back to the paralleling switchgear in the Central Energy Plant with stranded copper conductors. All start and load shed circuits shall be wired for fail-safe operation (i.e. open to start, open to shed). ATS's will also be equipped with network communications modules for monitoring voltage, current, power factor, switch position, etc. The network monitoring functions will operate over fiber optic and twisted pair network cables.

Two sets of generator paralleling switchgear will be provided to automatically synchronize the engine generator sets. One set of paralleling switchgear will serve the Hospital, Warehouse and CLC and other set will serve the Clinic, Domiciliary, and parking garage. Four engine generator sets will be connected to each paralleling switchgear lineup. Each of the paralleling switchgear line-ups will have provisions for connection of a future generator. A totalizing controller will provide for the selection of emergency loads on a priority basis (priority 1 loads will be connected first, then priority 2 loads, then priority 3 loads, then priority 4 loads). The totalizer monitors the power available from the generator and the electrical demand power required. Loads will be connected to the emergency power bus on an incremental basis depending on the priority of the load. If a generator unit fails to start or is shut down for any reason or the totalizer controls will shed loads to permit only the highest priority loads to remain connected to the emergency bus. An overload or under frequency at the bus will also initiate the load shed sequence. The system shall also have automatic load demand controls to remove excess generators from the bus as dictated by the load. The paralleling switchgear will contain medium voltage, vacuum type circuit breakers with multifunction electronic overcurrent relays. The bus will be rated for 2000A, 12,470V, 3 phase, 3 wire. The paralleling switchgear will be located in a dedicated climate controlled room adjacent to the generator room with a window to allow observation of the generators from the control room.

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5.8.3 Single Utility Feeder Power Failure

If only one utility feeder is lost, then that utility main breaker is opened and the tie breaker in the Normal switchgear is closed automatically after an adjustable time delay. Normal power to all feeder breakers in the Normal switchgear is now fed from a single utility feeder.

Upon return of the normal power to the failed utility feeder and after an adjustable time delay, the previously closed tie-breaker will open and the restored utility breaker will close (Open Transition).

5.8.4 Two (or more) Utility Feeder Power Failures or Failure of Feeder Serving ATS

As soon as two or more of the utility feeders to the normal gear have failed or an ATS senses under voltage or under frequency , the controls will signal all generators to start. The first generator to reach acceptable speed and voltage will close to the emergency bus on each side of the tie switch in each emergency generator switchgear system (EGS). The distribution breakers in EGS will normally be closed and the first generator closed to each side of the emergency bus will supply power to all downstream transfer switches fed from these breakers, allowing all Priority 1 transfer switches to transfer to emergency power (this will occur within 10 seconds). Once one generator is closed to each side of the emergency bus in each EGS, the two sides will sync to each other and close the tie breaker, creating one emergency bus in each EGS. As the remaining generators reach acceptable speed and voltage, each shall automatically parallel to the first two generators and close to the emergency bus. As soon as the third generator is on-line, the controls shall remove the block transfer signal to Priority 3 transfer switches allowing them to transfer to the emergency power source. Each subsequent generator shall parallel to the emergency bus and controls shall remove the block transfer signal to each subsequent priority transfer switches (Priority 4, 5, etc). Once all generators are connected to the emergency bus and have reached stable operation (achieved via a time delay), the controls will open the two Utility main breakers in the normal switchgear and close the back-feed breakers to the normal switchgear. The complete normal switchgear will now be energized by the emergency power system, restoring power to all hospital loads not fed via any automatic transfer switches. The automatic transfer switches (currently in the emergency position) will now see power on their normal source terminals, via the back-feed. Since the ATS's cannot distinguish that the normal power is now coming from the generators, controls will be provided to hold the transfer switches in the emergency position until normal power is restored. After a preset time the control system will initiate automatic load control whereby the system will run only as many generators as needed based on the current power demand (plus some spinning reserve) to maximize operating efficiency.

Upon restoration of all normal utility feeds, as sensed at the normal switchgear, and after a time delay to verify stable utility power is available, the control system shall execute a closed transition return to normal power. This shall be accomplished by sequentially restoring normal to each of the two sections of the normal switchgear. First, the emergency system will synchronize to the utility feeder in section S-1 of the normal

switchgear. Once achieved, the utility breaker will close and the back feed breaker to section S-1 will open in a closed transition transfer. The closed transition time will be approximately 20 seconds during which the system will automatically walk the load on utility section S-1 from the generators to the utility (soft loading). Likewise, the emergency system will then synchronize to the utility feeder in section S-2 of the normal switchgear and, once achieved, the utility breaker will close and the back feed breaker to section S-2 will open in a closed transition transfer, once again in a soft load transfer of approximately 20 seconds. Since all transfer switches are already in their normal position, the closed transition transfer shall result in each ATS maintaining its normal position with each now fed from Normal power. Once all utilities have been brought back on line, the emergency system will be unloaded and a controlled shutdown of the generators shall be completed following a cool down period.

5.8.5 Extended Outage Mode (Also applies to future Utility Load Curtailment)

The control system shall be furnished with an operator switch to select and initiate "Extended Outage" mode. Once selected and initiated, the controls will signal all generators to start. The first generator to reach acceptable speed and voltage will close to each side of the emergency bus in switchgear EGS. The system will sync both sides and close the tie breaker in EGS creating one emergency bus. As the remaining generators reach acceptable speed and voltage, each shall automatically parallel to the first two generators and close to the emergency bus. Once all generators are on the emergency bus and have reached stable operation (achieved via a time delay), the controls will initiate a closed transition transfer from the two utility sources to the emergency system. First, the emergency system will parallel to the utility feed to the S-1 section of the normal switchgear and, once achieved, close the back feed breaker to S-1 section of the normal switchgear and open the utility breaker in S-1 in a closed transition transfer. The closed transition time will be approximately 20 seconds during which the system will automatically walk the load on utility section S-1 from the utility to the generators (soft loading). Likewise, the emergency system will then synchronize to the utility feeder in section S-2 of the normal switchgear and, once achieved, the utility breaker will open and the back feed breaker to section S-2 will close in a closed transition transfer, once again in a soft load transfer of approximately 20 seconds. Since all transfer switches are already in their normal position, the closed transition transfer shall result in each ATS maintaining its normal position with each now fed from Emergency power via the Normal side feed. Since all ATS's are also seeing power on their emergency source terminals, any interruption of the power via the Normal gear (such as back feed breaker opened) or would result in an immediate transfer to the emergency side.

Upon an operator initiated command to end Extended Outage Mode, the control system shall execute a closed transition return to normal power. This shall be accomplished by sequentially restoring normal to each of the two sections of the normal switchgear. First, the emergency system will synchronize to the utility feeder in section S-1 of the normal switchgear. Once achieved, the utility breaker will close and the back feed breaker to section S-1 will open in a closed transition transfer. The closed transition time will be

approximately 20 seconds during which the system will automatically walk the load on utility section S-1 from the generators to the utility (soft loading). Likewise, the emergency system will then synchronize to the utility feeder in section S-2 of the normal switchgear and, once achieved, the utility breaker will close and the back feed breaker to section S-2 will open in a closed transition transfer, once again in a soft load transfer of approximately 20 seconds. Since all transfer switches are already in their normal position, the closed transition transfer shall result in each ATS maintaining its normal position with each now fed from Normal power. Once all utilities have been brought back on line, the emergency system will be unloaded and a controlled shutdown of the generators shall be completed following a cool down period.

Underground fuel-oil tanks will be provided to allow a 7 day supply when the generators are operated at full load. Each generator will be provided with a floor mounted day tank with overflow back to the main storage tank. Day tanks will be 400 gallons and will contain high and low fuel level monitoring with annunciation at the remote alarm annunciator panels. Day tanks will utilize ultrasonic type sensing for fuel level monitoring. The main storage tanks will be provided with a tank monitoring system for fuel level alarm and status indication located in the remote alarm panels. The generator fuel-oil return shall be piped directly to the main storage tank. A system shall be provided to automatically dry, filter and circulate the fuel oil in order to maintain the integrity of the fuel oil.

5.8.6 Lighting

Lighting will conform to VA Design Guidelines and IES with all fluorescent and HID lighting operation at 277 volts, 60 hertz. Fluorescent fixtures will utilize electronic programmed start ballasts and T-8 lamps. All low occupancy rooms such as single occupancy toilets, janitor closets, and storage rooms will be provided with occupancy sensing lighting controls. Mechanical rooms, communications rooms and electrical rooms will be provided with fluorescent industrial strip fixtures with wire guards. Chains will not be used to suspend fluorescent fixtures.

Fluorescent fixtures with battery backup will be provided in the generator room, generator control switchgear room, communications closets and electrical rooms. All fixtures in stairwells shall be equipped with battery backup type ballasts.

Snap switches will be quiet type switches rated for 20 amperes, 120/277V. Device color will be white except for those devices that are connected to emergency power will be red. Device cover plates will be smooth nylon.

Occupancy sensing switches shall be switch-box mounted with manual override switch, combination passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for the area covered. Programmed start ballasts will be provided for all fluorescent fixtures controlled by occupancy sensing switches.

Fluorescent lamps for general-purpose lighting will be rated, 3500 degree's Kelvin with a minimum CRI of 82. All fluorescent lamps will be specified to be low mercury type. HID lamps shall have dual restrike elements.

Fluorescent ballasts will be the high power factor electronic energy saver programmed start type. The total harmonic distortion shall not exceed 10 percent of the fundamental current.

All exit signs will be LED illuminated type.

5.8.7 Lightning Protection

A complete lightning protection system will be provided for the Clinic in accordance with NFPA 780. The system will consist of roof conductors, concealed down conductors, strike termination devices, ground loop conductor, bonding connections and ground rods. All strike termination devices will be mechanically fastened to the structure, adhesive mounted devices will not be used on the parapet walls.

5.8.8 Voice/Data System

Combination voice and data outlets will consist of a single gang six position angled face plate with one eight position modular jack and a 4 pair category 6 UTP cable for voice, three eight position modular jacks with three 4 pair category 6 UTP cable for data, and two blank inserts. All eight-position connectors will be category 6 rated and will be configured forT568A. All combination voice and data jacks will be installed in a 4 inch x 2 1/8 inch deep square boxes with a single gang plaster ring and 1 inch conduit back to the communications room.

The Premises Distribution System (PDS) will be a complete structured cabling and pathway system for both horizontal and backbone distribution. The PDS will be designed in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3, and will consist of raceways, cable, outlets, terminal blocks, backboards, patch panels, equipment racks, and equipment cabinets for the voice and data networks. The PDS will be designed as a star topology in accordance with TIA/EIA-568-B.1.

All PDS equipment in the telecommunications rooms will be located in free standing equipment racks with standard 19 inch mounting rails. Equipment racks will be provided with horizontal and vertical cable management. Equipment racks will also be provided with receptacle power strips.

All horizontal cabling from station outlets to the telecommunications closet will be designed to be either a voice or data outlet, completely dependant on how the patch cables are connected in the telecommunications room. All voice and data horizontal cables will be terminated on category 6 rated patch panels located on free standing equipment racks in the telecommunications rooms. A minimum 6 foot service loop will be provided at the termination point for each horizontal voice and data cable. This service loop will allow horizontal cables to be removed and re-terminated on a different patch panel port.

Backbone distribution will consist of multi-pair outside plant cable for voice and one 24-strand single mode, outside fiber optic cable for data from origination point to the communications room in the CEP. A minimum 6 foot service loop will be provided at the termination point of each backbone cable. The voice backbone cable will originate from

the MDF in the telephone equipment room located in the Hospital and the data backbone cable will originate in the main computer located in the hospital. The voice backbone cable will be sized to accommodate the initial installed capacity plus fifty percent spare capacity and will be terminated on patch panels in the equipment racks in each telecommunications room. Building protector modules will be provided where outside plant copper cable enters the building. The fiber optic data cable will be terminated on fiber optic patch panels mounted in the bottom third of the telecommunications equipment rack in each telecommunications closet. All fiber optic cable will be terminated using SC connectors. Data backbone fiber optic cable will be installed in 1 inch inner duct for added cable protection.

The communications rooms will be combined voice/data and signal rooms. The communications room will be 10 feet x 12 feet minimum. The communications room will be provided with 120V receptacles and power circuits served from the critical branch of the essential electrical system.

The telecommunications grounding system will be provided in accordance with TIA/EIA-607 and the VA Electrical Design Manual.

5.8.9 Access Control System

A complete door access control system will be provided for all perimeter doors.

5.8.10 Fire Alarm/Detection System

A complete addressable fire alarm system will be provided to serve the building. The system will control panel and a remote annunciator panel located at the main entrance to the building. The fire detection and alarm system shall have a four hour battery supply and will be connected to the life safety branch of the essential electrical system. Manual pull stations, smoke detectors, duct mounted smoke detectors, heat detectors, flow switches, tamper switches, audio/visual indicating appliances will be provided in accordance with NFPA 72, ADA and the VA Design Manual. The system will utilize Class B wiring methods for initiating device circuits, signaling line circuits and notification appliance circuits. All circuits and will be installed in metallic conduit, 3/4" minimum size. Communication circuits between buildings shall be Class A.

Manual stations will be double action type. Pull stations will be provided in accordance with NFPA 72.

Smoke detectors will be addressable photoelectric type and located in accordance with NFPA 72, 101 AND 90A. Smoke detectors will be located at the fire alarm control panel location. A corridor smoke detection system will not be provided unless code dictates. Duct mounted smoke detectors will be provided in supply and return ducts where required by code.

Notification appliances will consist of wall mounted combination horn/strobe units. Strobes will be ADA compliant with a light output of 75 candela and shall be located in accordance with ADA requirements.

All alarm and trouble signals will be transmitted to a listed central monitoring station via digital alarm communicator (DATC).

The fire alarm system will be interfaced with the supply and exhaust fans through addressable control modules. The fans shall be shut down upon activation of their respective duct mounted smoke detectors only.

5.9 Utility Company Meetings

A meeting with the Orlando Utilities Commission (OUC) was held on March 15, 2007 to discuss electrical service for the VA Medical Center campus at the Lake Nona site. The following is a summary of the meeting:

The proposed plan for the Lake Nona site was presented to OUC. OUC was informed that the estimated load for the campus is approximately 20MVA.

OUC will provide 12,470V, 3 phase underground service to the VA campus.

OUC indicated that the VA campus will be served from the OUC substation #32 located approximately 6000 feet to the north of the proposed site. The substation currently consists a single 37.5MVA unit, but two additional 37.5 MVA units will be added prior to the VA campus completion. OUC will provide two dedicated feeders (one will be the primary feed and the other will be standby), each will be served from a different transformer within substation #32.

OUC will have a 10-way 6" duct bank on the north side of Exploration Blvd. Two of these ducts will be used to serve the VA campus.

OUC will provide pad mounted automatic transfer gear, sectionalizing switches and metering cabinets to serve the VA campus. This gear will be located at the edge of the VA property at the north east corner of the site. The automatic transfer gear will provide the ability to automatically switch from the primary feeder to the standby feeder or vise versa in the event of a feeder or substation failure.

Automatic transfer gear and sectionalizing switches will be rated for 600A, 15KV. Up to 1000kcmil conductors can be terminated on this gear.

5.10 Site Utilities

5.10.1 Primary Power (Utility Company Owned)

The Orlando Utilities Commission (OUC) will provide electrical service to the VA campus. Two dedicated 12,470V, 3 phase feeders will be provided to serve the campus. Each feeder will be served from a separate transformer at the OUC substation #32 located just to the north of the proposed site. OUC will provide pad mounted automatic transfer gear and sectionalizing switches at the north east corner of the site. The automatic transfer gear will provide the ability to automatically switch from the primary feeder to the standby feeder or vise versa in the event of a feeder or substation failure. The VA owned feeders will terminate on the sectionalizing switches.

5.10.2 Normal Primary Power (VA Owned)

The VA will own and operate the primary power distribution system from the load side of the OUC pad mounted switches to the end use gear within the buildings.

Four primary power feeders will be provided from the OUC pad mounted switchgear to the medium voltage distribution gear located in the central energy plant. Each feeder will consist of 3 1/C, 15KV, MV-105, 750kcmil, type EPR shielded conductors and 1 #4/0 insulated copper ground.

Normal power will be distributed at 12,470V, 3 phase from the paralleling switchgear located in the Central Energy Plant to 12,470V – 480Y/277V substations located within each building. 5 inch schedule 40 PVC concrete encased duct banks will be provided from the distribution switchgear to each building. The underground duct bank system has been designed to comply with the VA Physical Security Standards to the greatest extent possible. Each substation is served by two separate feeders configured for primary selective system. The VA Physical Security Standards require the substation feeders be separated by 100 feet. Due to site constraints and practicality, 100 percent compliance with the standard was not possible in all areas. Warning tape and a #4/0 bare copper grounding conductor will be routed above each duct bank. 6' x 12' x 7' high pre-cast concrete manholes will be provided in the duct runs to limit cable pulls to approximately 400 feet.

5.11 Essential Electrical System Underground Distribution

Essential System Power will be distributed at 12,470V, 3 phase from the paralleling switchgear located in the Central Energy Plant to 12,470V – 480Y/277V substations located within each building. 5 inch schedule 40 PVC concrete encased duct banks will be provided from the paralleling switchgear to each building. The underground duct bank system has been designed to comply with the VA Physical Security Standards to the greatest extent possible. Each substation is served by two separate feeders configured for primary selective system. The VA Physical Security Standards require the substation feeders be separated by 100 feet. Due to site constraints and practicality, 100 percent compliance with the standard was not possible in all areas. Warning tape and a #4/0 bare copper grounding conductor will be routed above each duct bank.

Generator control and alarm wiring shall also be provided from the paralleling switchgear control cabinets to each building on the campus. Generator control wiring will consist of engine start, load shed and transfer inhibit functions. The generator control wiring will be multi-conductor stranded #12AWG copper with a gas/vapor proof PVC jacket UL listed for wet locations. Generator alarm functions will be transmitted over outside plant fiber optic cable. All control and alarm wiring will be routed in 4 inch concrete encased duct banks to each building. Warning tape and a #4/0 bare copper grounding conductor will be routed above each duct bank.

6' x 15' x 7' high pre-cast concrete manholes will be provided in the duct runs to limit cable pulls to approximately 400 feet. Warning tape and a #4/0 bare copper grounding conductor will be routed above each duct bank.

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5.12 Telephone Service

Telephone service to the VA campus will be provided by AT&T. AT&T will provide both copper and fiber optic lines for voice service to the campus. The VA will provide the telephone switch and all instruments in each building. The telephone switch located on the fourth floor of the Hospital and will serve all buildings on the campus.

Two separate 4-way, 4 inch concrete encased duct banks with diverse paths will be provided from Exploration Blvd to the telephone switch room located on the fourth floor of the Hospital. Manholes will be provided in the duct run to limit cable pulls to 400 feet. Warning tape and a #4/0 bare copper grounding conductor will be routed above each duct bank.

5.13 Cable Television Service

Cable television service to the VA campus will be provided by Brighthouse Networks. Cable television cables will share the same pathway as indicated above for the telephone cables.

5.14 Site Lighting

Exterior lighting will be provided along all roadways, pedestrian walkways, service drives and in parking lots. Roadways and parking lots shall be illuminated by pole mounted fixtures with metal halide lamps, maximum pole height will be 30'-0". Illuminated bollards or 12'-0" pole mounted fixtures with metal halide lamps will be provided along pedestrian walkways. All poles will be aluminum with an anodized finish and concrete base. All exterior lighting will have automatic controls. Lighting levels will be in accordance with the VA Electrical Design Manual and IES recommendations.

5.15 Life cycle cost analyses

Low impedance Busways, high efficienct lighting and high efficiency, harmonic mitigating dry type transformers are included in this submission. These are energy-efficient and low maintenance pieces of electrical power distribution equipment and meet the VA Guideline and Design Manuals. The Life-Cycle Costing Manual NIST Handbook 135 for the Federal Energy Management Program was studied to look for any pieces of alternate electrical equipment that could be compared with in terms of energy efficiency. As a result, it was found that there is not much to compare alternate electrical equipment for life cycle cost analysis.

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5.16 Specialty areas

The following specialty areas are included in the new Hospital design:

Medical, surgical and neurological nursing units

Intensive care units, cardiology, medical and neurological unit

Intensive care units, surgical unit

Psychiatric nursing units, mental health unit 1

Nuclear Medicine

Magnetic resonance imaging (MRI)

Radiology department

Radiation Therapy department

Surgery suite

Emergency department

Dietary department

Lab/Pharmacy department

Supply Process/Distribution department

5.17 Proposed Method Of Short Circuit, Voltage, Demand Calculation

These calculations would be done by using a systematic engineering methodology approach of SKM Power Tools analysis software called DAAPER. Short circuit study is based on Ohm's law. The short circuit study would model the current flow in the power distribution system under abnormal conditions and determine the fault currents. These fault current values would be used to specify the electrical equipment withstand and interrupting ratings. The load Flow study would be done to calculate the voltage drops in the power distribution feeders and branch circuits. Voltage drops would be limited to the National Electrical Code requirements. Demand Load Flow study would be done to calculate the connected, demand and design values for each bus, including the effect of load diversity.

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5.18 Area-based load calculations

5.18.1 Parking Garage – Area Based Load Calculations

Building Square Footage 675,400	SQ FT		KVA CONNECTED	KVA DEMAND
Lighting	Actual Load	KVA	140.0	140.0
Receptacle Demand	0.1 10KVA@100%+BAL@50%	VA/SQ FT	67.5	38.8
Mechanical Loads (Alt) Demand	Actual Load 0.90	KVA	240.0	216.0
Elevator Loads Demand	6@50hp 0.90	KVA	325.0	292.5
TOTAL			772.5	687.3

5.18.2 Central Energy Plant – Area Based Load Calculations

Building Square Footage 45,000	SQ FT		KVA CONNECTED	KVA DEMAND
Lighting Demand	2.0 50KVA@40%+BAL@20%	VA/SQ FT	90.0	28.0
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	90.0	50.0
Small Equipment Demand	2.0 0.60	VA/SQ FT	90.0	54.0
Mechanical Loads Demand	Actual Load 0.90	KVA	3,342.0	3,007.8
Mechanical Chillers Demand	Actual Load 0.90	KVA	4,215.0	3,793.5
TOTAL			7,840.9	6,939.3

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5.18.3 CLC – Area Based Load Calculations

Building Square Footage 108,000	SQ FT		KVA CONNECTED	KVA DEMAND
Lighting Demand	2.0 0	VA/SQ FT	216.0	216.0
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	216.0	113.0
Small Equipment Demand	3.0 0.60	VA/SQ FT	324.0	194.4
Mechanical Loads Demand	5.0 0.90	VA/SQ FT	540.0	486.0
Kitchen Equipment Demand Kitchen Area	60.00 0.65 1,100	VA/SQ FT SQ FT	66.0	42.9
TOTAL			1,362.0	1,052.3

5.18.4 Clinic – Area Based Load Calculations

Building Square Footage 421,724	SQ FT		KVA CONNECTED	KVA DEMAND
Lighting Demand	2.0 0	VA/SQ FT	843.4	843.4
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	843.4	426.7
Small Equipment Demand	2.0 0.60	VA/SQ FT	843.4	506.1
Mechanical Loads Demand	4.0 0.90	VA/SQ FT	1,686.9	1518.2
Elevator Loads Demand	8@50hp 0.75	KVA	400.0	300.0
TOTAL			4,617.2	3,594.4

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5.18.5 Domiciliary – Area Based Load Calculations

Building Square Footage 40,941	**SQ FT**		**KVA CONNECTED**	**KVA DEMAND**
Lighting Demand	2.0 50KVA@40%+BAL@20%	VA/SQ FT	81.9	26.4
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	81.9	45.9
Small Equipment Demand	2.0 0.60	VA/SQ FT	81.9	49.1
Mechanical Loads Demand	5.0 0.90	VA/SQ FT	204.7	184.2
Mechanical Loads (Alt) Demand	Actual Load 0.00	KVA	0.0	0.0
Elevator Loads Demand	2@50hp 0.95	KVA	154.6	146.9
Kitchen Equipment Demand Kitchen Area	52.00 0.65 0	VA/SQ FT SQ FT	0.0	0.0
TOTAL			605.0	452.6

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5.18.6 Warehouse/Engineering – Area Based Load Calculations

Building Square Footage 91,555	**SQ FT**		**KVA** CONNECTED	**KVA** DEMAND
Lighting Demand	2.0 50KVA@40%+BAL@20%	VA/SQ FT	183.1	46.6
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	183.1	96.6
Small Equipment Demand	2.0 0.60	VA/SQ FT	183.1	109.9
Mechanical Loads Demand	5.0 0.80	VA/SQ FT	457.8	366.2
Mechanical Loads (Alt) Demand	Actual Load 0.00	KVA	0.0	0.0
Elevator Loads Demand	1@50hp +2@60hp 0.90	KVA	260.3	234.3
TOTAL			1,267.4	853.5

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5.18.7 Hospital – Area Based Load Calculations

Building Square Footage 640,515	**SQ FT**		**KVA CONNECTED**	**KVA DEMAND**
Lighting Demand	2.0 50KVA@40%+BAL@20%	VA/SQ FT	1,209.0	251.8
Receptacle Demand	2.0 10KVA@100%+BAL@50%	VA/SQ FT	1,209.0	609.5
Small Equipment Demand	2.0 0.60	VA/SQ FT	1,209.0	725.4
Mechanical Loads Demand	6.0 0.80	VA/SQ FT	3,627.1	2,901.7
Mechanical Loads (Alt) Demand	Actual Load 0.00	KVA	0.0	0.0
Elevator Loads Demand	4@50hp +8@60hp 0.75	KVA	1,041.2	780.9
Imaging Equipment Demand	Actual Load 0.90	KVA	1,250.0	1,125.0
Mechanical Chillers Demand	Actual Load 0.00	KVA	0.0	0.0
Kitchen Equipment Demand Kitchen Area	52.00 0.65 24,500	VA/SQ FT SQ FT	1,274.0	828.1
TOTAL			10,819.4	7,222.4

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6. BUILDING & LIFE SAFETY CODE ANALYSIS

6.1 Codes, Standards, Criteria Project Analysis

NFPA 1 – 2006	Uniform Fire Code
NFPA 10 – 2007	Portable Fire Extinguisher
NFPA 13 – 2007	Standard for the Installation of Sprinkler Systems
NFPA 14 – 2007	Standard for the Installation of Standpipe and Hose Systems
NFPA 20 – 2007	Standard for the Installation of Stationary Fire Pumps for Fire Protection
NFPA 24 – 2007	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 30 – 2008	Flammable and Combustible Liquids Code
NFPA 37 – 2006	Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 45 – 2004	Standard on Fire Protection for Laboratories Using Chemicals
NFPA 54 – 2006	ANSI Z223.1-2006 National Fuel Gas Code
NFPA 55 – 2005	Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks
NFPA 70 – 2005	National Electrical Code
NFPA 72 – 2007	National Fire Alarm Code
NFPA 88A – 2007	Standard for Parking Garages
NFPA 90A – 2002	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 99 – 2005	Standard for Health Care Facilities
NFPA 101 – 2006	Life Safety Code
NFPA 211 – 2006	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 220 – 2006	Standard on Types of Building Construction
NFPA 291 – 2007	Recommended Practice for Fire Flow Testing and Marking of Hydrants
NFPA 1963 – 2003	Standard for Fire Hose Connections

VA Design Guide and Technical Guide

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VA Fire Protection Design Manual – 2005

Florida Building Code – 2004

International Building Code - 2006

6.2 Exit calculations

6.3 System Narrative and Supporting Calculations

6.4 Fire Suppression

6.5 General Fire Suppression Information

Current water flow information for the site water distribution system is not available. Flow tests are to be provided to determine the water and pressures available to the site.

The preliminary water flow requirements for the sprinkler system and hose stream calculates as follows (assuming worst case warehouse utilizing ESFR sprinklers):

.20	gpm/sq. ft. density (Ordinary Hazard Group 2)
x 2,000	sq. ft. design area (dry pipe system)
400	gpm/design area
+ 500	gpm/hose stream
900	gpm combined sprinkler and hose demand
x 90	minutes (duration of flow)
81,000	gallons total water demand for fire protection
125	gpm/ESFR
x 12	number of ESFR operating
1500	gpm/design area
+ 250	gpm/hose stream
1750	
x 90	minutes
157,500	gallons total water demand for fire protection

Per NFPA 14, the estimated pressure required to provide a 100 psi at the upper hose outlet is as follows:

100	psi at outlet
+ 43	psi (elevation loss) = .432 psi/foot of elevation times 100 feet
+ 25	psi (allowance for friction loss)
+ 10	psi (allowance for backflow preventer)
178	psi required at base of system riser

Per VA fire protection design criteria, the fire pump system is not required to be sized to provide standpipe pressure demands; VA design criteria indicates standpipe pressure demands will be provided via local fire department pumper trucks. In order to meet City of Orlando requiremtns, the fire pump system will be sized to accommodate standpipe pressure demands.

Duplex fire pumps rated at 1250-1500 gpm each will be required to provide the water demand and pressure to insure proper operation of the fire protection system. Each fire pump will be sized for 100% of connected load. The fire pumps will be located in a dedicated 1 hour rated pump room in the Central Energy Plant. With a large diesel generator to service the emergency systems within the Hospital, the fire pump motor can be electric and fed from the emergency generator. The electric motors would need to be 150-200 bhp. Once the taps to the county water main lines are made, a more accurate water supply and thus a more accurate pump rating can be determined.

Combined sprinkler and standpipe system will be connected to the fire service. Riser pipes will be provided in each enclosed exit stair. These 6" diameter risers will be fed from mains run in the first floor. A control valve will be provided between the feed main and each riser. Floor control valve assemblies with check valves will be provided in the stair enclosures and fed to zone piping.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below:

Light hazard occupancies will be designed to provide 0.10 gpm per square foot over most remote 1,500 square feet with quick response sprinklers.

Ordinary Hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet.

Ordinary Hazard Group 2 occupancies will be designed to provide 0.20 gpm per square foot over most remote 1,500 square feet.

Extra Hazard Group 1 occupancies will be designed to provide 0.30 gpm per square foot over the most remote 1,500 square feet.

Extra Hazard Group 2 occupancies will be designed to provide 0.40 gpm per square foot over the most remote 1,500 square feet.

Sprinkler systems in each building will be zoned to coincide with smoke zones and by prime areas such as the docks, lobbies and computer rooms. In addition, sprinkler systems protecting special hazards, elevator machine rooms, cooking hoods and associated exhaust ducts are to be zoned separately. Each sprinkler zone/system will be provided with all necessary valves, control valve with tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

6.5.1 Hospital / Clinic Fire Suppression Design

The Hospital will require a fire pump to elevate the system pressure. The fire pump system will be located in the Central Energy Plant (CEP). Two 10 inch fire suppression water service laterals are proposed, connecting to the below ground fire main from the fire pump system in the CEP. One 10 inch lateral will enter the building at the Clinic; the second 10 inch lateral will enter the building at the Hospital. Piping will be interconnected in the tunnel to provide redundant service for the facility. The services will be equipped with exterior installed Post Indicator valves. The service entrance

piping will also be equipped with electronically supervised shutoff valves. The Hospital fire suppression system will be equipped with pendant fire department connections installed approximately 40 feet from the Hospital.

An automatic wet pipe fire suppression system will be provided throughout the occupied floors of the Hospital. The system will utilize quick response sprinkler heads. The basic system classification will be light hazard. However, certain portions of the facility will require ordinary hazard design such as laboratories, pharmacy, kitchen, storage rooms, electrical equipment rooms, communication rooms, and mechanical equipment rooms. Bottled oxidizer gas storage will be extra hazard.

A supervised pre-action sprinkler system will be provided in computer rooms, electrical substation rooms, and switchgear rooms. A dry-pipe system or dry sprinklers will be provided in areas subject to temperatures below 40°F, such as dock areas and refrigerated areas. Distribution and interstitial zones will not be sprinklered. Commercial cooking hoods and exhaust duct shall be provided with an automatic wet chemical extinguisher system.

Due to the building height, a Class 1 standpipe system will be required. The standpipes will be hydraulically sized to provide 500 gpm at the topmost outlet with a residual pressure of 100 psi. Standpipe outlets will be equipped with a shut off valve and a 2-1/2"x 1-1/2" reducer with cap. Standpipe outlets will be provided to serve every occupied zone level within all stair enclosures. Standpipes will be located in each enclosed stairwell with fire hose valves located at an intermediate stair landing between each occupied floor. Additional outlets will be provided as required to reach all portions of the building within 200 feet of hose connection. Outlets will (where practical) be located within approximately 10 feet of designated horizontal exits, with an outlet on both sides of the horizontal exit wall. The automatic sprinkler system risers will be connected to the standpipes. Each sprinkler connection will be equipped with an electronically supervised shutoff valve, checkvalve, a flow switch, a calibrated test valve and a drain valve. Piping will extend from the riser to the sprinkler heads. Drain piping will extend to the building exterior at the lowest level. The supply control valves and flow switches in the Hospital will be electronically supervised by connection to the building's fire alarm system.

Piping in the Hospital will extend from the risers, to lateral main piping above ceilings to the sprinkler head locations. The piping system will be constructed of black steel; threaded joints for piping sizes 2 inches and smaller, ring-grooved, flanged or welded joints for pipe sizes 2-1/2 inches and larger. Threaded fittings will be malleable steel and ring-grooved and welding type fittings joints will be forged steel.

6.5.2 Community Living Center (CLC) Fire Suppression Design

The CLC may not require a fire pump to elevate the system pressure. However, the CLC fire suppression system is proposed to be connected to the fire pump system located in the Central Energy Plant (CEP). An 8 inch fire suppression water service lateral is proposed, connecting to the below ground fire main from the fire pump system in the CEP. The service will be equipped with an exterior installed Post Indicator valve.

The service entrance piping will also be equipped with electronically supervised shutoff valves. The CLC fire suppression system will be equipped with a pendant fire department connection installed roughly 40 feet from the CLC.

An automatic wet pipe fire suppression system will be provided throughout the CLC. The system will utilize quick response sprinkler heads. The basic system classification will be light hazard. However, certain portions of the facility will require ordinary hazard design such as storage rooms, electrical equipment rooms, communication rooms, and mechanical equipment rooms. Bottled oxidizer gas storage will be extra hazard.

Each sprinkler connection will be equipped with an electronically supervised shutoff valve, a flow switch, a calibrated test valve and a drain valve. Piping will exten from the riser to the sprinkler heads. Drain piping will extend to the building exterior a the lowest level. The control valves and flow switches in the CLC will be electronically supervised by connection to the building's fire alarm system.

Piping in the CLC will extend from the risers above ceilings to the sprinkler head locations. The piping system will be constructed of black steel; threaded joints for piping sizes 2 inches and smaller, ring-grooved, flanged or welded joints for pipe sizes 2-1/2 inches and larger. Threaded fittings will be malleable steel and ring-grooved and welding type fittings joints will be forged steel.

6.5.3 Domiciliary Fire Suppression Design

The Domiciliary will require a fire pump to elevate the system pressure. The fire pump system will be located in the Central Energy Plant (CEP). A 6 inch fire suppression water service lateral is proposed, connecting to the below ground fire main from the fire pump system in the CEP. The service will be equipped with an exterior installed Post Indicator valve. The service entrance piping will also be equipped with electronically supervised shutoff valves. The Domiciliary fire suppression system will be equipped with a pendant fire department connection installed approximately 40 feet from the Domiciliary.

An automatic wet pipe fire suppression system will be provided throughout the Domiciliary. The system will utilize quick response sprinkler heads. The basic system classification will be light hazard. However, certain portions of the facility will require ordinary hazard design such as storage rooms, electrical equipment rooms, communication rooms, and mechanical equipment rooms.

A Class 1 standpipe system will be provided. Standpipes will be located in each enclosed stairwell with fire hose valves located at each intermediate stair landing. The automatic sprinkler system risers will be connected to the standpipes. Each sprinkler connection will be equipped with an electronically supervised shutoff valve, checkvalve, a flow switch, a calibrated test valve and a drain valve. Piping will extend from the riser to the sprinkler heads. Drain piping will extend to the building exterior at the lowest level. The supply control valves and flow switches in the Domiciliary will be electronically supervised by connection to the building's fire alarm system.

Piping in the Domiciliary will extend from the risers above ceilings to the sprinkler head locations. The piping system will be constructed of black steel; threaded joints for piping sizes 2 inches and smaller, ring-grooved, flanged or welded joints for pipe sizes 2-1/2 inches and larger. Threaded fittings will be malleable steel and ring-grooved and welding type fittings joints will be forged steel.

6.5.4 Warehouse/Engineering Fire Suppression Design

The Warehouse may not require a fire pump to elevate the system pressure. However, the Warehouse fire suppression system is proposed to be connected to the fire pump system located in the Central Energy Plant (CEP). A 6 inch fire suppression water service lateral is proposed, connecting to the below ground fire main from the fire pump system in the CEP. The service will be equipped with an exterior installed Post Indicator valve. The service entrance piping will also be provided with electronically supervised shutoff valves. The Warehouse fire suppression system will be equipped with a fire department connection installed flush at the Warehouse exterior wall.

An automatic wet pipe fire suppression system will be provided throughout the Warehouse. The system will utilize early suppression fast response (ESFR) sprinkler heads in the warehouse storage areas.

The sprinkler riser will be equipped with an electronically supervised shutoff valve, check valve, a flow switch, a calibrated test valve and a drain valve. Piping will extend from the riser to the sprinkler heads. The supply control valves and flow switches in the warehouse will be electronically supervised by connection to the building's fire alarm system.

Piping in the Warehouse will extend from the risers above ceilings to the sprinkler head locations. The piping system will be constructed of black steel; threaded joints for piping sizes 2 inches and smaller, ring-grooved, flanged or welded joints for pipe sizes 2-1/2 inches and larger. Threaded fittings will be malleable steel and ring-grooved and welding type fittings joints will be forged steel.

6.5.5 Parking Garage Fire Suppression Design

The Parking Garages will require a fire pump to elevate the system pressure. The fire suppression system is proposed to be connected to the fire pump system located in the Central Energy Plant (CEP). An 8 inch fire suppression water service lateral is proposed to each parking garage, connecting to the below ground fire main from the fire pump system in the CEP. The services will be equipped with exterior installed Post Indicator valves. The service entrance piping will also be provided with electronically supervised shutoff valves. The Parking Garage fire suppression system will be equipped with pendant fire department connections installed approximately 40 feet from the Parking Garage exterior wall.

Considering the Parking Garage configuration, a Class 1 standpipe system is proposed. Standpipes will be located in each stairwell with fire hose valves located at each intermediate stair landing. Drain piping will extend to the building exterior at the lowest

level. The supply control valves and flow switches in the Parking Garages will be electronically supervised by connection to the building's fire alarm system.

6.5.6 Central Energy Plant Fire Suppression Design

Duplex fire pump systems are proposed in the Central Energy Plant. Duplex fire pumps will maintain fire service in the event a fire pump is out of service for maintenance purposes. Each system will include a horizontal double suction centrifugal pump0; electric motor driven, electric motor driven multiple stage centrifugal jockey pumps, pump motor controllers, listed fire pump system controllers, bypass with flow measurement devices, pressure switches, supervised shutoff valves and accessories. The fire pump systems will be supplied with power through dedicated transfer switches from the emergency generator plant. The pumps will be provided with a test header. The pump assembly will be factory assembled, with suction and discharge piping, valves, fittings and trim on a structural steel skid type base. The fire pump system will be available to serve all buildings on the site. Per VA fire protection design criteria, the fire pump need not be sized to provide the standpipe demands, this will be provided via local fire department pumpers.

A 10 inch fire suppression water service lateral is proposed, connecting to the below ground main service serving the site. The service will be equipped with an exterior installed Post Indicator valve. The service entrance piping will also be equipped with a double check backflow preventer, and electronically supervised shutoff valves. The fire pump piping system will be equipped with a fire department connection installed flush at the Central Energy Plant building exterior wall. The backflow preventer and riser assembly is proposed to be installed interior to the CEP.

An automatic wet pipe fire suppression system will be provided throughout the Central Energy Plant. The system will utilize quick response sprinkler heads. The basic system classification will be ordinary hazard group 2.

The sprinkler riser will be equipped with an electronically supervised shutoff valve, check valve, a flow switch, a calibrated test valve and a drain valve. Piping will extend from the riser to the sprinkler heads. The supply control valves and flow switches in the CEP will be electronically supervised by connection to the building's fire alarm system.

Piping in the Central Energy Plant will extend exposed from the riser location to the sprinkler heads. The piping system will be constructed of black steel; threaded joints for piping sizes 2 inches and smaller, ring-grooved, flanged or welded joints for pipe sizes 2-1/2 inches and larger. Threaded fittings will be malleable steel and ring-grooved and welding type fittings joints will be forged steel.

6.6 General Fire Protection Narrative – Hospital / Clinic

The Fire and Life Safety Program has been developed to provide a reliable system to protect building occupants, fire fighting personnel, building contents, building structure and continuity of building function. It's intent is to provide a reasonable level of fire safety by reducing the probability of injury, loss of life or building's functional use due to a fire. This can be accomplished by limiting the development and spread of a fire

emergency to the room or area of origin and reducing the need for total occupant evacuation.

The design aspects which relate to the fire and life safety of the facility include:

Occupancy - Building function
Exits - Design concept
Structural fire resistance - Type of Construction
Building Compartmentization - Fire areas
Fire detection
Fire alarm and supervisory control
Fire suppression
Smoke control and exhaust
Fire fighter access and facilities
Emergency power

6.6.1 Occupancy

The planned Hospital / Clinic complex is a four story free standing building. The Hospital / Clinic has two major use groups, which creates a mixed occupancy classification for the hospital of New Health Care and New Ambulatory Health Care (I-2 and B). They are:

Health Care/Hospital - This includes all areas where in-patients sleep, are provided treatment and areas where in-patients have reason to frequent. Treatment of in-patients may render them incapable of taking actions for self preservation in an emergency. The occupancy classification is I-2 (Institutional) under the International Building Code (IBC) and New Health Care Occupancy under the Life Safety Code (LSC).

Health Ambulatory Care/Clinic - This is outpatient treatment, diagnostic and administrative areas not frequented by hospital inpatients. Treatment of outpatients must not render them incapable of taking actions for self preservation in an emergency. The occupancy classification is B (Business) under the IBC and a New Ambulatory Health Care Occupancy under the LSC.

6.6.2 Occupancy Load

Occupancy loads are determined based on the gross sq. ft. and an occupancy load factor in sq. ft. per person. The occupancy load factor for institution (hospital) occupancy is 240 sq. ft. per person in treatment areas, and 120 sq. ft. per person in the patient sleeping areas (nursing units). The occupancy load factor for business (clinic, offices, and labs) occupancy is 100 sq. ft. per person. The calculated occupancy loads break down as follows:

Floor	Hospital	Clinic
5th	249	196
4th	887	1235
3rd	860	464

2nd	1097	631
1st	1123	800

(Reference the exit calculations for details on how occupancy loads were determined.)

The content hazard of the facilities varies, with the bulk of the facility areas being a light hazard. Light hazards are those where the quantity and /or combustibility of contents is low and fires with relatively low rates of heat release are expected (NFC 13 5.2). Light hazard areas include:

Patient areas
Office areas
Assembly areas such as dining, and chapels Class rooms
Libraries, except large stack rooms Computer room
Telephone switchboard rooms

Specific areas within these buildings have a higher quantity and /or combustibility that force them to be considered a higher class hazard. Ordinary Hazard Group 1 include areas where combustibility is low, and quantity of combustible is moderate, stockpiles of combustibles do not exceed 8 feet, and fire with moderate rates of heat release are expected (NFC 13 5.3.1). Ordinary Hazard Group 1 areas include:

Mechanical rooms
Repair shops
Kitchens
Laboratories
Laundries

Ordinary Group 2 include areas where quantity and combustibility of contents is moderate, stockpiles do not exceed 12 ft. and fire with moderate rate of heat release are expected (NFC 13 5.3.2). Ordinary Hazard Group 2 areas include:

Record storage
Storage rooms of combustibles
Mercantile (gift shops) Trash rooms
Loading docks

6.6.3 Exits

Institutional occupancies create difficulties in the evacuation of the building in an emergency. Patients may be immobile, or of limited mobility, and may not be capable of recognizing an emergency or perform needed actions for self preservation. This makes evacuation very difficult, as assistance is needed, greatly increasing the time required to evacuate an area. Emergency evacuation is further compounded by vertical exits (stairs). Patients on gurneys, in wheel chairs, and those with limited mobility must be carried down stairs.

To offset the problems associated with evacuation, institutional/health care occupancies are designed with the defend-in-place concept. The defend-in-place concept is based

on early detection, compartmentization and suppression. If the emergency requires evacuation of an area the first stage of an evacuation is horizontal into a protected area. The protected areas are created by compartmentization by rooms and smoke zones (1 hour rated smoke tight walls) on a given floor. Travel distances from any remote point to a smoke compartment access door is limited to 200 feet. The travel distance to a protected exit (enclosed stairway, horizontal exit or exterior exit) from any point is limited to 200 feet and 150 feet from any exit access (room) door. The maximum travel distance to an exit access (corridor) door is 50 feet, and 100 feet within a suite. Horizontal exits (2 hour rated walls) provide a higher degree of compartmentization, and while not required by the governing codes are highly recommended.

Exits consists of aisles within rooms and suites which shall be maintained to provide access to a corridor, exterior exit, exit stair or horizontal exit. Exit corridors with unprotected openings shall provide a smoke resistive assembly. Corridors shall provide two directions of travel to a main exit (stair enclosure, exterior exit or horizontal exit), except for allowable dead ends. Dead end corridors shall not exceed 30 feet in institutional/health occupancies.

Exit stairs shall be enclosed with 2 hour rated construction with 1-1 /2 hour rated doors. Stairs shall, where practical, discharge to the exterior, either directly or through a 2 hour rated exit passageway. A maximum of 50 percent of the exit stairs may discharge into the interior of the discharge level provided the direction to an exterior exit is obvious and visible from the stair discharge.

Horizontal exits consist of 2 hour rated walls subdividing the floor space from exterior well to exterior wall into separate fire areas. In order for these areas to be used as a horizontal exit, an exit stair or exterior exit shall be provided within each fire area.

Exterior exits are exits that discharge directly to the exterior and provides a clear unobstructed path to the public way. The path to the public way must be such that the exit path does not require exiting past unprotected portions of the building. Exterior exits shall not open onto an enclosed courtyard.

Exit signs indicating the direction of exiting will be provided such that all areas within any corridor have an exit sign visible. Exit signs will also be placed at all exit doors (stairs, horizontal and exterior exits), which are not obviously identifiable as an exit. Exit signs will also be placed at exit access doors (corridor doors) within large open rooms with an occupant load of 50 or more persons. Two exit signs shall be placed at interstitial exit access doors one high and one low.

Exit signs shall be illuminated and provide a directional symbol. Each exit sign will have two lamps and be provided with an emergency source of power. The emergency power source shall provide 1 ½ hour of illumination without normal power.

Illumination of the means of egress will be provided with an emergency power source, to provide a minimum of 1 foot candle in the following areas;

a. Exit corridors
b. Elevator lobbies

c. Elevator cabs
d. Main lobby
e. Meeting rooms*
f. Dining room*
g. Auditorium*
h. Central control station
i. Telephone operator's room
j. Administrative areas

* May be reduced to not less than 1/5 foot candles during performances or projections. Means of egress illumination in exit stair enclosures shall provide a minimum of 10 foot candles.

6.6.4 Building Exposure

The Hospital building site is 100 plus acres with no existing buildings. The proposed placement of the new medical center buildings will be a minimum of 40 feet from the hospital and each other. This separation does not pose an exposure concern. The buildings, except the open parking garage, are to be sprinklered throughout, as such NFPA standard 80A states that no exposure hazard is considered to exist. Reference Sections 4-4 and 4-5. Therefore, no special provisions are needed, other than separation and sprinklered facilities, for exposure protection.

6.6.5 Building Construction

The building height and area requires that the hospital building be fire rated noncombustible construction with a construction type of Type II (222) under NFPA 220 and I-B Fire Resistant (222) under the IBC. The minimum fire rating is as follows:

Structural frame (columns and beams) - 2 hour rated, beams supporting the occupied floor are non-rated noncombustible construction when located within the distribution zone.

Floors/Ceiling Assembly - 2 hour rated (where the composite interstitial walk-on-platform, interstitial space, and occupied floor above provides the 2 hour barrier, the occupied floor above the interstitial walk-on-platform is unprotected, non-combustible construction NBSIR 85-3158 & NISTIR 5560). This portion provides a 2 hour fire separation from occupied floor to occupied floor).

Roof/Ceiling Assembly - 1 hour rated (non-rated non-combustible where the interstitial platform is directly below the roof, as the composite assembly (walk-on-platform) provides a 2 hour barrier. This provides the 1 hour separation between the occupied floor and roof).

An architectural canopy covers the center third of the Hospital/Clinic roof. The architectural canopy will be non-rated non-combustible construction (IBC 1509.5.1). The roof below the canopy shall be a minimum of 1 ½ hour rated, unless an interstitial platform separates the occupied space from the roof.

Distribution zone: The hospital will use a modified integrated building system (IBS) with Occupied, Connection and Distribution zones.

Walk-on platform – based on NBSIR Report 85-3158 and NISTIR 5560

Columns – 2 hour rated

Ceiling (Occupied floor) - Unprotected noncombustible construction.

Walls:

Exterior bearing - 2 hour rated
Exterior non-bearing - 0 hour rated
Interior bearing - 2 hour rated
Interior non-bearing: - 0 hour rated, due to construction type, may require rating based on associated hazard.

6.6.6 Occupancy Separations

The Hospital / Clinic (Healthcare and Ambulatory Healthcare) building is being considered a mixed occupancy (LSC 6.1.14.2.2). As a mixed occupancy, an occupancy separation is not required. However, the most restrictive occupancy requirement for means of egress, type of construction, protection and other safeguards shall apply throughout (LSC 6.1.14.3.2). This is consistent with a non-separated mixed occupancy facility under the IBC.

Rated separations will be provided due to associated hazard or use as follows;

Storage rooms ≥ 100 sq. ft. - 1 hour rated
Repair and engineering shops - 1 hour rated
Gift shop storage area - 1 hour rated

Electrical equipment rooms - 1 hour rated

Special hazard rooms - 1 hour rated for:

Laboratories (with hazardous materials)
Paint shops
Soiled linen
Clean utility rooms
Soiled utility rooms
Trash service rooms
Linen service rooms
Cryogen storage
Flammable storage (limited amount)

Special high hazard rooms - 2 hour rated for:

Flammable storage (severe hazard)
Hazardous storage
Trash collection rooms and shafts
Linen collection rooms and shafts

Smoke dampers will be provided at each air transfer opening or duct penetrations of smoke barrier walls. A smoke damper is not required at the penetration of a 1 hour smoke barrier wall where the HVAC system is fully ducted (LSC 18.3.7.4).

Fire dampers will be provided at each duct penetration of walls and floors rated for 2 hours or greater, and shaft enclosures (NFC 90-5.3). Fire dampers are also required at transfer grills in 1 hour and above rated assemblies. Fire dampers are not required for penetrations of distribution zone walk-on-platform when serving only one floor level and not exceeding 225 square inches in area.

Fire-rated doors, frames and hardware will be provided on openings in rated partitions and shafts. Doors will be equipped with closer: where required to remain normally open, with magnetic holders. Doors will be:

Class B, 1-1 /2 hour fire-rated assemblies in 2-hour shafts and partitions.
Class B, 1 hour fire-rated assemblies in 1-hour shafts.
Class C, 3/4 hour fire-rated assemblies in 1-hour partitions designed for occupancy or hazard separations.
20 minute fire-rated doors or 1-3/4 inch solid bonded core wood doors in smoke barriers. Vision panel in smoke barrier doors limited to wired glass not exceeding 1296 square inches.
Corridor doors shall be constructed to resist the passage of smoke and do not require a fire resistive rating unless the door is protecting a vertical opening, exit, smoke zone, occupancy or hazardous area. A door closer is not required. Positive latching is required.

6.6.7 Building Compartmentization

Corridor doors are required to form a barrier to limit the transfer of smoke thus providing some degree of compartmentization. Hazardous rooms are protected with a rated enclosure with protected opening (see Occupancy Separations).

Smoke zones are provided within the healthcare and ambulatory healthcare areas and provide a second level of compartmentization. Walls creating smoke zones are one hour rated with 1/3 hour rated doors and protected penetrations, designed to restrict the passage of smoke. Smoke zones are limited to 22,500 square feet maximum, with the maximum travel distance from any remote point within zone to smoke barrier door limited to 200 feet. Smoke barrier walls shall be routed to minimize the number of doors in the wall, and arranged, where practical, so as not to bisect departments.

The final compartmentization is by floor. Each occupied floor is separated from the adjoining occupied floors with a two hour rated assembly. In the case of the hospital and clinic occupancies this is accomplished by the distribution zone assembly.

6.6.8 Vertical Openings

Enclosed vertical openings such as stairs, mechanical chases, linen chutes and trash chutes are enclosed with 2 hour rated construction with 1-1 /2 hour rated doors and protected openings. These enclosures shall run continuous through the interstitial

spaces, and be provided with combination smoke and heat damper where penetrated with ducts.

Court walls between the hospital and clinic are separated such that unprotected openings and walls will be permitted, while being utilized as an exterior exit discharge path.

The four story atriums between the clinic and hospital will be separated from the occupied space with protected walls. This vertical opening will be considered as an atrium. The atrium walls will be 1 hour rated with 45 minute rated doors, or close space sprinklered tempered or laminated glass. The atrium space will be provided with a smoke control system activated by area automatic sprinkler water flow switch, or manual controls for fire department use.

The smoke control system shall keep the smoke layer interface above the highest unprotected opening or 6 ft. above highest floor with exit access open for 20 minutes or 1½ times the calculated egress time (LSC 8.6.7).

6.6.9 Interior Finishes

Interior finish, maximum flame spread and smoke developed limits are based on ASTM E-84 fire hazard classification test and will be as follows:

Exits (Enclosed exit stairs, exit passageways):

Class A

Flame spread - 25 maximum Smoke developed - 50 maximum

Occupied spaces (walls and ceilings):

Patient and Sleeping rooms > 4 occupants per room

Class A

Flame spread - 25 maximum Smoke developed - 50 maximum

Other occupied rooms and spaces

Class B

Flame spread - 75 maximum Smoke developed - 100 maximum

Corridors, enclosed exits and areas open there-to floor finish - Class II:

Carpet for corridors will pass DOC FF 1-70 and for critical radiant flux, minimum of 0.50 watts/sq. cm as determined by NFPA 253 - 1990 edition, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source".

Insulation:

Flame spread rating limitation - 75 maximum

Smoke developed limitation - 150 maximum except when isolated by masonry walls or floors.

Combustible foam plastic thermal insulation shall not be used as an interior finish.

6.6.10 Water Supply

The current water flow information for the site water distribution system is not available. Flow tests are to be provided to determine the water and pressures available to the site.

The site will have an on-site potable water storage tank to provide up to 7 day normal demand. This has been estimated between 500,000 gallons to 1 million gallons. The fire protection water will utilize this storage volume with a fire pump to provide the needed pressures. The potable water storage tank will be fed by the county water service and domestic water will be drawn from the tank. In essence, the potable water tank is a break tank.

The preliminary water flow requirements for the sprinkler system and hose stream calculates as follows (assuming worst case warehouse utilizing ESFR sprinklers):

.20 gpm/sq. ft. density (Ordinary Hazard Group 2)
x 2,000 sq. ft. design area (dry pipe system)
400 gpm/design area
+ 500 gpm/hose stream
900 gpm combined sprinkler and hose demand
x 90 minutes (duration of flow)
81,000 gallons total water demand for fire protection

125 gpm/ESFR
x 12 number of ESFR operating
1500 gpm/design area
+ 250 gpm/hose stream
1750
x 90 units
157,500 gallons total water demand for fire protection

The estimated pressure required to provide a 100 psi at the upper hose outlet is as follows:

100 psi at outlet
+ 43 psi (elevation loss) = .432 psi/foot of elevation times 100 feet
+ 25 psi (allowance for friction loss)
+ 10 psi (allowance for backflow preventer)
178 psi required at base of system riser

A fire pump rated at 1250-1500 gpm will be required to provide the water demand and pressure to insure proper operation of the fire protection system. The fire pump will be located in a dedicated 1 hour rated pump room in the energy center and selected to provide the 175 ± psi water pressure. With a large diesel generator to service the

emergency systems within the hospital, the fire pump motor can be electric and fed from the emergency generator. The electric motor would need to be 150-200 bhp. Once the taps to the county water main lines are made a more accurate water supply and thus a more accurate pump rating can be determined.

6.6.11 Automatic Fire Suppression

A supervised pre-action sprinkler system will be provided in computer rooms and electrical substation, and switchgear rooms. A dry-pipe system will be provided in areas subject to temperatures below 40 °F, such as dock areas and refrigerated areas. Distribution zones will not be sprinklered. Commercial cooking hoods and exhaust duct shall be provided with an automatic water spray extinguisher system.

A supervised wet pipe sprinkler system shall be provided throughout the remaining areas of the building including the electrical and telecommunication rooms.

A 1,500± gpm electric motor driven fire pump located in the central energy plant will supply water to the fire service water loop that will feed the combined sprinkler and standpipe system.

The combined sprinkler and standpipe system will be connected to the new fire service loop. Riser pipes will be provided in each enclosed exit stair. These 4" dia. riser pipes will be fed from mains run in the first floor interstitial zone. A control valve will be provided between the feed main and each riser. Floor controlled valve assemblies with check valves will be provided in the stair enclosures and fed to zone piping in the interstitial zone.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below.

Light hazard occupancies will be designed to provide 0.10 gpm per square foot over most remote 1,500 square feet with quick response sprinklers.

Ordinary hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet.

Ordinary hazard Group 2 occupancies will be designed to provide 0.20 gpm per square foot over most remote 1,500 square feet.

The sprinkler systems will be zoned to coincide with smoke zones and by prime areas such as the docks, lobby and computer room. In addition, sprinkler systems protecting special hazards, elevator machine rooms, cooking hoods and associated exhaust ducts are to be zoned separately. Each sprinkler zone/system will be provided with all necessary valves, control valve tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

6.6.12 Standpipes

A Class I wet standpipe system with 2-1 /2 inch outlets shall be installed in accordance with NFPA 14, 2007 edition. The standpipe system will be combined with the sprinkler

risers with all main risers interconnected at the first floor interstice. The standpipes will be hydraulically sized to provide 500 gpm at the topmost outlet with a residual pressure of 100 psi. The site fire pump need not be sized to provide the standpipe demands, this will be provided via local fire department pumpers.

Standpipe outlets will be equipped with a shut off valve and a 2-1/2"x 1-1/2" reducer with cap. Standpipe outlets will be provided to serve every occupied zone level within all stair enclosures. Standpipe outlets will be located at the highest intermediate landing between every occupied floor level and at the highest landing in each stair with access to the roof and on the roof where roof access is not provided. Additional outlets will be provided as required to reach all portions of the building within 200 feet of hose connection. Outlets will (where practical) be located within approximately 10 feet of designated horizontal exits, with an outlet on both sides of the horizontal exit wall.

6.6.13 Fire Extinguishers

Portable fire extinguishers shall be located throughout all areas of the buildings in accordance with NFPA 10-2007 Edition. Fire extinguishers will not be provided under this project. Fire extinguisher cabinets and proposed locations for extinguishers on hooks, along with appropriate signage will be provided.

Extinguishers shall also be provided in the following specific areas:

a. Near each stair entry.
b. In major mechanical, electrical and telephone equipment rooms
c. Elevator machine rooms
d. Kitchens
e. Locker rooms
f. Maintenance shops
g. Storage rooms (large)
h. Surgical suite
i. High value IT equipment
j. Telephone switch rooms

Portable fire extinguishers shall be located throughout all areas of the building. The class, size and spacing will be as follows:

Class A combustibles (ordinary combustible materials such as wood, cloth and paper):

Maximum travel distance to an extinguisher will be 75 feet. Minimum extinguisher rating will be 2A. Maximum coverage per unit of A will be:

- 3000 square feet in patient rooms, treatment areas and administrative areas.

- 1500 square feet in retail, locker rooms, mechanical rooms, electrical rooms, storage rooms, laundry, maintenance work-shops and kitchen.

Class B combustibles (flammable liquids, oils, gases):

Maximum travel distance to an extinguisher will be 50 feet.

Minimum extinguisher rating will be 1OB.

Class C (energized electrical equipment):

Extinguishers sized and located for Class A and B hazards.

Class K (cooking media, vegetable or animal oils):

Maximum travel distance to hazard will be 30 feet.

Minimum extinguisher size 1.6 gal/each 5 ft3 of oils.

Multi-purpose dry chemical fire extinguishers will be used as they are suitable for use on all three common fire classifications.

Fire extinguishers will be large enough that they cannot be easily concealed and removed from the building. The recommended fire extinguisher size is 3A-30B:C.

Extinguishers will be located in flush mounted cabinets sized to accommodate 2½ gallon pressurized water extinguishers in public areas to prevent damage and discourage tampering. Extinguishers may be installed on hangers in non-public areas.

6.6.14 Detection, Alarms And Controls

A fire detection and alarm system will be provided throughout the facility in accordance with NFPA 72, 2007 edition and the design criteria.

The fire alarm control center shall be provided with a two-way communication system to all floors, elevators and stair towers.

The fire detection and alarm system (FDAS) will be a microprocessor based, multiplexed device addressable system connected to and capable of communicating with the Site Fire Alarm Notification System located in the Center Energy Plant, and off-site monitoring service.

Manual pull stations will be located in the natural path of escape near exit doors, horizontal exits, doors from distribution zones and at nurses' stations. Pull stations will be so located that no place on any floor will be more than 200 feet from a pull station.

Automatic photoelectric smoke detectors will be located as required by NFPA 72, LSC 101 and NFPA 90A in the following spaces:

Elevator Lobbies
Elevator Machine Rooms
Smoke Barrier Corridor Doors, when on hold open devices
HVAC System Ductwork
Spaces open to the egress corridor

Fire alarm speakers, for fire location announcements and evacuation instructions, will be located so as to be clearly audible in all areas. Critical care areas may be by strobes only.

Visual alarm indicators will be provided in all public areas, but may be omitted in psychiatric areas.

Magnetic hold open devices will be provided for smoke barrier corridor doors and horizontal exit doors.

Supervision of sprinklers:

Position indicator switches on all gate control valves.

Flow switches on each floor and each zone of the sprinkler system.

The FDAS control panel will have visual and audible signals for power failure, open circuit, ground, smoke detector failure and alarm.

Alarm notification by pre-recorded messages will be automatically transmitted throughout the facility. Alarm and evacuation instructions will be given by a manual voice annunciation system. Trouble signals will be automatically transmitted to the central energy plant.

The fire detection and alarm system will have four hour battery standby power and will be connected to the "life safety" power system as described in the electrical section.

The smoke detectors, sprinkler water flow devices and manual pull stations will be electrically interconnected to the system. The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at the central energy plant and local fire alarm control panel and the control functions will be initiated.

Activation of any fire alarm initiation device, except manual pull station, will release door hold open devices on the floor of activation, allowing them to close automatically. The hold open device is released by the interruption of electric power and manual release of the door as well as by the fire alarm system.

Actuation of the smoke detectors at compartmentation (smoke and fire barriers) doors will initiate the fire alarm system, and close the compartmention doors.

Actuation of smoke or heat detectors in mechanical and electrical rooms will initiate the fire alarm system and close the compartmentation doors.

Actuation of the duct smoke detectors for mechanical air handling units will initiate the fire alarm system, close the compartmentation doors, and shut down the air handler.

6.6.15 Smoke Control

Duct smoke detectors will be installed in all HVAC systems in:

Return air ducts with 2,000 cfm air flow, placed before air is exhausted from building or prior to dilution by outside air.

Main supply air ducts with 15,000 cfm air flow, placed downstream of filters.

Activation of an induct smoke detector will initiate shutdown of the associated air handling unit.

Manual emergency stop switch for fans will be provided.

The hospital (institutional occupancy areas) will be divided into smoke compartments by 1-hour smoke barriers. Smoke zones shall not exceed 22,500 square feet and the maximum zone length plus width shall not exceed 300 feet.

The four story atrium will have a smoke exhaust system. The system will be designed to maintain a smoke interface level at least 6 ft above the fourth floor walkway for at least 20 minutes. All levels will be separated from the atrium with either a 1 hour hire barrier or sprinklered glass walls. The upper levels will have open walkways in the atrium to connect the hospital side to the clinic side. The fourth floor walkway is a means of egress to the clinic stairs, to maintain travel distances below 200 feet.

The system will be designed in accordance with NFPA 92 B – 2005 edition. The atrium floor will contain the main lobby and a large dining room, both considered a light hazard occupancy.

Make-up air will be provided such that the door opening forces will not exceed allowable limits and air velocity should not exceed 200 feet per minute.

6.6.16 Emergency Power

A level 1 emergency power supply system (EPSS), as defined by NFPA 101, shall be provided and will consist of emergency generators located in the energy center. The EPSS will supply the essential electrical system for the hospital, which is comprised of the life safety, critical and equipment branches and serve the following loads:

Life Safety Branch

- Illumination of means of egress
- Exit signs
- Fire detection and alarm system
- Emergency communications systems
- Elevator cab lighting, control, communications, and signal systems.

Critical Branch

- Patient care tasks illumination and receptacles

Equipment Branch

- Sump pumps
- Compressed air systems
- Heating systems
- Elevators
- Selected HVAC systems
- Fire pump

6.6.17 Fire Department Accessibility

The exterior of the facility shall be sufficiently open so that fire apparatus and/or fire fighters have access to all open sides of the building.

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New hydrants shall be provided as part of the fire service loop. Hydrants shall be fed by at least a 6" diameter connection with a road/curb valve at the connection. Hydrants should be spaced at least 40 feet from the building and adjacent fire lanes. Hydrants should be spaced no more than 600 feet apart around the perimeter of the building.

6.6.18 Smoke Zone Occupancy Load Calculations

Hospital Clinic - First Floor

			Hospital				Clinic		
Zone	Use	Factor	Area	Occ. Load	Use	Factor	Area	Occ. Load	
1-A	Treatment	240	17200	72	Treatment	240	19257	80	
1-B	Treatment	240	13892	58	Treatment	240	21628	90	
1-C	Treatment	240	11305	47	Office	100	18660	187	
1-D	Treatment	240	18109	75	Treatment	240	10662	44	
1-E	Treatment	240	11229	47	Treatment	240	21923	91	
1-F	Office	100	17618	176	Treatment	240	11871	49	
1-G	Office	100	18341	183		50	8742	175	
1-H	Office	100	26980	270	Treatment	240	2175	9	
1-I	Storage	300	24912	83	Treatment	240	2168	9	
1-K	Office	100	11193	112	Treatment	240	15822	66	
			170779	1123			132908	800	303687 Area Total
									1923 Occup Total

Occupant Load Calcs by Smoke Zone

Hospital Clinic - Second Floor

			Hospital				Clinic		
Zone	Use	Factor	Area	Occ. Load	Use	Factor	Area	Occ. Load	
2-A	Labs	100	19,258	193	Treatment	240	18,635	78	
1-B	1st Zone	0	6,890	0	Treatment	240	20,688	86	
2-C	Sleeping	120	8,195	68	1/2 Office	200	20,086	100	
2-D	Office	100	15,075	151	Exam	240	21,046	88	
2-E	Sleeping	120	8,170	68	Counseling	100	22,479	225	
2-F	Office	100	11,937	119	Atrium	240	2,016	8	
2-G	Office	100	11,727	117	Atrium	300	13,816	46	
2-H 1	Office	100	14,894	149					
2-H 2	Office	300	4,000	13					
2I	Office	100	13,176	132			118,766	631	244,336 Area Total
2J1	Office	100	6,124	61					1,728 Occup Total
2J2	Treatment	240	6,124	26					
			125,570	1097					

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Occupant Load Calcs by Smoke Zone

Hospital Clinic - Third Floor

Zone	Use	Factor	Hospital Area	Occ. Load	Use	Factor	Clinic Area	Occ. Load	
3-A	Office	100	1,441	14	Exam	240	15,673	65	
	Exam	240	12,966	54	Office	100	13,453	135	
3-B	Exam	240	19,396	81	Treatment	240	7,317	30	
3-C	Exam	240	14,389	60	Office	100	7,317	73	
3-D	Office	100	12,080	121	Atrium	0	0	0	
3-E	Exam	240	13,514	56	Exam	240	23,737	99	
3-F	Office	100	5,972	60	Exam	240	14,908	62	
	Exam	240	5,972	25					
3-G	Storage	300	16,848	56			82,405	464	218,441 Area Total
	Exam	240	2,407	10					1,324 Occup Total
	Office	100	2,407	24					
	Waiting	15	2,407	160					
3-H	Exam	240	20,989	87					
	Office	100	5,248	52					
			136,036	860					

Occupant Load Calcs by Smoke Zone

Hospital Clinic - Fourth Floor

Zone	Use	Factor	Hospital Area	Occ. Load	Zone	Use	Factor	Clinic Area	Occ. Load	
4-A	Sleeping	120	13,520	113	4A	Office	100	10,313	103	
4-B	Info.	120	14,018	117		Treatment	240	10,313	43	
4-C	Sleeping	120	13,514	113	4B	Lib. Reading	50	2,000	40	
4-D	Office	100	13,322	133		Stacks/Office	100	9,724	97	
4-E	Ancillary	0	2,580	0	4C	Ancillary	0	14,200	0	
4-F	Office	100	14,258	143	4D	Auditorium	7	3,600	514	
4-G	Office	100	15,570	156		Classrooms	20	5,500	275	
4-H	Office	100	11,192	112		Storage	300	500	2	
			97,974	887		Office	100	600	6	
						Kitchen	200	400	2	
						Ancillary	0	9,575	0	
					4E	Office	100	15,324	153	
								82,049	1235	180,023 Area Total
										2,122 Occup Total

Occupant Load Calcs by Smoke Zone

Hospital Clinic - Fifth Floor

Zone	Use	Factor	Hospital Area	Occ. Load	Zone	Use	Factor	Clinic Area	Occ. Load	
5-A		300	74,418	248	5A	Office	300	58,536	195	
			74,418	248						
								58,536	195	132,954 Area Total
										443 Occup Total

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6.7 Code Summary – Hospital / Clinic

The code summary is specifically for fire protection and life safety issues associated with the proposed layout of the Veterans Affairs Medical Center New Hospital and Clinic in Orlando, Florida. The summary is not intended to cover other non- related code/standard safety/operational issues such as handicap accessibility or energy conservation, nor installation standards such as mechanical or electrical equipment.

The code summary is based on several different codes/standards listed under Design Criteria in this report. Due to the number of standards involved some code/standard requirements may differ. The intent of the code summary is to identify the most stringent requirement. If the requirements covered in different codes/standards are in conflict, the one that most closely resembles the national accepted practice is cited in the summary. Conflicting code/standard requirements are discussed in detail under "Code/Standard Considerations".

The code summary is broken down into three columns. The first column identifies the subject matter. The subjects are broken down by general category such as Building Construction, Exits, Fire Suppression. Within the general category the subjects may be further broken down into subsets such as Exits, Doors, Max. Width, Min. Width, Swing, etc. Subsets are indicated by indentation from the left margin.

The second column briefly describes the Code/Standard requirements on the subject, however it does not list all the exceptions, alternatives, design considerations and conditions associated with the subject. The summary is only a reference to the basic code/standard requirements and the listed codes must be used for further specific information on each subject.

The third column lists the code/standard abbreviation and section number for the requirement. See "Design Criteria" for the unique three letter abbreviation used for each code/standard. In some cases a chapter is listed which indicates the subject is broad and a single section does not do justice to the subject. Where a code/standard and a section number are not provided, specific requirements could not be located for the subject within the listed codes/standards. In several cases more than one code/standard and section are listed for a given subject this indicates that the code/standards either cross reference the other listed codes/standards or that the requirements are essentially equivalent in all the listed codes/standards. When one code is more stringent than the others, only the most stringent is cited. Code abbreviations and Section numbers in italic indicate a local amendment to the Section.

The following are common abbreviations used within the code summary:

§ = Sprinkler system throughout	cfm = Cubic feet/minute	Fig = Figure
> = Greater than	Exc. = Exception	hr. = Hour
$= Greater than or equal to	Max = Maximum	ed. = Edition
< = Less than	Min = Minimum	in. or " = Inches

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#= Less than or equal to	Tbl = Table	ft. or ' = Feet
FD = Fire Department	AHJ = Authority having jurisdiction	
sq. ft. or ft^2 = Square Feet	LBO = Local Building Official	

This report is designed specifically for the referenced project and shall not be used, in whole or in part, for any other purpose or project without the written consent of Lovett Consultants. Lovett Consultants assumes no responsibility for the unauthorized use of this report.

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6.7.1 Design Criteria

Primary Codes and Standards used for Design and Construction - Fire Protection Portions

Std No	Ed. Date Abbrev.	Title	Comments
NFPA 101	2006 ed. **LSC**	The 2006 Life Safety Code by the National Fire Protection Association	Life Safety
-	2003 ed. **IBC**	The 2003 International Building Code by the International Code Council	Allowable Area and Height, Structural loads,& Features not addressed by the National Fire Codes
Vol 1 to Vol 12	2007 ed **NFC**	2007 National Fire Codes[1] as applicable by the National Fire Protection Association including but not limited to: NFPA 10 - 2007; Portable Fire Extinguishers NFPA 13 - 2007; Installation of Sprinkler Systems NFPA 14 - 2007; Standpipe and Hose Systems NFPA 20 - 2007; Installation of Stationary (Fire) Pumps NFPA 24 - 2007; Private Fire Service Mains NFPA 30 - 2003; Flammable & Combustible Liquid Code NFPA 37 - 2006; Stationary Combustion Engines and Gas Turbines NFPA 45 - 2004; Fire Protection for Laboratories Using Chemicals NFPA 72 - 2007; National Fire Alarm Code NFPA 88A - 2007 Parking Structures NFPA 90A - 2002; Installation of Air-Conditioning and Ventilating Sys. NFPA 99 - 2005; Standard for Health Care Facilities NFPA 110 - 2005; Standard for Emergency and Standby Power Systems NFPA 220 - 2006; Types of Building Construction	Various F.P. Subjects
-	11-05 ed. ***FPM***	The Fire Protection Design Manual by the Department of Veterans Affairs	Frame work for Fire Protection
AISC 325-05	13th ed. **AISC**	The Steel Construction Manual by the American Institute of Steel Construction	Steel - Structural

[1] Excluding NFPA Standards 5000 and 900

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Std No	Ed. Date Abbrev.	Title	Comments
ACI 318-05	2005 ed. **ACI**	The Building Code Requirements for Reinforced Concrete ACI 318-05 by the American Concrete Institute.	Concrete - Structural
NSPC	2006 ed. **SPC**	The 2006 National Standard Plumbing Code by the National Association of Plumbing-Heating-Cooling Contractors	Plumbing Systems
ASME	2007 ed **PVC**	The 2007 Boiler and Pressure Vessel Code by the American Society of Mechanical Engineers	Boilers
ASME B31.1	2004 ed **CPP**	The 2004 Building Services Piping by the American Society of Mechanical Engineers	Pressure Piping
ASHRAE 15	2004 ed **SRS**	The 2004 Safety Standard for Refrigeration Systems by the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.	Refrigeration Systems
ASHRAE 62.1	2004 ed **IAQ**	The 2004 Ventilation for Acceptable Indoor Air Quality by the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.	Ventilation
NFPA 70	2005 ed. **NEC**	The 2005 National Electrical Code by the National Fire Prevention Association	Electrical Systems
ASME A17.1	2004 ed. **ESC**	The 2004 Safety Code for Elevators and Escalators ASME A17.1, by the American Society of Mechanical Engineers	Elevator & Escalators
UFAS	1988 ed. **FAS**	The Uniform Federal Accessibility Standards including the VA Supplement, Barrier Free Design Guide (PG - 18-13)	Handicap Accessibility
CFR Parts 434 & 435	- **FEC**	Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings by the Department of Energy	Energy Conservation Requirements
20 CFR10	- **OSHA**	The Occupational, Safety and Health Administration (OSHA) Standards	Safety Standards

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The following VA specific Directives, Design Manuals and Program Guides will affect the VAMC building design and construction.

ARCHITECTURAL

A. Architectural Design Manual for New Hospitals, Replacement Hospitals, Ambulatory Care, Clinical Additions, Energy Centers, and Outpatient Clinics (May 2006/m)

B. Architectural Design Manual for CLC Care Units and Domiciliary Projects (May 2006/m)

C. Architectural Design Manual for CLC (Design/build) Projects (May 2006/m)

D. Architectural Design Manual for Regional Office Projects (May 2006/m)

ELECTRICAL

A. Electrical Design Manual for Hospital Projects (May 2006/m)

B. Electrical Design Manual for Regional Office Projects (May 2006/m)

FIRE PROTECTION

A. Fire Protection Design Manual (September 2001/m)

HEATING, VENTILATION, & AIR CONDITIONING

A. HVAC Design Manual for Domiciliary and CLC Projects (June/2006/M)

B. HVAC Design Manual for Hospital Projects (Ambulatory Care/Clinical Addition/Energy Center/Outpatient Clinic) (June/2006/M)

C. HVAC Design Manual for Regional Office Projects (June 2006/M)

INTERIOR DESIGN

A. Interior Design Manual for Hospital Projects Clinic/Domiciliary/CLC) (May 2006/M)

B. Interior Design Manual for Regional Office Projects (May 2006/M)

PLUMBING

A. Plumbing Design Manual for Domiciliary Projects (June 2006/M)

B. Plumbing Design Manual for Hospital Projects (Ambulatory Care/clinical Addition/energy Center/outpatient Clinic) (June 2006/M)

C. Plumbing Design Manual for Laundry Projects (June 2006/M)

D. Plumbing Design Manual for CLC Projects (June 2006/M)

E. Plumbing Design Manual for Parking Structure Projects (June 2006/M)

F. Plumbing Design Manual for Regional Office/Warehouse Projects (June 2006/M)

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SANITARY

Sanitary Design Manual for Hospital Projects (June 2006/M)

SITE DEVELOPMENT

Site Development Design Manual (June 2006/M)

These are prime applicable codes and VA publications for the VAMC. Several other standards and VA publications covering specific topics are applicable, but should not impact the conceptual design stage. Other specific standards may be referenced within the body of the code summary, as appropriate.

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Building Description

BUILDING:	VA Hospital and Clinic:		
USE & OCCUPANCY CLASSIFICATION:			
Hospital:	Institution (I-2), New Health Care		LSC 3.3.168.7
Outpatient Clinic:	Institutional (I-2), New Ambulatory Health Care		LSC 3.3.168.1
AREA (± sq ft):	1st Floor	303,680 ft^2	
	Hospital	170,780 ft^2	
	Clinic	132,900 ft^2	
	2nd Floor	248,240 ft^2	
	Hospital	125,570 ft^2	
	Clinic	122,670 ft^2	
	3rd Floor	232,940 ft^2	
	Hospital	186,040 ft^2	
	Clinic	96,900 ft^2	
	4th Floor	180,025 ft^2	
	Hospital	97,975 ft^2	
	Clinic	82,050 ft^2	
	5th Floor	132,960 ft^2	
	Hospital	74,420 ft^2	
	Clinic	58,540 ft^2	
HEIGHT:	Hospital: 5 stories	108 ft.	
	Outpatient Clinic: 5 stories	108 ft.	
SPRINKLED:	New Hospital and Outpatient Clinic to be fully sprinkled utilizing quick response sprinklers.		
YARDS/SEPARATIONS:	Hospital open 40 ft plus on all sides except south side where it abuts the ambulatory clinic and west to the engineering/warehouse facility.		
	The ambulatory clinic is open 40 ft plus on all sides except north side where it abuts the hospital and west to the open parking deck.		

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SPECIAL FEATURES:

1. The hospital and clinic floors will have a non-occupied walk-on platform above creating an interstitial space for horizontal runs of mechanical, electrical and plumbing systems.

2. A four story entry atrium will be sandwiched between the hospital and clinic areas.

3. Portions of the hospital north/south egress corridors will be open for two stories.

CODE SUMMARY – HOSPITAL AND CLINIC

CONSTRUCTION TYPE:	Hospital – New Health Care Fire Resistant (222)	LSC Tbl 18.1.6.4
	Outpatient Clinic – New Ambulatory Health Care as part of the hospital building, II-Fire Resistant (222).	LSC 20.1.6.4
ALLOWABLE HEIGHT AND AREA:		
Hospital:	Unlimited area and 4 stories or more in height, II-(222)	LSC Tbl 18.1.6.4
	Unlimited, and 5 stories (180 ft) I-B sprinklered	IBC Tbl 503
Clinic:	Unlimited area and no height restriction II-(000) sprinklered	LSC 20.16.5
	Not allowed > 2 stories (75 ft) II-B (000)	IBC Tbl 503
	Unlimited and 5 stories (180 ft) I-B (222) sprinklered.	IBC Tbl 503

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BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS
The following is based on II-(222) construction
Note: Type I-B fire rated non-combustible construction under the IBC is equivalent to Type II (222) under NFPA 220 and LSC.

BUILDING ELEMENT MATERIALS:	Non-combustible fire rated construction	NFC 220 4.3.1 IBC 602.2
EXTERIOR WALLS		
Bearing walls:	2 hour rated non-combustible	NFC 220 Tbl 4.1.1
	1 hour rated non-combustible when supporting roof only	
Non-bearing:	0 hour rated non-combustible ≥ 30 ft. open yards	IBC Tbl 602
	1 hour rated non-combustible < 30 ft.	
Opening Protection:	Not required in facility with >10 ft. open yard with up to 45% of wall opening, per floor	IBC Tbl 704.8 NFC 220 Tbl 4.1.1
STRUCTURAL FRAME: (Columns, Trusses, Beams and Girders)	2 hour rated non-combustible	NFC 220 Tbl 4.1.1
	1 hour rated non-combustible when supporting roof only	
FLOOR:	2 hour rated smoke barrier non-combustible	NFC 220 Tbl 4.1.1 LSC 8.6.1
ROOF:	1 hour rated non-combustible	NFC 220 Tbl 4.1.1
WALLS & PARTITIONS		
Non-bearing:	0 hour rated non-combustible	NFC 220 Tbl 4.1.1
Load-bearing:	2 hour rated non-combustible	NFC 220 Tbl 4.1.1
	1 hour rated non-combustible when supporting roof only	
SHAFT ENCLOSURES (Excludes Stair enclosures): Rating:		
	2 hour rated fire and smoke barrier	LSC 8.6.5 LSC 8.5.1

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Opening Protection:	1 ½ hour rated in 2 hour shafts	LSC Tbl 8.3.4.2
Top & Bottom:	Enclosed with rated construction equal to shaft wall rating or extend to roof deck and bottom of building OR Terminate in 2 hour rated associated room or space.	LSC 8.6.4
UNENCLOSED VERTICAL OPENINGS:	Permitted when: - connects only two adjacent floor levels - is separated for other floors - is separated from corridors - is not a required means of egress OR - is designed as an atrium	LSC 8.6.8 LSC 8.6.7
	The communicating space under LSC 8.6.6 is prohibited in New Health Care	LSC 18.3.1.5
PENTHOUSE (MECHANICAL)		
Size:	1/3 the supporting roof area (aggregate maximum) otherwise considered a mechanical equipment story	IBC 1509.2
Walls, Roof & Structural Frame:	Same as for I-B (222) construction above 0 hour rated non-combustible when 20 ft plus fire separation distance	IBC 1509.2.1 Exc 1

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RATED SEPARATIONS

AREA SEPARATIONS (FIRE WALLS):		
Rating:	2 hour rated (not required between hospital and clinic due to the type of construction)	LSC 8.2.1.3 (1)
SPECIAL SEPARATIONS:		
Soiled Linen:	1 hour rated	LSC Tbl 18.3.2.1
Storage Room:	1 hour rated All rooms used primarily for the storage of combustible material shall be considered a storage room regardless of the room name (ie., clean linen, file)	LSC Tbl 1.8.3.2.1
Trash Collection Room:	1 hour rated	FPM 3.1A
Medical Record Storage:	1 hour rated	FPM 3.1B
Moveable aisle/mobile shelving:	1 hour rated	FPM 3.1B
Compressed Medical Gas:		
Laboratories:	1 hour rated if over 3,000 ft^3 @ STP	NFC 99 5.1.3.3.2
VA Canteen Retail Stores:	1 hour rated if using flammable or combustible liquids	FPM 3.5B
Pharmacies:	1 hour rated	FPM 3.10
Chutes (linen & trash):	1 hour rated	FPM 3.11
Flammable Liquid Storage Rooms:	2 hour rated	NFC 82.5.2.4.2
	1 hour rated ≤ 150 sq ft	NFC 30 Tbl 6.4.2.1
	2 hour rated (high hazard) > 150 sq ft and ≤ 500 sq ft	NFC 30 Tbl 6.4.2.1
Room/Vaults for Dry Transformers:		
112½ KVA or less:	0 hour enclosure, maintain 12" from combustibles	NFC 70 450-21(a)
Over 112½ KVA:	1 Hour enclosure (See exceptions for 80° C rise or higher)	NFC 70 450-21(b)

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Over 35,000 Volts:	3 hour enclosure or 1 hour enclosure and sprinkled	NFC 70 450-21(c) NFC 70 450-42 Exc.
OPENING PROTECTION:		
Doors in:		
2 hour rated walls:	1½ hour rated	LSC Tbl 8.3.4.2
1 hour rated walls:	1 hour rated for vertical opening (shafts)	LSC Tbl 8.3.4.2
	¾ hour rated elsewhere	
	20 minute in smoke barrier walls and atrium enclosure	
Corridor Walls:	No fire rating required, constructed to resist passage of smoke	LSC 18.3.6.3
Windows/Viewing Panels:		
1 hour rated walls:	Limited to 25 % (Max.) of walls area	LSC 8.3.3.9
2 hour rated walls:	Not permitted	LSC Tbl 8.3.4.2
1 hour rated walls (other than shaft walls):	¾ hour rated assembly	LSC Tbl 8.3.4.2
Fire Dampers:		
Air ducts:	Required in fire barriers or partitions, 2 hours, at duct penetrations of the floor not enclosed in a rated shaft, and duct penetrations of shafts	NFC 90A 5.3.1.1 NFC 90A 5.3.2 NFC 90A 5.3.4.4
Air transfer grills:	Required where opening protection required.	LSC 18.3.6.4.1
	Not permitted in corridor walls or doors, except in doors to toilet rooms	
SMOKE BARRIERS/ZONES:	Minimum 2 zones required / floor in health care occupancies	LSC 18.3.7.1
Size:	22,500 sq. ft. Max., travel distance to smoke barrier door ≤ 200 ft.	LSC 18.3.7.1 (3) LSC 18.3.7.1 (4)

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VA INTERSTITIAL SPACES

PLATFORM:	The interstitial walk-on deck/platform shall be lightweight insulating concrete per tests NBSIR 85-3158 or NISTIR 5560 except wire mesh on bottom of supporting purlins may be omitted, fire proofing on bottom of purlins to be as least 1" thick	FPM 2.2.A
STEEL:	Steel within interstice space need not be fire proofed except for columns	FPM 2.2.B
	Girders, trusses and other structural member supporting more than one floor and within interstitial space shall be 2 hour fire rated	FPM 2.2.C
COMPARTMENTATION:	Smoke barrier walls and horizontal exit walls need not extend into interstice space	FPM 2.2.D
	Shafts shall be 2 hour rated through interstice, mechanical rooms shall be 1 hour rated where it interfaces interstice	FPM 2.2.E
Dampers:	Smoke damper required in 1 hour wall between mechanical rooms and interstice	FPM 2.2.F
	Fire dampers are required at duct penetrations of interstice platform when opening is greater than 225 sq in	FPM 2.2.F
Penetrations:	Shall be protected, horizontal and vertical	FPM 2.2.G
Fire Alarm System:	Pull stations shall be provided at exit doors from interstice space	FPM 2.2.H
	Sufficient audible and visual notification appliances to alarm interstice	FPM 2.2.H
SIGNS & LIGHTING:	Exit signs to be provided at interstice exit doors and where needed to provide clear direction	FPM 2.2.I
	Emergency lighting shall be provided sufficient for egress	FPM 2.2.I
SPRINKLERS:	Not required in interstitial space except for electrical closets, signaling rooms, etc. located in interstice and over ETVS systems in interstice	FPM 6.1.B

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EXITS

Applicable Design Code/Standard:	NFPA 101 "Life Safety Code" 2006 ed.	FPM 1.3.B
OCCUPANT LOAD FACTORS:	(gross sq. ft. / person)	LSC Tbl 17.3.1.2
Ambulatory Health Care	120	
Inpatient Treatment Dept.	240	
Waiting Room/Lounge/Dining	15 (Net sq. ft./person)	
Sleeping Department	120	
Conference	15 (Net sq. ft./person)	
Eng. Shops	100	
Laboratories	100	
Locker Rooms	50 (IBC)	
Mechanical	300 (IBC)	
Offices/Kitchen	100	
Retail	30 on 1st floor, 60 on other floors	
Storage	500	

NUMBER OF EXITS:

Rooms:		
2 exits required when:	Patient sleeping room or suite > 1000 sq. ft.	LSC 18.2.5.4
	Other rooms or suites > 2500 sq. ft.	LSC 18.2.5.6.3.2
	Assembly rooms ≥ 50 occupants	LSC 12.2.5.1.2
	From each smoke compartment	LSC 18.2.4.4
Floors:	Two min. from each floor or fire area	LSC 18.2.4.1
	Three when occupancy load 1000	LSC 7.4.1.2
	Four when occupancy load > 1000	
	One from exclusively mechanical story when travel distance to exit is 100 ft. or less	LSC 12.2.2
EXIT & EXIT ACCESS SEPARATION:	a maximum diagonal dimension of room, space or floor served	LSC 7.5.1.3.3

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TRAVEL DISTANCE TO AN EXIT (MAX.):	150 ft. room access door to an exit AND 200 ft. any point to an exit AND 50 ft. any point within sleeping room to an exit access door	LSC 18.2.6.2.1 LSC 18.2.6.2.3
Common Path:	100 ft. within Mechanical Equipment Room	LSC 7.12.1(l)
	20 ft within Assembly Rooms	LSC 12.2.5.1.2
ACCESS THROUGH ADJOINING ROOMS:	Permitted, provided intervening room use is not a storeroom, workroom, maintenance room or similar space	LSC 7.5.1.6 LSC 7.5.2.1 LSC 18.2.5.1
EGRESS WIDTH FACTOR:	0.2 inches/person for level components and ramps	LSC Tbl 7.3.3.1
EXIT DOORS:		
Width: For patient use: (Min.):	41.5 inches (clear open width), includes sleeping rooms, diagnostic and treatment rooms	LSC 18.3.7.7(4)a
	32 inches (clear open width) (door panel in exit stair enclosures, newborn nurseries)	LSC 18.2.3.7(2)
For non-patient use: (Min.):	32 inches (clear opening)	LSC 18.2.3.7(1)
Height (Min.):	6 ft. 8 inches	LSC 7.1.5.1
Swing:	In direction of exit when: - Serving a high hazard area - Serving 50 people	 LSC 7.2.1.4.3 LSC 7.2.1.4.2
	OR - Used in an exit enclosure	LSC 18.2.2.2.9.2
	Horizontal sliding permitted where serving 10 or fewer persons	
Panic Hardware:	Not required unless serving an assembly occupancy with an occupant load 100	LSC 12.2.2.2.3

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EXIT DOORS: (continued)		
Power Operated:	Upon power failure: - be capable of manual operation - be capable of swinging to the full open from any position - be set in motion with a force of 50 lbs.	LSC 7.2.1.9
EXIT SIGNS:	Illuminated (internally or externally) with directional signs on life safety circuit	LSC 18.2.10.3 LSC 7.10.5
Placement:	- Within 100 ft. of any point in exit access corridor	LSC 7.10.1.5.2
	- Where exit or way is not readily apparent	LSC 7.10.1.5.1
Power Supply:	On Life Safety Branch	LSC 18.2.10.3
EXIT ILLUMINATION:	1 foot candle min. along egress route	LSC 18.2.8
	10 foot candle min. on exit stairs	LSC 7.8.1.3
	2 bulbs per fixture	LSC 7.8.1.4
Power Supply:	House wiring, with emergency backup, Min. of 90 minutes, min. type 10, Class 1.5, Level 1	LSC 7.8.2 LSC 7.9.1.1 LSC 7.9.2.2

SUITES

SEPARATION:	Separated from the rest of the building with walls designed to limit the passage of smoke (See corridor wall construction)	LSC 18.2.5.6.1.2
SUBDIVISION:	Partitions within suites of non-combustible or fire retardant treated wood	LSC 18.2.5.6.1.4
INTERVENING ROOMS:	One intervening room between habitable room and egress corridor access (Hall in suite typically the one allowable intervening room)	LSC 18.2.5.6.2.1(A) LSC 18.2.5.6.3.1

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SLEEPING SUITE:	Direct, constant staff supervision of sleeping rooms required, via glass walls, curtained cubicles or smoke detector in sleeping room	LSC 18.2.5.6.2.1(B) LSC 18.2.5.6.2.1(C)(I)
	OR	
	Automatic smoke detection required throughout suite when constant staff supervision is not provided	LSC 18.2.5.6.2.1(C)(2)
Size Limits:	5,000 sq ft	LSC 18.2.5.6.2.3(A)
	Up to 7,500 sq ft with direct supervision and automatic smoke detection throughout suite	LSC 18.2.5.6.2.3(B)
No. of Means of Egress:	Min. of two when suite is over 1,000 sq ft, one being directly to an egress corridor, second means of egress may be through an adjacent suite	LSC 18.2.5.6.2.2(A) LSC 18.2.5.6.2.2(B) LSC 18.2.5.6.2.2(C)
Travel Distance:	100 ft, any point within suite to an exit access door	LSC 18.2.5.6.2.4(A)
	200 ft, any point within suite to an exit	LSC 18.2.5.6.2.4(B)
NON-SLEEPING SUITE		
Size LImits:	10,000 sq ft max.	LSC 18.2.5.6.3.3
No. of Means of Egress:	Min. of two when suite exceeds 2,500 sq ft, one being directly to a corridor, second means of egress may be through an adjacent suite	LSC 18.2.5.6.3.2(A) LSC 18.2.5.6.3.2(B) LSC 18.2.5.6.3.2(C)
Travel Distance:	Any point in suite to an exit access door: - 100 ft with one intervening room - 50 ft with two intervening rooms	LSC 18.2.5.6.3.4(A)
	200 ft from any point in suite to an exit	

STAIRWAYS

EGRESS WIDTH FACTOR:	0.3 inches/person for vertical exitways	LSC Tbl 7.3.3.1
ENCLOSURES:		
Rating:	2 hour rated when serving 4 or more stories	LSC 7.1.3.2.1(1)
	1 hour rated when serving 3 stories or less	LSC 7.1.3.2.1(2)

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Doors:	1 ½ hour rated in 2 hour enclosures	LSC Tbl 8.3.4.2
	1 hour rated in 1 hour enclosures	
Closures:	Self or automatic closing	LSC 7.1.3.2.1(4) LSC 7.2.1.8
Other Openings:	Limited to access for normally occupied spaces and exit enclosure discharge allowed into interstitial spaces	LSC 7.1.3.2.1(5)
Penetration:	Prohibited except where serving enclosure (i.e. electrical, heating) and fire suppression systems	LSC 7.1.3.2.1(6)
Smoke Proof Enclosure/ Pressurization:	Not required	LSC 18.2.2.4
Roof Access:	Required to roofs on buildings with 4 stories or more (1 by stair may be through Penthouse)	IBC 1009.12
Discharge:	Directly to the exterior, Maximum 50% through discharge level lobby when way is readily visible and identifiable at stair discharge	LSC 7.7.1 LSC 7.7.2.3
STAIRS:		
Materials:	Non-combustible	LSC 7.2.2.3.1.2
Width:	44 inches min. stair serving < 2000 people on all levels	LSC 7.2.2.2.1.2
Projections:		
Handrails:	4 ½ inches max. at handrail and below	LSC 7.2.2.2.1.2
Doors onto Landings:	Half of the required landing width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when fully open	LSC 7.2.1.4.4
Rise & Run:	4 inch min. - 7 inch max. Rise &11 inch min. Run	LSC Tbl 7.2.2.2.1.1(a)
Handrails:	Required on both sides of stairs and within 30 inches of all required exit stair width	LSC 7.2.2.4.1.2
Height:	34 to 38 inches from stair nosing	LSC 7.2.2.4.4.1
Size:	1 ¼ to 2 inch diameter with 2 ¼" clearance to walls	LSC 7.2.2.4.4.6

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Termination:	Returned to wall, floor or newel post, & extend min. of 12 inches at top riser, 12 inches plus 1 tread width at bottom riser	LSC 7.2.2.4.4.10 FAS 4.9.4(2)
Baluster/Guard:	Required on open sides, such that a 4 inch sphere will not pass through	LSC 7.2.2.4.5.3
Head Room:	6 ft. 8 inches min.	LSC Tbl 7.2.2.2.1
Landings:	12 ft. max vertical height between	LSC Tbl 7.2.2.2.1
Width:	Equal to stair width	LSC 7.2.2.3.2.2
Length:	Equal to stair width, needs not exceed 4 ft. on straight run stairs	LSC 7.2.2.3.2.4
Interruption at exit level:	Required if over ½ story beyond level of exit discharge	LSC 7.7.3
Space Under Stair:	Use not permitted	LSC 7.2.2.5.3
OTHER STAIR TYPES:		
Winding:	Not Permitted	LSC 7.2.2.2.4.1 LSC 18.2.2.3
Curved:	Permitted as means of egress	LSC 7.2.2.2.2.1
Tread:	11 inch min. at 12 inches from narrow end	LSC 7.2.2.2.2.1
Inside Radius:	Twice the stair width min.	LSC 7.2.2.2.2.1
Spiral:	Not Permitted	LSC 7.2.2.2.3 LSC 18.2.2.3

EXIT PASSAGEWAY

ENCLOSURE:	To be fire rated equal to exit stair it serves (2 hour if serving 4 stories) LSC 7.1.3.2	LSC 7.2.6.2 LSC 7.2.6.3
Windows:	Fire windows not allowed in 2 hour enclosure, allowed in 1 hour enclosure if window ¾ hour rated per LSC 8.3.3.2	LSC 7.2.6.2(1)
Width:	44" minimum and sufficient to handle egress capacity	LSC 7.2.6.4
USE:	Shall not have potential to interfere with use as an exit	LSC 7.1.3.2.3
OPENING:	Limited to doors from normally occupied spaces & corridor, and discharge doors	LSC 7.1.3.2.3 (5)

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PENETRATIONS: Limited to: LSC 7.1.3.2.3(6)

- door openings from normally occupied spaces
- electrical conduit serving exit
- water and steam piping to heat or cool exit
- sprinkler piping and standpipes
- fire alarm circuits
- duct work for pressurization

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HORIZONTAL EXITS

DEFINITION:	A path of egress travel through a rated wall to a fire area or building which affords safety from fire and smoke in the area of incidence	LSC 3.3.70.1
	The doors in the rated horizontal exit wall may be considered an exits	LSC 7.2.4.1.2
NUMBER & CAPACITY:	May not be the only exit from a fire area or portion	LSC 7.2.4.2.1
	At least one of the required exits shall discharge to the exterior or an exit enclosure	
	Not more than ½ of the required number of exits may be by a horizontal exit	LSC 7.2.4.1
	Not more than ⅔ of the required exit capacity may be by a horizontal exit	LSC 18.2.2.5.2
REFUGE AREA:	30 sq. ft. net per patient within aggregate area of corridors, patient rooms, treatment rooms, lounges, dining or other low hazard use on each side of the horizontal exit	LSC 18.2.2.5.1.1
	6 sq. ft. net per occupant on stories not housing bed or litter borne patients	LSC 18.2.2.5.1.2
SEPARATION WALLS:	2 hour "fire barrier"	LSC 7.2.4.3.1
	Construction supporting the wall to be fire rated equal to the wall	IBC 706.4
Vertical Continuity:	Continuous through all levels of the building to ground OR	LSC 7.2.4.3.1
	To a 2 hour floor assembly with no unprotected openings (min. 2 hour) and all other exits discharge directly to the exterior	LSC 7.2.4.3.2
	From top of floor to bottom of the floor or roof deck above	IBC 706.5
	Need not extend into interstitial space when terminated at interstitial platform (2 hour)	FPM 2.2.D
Horizontal Continuity:	Continuous from exterior wall to exterior wall to divide the floor served by the horizontal exit ("fire barrier")	LSC 7.2.4.3.3
	Exterior walls within 10 ft. of horizontal exit wall intersection and less than 180° to be 1 hour rated	LSC 7.2.4.3.3
OPENINGS:	Doors to swing in the direction of egress	LSC 7.2.4.3.7

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	Windows not permitted	LSC Tbl 8.3.4.2
Penetrations & Joints:	Protected to meet wall ratings	LSC 8.3.5
Duct Openings	Protected with fire dampers	LSC 8.3.5.7 NFC 90A5.3.1.1
DOORS:		
Closures:	Self closing or automatic closing activated by local smoke detector(s)	LSC 7.2.4.3.9
Cross Corridor:	Shall be automatic closing by activation of smoke detector	LSC 7.2.4.3.10
Rating:	1 ½ hour rated min. and installed to limit air leakage per NFPA 105	LSC Tbl 8.3.4.2 LSC 7.2.4.3.8
Vision Panel:	Required in cross corridor doors by fire-rated glazing or wire glass in approved frames	LSC 18.2.2.5.6
Latching:	Positive Latching required	NFC 80.6.4.4.3
Features:	Center mullions prohibited	LSC 18.2.2.5.7
Dual Egress:	Shall be double egress (opposite swing) when serving as an exit from both sides, with 41 ½" clear width per leaf in an 8 ft. corridor	LSC 18.2.2.5.4
	(32" clear in a 6 ft. corridor)	LSC 18.2.2.5.5
	Horizontal sliding may be utilized with a clear opening of 83" in an 8 ft. corridor	LSC 18.2.2.5.4
	(64" in a 6 ft. corridor)	LSC 18.2.2.5.5
Single Egress:	Single swing or horizontal sliding horizontal exit door allowed when serving as an exit from one side only with 41 ½" clear width	LSC 18.2.2.5.3

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CORRIDORS

SEPARATION:	Corridors to be separated from all other areas by partitions except:	LSC 18.3.6.1
	1. Spaces not used for patient sleeping, treatment or hazardous and - Quick response sprinklers throughout smoke zone or smoke detectors in open corridors of smoke zone - Space provided with smoke detectors or space permits direct supervision by staff - Space does not obstruct access to exit	LSC 18.3.6.1(1)
	2. Waiting areas (600 sq. ft. aggregate) per smoke zone - Space provided with smoke detectors or space permits direct supervision by staff - Space does not obstruct access to exit	LSC 18.3.6.1(2)
	3. Spaces for nurses station	LSC 18.3.6.1(3)
	4. Gift shop ≤ 500 sq. ft.	LSC 18.3.6.1(4)
Intervening Rooms:	Not permitted, corridor to provide access to 2 or more approved exits	LSC 18.2.5.3
PROTECTION:		
Walls:	0 hour rated non-combustible construction designed to limit smoke transfer (atmospheric separation)	LSC 18.3.6.2.2 LSC 18.3.6.2.3
Floors:	No special requirements	-
Ceilings:	Smoke tight or corridor walls run to deck or platform above	LSC 18.3.6.2.1
Doors & Frames:	Non-rated constructed to limit the transfer of smoke (with exceptions)	LSC 18.3.6.3.1
Latches:	Positive latching required (with exceptions) Roller latches prohibited	LSC 18.3.6.3.5 LSC 18.3.6.3.7
Closing Devices:	Not required (except when rated door required do to adjacent space/room or exit)	LSC 18.3.6.3.9
Glazed Openings:	No restriction on glass rating or size	LSC 18.3.6.3
Duct Penetrations:	Dampers not required	LSC 18.3.6.4.1

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WIDTH (MIN.):		
Inpatient use:	8 ft. for required exit access of patients	LSC 18.2.3.4
	6 ft. for psychiatric care	LSC 18.2.3.5
Non-patient use:	44 inches	LSC 18.2.3.4(1)
PROJECTIONS:		LSC 18.2.1
Doors:	Half of the required exitway width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4
Trim/fixtures:	4 ½ inches max. each side within 38" of floor	LSC 7.3.2.2
CEILING HEIGHT:	7 feet 6 inches min. with no projections below 6 ft. 8 inches	LSC 7.1.5.1
DEAD ENDS:	30 feet max.	LSC 18.2.5.2
	20 ft Max. when serving Assembly Occupancy Room	LSC 12.2.5.1.3
ATRIUM		
DEFINITION:	A large-volume space created by a floor opening or series of floor openings connecting two or more stories that is covered at the top of the series of openings and is used for purposes other than an enclosed stairway; an elevator hoistway; an escalator opening; or as a utility shaft used for plumbing, electrical, air-conditioning, or communications facilities.	LSC 3.3.22
USE:	Occupancy within to be low or ordinary hazard	LSC 8.6.7(3)
MIN. DIMENSIONS:	None indicated	LSC 8.6.7
SMOKE CONTROL SYSTEMS:	System/design required to keep smoke interface level 6 ft. above highest egress level or unprotected opening for a period of 20 minutes or 1.5 times the calculated egress time, whichever is greater	LSC 8.6.7(5)
Activation:	Automatically by dedicated sprinkler water flow, smoke detection system, if provided, and manually at a point readily accessible to the fire department	LSC 8.6.7(6)

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Design/Standard:	NFPA 92B, 2005 edition "Standard for Smoke Management Systems in Malls, Atria, and Large Spaces"	LSC 2.1
FIRE DETECTION SYSTEM:	Smoke detectors not required at the atrium unless required by engineering analysis	LSC 8.6.7
ENCLOSURE:	Enclosed on all levels, and may be used as a smoke barrier	LSC 18.3.7.4
Walls:	1 hour rated "fire barrier" enclosure	LSC 8.6.7(1)
	OR	
	Close spaced sprinklered glass in gasketed framed wall	LSC 8.6.7(1)(c)v
Doors:	¾ hour rated in 1 hour rated fire barrier walls	LSC Tbl 8.3.4.2
	Glass or other material that resists the passage of smoke in glass wall	LSC 8.6.7(1)(c)
Windows:	¾ hour rated OR	LSC Tbl 8.3.4.2
	Inoperable, wired, laminated, tempered glass or glass blocks when sprinklered to wet entire glass area, gasketed frame except glass block, and no obstructions between sprinklers and glass.	LSC 8.6.7(1)(c)
STANDBY POWER:	Recommended for atrium smoke control systems	NFC 90B A.7.4
SPRINKLER SYSTEM:	Required throughout the building containing an atria	LSC 8.6.7(4)
EGRESS:	Access to exits may be within an atrium	LSC 8.6.7(2)
	Exit discharge allowed within atrium per LSC 7.7.2	LSC 8.6.7(2)
	Egress path to be readily visible and identifiable from stair discharge door	LSC 7.7.2.3

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SMOKE ZONES

ZONES:	Required to divide every story in at least two zones	LSC 18.3.7
	Sprinkler and fire alarm system zones to coincide with smoke zones	
Size:	Not to exceed 22,500 sq ft	LSC 18.3.7(3)
	No limit if the zone is an atrium	
Travel Distance:	Max. 200 ft from any point to a smoke barrier access door	LSC 18.3.7(4)
SMOKE BARRIER WALL Continuity:	From an outside wall to an outside wall, from a floor to a floor or interstitial platform, from a smoke barrier to a smoke barrier or any combination	LSC 8.5.2.1
Rating:	1 hour rated, smoke resistant	LSC 18.3.7.4
	Atrium walls used as smoke barrier may be sprinklered glass per LSC 8.6.7(1)(c)	
Dampers:	Smoke damper normally required except: - fully ducted HVAC systems - opening is part of an engineered smoke control system - continuous air movement and system does not recalculate exhaust or return air under fire emergency - openings in duct limited to a single zone - floor penetrations	LSC 18.3.7.4(2) LSC 8.5.5.3
	Smoke damper to be Class II and at least 250°F	LSC 8.5.5.6
	Fire damper not required unless the wall is also a "fire barrier"	LSC 8.5.5.2
Doors:	20 minute rated or 1 ¾ solid wood	LSC 18.3.7.7
Cross Corridor:	Double egress (swing) or horizontal sliding, except where not a required means of egress	LSC 18.3.7.7(2) LSC 18.3.7.7(3) LSC 18.3.7.8
Width:	41 ½" clear per swinging leaf	LSC 18.3.7.7(4)
	83" clear for horizontal sliding	LSC 18.3.7.7(5)

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Closure:	Self closing or automatic closing with adjacent smoke detector	LSC 18.3.7.9
Undercut:	¾" maximum	LSC 18.3.7.7(6)
Vision Panel:	Required in cross corridor doors by fire-rated glazing or wire glass in approved frames	LSC 18.3.7.10
Latching:	Positive latching required	LSC 18.3.7.11
Features:	Center mullions prohibited	LSC 18.3.7.11
	Stops required at sides and head	LSC 18.3.7.11
	Rabbets, bevels or astragals required at meeting edges	LSC 18.3.7.11
Fire Window:	Permitted when ¾ hour rated	LSC Tbl 8.3.5.4.2 LSC 8.5.4.5
Penetrations:	Shall be sealed to restrict the transfer of smoke	LSC 8.5.6
Joints:	To walls, floors, platforms to restrict the transfer of smoke	LSC 8.5.7
ACCUMULATION SPACE:		
	30 sq ft net per patient within aggregate area of corridors, patient rooms, treatment rooms, lounges, dining or other low hazard use on each side of smoke barrier	LSC 18.3.7.6.1
	6 sq ft net per occupant on stories not housing bed or litter borne patients	LSC 18.3.7.6

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ELEVATORS

ENCLOSURE:

Rating:	2 hour rated when connecting 4 stories or more	LSC 8.6.5
	1 hour rated when connecting 3 stories or less	
Doors:	1½ hour rated in 2 hour enclosures	LSC Tbl 8.3.4.2
	1 hour rated in 1 hour enclosures	
Shaft Venting:	Required to vent smoke and hot gases when serving 3 levels or more	ESC 2.1.4 IBC 3004.1
Size:	3 ½% of hoistway area, 3 sq. ft. min.	IBC 3004.3
Location:	Below floor at top of hoistway and open to outside air (directly or through non-combustible duct)	IBC 3004.3
Rating:	Venting duct outside elevator machine room to be equal to the shaft rating if passing through the elevator machine room	IBC 3004.3
ELEVATOR LOBBY VESTIBULES:	Not required	-
CAB SIZE (Min. inside wall to wall)(Handicapped Req.):		
	4 ft. 3 inches deep X 5 ft 8 inches wide with offset side door	FAS 4.10.9
	4 ft. 3 inches deep X 6 ft 8 inches wide with center located door	FAS 4.10.9
	1 cab to accommodate a 24" x 76" cot in the horizontal position (and building is 4 stories or more in height)	IBC 3002.4
EQUIPMENT ROOM:		
Rating:	Equal to shaft rating (1 or 2 hours)	ESC 2.7.1.1 IBC 3006.4
Door:	1 or 1½ hour rated based on wall rating	ESC 2.7.1.1.2
Ceiling Height:	7 feet clear	ESC 2.7.4.1

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Restricted Systems/Equip.:	Equip. not required for elevator operation	ESC 2.7.2
DESIGN CODE/STANDARD:	ANSI/ASME A17.1 "Safety Code for Elevators and Escalators" 2004 ed.	LSC 9.4.2

FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:		
Sprinklers:	Required throughout with quick response heads	LSC 18.3.5.1
Zoning:	Sprinkler zones to coincide with smoke zone	FPM 6.1 G
Sprinkler System Supervision:	Required	LSC 18.3.5.1
Methods of Supervision:	In accordance with NFPA 72 to a constantly manned location (Currently to boiler control room & local fire department)	LSC 9.7.2.1
Location of Fire Dept. Connection:	Readily accessible to Fire Depart.	NFC 14 6.4.5.1
DESIGN CODE/STANDARD:	NFPA 13 "Standard for the Installation of Sprinkler Systems" 2007 edition	LSC 9.7.1.1
MANUAL SYSTEMS:		
Standpipes:	Class I system required on 4 story or more or floors over 50 ft. above grade	FPM 6.2 NFC 1 13.2.2.2
Outlet Size:	2½ inch	NFC 14 7.3.2
Outlet Location:	In stair towers at the highest intermediate floor landings between each occupied floor and at roof	NFC 14 7.3.2(1)
	Each side of horizontal exits	NFC 14 7.3.2(2)
	Each exit passageway at entrance into building areas	NFC 14 7.3.2(3)
	Highest landing of stairway with access to roof and on roof where no stair access	NFC 14 7.3.2(5)
Drain Riser:	3 inch diameter min. required if standpipe provided	NFC 14 7.11.1 FPM 6.1 O

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Hose Stations:	Not required	-
Fire Protection of Risers and Laterals of Standpipe System:	Routed to minimize exposure to fire and mechanical damage	NFC 14 6.1.2.2.1
Design Code/Standard:	NFPA 14 "Standard for the Installation of Standpipe and Hose Systems" 2007 edition	LSC 9.7.4.2 FPM 6.2 B
PORTABLE FIRE EXTINGUISHERS:	Locate cabinets sized to handle 2 ½ gallon pres. water, do not provide fire extinguishers	LSC 18.3.5.10 FPM 6.4
Cabinets:	Locate per NFC 10 and in surgical suite, high valve IT, telephone switch room and elevator machine room	FPM 6.4 A
Design Code/Standard:	NFPA 10 "Standard for Portable Fire Extinguishers" 2007 edition	LSC 9.7.4.1 FPM 6.4
SPECIALS CONDITIONS:		
Elevator Equip. Rooms:	Electricity to equipment must be shut off upon or prior to sprinkler activation	ESC 2.8.2.3.2
Elevator Shafts:	Sprinklers not required at top of shafts	NFC 13 8.15.5.5
	Sprinklers required within 2 ft. of pit floor for hydraulic elevators	NFC 13 8.15.5.1 NFC 13 8.15.5.2
Electrical Equip. Rooms:	Sprinklers required	FPM 6.1 B

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FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Required throughout including interstitial space	LSC 18.3.4.1 FPM 2.1 H FPM 7.3 C
Zoning:	The fire alarm zones to be coordinated with smoke zones and sprinkler zones	
MANUAL FIRE ALARM STATIONS:	Required at exits, nurses stations and interstitial space	LSC 18.3.4.2 FPM 2.1 H
SIGNALING DEVICES:		
Audible:	Required, visual only may be used in critical care areas	LSC 9.6.3.5 LSC 18.3.4.3.1
Visual:	Required	LSC 9.6.3.5
Zoning:	Required by smoke zone	LSC 9.6.3.6.2
SMOKE DETECTORS:		
Locations:	Located per NFPA 101, 2006 ed. and NFPA 72, 2007 ed.	FPM 7.2
	Areas open to corridors or provide direct staff supervision	LSC 18.3.6.1
	Cross-corridor smoke barrier doors held open by magnetic latch	LSC 7.2.1.8.2
	Air handling units supply side, 2,000 cfm return side, 15,000 cfm	NFC 90A 6.4.2.1
	Elevator Machinery Room & Lobbies (Not required in hoistway)	ESC 2.27.4.2
REMOTE ANNUNCIATOR PANEL:	Provide F.A. panel at main entry or 24 hour manned location, thus, remote panel not required	FPM 7.4 A & G
SUPERVISING STATION:		
	Required by auxiliary, proprietary, central station or remote station to notify serving Fire Department	FPM 7.3 H

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SECONDARY POWER:	Required by generator or batteries with 30 second switch over time, max.	NFC 72 4.4.1.3.1 NFC 72 4.4.1.5.2.1
DESIGN CODE/STANDARDS:	NFPA 72 "National Fire Alarm Code" 2007 edition	LSC 9.6.1.3

FINISHES

Applicable Design Codes/Standards:	NFPA 101 "Life Safety Code" 2006 edition	FPM 2.3
FLAME SPREAD RATINGS:		
Room Finish:		
Patient & Sleeping:	Class A any may be Class B if room capacity is 4 or less	LSC 18.3.3.2.1
Other rooms:	Class A or B	LSC 18.3.3.2.1
Exitways (Hort. or Vert.):	Class A	LSC 18.3.3.2
Textiles:	Class A on walls or ceilings	LSC 10.2.4.1
Floor Finish:	Class I or II in exit enclosures and exit access corridor	LSC 18.3.3.3.2
	Min. critical radiant flux of 0.1 W/cm^2 for other spaces and not carpeting	LSC 10.2.7.2
Incidental Trim:	Class C, Max. 10% of wall/ceiling area	LSC 10.2.5.1
Foam/Cellular Plastic Insulation:	Not permitted as interior finish	LSC 10.2.4.3
ROOF COVERING:	Class B, FM Class I or UL Fire Classified	FPM 2.7 A
SMOKE DENSITY RATINGS:	450 or less for Class A, B or C for interior finishes	LSC 10.2.3.4

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MISCELLANEOUS REQUIREMENTS

GUARDRAILS:

Where Required:	At offsets, 30 inches above floor or grade below	LSC 7.1.8
Height:	42 inches min.	LSC 7.2.2.4.5.2
Rail Design:	Spaced so that a 4" sphere will not pass through to a height of 34 inches	LSC 7.2.2.4.5.3
HANDICAP DESIGN CODE/STANDARD:	Uniform Federal Accessibility Standards, FED-STD-795, April 1, 1988	FPM 1.5
OUTSIDE WINDOW OR DOOR:	Required in every patient sleeping room except for:	LSC 18.3.8.1
	newborn nurseries room for occupancy < 24 hours, such as obstetrical labor beds, recovery beds and observation	
	Windows into atrium equivalent to an outside window	LSC 18.3.8.1(2)
Sill Height:	36" max. above the floor	LSC 18.3.8.2
	60" max. above the floor in special nursing care areas such as: ICU CCU Hemodialysis Neonatal patients	

6.8 General Fire Protection Narrative – Community Living Center

The Fire and Life Safety Program has been developed to provide a reliable system to protect building occupants, fire fighting personnel, building contents, building structure and continuity of building function. It's intent is to provide a reasonable level of fire safety by reducing the probability of injury, loss of life or building's functional use due to a fire. This can be accomplished by limiting the development and spread of a fire emergency to the room or area of origin and reducing the need for total occupant evacuation.

The design aspects which relate to the fire and life safety of the facility include:

Occupancy - Building function
Exits - Design concept
Structural fire resistance - Type of Construction

Building Compartmentization - Fire areas
Fire detection
Fire alarm and supervisory control
Fire suppression
Smoke control and exhaust
Fire fighter access and facilities
Emergency power

6.8.1 Occupancy

The planned CLC complex is comprised of four 1-story modules (3 residential and 1 support module). The CLC has an occupancy classification of New Health Care (I-2). This includes facilities where in-patients sleeping accommodations are provided. Occupants are mostly incapable of taking actions for self preservation in an emergency because of age and/or physical or mental disabilities. The occupancy classification is I-2 (Institutional) under the International Building Code (IBC) and New Health Care Occupancy under the Life Safety Code (LSC).

6.8.2 Occupancy Load

Occupancy loads are determined based on the gross sq. ft. and an occupancy load factor in sq.ft./person. The occupancy load factor for institution (CLC) occupancy is 240 sq. ft. per person in treatment areas, and 120 sq. ft. per person in the patient sleeping areas (nursing units). The occupancy load factor for business (clinic, offices, and labs) occupancy is 100 sq.ft. per person. The calculated occupancy load is 1,269 total for the various use areas, all being fully occupied at the same time.

(Reference the exit calculations for details on how occupancy loads were determined.)

6.8.3 Hazard Classification

The content hazard of the facilities varies, with the bulk of the facility areas being a light hazard. Light hazards are those where the quantity and /or combustibility of contents is low and fires with relatively low rates of heat release are expected (NFC 13 5.2). Light hazard areas include:

Patient sleeping areas
Office areas
Assembly areas such as dining and chapel
Rehabilitation and therapy rooms, day rooms and activity rooms
Libraries, except large stack rooms
Computer rooms
Telephone switchboard rooms

Specific areas within these buildings have a higher quantity and /or combustibility that force them to be considered a higher class hazard. Ordinary Hazard Group 1 include areas where combustibility is low, and quantity of combustible is moderate, stockpiles of combustibles do not exceed 8 feet, and fire with moderate rates of heat release are expected (NFC 13 5.3.1). Ordinary Hazard Group 1 areas include:

Mechanical and electrical rooms
Lockers
Kitchens
Laundries

Ordinary Group 2 include areas where quantity and combustibility of contents is moderate, stockpiles do not exceed 12 ft. and fire with moderate rate of heat release are expected (NFC 13 5.3.2). Ordinary Hazard Group 2 areas include:

Record storage
Storage rooms of combustibles
Mercantile (gift shops)
Trash rooms
Loading docks

6.8.4 Exits

Health Care/Institutional occupancies create difficulties in the evacuation of the building in an emergency. Patients may be immobile, or of limited mobility, and may not be capable of recognizing an emergency or perform needed actions for self preservation. This makes evacuation very difficult, as assistance is needed, greatly increasing the time required to evacuate an area. Emergency evacuation is further compounded by vertical exits (stairs). Patients on gurneys, in wheel chairs, and those with limited mobility must be carried down stairs.

To offset the problems associated with evacuation, institutional/health care occupancies are designed with the defend-in-place concept. The defend-in-place concept is based on early detection, compartmentization and suppression. If the emergency requires evacuation of an area the first stage of an evacuation is horizontal into a protected area. The protected areas are created by compartmentization by rooms and smoke zones (1 hour rated smoke tight walls) on a given floor. Travel distances from any remote point to a smoke compartment access door is limited to 200 feet. The travel distance to a protected exit (enclosed stairway, horizontal exit or exterior exit) from any point is limited to 200 feet and 150 feet from any exit access (room) door. The maximum travel distance to an exit access (corridor) door is 50 feet. Horizontal exits (2 hour rated walls) provide a higher degree of compartmentization, and while not required by the governing codes are highly recommended.

Exits consists of aisles within rooms and suites which shall be maintained to provide access to a corridor, exterior exit, exit stair or horizontal exit. Exit corridors with unprotected openings shall provide a smoke resistive assembly. Corridors shall provide two directions of travel to a main exit (exterior exit or horizontal exit), except for allowable dead ends. Dead end corridors shall not exceed 30 feet in institutional/health occupancies.

Horizontal exits consist of 2 hour rated walls subdividing the floor space into separate fire areas. In order for these areas to be used as a horizontal exit or an exterior exit shall be provided within each fire area.

Exterior exits are exits that discharge directly to the exterior and provides a clear unobstructed path to the public way. The path to the public way must be such that the exit path does not require exiting past unprotected portions of the building.

Exit signs indicating the direction of exiting will be provided such that all areas within any corridor have an exit sign visible. Exit signs will also be placed at all exit doors (horizontal and exterior exits), which are not obviously identifiable as an exit. Exit signs will also be placed at exit access doors (corridor doors) within large open rooms with an occupant load of 50 or more persons.

Exit signs shall be illuminated and provide a directional symbol. Each exit sign will have two lamps and be provided with an emergency source of power. The emergency power source shall provide 1 ½ hour of illumination without normal power.

Illumination of the means of egress will be provided with an emergency power source, to provide a minimum of 1 foot candle in the following areas;

Exit corridors
Rehabilitation/Therapy rooms
Main lobby
Meeting rooms*
Dining room*
Auditorium*
Central control station
Telephone operator's room
Administrative areas

* May be reduced to not less than 1/5 foot candles during performances or projections.

6.8.5 Building Exposure

The Veterans Affairs Medical Center site is 100 plus acres with no existing buildings. The proposed placement of the new medical center buildings will be a minimum of 20 feet from the warehouse/engineering building to the south and 60 plus ft. on the other sides. The fire separation of only 20 feet allows unprotected exterior walls (IBC Tbl 602) and 25% of wall o be unprotected windows (IBC Tbl 704.8). The buildings on site, except the open parking garage, are to be sprinklered throughout. As such, NFPA standard 80A states that no exposure hazard is considered to exist. Reference Sections 5.6.3 and 5.6.4. Therefore, no special provisions are needed, other than separation and sprinklered facilities, for exposure protection.

6.8.6 Building Construction

The building height and area requires that the health care/CLC be non-rated non-combustible or limited combustible construction with a construction type of Type II (000) under NFPA 220 and II-B (000) under the IBC. The minimum fire rating is as follows:

Structural frame (columns and beams) - 0 hour rated, beams supporting the occupied floor are non-rated noncombustible construction when located within the distribution zone.

Floors/Ceiling Assembly - 0 hour rated

Roof/Ceiling Assembly - 0 hour rated

Wall Assembly

Exterior bearing - 0 hour rated with 10 plus ft. fire separation

Exterior non-bearing - 0 hour rated with 10 plus ft. fire separation

Interior bearing - 0 hour rated

Interior non-bearing: - 0 hour rated, due to construction type, may require rating based on associated room hazard.

6.8.7 Occupancy Separations

The CLC (Health Care) is being considered a single use occupancy (LSC 6.1.14.2.). This is consistent with a non-separated mixed occupancy facility under the IBC.

The function or use within a room may be more hazardous than the overall occupancy classification, requiring a fire rated enclosure. Rated separations will be provided due to associated hazard or use as follows:

Storage rooms ≥ 100 sq. ft. - 1 hour rated
Repair and engineering shops - 1 hour rated
Gift shop storage area - 1 hour rated

Special hazard rooms - 1 hour rated for:

Laboratories (with hazardous materials)
Paint shops
Soiled linen
Clean utility rooms
Soiled utility rooms
Trash service rooms
Linen service rooms
Flammable storage (limited amount)

Special high hazard rooms - 2 hour rated for:

Flammable storage (severe hazard)
Hazardous storage
Trash collection rooms
Linen collection rooms

Smoke dampers will be provided at each air transfer opening or duct penetrations of smoke barrier walls. A smoke damper is not required at the penetration of a 1 hour smoke barrier wall where the HVAC system is fully ducted (LSC 18.3.7.4).

Fire dampers will be provided at each duct penetration of walls and floors rated for 2 hours or greater (NFC 90-5.3). Fire dampers are also required at transfer grills in 1 hour and above rated assemblies.

Fire-rated doors, frames and hardware will be provided on openings in rated partitions. Doors will be equipped with closer and where required to remain normally open, with magnetic holders. Doors will be:

Class B, 1-1 /2 hour fire-rated assemblies in 2-hour shafts and partitions.

Class C, 3/4 hour fire-rated assemblies in 1-hour partitions designed for occupancy or hazard separations.

20 minute fire-rated doors or 1-3/4 inch solid bonded core wood doors in smoke barriers. Vision panel in smoke barrier doors limited to wired glass not exceeding 1296 square inches.

Corridor doors shall be constructed to resist the passage of smoke and do not require a fire resistive rating unless the door is protecting a smoke zone, occupancy or hazardous area.

6.8.8 Building Compartmentization

Corridor doors are required to form a barrier to limit the transfer of smoke thus providing some degree of compartmentization. Hazardous rooms are protected with a rated enclosure with protected opening (see Occupancy Separations).

Smoke zones are provided within the CLC/healthcare providing a second level of compartmentization. Walls creating smoke zones are one hour rated with 1/3 hour rated doors and protected penetrations, designed to restrict the passage of smoke. Smoke zones are limited to 22,500 square feet maximum, with the maximum travel distance from any remote point within a zone to a smoke barrier door limited to 200 feet. Smoke barrier walls shall be routed to minimize the number of doors in the wall, and arranged, where practical, so as not to bisect departments.

6.8.9 Interior Finishes

Interior finish, maximum flame spread and smoke developed limits are based on ASTM E-84 fire hazard classification test and will be as follows:

Egress Corridors:
Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

Occupied spaces (walls and ceilings):

Patient and Sleeping rooms > 4 occupants per room

Class A
Flame spread - 25 maximum
Smoke developed - 450 maximum

Other occupied rooms and spaces

Class B

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Flame spread - 75 maximum
Smoke developed - 450 maximum

Floor Finish of corridors, enclosed exits and areas open there-to - Class II:

Carpet for corridors will pass DOC FF 1-70 and for critical radiant flux, minimum of 0.50 watts/sq. cm as determined by NFPA 253 - 1990 edition, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source".

Insulation:

Flame spread rating limitation - 25 maximum

Smoke developed limitation - 450 maximum except when isolated by masonry walls or floors.

Combustible foam plastic thermal insulation shall not be used as an interior finish.

6.8.10 Water Supply

The current water flow information for the site water distribution system is not available. Flow tests are to be provided to determine the water and pressures available to the site.

The site will have an on-site potable water storage tank to provide up to a 7 day normal demand. This has been estimated between 500,000 gallons to 1 million gallons. The fire protection water will utilize this storage volume with a fire pump to provide the needed pressures. The potable water storage tank will be fed by the county water service and domestic water will be drawn from the tank. In essence, the potable water tank is a break tank.

The preliminary water flow requirements for the sprinkler system and hose stream calculates as follows (assuming worst case warehouse utilizing ESFR sprinklers):

.20	gpm/sq. ft. density (Ordinary Hazard Group 2)
x 2,000	sq. ft. design area (dry pipe system)
400	gpm/design area
+ 500	gpm/hose stream
900	gpm combined sprinkler and hose demand
x 90	minutes (duration of flow)
81,000	gallons total water demand for fire protection
125	gpm/ESFR
x 12	number of ESFR operating
1500	gpm/design area
+ 250	gpm/hose stream
1750	
x 90	units
157,500	gallons total water demand for fire protection

The estimated pressure required to provide a 100 psi at the upper hose outlet is as follows:

100	psi at outlet
+ 43	psi (elevation loss) = .432 psi/foot of elevation times 100 feet
+ 25	psi (allowance for friction loss)
+ 10	psi (allowance for backflow preventer)
178	psi required at base of system riser

A site fire pump rated at 1250-1500 gpm will be required to provide the water demand and pressure to insure proper operation of the site fire protection water supply system. The fire pump will be located in a dedicated 1 hour rated pump room in the energy center and selected to provide the 175 ± psi water pressure. With a large diesel generator to service the emergency systems within the hospital, the fire pump motor can be electric and fed from the emergency generator. The electric motor would need to be 150-200 bhp. Once the taps to the county water main lines are made a more accurate water supply and thus a more accurate pump rating can be determined.

6.8.11 Automatic Fire Suppression

A dry-pipe system or dry pendents / sidewall sprinklers will be provided in areas subject to temperatures below 40 °F, such as dock areas and refrigerated areas. Commercial cooking hoods and exhaust duct shall be provided with an automatic water spray extinguisher system.

A supervised wet pipe sprinkler system shall be provided throughout the remaining areas of the building including the electrical and telecommunication rooms. A 1,500± gpm electric motor driven fire pump located in the central energy plant will supply water to the fire service water loop that will feed the sprinkler system.

The sprinkler system will be connected to the new site fire service loop. Riser pipes will be provided in each of the four facility modules. These 4" dia risers will be fed from mains run underground and equipped with post indicator valves. An interior control valve will be provided for each sprinkler zone.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below.

Light hazard occupancies will be designed to provide 0.10 gpm per square foot over most remote 1,500 square feet with quick response sprinklers.

Ordinary hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet.

Ordinary hazard Group 2 occupancies will be designed to provide 0.20 gpm per square foot over most remote 1,500 square feet.

The sprinkler systems will be zoned to coincide with smoke zones and by prime areas such as the docks, lobby and computer room. In addition, sprinkler systems protecting special hazards, cooking hoods and associated exhaust ducts are to be zoned separately. Each sprinkler zone/system will be provided with all necessary valves, control valve tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

6.8.12 Fire Extinguishers

Portable fire extinguishers shall be located throughout all areas of the buildings in accordance with NFPA 10-2007 Edition. Fire extinguishers will not be provided under this project. Fire extinguisher cabinets and proposed locations for extinguishers on hooks, along with appropriate signage will be provided.

Extinguishers shall also be located in the following specific areas:

Near each exits
In major mechanical, electrical and telephone equipment rooms
Kitchens
Locker rooms
Maintenance shops
Storage rooms (large)
High value IT equipment
Telephone switch rooms

The class, size and spacing will be as follows:

Class A combustibles (ordinary combustible materials such as wood, cloth and paper):

Maximum travel distance to an extinguisher will be 75 feet. Minimum extinguisher rating will be 2A. Maximum coverage per unit of A will be:

- 3000 square feet in patient rooms, treatment areas and administrative areas.

- 1500 square feet in retail, locker rooms, mechanical rooms, electrical rooms, storage rooms, laundry, maintenance work-shops and kitchen.

Class B combustibles (flammable liquids, oils, gases):

Maximum travel distance to an extinguisher will be 50 feet.

Minimum extinguisher rating will be 1OB.

Class C (energized electrical equipment):

Extinguishers sized and located for Class A and B hazards.

Class K (cooking media, vegetable or animal oils):

Maximum travel distance to hazard will be 30 feet.

Minimum extinguisher size 1.6 gal/each 5 ft3 of oils.

Multi-purpose dry chemical fire extinguishers will be used as they are suitable for use on all three common fire classifications.

Fire extinguishers will be large enough that they cannot be easily concealed and removed from the building. The recommended fire extinguisher size is 3A-30B:C.

Extinguishers will be located in flush mounted cabinets sized to accommodate 2½ gallon pressurized water extinguishers in public areas to prevent damage and discourage tampering. Extinguishers may be installed on hangers in non-public areas.

6.8.13 Detection, Alarms And Controls

A fire detection and alarm system will be provided throughout the facility in accordance with NFPA 72, 2007 edition and the design criteria.

The fire detection and alarm system (FDAS) will be a microprocessor based, multiplexed device addressable system connected to and capable of communicating with the Site Fire Alarm Notification System located in the Center Energy Plant, and off-site monitoring service.

Manual pull stations will be located in the natural path of escape near exit doors, horizontal exits, and at nurses' stations. Pull stations will be so located that no place on any floor will be more than 200 feet from a pull station.

Automatic photoelectric smoke detectors will be located as required by NFPA 72, LSC 101 and NFPA 90A in the following spaces:

Smoke Barrier Corridor Doors, when on hold open devices

HVAC System Ductwork as required by NFPA 90A

Fire alarm speakers, for fire location announcements and evacuation instructions, will be located so as to be clearly audible in all areas.

Visual alarm indicators will be provided in all public areas.

Magnetic hold open devices will be provided for smoke barrier corridor doors and horizontal exit doors.

Supervision of sprinklers:

Position indicator switches on all gate control valves.

Flow switches on each floor and each zone of the sprinkler system.

The FDAS control panel will have visual and audible signals for power failure, open circuit, ground, smoke detector failure and alarm.

Alarm notification by pre-recorded messages will be automatically transmitted throughout the facility. Alarm and evacuation instructions will be given by a manual voice annunciation system. Trouble signals will be automatically transmitted to the central energy plant.

The fire detection and alarm system will have four hour battery standby power and will be connected to the "life safety" power system as described in the electrical section.

The smoke detectors, sprinkler water flow devices and manual pull stations will be electrically interconnected to the system. The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at the central energy plant and local fire alarm control panel and the control functions will be initiated.

Activation of any fire alarm initiation device, except manual pull station, will release door hold open devices on the floor of activation, allowing them to close automatically. The hold open device is released by the interruption of electric power and manual release of the door as well as by the fire alarm system.

Activation of the smoke detectors at compartmentation (smoke and fire barriers) doors will initiate the fire alarm system, and close the compartmentation doors.

Activation of smoke or heat detectors in mechanical and electrical rooms will initiate the fire alarm system and close the compartmentation doors.

Activation of the duct smoke detectors for mechanical air handling units will initiate the fire alarm system, close the compartmentation doors, and shut down the air handler.

6.8.14 Smoke Control

Duct smoke detectors will be installed in all HVAC systems in:

Return air ducts with 2,000 cfm air flow, placed before air is exhausted from building or prior to dilution by outside air.

Main supply air ducts with 15,000 cfm air flow, placed downstream of filters.

Activation of an induct smoke detector will initiate shutdown of the associated air handling unit.

Manual emergency stop switch for fans will be provided.

The CLC/health care will be divided into smoke compartments by 1-hour smoke barriers. Smoke zones shall not exceed 22,500 square feet and arranged so that a smoke barrier door is within 200 ft. of any point on the floor.

6.8.15 Emergency Power

A level 1 emergency power supply system (EPSS), as defined by NFPA 101, shall be provided and will consist of emergency generators located in the energy center. The EPSS will supply the essential electrical system for the hospital, which is comprised of the life safety, critical and equipment branches and serve the following loads:

Life Safety Branch

Illumination of means of egress

Exit signs
Fire detection and alarm system
Emergency communications systems
Elevator cab lighting, control, communications, and signal systems.

Critical Branch

Patient care tasks illumination and receptacles

Equipment Branch

Sump pumps
Compressed air systems
Heating systems
Elevators
Selected HVAC systems
Fire pump

6.8.16 Fire Department Accessibility

The exterior of the facility shall be sufficiently open so that fire apparatus and/or fire fighters have access to all open sides of the building.

New hydrants shall be provided as part of the fire service loop. Hydrants shall be fed by at least a 6" diameter connection with a road/curb valve at the connection. Hydrants should be spaced at least 40 feet from the building and adjacent fire lanes. Hydrants should be spaced no more than 600 feet apart around the perimeter of the building.

6.9 Building Description – Community Living Center

BUILDING:	VA New CLC		
USE & OCCUPANCY CLASSIFICATION:	CLC - Institution (I-2), New Health Care		LSC 3.3.168.7 IBC 308.3
AREA (± sq ft):	1st Floor	109,000 ± ft^2	
HEIGHT:	1 story	19 ± ft.	
SPRINKLED:	CLC to be fully sprinkled utilizing quick response sprinklers.		
YARDS/SEPARATIONS:	Open 40 ft plus on all sides except the south side where it is set back 20 ± ft. from the warehouse/engineering building.		

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SPECIAL FEATURES: The facility has grade level enclosed pedestrian walkways connecting the three residential pods/modules and the utility/support pod/module.

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6.10 Code Summary – Community Living Center

CONSTRUCTION TYPE:	Community Living Center – New Health Care Non-combustible II (000) <AS>	LSC Tbl 18.1.6.4 FPM 2.1.B
	II-B Non-combustible under IBC	NFC 220 Tbl A4.1.1
ALLOWABLE HEIGHT AND AREA:	Unlimited area and 1 story in height, II (000) <AS>	LSC Tbl 18.1.6.4

BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS

The following is based on II (000) construction

Note: Type II-B fire rated non-combustible construction under the IBC is equivalent to Type II (000) under NFPA 220 and LSC.

BUILDING ELEMENT MATERIALS:	Non-combustible or limited combustible construction	NFC 220 4.3.1
EXTERIOR WALLS:		
Bearing walls:	0 hour rated non-combustible	NFC 220 Tbl 4.1.1
Non-bearing:	0 hour rated non-combustible ≥ 30 ft. open yards	IBC Tbl 602
Opening Protection:	Not required in facility with >10 ft. open yard with up to 45% of wall opening, per floor	IBC Tbl 704.8 NFC 220 Tbl 4.1.1
STRUCTURAL FRAME: (Columns, Trusses, Beams and Girders)	0 hour rated non-combustible	NFC 220 Tbl 4.1.1
FLOOR:	0 hour rated smoke barrier non-combustible	NFC 220 Tbl 4.1.1 LSC 8.6.1
ROOF:	0 hour rated non-combustible	NFC 220 Tbl 4.1.1
WALLS & PARTITIONS		
Non-bearing:	0 hour rated non-combustible or limited combustible	NFC 220 Tbl 4.1.1 NFC 220 4.3.2.11.1
Load-bearing:	0 hour rated non-combustible	NFC 220 Tbl 4.1.1

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PENTHOUSE (MECHANICAL)		
Size:	1/3 the supporting roof area (aggregate maximum) otherwise considered a mechanical equipment story	IBC 1509.2
Walls, Roof & Structural Frame:	Same as for II-B (000) construction above	IBC 1509.2.1

RATED SEPARATIONS

AREA SEPARATIONS (FIRE WALLS):		
Rating:	2 hour rated (not required)	LSC 8.2.1.3 (1)
SPECIAL SEPARATIONS:		
Soiled Linen:	1 hour rated	LSC Tbl 18.3.2.1
Storage Room:	1 hour rated	LSC Tbl 1.8.3.2.1
	All rooms used primarily for the storage of combustible material shall be considered a storage room regardless of the room name (ie., clean linen, file)	
Trash Collection Room:	1 hour rated	FPM 3.1A
Medical Record Storage:	1 hour rated	FPM 3.1B
Moveable aisle/mobile shelving:	1 hour rated	FPM 3.1B
Compressed Medical Gas:	1 hour rated if over 3,000 ft^3 @ STP	NFC 99 5.1.3.3.2
Flammable Liquid Storage Rooms:	1 hour rated ≤ 150 sq ft	NFC 30 Tbl 6.4.2.1
	2 hour rated (high hazard) > 150 sq ft and ≤ 500 sq ft	NFC 30 Tbl 6.4.2.1

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Room/Vaults for Dry Transformers:		
112½ KVA or less:	0 hour enclosure, maintain 12" from combustibles	NFC 70 450-21(a)
Over 112½ KVA:	1 Hour enclosure (See exceptions for 80° C rise or higher)	NFC 70 450-21(b)
Over 35,000 Volts:	3 hour enclosure or 1 hour enclosure and sprinkled	NFC 70 450-21(c) NFC 70 450-42 Exc.
OPENING PROTECTION:		
Doors in:		
2 hour rated walls:	1½ hour rated	LSC Tbl 8.3.4.2
1 hour rated walls:	1 hour rated for vertical opening (shafts)	LSC Tbl 8.3.4.2
	¾ hour rated elsewhere	
	20 minute in smoke barrier walls and atrium enclosure	
Corridor Walls:	No fire rating required, constructed to resist passage of smoke	LSC 18.3.6.3
Windows/Viewing Panels:		
1 hour rated walls:	Limited to 25 % (Max.) of walls area	LSC 8.3.3.9
2 hour rated walls:	Not permitted	LSC Tbl 8.3.4.2
1 hour rated walls (other than shaft walls):	¾ hour rated assembly	LSC Tbl 8.3.4.2
Fire Dampers:		
Air ducts:	Required in fire barriers or partitions ∃ 2 hours	NFC 90A 5.3.1.1

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Air transfer grills:	Required where opening protection required.	LSC 18.3.6.4.1
	Not permitted in corridor walls or doors, except in doors to toilet rooms	

EXITS

Applicable Design Code/Standard:	NFPA 101 "Life Safety Code" 2006 ed.	FPM 1.3.B
OCCUPANT LOAD FACTORS:	(gross sq. ft. / person)	LSC Tbl 7.3.1.2
Board and Care (Large):	200	
Waiting Room/Lounge/ Dining:	15 (Net sq. ft./person)	
Conference:	15 (Net sq. ft./person)	
Eng. Shops:	100	
Laboratories:	100	
Locker Rooms:	50 (IBC)	
Mechanical:	300 (IBC)	
Offices/Kitchen:	100	
Exercise w/Equipment:	50	
Storage	500	

NUMBER OF EXITS:

Rooms:

2 exits or exit access required when:	Patient sleeping room or suite > 1000 sq. ft.	LSC 18.2.5.4
	Other rooms or suites > 2500 sq. ft.	
	Assembly rooms ≥ 50 occupants	LSC 18.2.5.6.3.2
	From each smoke compartment	LSC 12.2.5.1.2
		LSC 18.2.4.4
Floors (exits):	Two min. from each floor or fire area	LSC 18.2.4.1
	Three when occupancy load # 1000	LSC 7.4.1.2
	Four when occupancy load > 1000	

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EXIT & EXIT ACCESS SEPARATION:	a maximum diagonal dimension of room, space or floor served	LSC 7.5.1.3.3
TRAVEL DISTANCE TO AN EXIT (MAX.):	150 ft. room access door to an exit AND 200 ft. any point to an exit AND 50 ft. any point within sleeping room to an exit access door	LSC 18.2.6.2.1 LSC 18.2.6.2.3
Common Path:	100 ft. within Mechanical Equipment Room 20 ft within Assembly Rooms	LSC 7.12.1(I) LSC 12.2.5.1.2
ACCESS THROUGH ADJOINING ROOMS:	Permitted, provided intervening room use is not a storeroom, workroom, maintenance room or similar space	LSC 7.5.1.6 LSC 7.5.2.1 LSC 18.2.5.1
EGRESS WIDTH FACTOR:	0.2 inches/person for level components and ramps	LSC Tbl 7.3.3.1
EXIT DOORS:		
Width:		
For patient use:	41.5 inches min. (clear open width), includes sleeping rooms, diagnostic and treatment rooms	LSC 18.2.3.6
	32 inches min. (clear open width) (door panel in exit stair enclosures, newborn nurseries)	LSC 18.2.3.7(2)
For non-patient use:	32 inches (clear opening)	LSC 18.2.3.7(1)
Height (Min.):	6 ft. 8 inches	LSC 7.1.5.1

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Swing:	In direction of exit when: - Serving a high hazard area - Serving ∃ 50 people OR - Used in an exit enclosure Horizontal sliding permitted where serving 10 or fewer persons	 LSC 7.2.1.4.3 LSC 7.2.1.4.2 LSC 18.2.2.2.9.2
Panic Hardware:	Not required unless serving an assembly occupancy with an occupant load ∃ 100	LSC 12.2.2.2.3
Power Operated:	Upon power failure: - be capable of manual operation - be capable of swinging to the full open from any position - be set in motion with a force of 50 lbs.	LSC 7.2.1.9
EXIT SIGNS:	Illuminated (internally or externally) with directional signs on life safety circuit	LSC 18.2.10.3 LSC 7.10.5
Placement:	- Within 100 ft. of any point in exit access corridor - Where exit or way is not readily apparent	LSC 7.10.1.5.2 LSC 7.10.1.5.1
Power Supply:	On Life Safety Branch	LSC 18.2.10.3
EXIT ILLUMINATION:	1 foot candle min. along egress route 10 foot candle min. on exit stairs 2 bulbs per fixture	LSC 18.2.8 LSC 7.8.1.3 LSC 7.8.1.4
Power Supply:	House wiring, with emergency backup, Min. of 90 minutes, min. Type 10, Class 1.5, Level 1	LSC 7.8.2 LSC 7.9.1.1 LSC 7.9.2.2

HORIZONTAL EXITS

DEFINITION:	A path of egress travel through a rated wall to a fire area or building which affords safety from fire and smoke in the area of incidence	LSC 3.3.70.1

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	The doors in the rated horizontal exit wall may be considered an exits	LSC 7.2.4.1.2
NUMBER & CAPACITY:	May not be the only exit from a fire area or portion	LSC 7.2.4.2.1
	At least one of the required exits shall discharge to the exterior or an exit enclosure	
	Not more than ½ of the required number of exits may be by a horizontal exit	LSC 7.2.4.1
	Not more than ⅔ of the required exit capacity may be by a horizontal exit	LSC 18.2.2.5.2
REFUGE AREA:	30 sq. ft. net per patient within aggregate area of corridors, patient rooms, treatment rooms, lounges, dining or other low hazard use on each side of the horizontal exit	LSC 18.2.2.5.1.1
	6 sq. ft. net per occupant on stories not housing bed or litter borne patients	LSC 18.2.2.5.1.2
SEPARATION WALLS:	2 hour "fire barrier"	LSC 7.2.4.3.1
	Construction supporting the wall to be fire rated equal to the wall	IBC 706.4
Vertical Continuity:	From top of floor to bottom of the floor or roof deck above	IBC 706.5
Horizontal Continuity:	Continuous from exterior wall to exterior wall to divide the floor served by the horizontal exit ("fire barrier")	LSC 7.2.4.3.3
	Exterior walls within 10 ft. of horizontal exit wall intersection and less than 180° to be 1 hour rated	LSC 7.2.4.3.3
OPENINGS:	Doors to swing in the direction of egress	LSC 7.2.4.3.7
	Windows not permitted	LSC Tbl 8.3.4.2

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Penetrations & Joints:	Protected to meet wall ratings	LSC 8.3.5
Duct Openings	Protected with fire dampers	LSC 8.3.5.7 NFC 90A 5.3.1.1
DOORS:		
Closures:	Self closing or automatic closing activated by local smoke detector(s)	LSC 7.2.4.3.9
Cross Corridor:	Shall be automatic closing by activation of smoke detector	LSC 7.2.4.3.10
Rating:	1 ½ hour rated min. and installed to limit air leakage per NFPA 105	LSC Tbl 8.3.4.2 LSC 7.2.4.3.8
Vision Panel:	Required in cross corridor doors by fire-rated glazing or wire glass in approved frames	LSC 18.2.2.5.6
Latching:	Positive Latching required	NFC 80 6.4.4.3
Features:	Center mullions prohibited	LSC 18.2.2.5.7
Dual Egress:	Shall be double egress (opposite swing) when serving as an exit from both sides, with 41 ½" clear width per leaf in an 8 ft. corridor	LSC 18.2.2.5.4
	(32" clear in a 6 ft. corridor)	LSC 18.2.2.5.5
	Horizontal sliding may be utilized with a clear opening of 83" in an 8 ft. corridor	LSC 18.2.2.5.4
	(64" in a 6 ft. corridor)	LSC 18.2.2.5.5
Single Egress:	Single swing or horizontal sliding horizontal exit door allowed when serving as an exit from one side only with 41 ½" clear width	LSC 18.2.2.5.3

CORRIDORS

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SEPARATION:	Corridors to be separated from all other areas by partitions except:	LSC 18.3.6.1
	1. Spaces not used for patient sleeping, treatment or hazardous and - Quick response sprinklers throughout smoke zone or smoke detectors in open corridors of smoke zone - Space provided with smoke detectors or space permits direct supervision by staff - Space does not obstruct access to exit	LSC 18.3.6.1(1)
	2. Waiting areas (600 sq. ft. aggregate) per smoke zone - Space provided with smoke detectors or space permits direct supervision by staff - Space does not obstruct access to exit	LSC 18.3.6.1(2)
	3. Spaces for nurses station	LSC 18.3.6.1(3)
	4. Gift shop ≤ 500 sq. ft.	LSC 18.3.6.1(4)
Intervening Rooms:	Not permitted, corridor to provide access to 2 or more approved exits	LSC 18.2.5.3
PROTECTION:		
Walls:	0 hour rated non-combustible or limited combustible construction designed to limit smoke transfer (atmospheric separation)	LSC 18.3.6.2.2 LSC 18.3.6.2.3
Floors:	No special requirements	-
Ceilings:	Smoke tight or corridor walls run to deck above	LSC 18.3.6.2.1
Doors & Frames:	Non-rated constructed to limit the transfer of smoke (with exceptions)	LSC 18.3.6.3.1
Latches:	Positive latching required (with exceptions) Roller latches prohibited	LSC 18.3.6.3.5 LSC 18.3.6.3.7
Closing Devices:	Not required (except when rated door required do to adjacent space/room or exit)	LSC 18.3.6.3.9
Glazed Openings:	No restriction on glass rating or size	LSC 18.3.6.3
Duct Penetrations:	Dampers not required	LSC 18.3.6.4.1

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WIDTH (MIN.):		
Inpatient use:	8 ft. for required exit access of patients	LSC 18.2.3.4
	6 ft. for psychiatric care	LSC 18.2.3.5
Non-patient use:	44 inches	LSC 18.2.3.4(1)
PROJECTIONS:		LSC 18.2.1
Doors:	Half of the required exitway width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4
Trim/fixtures:	4 ½ inches max. each side within 38" of floor	LSC 7.3.2.2
CEILING HEIGHT:	7 feet 6 inches min. with no projections below 6 ft. 8 inches	LSC 7.1.5.1
DEAD ENDS:	30 feet max.	LSC 18.2.5.2
	20 ft Max. when serving Assembly Occupancy Room	LSC 12.2.5.1.3

SMOKE ZONES

ZONES:	Required to divide every story with sleeping or treatment in at least two zones	LSC 18.3.7
	Sprinkler and fire alarm system zones to coincide with smoke zones	FPM 6.1G
	Not required on lower level with no patient access and ≤ 50 occupants	LSC 18.3.7.1(2)
Size:	Not to exceed 22,500 sq ft	LSC 18.3.7(3)
Travel Distance:	Max. 200 ft from any point to a smoke barrier access door	LSC 18.3.7(4)
SMOKE BARRIER WALL Continuity:	From an outside wall to an outside wall, from a floor to a floor or roof deck, from a smoke barrier to a smoke barrier or any combination	LSC 8.5.2.1
Rating:	1 hour rated, smoke resistant "smoke barrier"	LSC 18.3.7.4

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Dampers:	Smoke damper normally required except: - fully ducted HVAC systems - opening is part of an engineered smoke control system - continuous air movement and system does not recirculate exhaust or return air under fire emergency - openings in duct limited to a single zone - floor penetrations	LSC 18.3.7.4(2) LSC 8.5.5.3
	Smoke damper to be Class II and at least 250°F	LSC 8.5.5.6
	Fire damper not required unless the wall is also a "fire barrier"	LSC 8.5.5.2
Doors:	20 minute rated or 1 ¾ solid wood	LSC 18.3.7.7
Cross Corridor:	Double egress (swing) or horizontal sliding, except where not a required means of egress	LSC 18.3.7.7(2) LSC 18.3.7.7(3) LSC 18.3.7.8
Width:	41 ½" clear per swinging leaf	LSC 18.3.7.7(4)
	83" clear for horizontal sliding	LSC 18.3.7.7(5)
Closure:	Self closing or automatic closing with adjacent smoke detector	LSC 18.3.7.9
Undercut:	¾" maximum	LSC 18.3.7.7(6)
Vision Panel:	Required in cross corridor doors by fire-rated glazing or wire glass in approved frames	LSC 18.3.7.10
Latching:	Positive latching required	LSC 18.3.7.11
Features:	Center mullions prohibited	LSC 18.3.7.11
	Stops required at sides and head	LSC 18.3.7.11
	Rabbets, bevels or astragals required at meeting edges	LSC 18.3.7.11
Fire Window:	Permitted when ¾ hour rated	LSC Tbl 8.3.5.4.2 LSC 8.5.4.5
Penetrations:	Shall be sealed to restrict the transfer of smoke	LSC 8.5.6
Joints:	To walls, floors, roof deck designed to restrict the transfer of smoke	LSC 8.5.7

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ACCUMULATION SPACE:	30 sq ft net per patient within aggregate area of corridors, patient rooms, treatment rooms, lounges, dining or other low hazard use on each side of smoke barrier	LSC 18.3.7.6.1

PEDESTRIAN WALKWAY

GENERAL:	Connected buildings may be considered separate buildings	IBC 3104.2
	Covers pedestrian walkways and tunnels at, above or below grade used as a means of travel by persons	IBC 3104.1
CONSTRUCTION:	Non-rated, non-combustible	IBC 3104.3
CONTENTS:	Materials, furnishings, and decoration to be approved by LBO, should be low fire hazard	IBC 3104.4
	The walkway or portion thereof may not be used for functions other than a walkway (i.e. storage, offices, vending, kiosk)	
SEPARATIONS:	2 hour rated wall with 1½ hour door to separate walkway and buildings (both ends) to extend 10' in all directions along the face of the building	IBC 3104.5
	Windows/openings within 10 ft. are to be ¾ hour rated	IBC 3104.5 Exc 1
	The separations may be tempered, laminated or wire glass and door when both the connected buildings and walkway are sprinklered throughout and the buildings are > 10 ft. apart	
EGRESS:	Pedestrian walkways may be used as a required means of egress provided the walkways are accessible at all times	IBC 3104.7
WIDTH:	36 inches min. and 30 ft. max. width,	IBC 3104.8
EXIT ACCESS TRAVEL:	200 ft. max length (250 feet if walkway sprinklered)	IBC 3104.9 IBC 3104.9 Exc 1

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SPRINKLERS:	Not required unless used for one of the exceptions. - increase in exit access travel - reduction of rated separation	 IBC 3104.9 Exc 1 IBC 3104.5 Exc 1

FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:		
Sprinklers:	Required throughout with quick response heads	LSC 18.3.5.1
Zoning:	Sprinkler zones to coincide with smoke zone	FPM 6.1 G
Sprinkler System Supervision:	Required by fire alarm	LSC 18.3.5.1
Methods of Supervision:	In accordance with NFPA 72 to a constantly manned location (Currently to boiler control room & local fire department)	LSC 9.7.2.1
Location of Fire Dept. Connection:	Readily accessible to Fire Depart.	NFC 14 6.4.5.1
DESIGN CODE/STANDARD:	NFPA 13 "Standard for the Installation of Sprinkler Systems" 2007 edition	LSC 9.7.1.1
MANUAL SYSTEMS:		
Standpipes:	Not required in 1 story	FPM 6.2 NFC 1 13.2.2.2
PORTABLE FIRE EXTINGUISHERS:	Locate cabinets sized to handle 2 ½ gallon pres. water, do not provide fire extinguishers	LSC 18.3.5.10 FPM 6.4
Cabinets:	Locate per NFC 10 and in high valve IT and telephone switch	FPM 6.4 A
Design Code/Standard:	NFPA 10 "Standard for Portable Fire Extinguishers" 2007 edition	LSC 9.7.4.1 FPM 6.4
SPECIALS CONDITIONS:		
Electrical Equip. Rooms:	Sprinklers required	FPM 6.1 B

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FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Required throughout	LSC 18.3.4.1 FPM 2.1 H
Zoning:	The fire alarm zones to be coordinated with smoke zones and sprinkler zones	FPM 7.3 C
MANUAL FIRE ALARM STATIONS:	Required near exits and at nurses stations	LSC 18.3.4.2 FPM 2.1 H
SIGNALING DEVICES:		
Audible:	Required, visual only may be used in critical care areas	LSC 9.6.3.5 LSC 18.3.4.3.1
Visual:	Required	LSC 9.6.3.5
Zoning:	Required to coincide with the smoke zones	LSC 9.6.3.6.2
SMOKE DETECTORS:		
Locations:	Located per NFPA 101, 2006 ed. and NFPA 72, 2007 ed.	FPM 7.2
	Areas open to corridors or provide direct staff supervision	LSC 18.3.6.1
	Cross-corridor smoke barrier doors held open by magnetic latch	LSC 7.2.1.8.2
	Air handling units supply side, ∃ 2,000 cfm return side, ∃ 15,000 cfm	NFC 90A 6.4.2.1
	Elevator Machinery Room & Lobbies (Not required in hoistway)	ESC 2.27.4.2
REMOTE ANNUNCIATOR PANEL:	Provide F.A. panel at main entry or 24 hour manned location, thus, remote panel not required	FPM 7.4 A & G
SUPERVISING STATION:	Required by auxiliary, proprietary, central station or remote station to notify serving Fire Department	FPM 7.3.H

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SECONDARY POWER:	Required by generator or batteries with 30 second switch over time, max.	NFC 72 4.4.1.3.1 NFC 72 4.4.1.5.2.1
DESIGN CODE/STANDARDS:	NFPA 72 "National Fire Alarm Code" 2007 edition	LSC 9.6.1.3

FINISHES

Applicable Design Codes/Standards:	NFPA 101 "Life Safety Code" 2006 edition	FPM 2.3
FLAME SPREAD RATINGS:		
Room Finish:		
Patient & Sleeping:	Class A any may be Class B if room capacity is 4 or less	LSC 18.3.3.2.1
Other rooms:	Class A or B	LSC 18.3.3.2.1
Exitways (Hort. or Vert.):	Class A	LSC 18.3.3.2
Textiles:	Class A on walls or ceilings	LSC 10.2.4.1
Floor Finish:	Class I or II in exit enclosures and exit access corridor	LSC 18.3.3.3.2
	Min. critical radiant flux of 0.1 W/cm^2 for other spaces and not carpeting	LSC 10.2.7.2
Incidental Trim:	Class C, Max. 10% of wall/ceiling area	LSC 10.2.5.1
Foam/Cellular Plastic Insulation:	Not permitted as interior finish	LSC 10.2.4.3
ROOF COVERING:	Class B, FM Class I or UL Fire Classified	FPM 2.7 A
SMOKE DENSITY RATINGS:	450 or less for Class A, B or C for interior finishes	LSC 10.2.3.4

MISCELLANEOUS REQUIREMENTS

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GUARDRAILS:		
Where Required:	At offsets ∃ 30 inches above floor or grade below	LSC 7.1.8
Height:	42 inches min.	LSC 7.2.2.4.5.2
Rail Design:	Spaced so that a 4" sphere will not pass through to a height of 34 inches	LSC 7.2.2.4.5.3
HANDICAP DESIGN CODE/STANDARD:	Uniform Federal Accessibility Standards, FED-STD-795, April 1, 1988	FPM 1.5
OUTSIDE WINDOW OR DOOR:	Required in every patient sleeping	LSC 18.3.8.1
Sill Height:	36" max. above the floor	LSC 18.3.8.2

6.11 General Fire Protection Narrative - Domiciliary

The Fire and Life Safety Program has been developed to provide a reliable system to protect building occupants, fire fighting personnel, building contents, building structure and continuity of building function. It's intent is to provide a reasonable level of fire safety by reducing the probability of injury, loss of life or building's functional use due to a fire. This can be accomplished by limiting the development and spread of a fire emergency to the room or area of origin and reducing the need for total occupant evacuation.

The design aspects which relate to the fire and life safety of the facility include:

Occupancy - Building function
Exits - Design concept
Structural fire resistance - Type of Construction
Building Compartmentization - Fire areas
Fire detection
Fire alarm and supervisory control
Fire suppression
Smoke control and exhaust
Fire fighter access and facilities
Emergency power

6.11.1 Occupancy

The planned domiciliary is a four story free standing building. The domiciliary has two major use groups, which creates a mixed occupancy classification. They are:

Residential Board and Care – This includes buildings or portions that are used for the lodging and boarding of four or more residents, not related, for the purpose of

providing personal care service. The occupancy classification of the third and fourth floors are as an "I-1" (Institutional) under the International Building Code and as a Residential Board and Care (Large) under the Life Safety Code.

Business – This includes buildings or portions that are used for the transaction of business other than mercantile and includes offices, small dining rooms, kitchens, activity rooms and multi-purpose rooms. The occupancy classification of the domiciliary first and second floors are "B" (Business) under the International Building Code and as a New Business occupancy under the Life Safety Code.

Assembly – This includes portions for the gathering of person for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation. The dining and training and classroom with 50 occupants or more are considered assembly occupancies.

6.11.2 Occupancy Load

Occupancy loads are determined based on the gross sq. ft. and an occupancy load factor in sq.ft./person. The occupancy load factor for Residential Board and Care occupancy is 200 sq. ft. per person in residential sleeping rooms or the bed count whichever is larger. The occupancy load factor for business (clinic, offices, and labs) occupancy is 100 sq.ft. per person. The calculated occupancy loads break down as follows:

Floor	Occupancy load
4th	33
3rd	34
2nd	122
1st	200
Total	389

(Reference the exit calculations for details on how occupancy loads were determined.)

6.11.3 Hazard Classification

The content hazard of the facilities varies, with the bulk of the facility areas being a light hazard. Light hazards are those where the quantity and /or combustibility of contents is low and fires with relatively low rates of heat release are expected (NFC 13 5.2). Light hazard areas include:

Resident areas
Office areas
Assembly areas such as dining, class rooms and activity rooms
Telephone switchboard rooms

Specific areas within these buildings have a higher quantity and /or combustibility that force them to be considered a higher class hazard. Ordinary Hazard Group 1 include

areas where combustibility is low, and quantity of combustible is moderate, stockpiles of combustibles do not exceed 8 feet, and fire with moderate rates of heat release are expected (NFC 13 5.3.1). Ordinary Hazard Group 1 areas include:

Mechanical rooms
General Storage
Kitchens
Soiled Linen
Clothing/Luggage Storage

Ordinary Group 2 include areas where quantity and combustibility of contents is moderate, stockpiles do not exceed 12 ft. and fire with moderate rate of heat release are expected (NFC 13 5.3.2). Ordinary Hazard Group 2 areas include:

Record storage
Storage rooms of combustibles
Mercantile (gift shops) Trash rooms
Loading docks
Trash Collection Room

6.11.4 Exits

Residential Board and Care occupancies create difficulties in the evacuation of the building in an emergency. Residents may be immobile, or of limited mobility, and may not be capable of recognizing an emergency or perform needed actions for self preservation. This makes evacuation difficult, increasing the time required to evacuate an area. Emergency evacuation is further compounded by vertical exits (stairs). Residents in wheel chairs, and those with limited mobility must be carried down stairs.

To offset the problems associated with evacuation, Residential Board and Care occupancies are designed with the defend-in-place concept. The defend-in-place concept is based on early detection, compartmentization and suppression. If the emergency requires evacuation of an area the first stage of an evacuation is horizontal into a protected area. The protected areas are created by compartmentization by rooms and smoke zones (1 hour rated smoke tight walls) on a given floor. Travel distances from any remote point to a smoke compartment access door is limited to 200 feet. The travel distance to a protected exit (enclosed stairway, horizontal exit or exterior exit) from any point is limited to 250 feet, 300 feet in Business portions.

Exits consists of aisles within rooms and suites which shall be maintained to provide access to a corridor, exterior exit or exit stairs. Exit corridors with unprotected openings shall provide a ½ hour rated smoke resistive assembly when serving the board and care portions. Egress corridors serving only the business portion need only be smoke resistive. Corridors shall provide two directions of travel to a main exit (stair enclosure or exterior exit), except for allowable dead ends. Dead end corridors shall not exeed 30 feet in the Residential Board and Care portion and 50 feet in the Business portion.

Exit stairs shall be enclosed with 1 hour rated construction with 1 hour rated doors. Stairs shall, where practical, discharge to the exterior.

Exterior exits are exits that discharge directly to the exterior and provides a clear unobstructed path to the public way. The path to the public way must be such that the exit path does not require exiting past unprotected portions of the building.

Exit signs indicating the direction of exiting will be provided such that all areas within any corridor have an exit sign visible. Exit signs will also be placed at all exit doors (stairs, horizontal and exterior exits), which are not obviously identifiable as an exit. Exit signs will also be placed at exit access doors (corridor doors) within large open rooms with an occupant load of 50 or more persons.

Exit signs shall be illuminated and provide a directional symbol. Each exit sign will have two lamps and be provided with an emergency source of power. The emergency power source shall provide 1 ½ hour of illumination without normal power.

Illumination of the means of egress will be provided with an emergency power source, to provide a minimum of 1 foot candle in the following areas;

a. Exit corridors
b. Stairways
c. Elevator lobbies
d. Elevator cabs
e. Main lobby
f. Meeting rooms*
g. Dining room*
h. Auditorium*
i. Central control station
j. Telephone operator's room
k. Administrative areas

* May be reduced to not less than 1/5 foot candles during performances or projections.

6.11.5 Building Exposure

The Veterans Affairs Medical Center building site is 100 plus acres with no existing buildings. The proposed placement of the new domiciliary will be a minimum of 100 feet from other structures planned for the site. This separation distance allows non-rated exterior walls and unlimited area unprotected exterior openings. The buildings, except the open parking garage, are to be sprinklered throughout. As such, NFPA standard 80A states that no exposure hazard is considered to exist. Reference Sections 5.6.3 and 5.6.4. Therefore, no special provisions are needed, other than separation and sprinklered facilities, for exposure protection.

6.11.6 Building Construction

The building height and area, based on the 2006 IBC, requires that the domiciliary (I-1) building be non-rated non-combustible construction with a construction type of Type II-B which is a type II (000) under NFPA 220. The minimum fire rating is as follows:

Structural frame (columns and beams) - 0 hour rated

Floors/Ceiling Assembly - 0 hour rated

Roof/Ceiling Assembly - 0 hour rated

Wall Assembly

Exterior bearing - 0 hour rated
Exterior non-bearing - 0 hour rated
Interior bearing - 0 hour rated
Interior non-bearing: - 0 hour rated, due to construction type, may require rating based on associated hazard.

6.11.7 Occupancy Separations

The domiciliary (residential board and care) building is being considered a separated occupancy (LSC 6.1.14.4.1). As a separated occupancy, a 1 hour occupancy separation is required between the second and third floor levels, and between assembly room (dining, training, classroom) and business occupancy.

The function or use within a room may be more hazardous than the overall occupancy classification, requiring a fire rated enclosure. Rated separations will be provided due to associated hazard or use as follows:

Storage rooms ≥ 100 sq. ft. - 1 hour rated
Special hazard rooms - 1 hour rated for:

Soiled linen
Clean utility rooms
Soiled utility rooms
Trash service rooms
Linen service rooms

Special high hazard rooms - 2 hour rated for:

Trash collection rooms and shafts
Linen collection rooms and shafts

Smoke dampers will be provided at each air transfer opening or duct penetrations of smoke barrier walls. A smoke damper is not required at the penetration of a 1 hour smoke barrier wall where the HVAC system is fully ducted (LSC 18.3.7.4).

Fire dampers will be provided at each duct penetration of walls and floors rated for 2 hours or greater, and shaft enclosures (NFC 90-5.3). Fire dampers are also required at transfer grills in 1 hour and above rated assemblies.

Fire-rated doors, frames and hardware will be provided on openings in rated partitions and shafts. Doors will be equipped with closer: where required to remain normally open, with magnetic holders. Doors will be:

Class B, 1-1 /2 hour fire-rated assemblies in 2-hour shafts and partitions.

Class B, 1 hour fire-rated assemblies in 1-hour shafts.

Class C, 3/4 hour fire-rated assemblies in 1-hour partitions designed for occupancy or hazard separations.

20 minute fire-rated doors or 1-3/4 inch solid bonded core wood doors in smoke barriers. Vision panel in smoke barrier doors limited to wired glass not exceeding 1296 square inches.

Corridor doors shall be constructed to resist the passage of smoke and do not require a fire resistive rating unless the door is protecting a vertical opening, exit, smoke zone, occupancy or hazardous area.

6.11.8 Building Compartmentization

Corridor doors are required to form a barrier to limit the transfer of smoke thus providing some degree of compartmentization. Hazardous rooms are protected with a rated enclosure with protected opening (see Occupancy Separations).

Smoke zones are provided within all levels of the domiciliary and provide a second level of compartmentization. Walls creating smoke zones are one hour rated with 1/3 hour rated doors and protected penetrations, designed to restrict the passage of smoke. Smoke zones are limited to 22,500 square feet maximum, with the maximum travel distance from any remote point within zone to smoke barrier door limited to 200 feet. Smoke barrier walls shall be routed to minimize the number of doors in the wall, and arranged, where practical, so as not to bisect departments.

The final compartmentization is by floor. Each occupied floor is separated from the adjoining occupied floors with a smoke tight assembly and 1 hour rated third floor slab.

6.11.9 Vertical Openings

Enclosed vertical openings such as stairs, mechanical chases, linen chutes and trash chutes are enclosed with a 2 hour rated construction with 1 ½ hour rated doors and protected openings. These enclosures shall run continuous from the floor up to the roof and be provided with combination smoke and heat damper where penetrated with ducts.

6.11.10 Interior Finishes

Interior finish, maximum flame spread and smoke developed limits are based on LSC 32..3.3.3.2 and ASTM E-84 fire hazard classification test and will be as follows:

Exits (Enclosed exit stairs):

Class A
Flame spread - 25 maximum
Smoke developed - 450 maximum

Exit access corridors and lobbies:

Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

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Other occupied rooms and spaces

Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

Floor Finishes in corridors, enclosed exits and areas open there-to - Class II:

Carpet for corridors will pass DOC FF 1-70 and for critical radiant flux, minimum of 0.50 watts/sq. cm as determined by NFPA 253 - 1990 edition, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source".

Insulation:

Flame spread rating limitation - 25 maximum
Smoke developed limitation - 450 maximum except when isolated by masonry walls or floors.
Combustible foam plastic thermal insulation shall not be used as an interior finish.

6.11.11 Water Supply

The current water flow information for the site water distribution system is not available. Flow tests are to be provided to determine the water and pressures available to the site.

The site will have an on-site potable water storage tank to provide up to 7 day normal demand. This has been estimated between 500,000 gallons to 1 million gallons. The fire protection water will utilize this storage volume with a fire pump to provide the needed pressures. The potable water storage tank will be fed by the county water service and domestic water will be drawn from the tank. In essence, the potable water tank is a break tank.

The preliminary water flow requirements for the sprinkler system and hose stream calculates as follows (assuming worst case warehouse utilizing ESFR sprinklers):

.20	gpm/sq. ft. density (Ordinary Hazard Group 2)
x 2,000	sq. ft. design area (dry pipe system)
400	gpm/design area
+ 500	gpm/hose stream
900	gpm combined sprinkler and hose demand
X 90	minutes (duration of flow)
81,000	gallons total water demand for fire protection
125	gpm/ESFR
X 12	number of ESFR operating
1500	gpm/design area
+ 250	gpm/hose stream
1750	
x 90	units

157,500 gallons total water demand for fire protection

The estimated pressure required to provide a 100 psi at the upper hose outlet is as follows:

100 psi at outlet
+ 43 psi (elevation loss) = .432 psi/foot of elevation times 100 feet
+ 25 psi (allowance for friction loss)
+ 10 psi (allowance for backflow preventer)
178 psi required at base of system riser

A site fire pump rated at 1250-1500 gpm will be required to provide the water demand and pressure to insure proper operation of the site fire protection system. The fire pump will be located in a dedicated 1 hour rated pump room in the energy center and selected to provide the 175 ± psi water pressure. With a large diesel generator to service the emergency systems within the hospital, the fire pump motor can be electric and fed from the emergency generator. The electric motor would need to be 150-200 bhp. Once the taps to the county water main lines are made a more accurate water supply and thus a more accurate pump rating can be determined.

6.11.12 Automatic Fire Suppression

A dry-pipe system or dry type sprinkler heads will be provided in areas subject to temperatures below 40°F, such as dock areas and refrigerated areas. A supervised wet pipe sprinkler system shall be provided throughout the remaining areas of the building including the electrical and telecommunication rooms.

The sprinkler system will be connected to the new fire service loop. Riser pipes will be provided in the enclosed exit stairs. A control valve will be provided between the feed main and each riser. Floor control valve assemblies with check valves will be provided in the stair enclosures and fed to zone piping at each floor level.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below.

Light hazard occupancies will be designed to provide 0.10 gpm per square foot over most remote 1,500 square feet with quick response sprinklers.

Ordinary hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet.

Ordinary hazard Group 2 occupancies will be designed to provide 0.20 gpm per square foot over most remote 1,500 square feet.

The sprinkler systems will be zoned by floor do to the small footprint. In addition, sprinkler systems protecting special hazards, elevator machine rooms, are to be zoned separately. Each sprinkler zone/system will be provided with all necessary valves, control valve tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

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6.11.13 Standpipes

A Class 1 wet standpipe system with 2 ½ inch outlets shall be installed in accordance with NFPA 14, 2007 edition. The standpipe system will be combined with the sprinkler risers with all main risers interconnected. The standpipes will be hydraulically sized to provide 500 gpm at the topmost outlet with a residual pressure of 100 psi. The site fire pump need not be sized to provide the standpipe demands, this will be provided via local fire department pumpers.

Standpipe outlets will be equipped with a shut off valve and a 2 1/2'" x 1 ½" reducer with cap. Standpipe outlets will be provided to serve every level within all stair enclosures. Standpipe outlets will be located at the highest intermediate landing between every floor level and at the highest landing in each stair with access to the roof and on the roof where roof access is not provided.

6.11.14 Fire Extinguishers

Portable fire extinguishers shall be located throughout all areas of the buildings in accordance with NFPA 10-2007 Edition. Fire extinguishers will not be provided under this project. Fire extinguisher cabinets and proposed locations for extinguishers on hooks, along with appropriate signage will be provided.

Extinguishers shall also be located in the following specific areas:

a. Near each stair entry.
b. In major mechanical, electrical and telephone equipment rooms
c. Elevator machine rooms
d. Locker rooms
f. Storage rooms (large)

Portable fire extinguishers shall be located throughout all areas of the building. The class, size and spacing will be as follows:

Class A combustibles (ordinary combustible materials such as wood, cloth and paper):

Maximum travel distance to an extinguisher will be 75 feet. Minimum extinguisher rating will be 2A. Maximum coverage per unit of A will be:

- 3000 square feet in patient rooms, treatment areas and administrative areas.

- 1500 square feet in locker rooms, mechanical rooms, electrical rooms and storage rooms.

Class B combustibles (flammable liquids, oils, gases):

Maximum travel distance to an extinguisher will be 50 feet.

Minimum extinguisher rating will be 1OB.

Class C (energized electrical equipment):

Extinguishers sized and located for Class A and B hazards.

Multi-purpose dry chemical fire extinguishers will be used as they are suitable for use on all three common fire classifications.

Fire extinguishers will be large enough that they cannot be easily concealed and removed from the building. The recommended fire extinguisher size is 3A-30B:C.

Extinguishers will be located in flush mounted cabinets sized to accommodate 2½ gallon pressurized water extinguishers in public areas to prevent damage and discourage tampering. Extinguishers may be installed on hangers in non-public areas.

6.11.15 Detection, Alarms And Controls

A fire detection and alarm system will be provided throughout the facility in accordance with NFPA 72, 2007 edition and the design criteria.

The fire detection and alarm system (FDAS) will be a microprocessor based, multiplexed device addressable system connected to and capable of communicating with the Site Fire Alarm Notification System located in the Center Energy Plant, and off-site monitoring service.

Manual pull stations will be located in the natural path of escape near exit doors. Pull stations will be so located that no place on any floor will be more than 200 feet from a pull station.

Automatic photoelectric smoke detectors will be located as required by NFPA 72, LSC 101 and NFPA 90A in the following spaces:

Elevator Lobbies
Elevator Machine Rooms
Smoke Barrier Corridor Doors, when on hold open devices
HVAC System Ductwork as required by NFPA 90A

Fire alarm speakers, for fire location announcements and evacuation instructions, will be located so as to be clearly audible in all areas.

Visual alarm indicators will be provided in all public areas, but may be omitted in psychiatric areas.

Magnetic hold open devices will be provided for smoke barrier corridor doors and horizontal exit doors.

Supervision of sprinklers:

Position indicator switches on all supply control valves.

Flow switches on each floor and each zone of the sprinkler system.

The FDAS control panel will have visual and audible signals for power failure, open circuit, ground, smoke detector failure and alarm.

Alarm notification by pre-recorded messages will be automatically transmitted throughout the facility. Alarm and evacuation instructions will be given by a manual

voice annunciation system. Trouble signals will be automatically transmitted to the central energy plant.

The fire detection and alarm system will have four hour battery standby power and will be connected to the "life safety" power system as described in the electrical section.

The smoke detectors, sprinkler water flow devices and manual pull stations will be electrically interconnected to the system. The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the smoke zone. A voice message will be transmitted throughout the rest of the building indicating the zone of alarm origin. Visual alarms will not activate outside the smoke zone of origin. The alarm will be recorded at the central energy plant and local fire alarm control panel and the control functions will be initiated.

Activation of any fire alarm initiation device, except manual pull station, will release door hold open devices on the floor of activation, allowing them to close automatically. The hold open device is released by the interruption of electric power and manual release of the door as well as by the fire alarm system.

Activation of the smoke detectors at compartmentation (smoke and fire barriers) doors will initiate the fire alarm system, and close the compartmention doors.

Activation of smoke or heat detectors in mechanical and electrical rooms will initiate the fire alarm system and close the compartmentation doors.

Activation of the duct smoke detectors for mechanical air handling units will initiate the fire alarm system, close the compartmentation doors, and shut down the air handler.

6.11.16 Smoke Control

Duct smoke detectors will be installed in all HVAC systems in:

Return air ducts with 2,000 cfm air flow, placed before air is exhausted from building or prior to dilution by outside air.

Main supply air ducts with 15,000 cfm air flow, placed downstream of filters.

Activation of an induct smoke detector will initiate shutdown of the associated air handling unit.

Manual emergency stop switch for fans will be provided.

Each floor of the domiciliary will be divided into smoke compartments by 1-hour smoke barriers. Smoke zones shall not exceed 22,500 square feet and arranged so that a smoke barrier door is within 200 feet of any point on the floor.

6.11.17 Emergency Power

A level 1 emergency power supply system (EPSS), as defined by NFPA 101, shall be provided and will consist of emergency generators located in the energy center. The EPSS will supply the essential electrical system for the hospital, which is comprised of the life safety, critical and equipment branches and serve the following loads:

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Life Safety Branch

Illumination of means of egress
Exit signs
Fire detection and alarm system
Emergency communications systems
Elevator cab lighting, control, communications, and signal systems.

Critical Branch

Patient care tasks illumination and receptacles

Equipment Branch

Sump pumps
Compressed air systems
Heating systems
Elevators
Selected HVAC systems
Fire pump in the CEP

6.11.18 Fire Department Accessibility

The exterior of the facility shall be sufficiently open so that fire apparatus and/or fire fighters have access to all open sides of the building.

New hydrants shall be provided as part of the fire service loop. Hydrants shall be fed by at least a 6" diameter connection with a road/curb valve at the connection. Hydrants should be spaced at least 40 feet from the building and adjacent fire lanes. Hydrants should be spaced no more than 600 feet apart around the perimeter of the building.

6.12 Building Description - Domiciliary

BUILDING:	VA Domiciliary
USE(S):	The domiciliary is to be free standing, three (3) story dormitory for patient rehabilitation. The first floor will have a kitchen, servery, dining, multi-purpose rooms, conference room, offices and building support services. The upper two floors are primarily two occupant dorm rooms.
AREA	
First Floor:	15,000± sq. ft.
Second Floor:	8,400± sq. ft.
Third Floor:	8,400± sq. ft.
Fourth Floor:	sq. ft.
Penthouse:	sq. ft.
Total building:	31,800± sq. ft.
HEIGHT:	4 stories , 48± ft. estimated to main roof

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SPRINKLERED:	Sprinkler system throughout in accordance with NFPA 13 utilizing quick response sprinklers
YARDS/SEPARATIONS:	The domiciliary is a free standing building with 100+ ft. clear on all sides.
SPECIAL FEATURES:	Several of the activity rooms on the first and second floors, due to their small size, are not considered as assembly occupancies, but part of the adjacent business occupancy.

6.13 Code Summary - Domiciliary

OCCUPANCY CLASSIFICATION:	Mixed Occupancy (non-separated uses)		IBC 302.3.2
	New Residential Board and Care (Large Facility)		LSC 3.3.168.12 IBC 308.2
	Group I Division 1 - Institutional - Residential Board and Care on 2nd and 3rd floors		LSC 3.3.168.3
	New Business Occupancy		IBC 304.1
	Group B - Business - Kitchen, Small Multi-purpose, Dining, Small Waiting, Conference and Offices on 1st floor		
CONSTRUCTION TYPE:	II-B (000) non-combustible		FPM 2.1.B
ALLOWABLE AREA/FLOOR (ft2)2:	I-1	B	
	37,500	86,250	
Basic Allowable:	10,000	23,000	IBC Tbl 503
(IB)	200%	200%	IBC 506.3
Sprinkler Increase:	75%	75%	IBC 506.1
Yard Increase:			
ALLOWABLE AREA/BUILDING:	112,500	258,750	IBC 503.3

[2] The LSC does not set minimum construction types for Business or Board and Care facilities. Therefore, per FPM 2.1.B, the allowable construction type is based on the IBC allowable area and height.

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ALLOWABLE			IBC Tbl 503
BUILDING	I-1	B	
HEIGHT:	4	5	
Stories:	75 ft.	75 ft.	
Feet:			

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BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS

The following is based on a Type II (000) construction

BUILDING ELEMENT MATERIALS:	Non-combustible or approved limited combustible construction	IBC 602.2 NFC 220
EXTERIOR WALLS		
Bearing walls:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
Non-bearing:	0 hour rated non-combustible construction > 10 ft. separation	IBC Tbl 602
Opening Protection:	Not required in sprinkled facility, unlimited wall openings > 20 ft. fire separation distance	IBC Tbl 704.8 IBC 704.8.1
INTERIOR WALLS:		
Bearing:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
Non-bearing:	0 hour rated non-combustible construction (fire retardant treated wood permitted where fire rating is 2 hour or less)	IBC 603.1.1 NFC 220 Tbl 4.1.1
STRUCTURAL FRAME:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
	1 hour rated non-combustible construction when supporting the rated 2nd floor	LSC 6.1.14.4
FLOOR:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
	1 hour rated non-combustible construction, 2nd floor to separate the business occupancy and the Board and Care occupancy	NFC 220 Tbl 4.1.1
ROOF:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
SHAFT ENCLOSURES:	(Excludes Stair Enclosures)	IBC 707.4
Rating:	1 hour rated when penetrating a 1 hour rated floor or serving 3 stories or less	IBC 403.3.2 LSC 8.6.5
Opening Protection:	1 hour rated in 1 hour shafts	LSC Tbl 8.3.4.2
Supporting Structure:	Structure (beam, column, walls, etc) supporting rated shafts shall be rated equal to shaft rating	IBC 706.5

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Top & Bottom:	Enclosed with rated construction equal to shaft wall rating or extend to deck above and floor deck below (see code exceptions).	IBC 707.11 IBC 707.12 LSC 8.6.4
Fire Dampers:	Required in ducts and air transfer openings through shaft walls	NFC 90A 5.3.4.6
Smoke Dampers:	Not required in ducts and air transfer openings through shaft walls	NFC 90A 5.3.5
UNENCLOSED VERTICAL OPENINGS:	Permitted when: - designed as a communicating space OR - designed as a convenience opening OR - is designed as an atrium	LSC 32.3.3.1.1 LSC 8.6.6 LSC 8.6.8 LSC 8.6.7
PENTHOUSE (MECHANICAL): Size:	a the roof area (maximum) used exclusively for sheltering mechanical equipment or vertical shafts, otherwise considered a story	IBC 1502.1 IBC 1509.2
FIRE BLOCKING:	Not normally required in a Type II-B (000) non-combustible construction	IBC 716.4
DRAFT STOPPING:	Not normally required in a Type II-B (000) non-combustible construction	IBC 716.4 LSC 8.6.10.1
	RATED SEPARATIONS	
OCCUPANCY SEPARATIONS:	May be non-separated use group under IBC due to construction type, however LSC requires some occupancy separations	IBC 302.3.2
	Separated occupancies to have a rated separation wall or floor	LSC 6.1.14.4
	The 2nd floor slab separates the business occupancy (1st floor) and the Board and Care occupancy (2nd floor), therefore the 2nd floor slab and supports needs to be 1 hour rated	LSC Tbl 6.1.14.4
Tenant Separations: (Between Sleeping Rms)	0 hour rated required between sleeping units	LSC 32.3.3.7

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Supporting Structure:	Structure (beam, column, walls, etc) supporting fire barriers shall be rated equal to wall rating supported	IBC 706.5 LSC 8.2.3.3
INCIDENTAL USE AREAS:		
Laundry:	1 hour rated when > 100 sq. ft.	LSC Tbl 32.3.3.2.2
Storage Room:	1 hour rated when > 100 sq. ft.	LSC Tbl 32.3.3.2.2
	Smoke partition when > 50 sq. ft. and < 100 sq. ft.	LSC Tbl 32.3.3.2.2
Waste Collection/ Termination Room:	1 hour rated	LSC Tbl 32.3.3.2.2
Soiled Linen Room:	1 hour rated	LSC Tbl 32.3.3.2.2
Maintenance Shops:	1 hour rated	LSC Tbl 32.3.3.2.2
Fuel Fired Heater Rooms:	1 hour rated	LSC Tbl 32.3.3.2.2
Supporting Structure:	Structure supporting 1 hour rated incidental separations need not be so rated	LSC 8.2.3.3
OPENING PROTECTION:		
Fire Dampers:	Required in duct openings through fire barrier walls greater than 1 hour rated	NFC 90A-3.1.1
	Required in air transfer openings through a fire rated assembly	NFC 90A-3.1.2
	Not required in duct penetrations of corridor walls nor tenant separation walls (fire partitions)	NFC 90A-3.1.1
Smoke Dampers:	Not required in fire barriers	

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EXITS

OCCUPANT LOAD FACTORS:		
Board & Care:	200 sq. ft. per occupant (gross)	LSC Tbl 7.3.1.2
General Offices, Kitchen:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.1.2
Exercise Room w/Equip.:	50 sq. ft. per occupant	LSC Tbl 7.3.1.2
Dining:	15 sq. ft. per occupant (net w/table and chairs)	LSC Tbl 7.3.1.2
Storage:	500 sq. ft. per person	LSC Tbl 7.3.1.2
ADJOINING ROOMS:	Permitted, provided intervening rooms use is not a storage room, workroom, maintenance room or similar space	LSC 7.5.1.6
NUMBER OF EXITS:		
Rooms:	2 exit access required from any Board and Care occupancy room or suite over 2,000 sq. ft.	LSC 32.3.2.5.5
Floors:	2 exits required per floor	LSC 7.4.1.2
TRAVEL DISTANCE TO AN EXIT (MAX.):	250 feet in Board and Care occupancy	LSC 32.3.2.6
	300 feet - Offices - "B"	LSC 38.2.6.1
EXIT & EXIT ACCESS SEPARATION:	1/3 maximum diagonal dimension of room, space or floor served	LSC 7.5.1.3.3
COMMON PATH:	75 ft. max. in Board and Care	LSC 32.3.2.5.2
	100 ft. in Business	LSC 38.2.5.3.1
EXIT DOORS		
Egress Width Factor(s):	0.2 inches per person	LSC Tbl 7.3.3.1
Swing:	In direction of egress when - serving 50 or more occupants - used in an exit enclosure - serving a high hazard area	LSC 7.2.1.4.2 LSC 7.2.1.4.3

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Locks:	Delayed egress locks allowed	LSC 32.3.2.2.2(4) LSC 38.2.2.2.4
Width:	32 inches min.	LSC 7.2.1.2.4
Height:	80 inches min.	LSC 7.2.1.2.3.3
EXIT SIGNS:	Required in common corridors, and rooms where 2 means of egress are required	LSC 7.10.1.5
	Floor proximity exit sign not required	LSC 32.3.2.10
Power Supply:	House wiring, with emergency backup, Min. of 90 minutes	LSC 7.9.2.1
EXIT ILLUMINATION:	1 foot candle min. along egress route	LSC 7.8.1.3
	10 foot candle min. on exit stairs	LSC 7.8.1.3
Power Supply:	House wiring, with emergency backup, Min. of 90 minutes, min. Type 10, Class 1.5, Level 1On life Safety Branch	LSC 7.8.2 LSC 7.9.2.1 LSC 7.9.2.2
EMERGENCY EGRESS & RESCUE (window):	Not required in Board and Care facilities	LSC 32.3.2.1

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STAIRWAYS

EGRESS WIDTH FACTOR(S):	0.4 inches per person for Board and Care	LSC Tbl 7.3.3.1
ENCLOSURES: (Includes exit passageway)	Required around exit stairs and exit passageways	LSC 7.1.3.2.1 LSC 7.2.2.5.1.1
Rating:	1 hour rated "fire barrier" when connecting 3 stories or less	LSC 7.1.3.2.1
Doors:	1 hour rated in 1 hour exit enclosures	LSC Tbl 8.3.4.2
Supporting Structure:	Structure (beam, column, walls, etc) supporting rated exit enclosure wall are to be rated equal to enclosure supporting	LSC 8.2.3.3
Other Openings: (Into stair enclosure or exit passageway)	Openings other than for egress are not permitted except for required ventilation, sprinkler and standpipes, and electrical serving stair enclosure	LSC 7.1.3.2.1(5)
Smoke Proof or Pressurization:	Not required	LSC 7.2.3.1
Roof Access:	Not required by a stairway or ladder & trap door in buildings of 3 stories or less	IBC 1009.11
Discharge:	To exterior, directly, through rated passageways or vestibules (10' deep max.)	LSC 7.7.1
	Max. of 100% of egress allowed through a vestibule with restrictions	LSC 7.7.2.5
	A max. of 50% of required exit capacity may egress through areas of the level of discharge with restrictions	LSC 7.7.2
STAIRS		
Materials:	Non-combustible construction in Type II construction	LSC 7.2.2.3.1.2
	Handrails may be of wood	IBC 1009.5

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Width:	44 inches min. serving < 2,000 occupants	LSC Tbl 7.2.2.2.1.2(B)
	36 inches min serving ≤ 50 occupants	LSC Tbl 7.2.2.2.1.2(A)
	Sufficient in width to handle the calculated occupant load	LSC Tbl 7.2.2.2.1.2
Projections Handrails:	4½ inches max. at handrail height and below	LSC Tbl 7.2.2.2.1.2(A)
Trims:	4½ inches max. at handrail height and below	LSC Tbl 7.2.2.2.1.2(A)
	No limit when over 80" above	LSC Tbl 7.2.2.2.1.1(a)
Doors onto Landings:	Half of the required landing width (max.) with door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4
Rise & Run:	7 inch max. 4 inch min. rise & 11 inch min. run with 1¼" max. nosing	LSC Tbl 7.2.2.2.1.1(a)
	Riser to be solid, vertical to 30 deg. Off vertical	LSC 7.2.2.3.3.3
Handrails:	Required to be continuous on both sides of stairs	LSC 7.2.2.4.1.2
Height:	34 to 38 inches above stair nosing	LSC 7.2.2.4.4.1
Size:	1¼ to 2 inches in diameter with 2¼ clearance to wall	LSC 7.2.2.4.4.6
	If non-circular ≥ 4" ≤ 6½" perimeter with 2.25 in2 max. section	LSC 7.2.2.4.4.6(2)
Clearance:	2¼" min. between handrail and other surfaces	LSC 7.2.2.4.4.5
Termination:	Returned to wall, floor or newel post, & extended horizontally 12 inches beyond top riser and slope for one tread width and extend horizontally 12" at bottom riser	LSC 7.2.2.4.4.9 LSC 7.2.2.4.4.10 FAS 4.9.4(2)

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Baluster/Guard:	Required on open sides, such that a 4 inch sphere will not pass through	LSC 7.2.2.4.5.3
	8" sphere allowed above the 34" height	LSC 7.2.2.4.5.3
Height:	42 inches above adjacent walking surface and stair nosing	LSC 7.2.2.4.5.2
Head Room:	6 feet 8 inches min. above plane of tread nosing	LSC Tbl 7.2.2.2.1.1(a)
Landings:	12 feet max. vertical height between landings	LSC Tbl 7.2.2.2.1.1(a)
Width:	Equal to stair width	LSC 7.2.2.3.2.2
Length:	Equal to stair width, needs not exceed 4 feet in straight run stairs	LSC 7.2.2.3.2.4
Extension to Roof:	Access to roof is not required by a stair or ladder in a building 3 stories or less in height	LSC 7.2.2.5.3
Spaces Under Stair & Within Enclosure:	Use not permitted	LSC 7.2.2.5.3
OTHER STAIR TYPES:		LSC 32.3.2.2.3
Winding:	Not permitted for exiting	LSC 7.2.2.2.4.1
Circular:	Permitted for exiting	LSC 7.2.2.2.2.1
Spiral:	Not permitted for exiting	LSC 7.2.2.2.3

CORRIDORS

PROTECTION		
Walls:	½ hour rated (smoke partitions) from all sleeping rooms	LSC 32.3.3.6.3
Floors:	No special requirements	LSC 32.3.3.6.3

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Ceilings:	No special requirements when the rated corridor walls run continuous up to the floor/roof deck above	LSC 8.4.2
	The corridor walls may stop at a monolithic ceiling assembly	LSC 8.4.2
Doors:	Constructed to resist the passage of smoke in ½ hour smoke partition	LSC 32.3.3.6.4
	Closers not required	LSC 32.3.3.6.5
Glazed Openings:	Constructed to limit the passage of smoke	LSC 8.4.1
Ducts:	Smoke and Fire Dampers not required in ducts penetrating ½ hour rated corridor walls	LSC 8.4.6 NFC 90A - 3.3.1.1
	Smoke dampers required in air transfer openings	LSC 8.4.6
Penetrations:	Sealed or protected by material or system capable of limiting the transfer of smoke	LSC 8.4.4.1
WIDTH (MIN.):	60 inches minimum and sufficient for the occupant load served	LSC 32.3.2.3.3
PROJECTIONS		
Doors:	Half of the required exitway width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when door is fully open	LSC 7.2.1.4.4
Trim/fixtures:	Not permitted into required exit width except handrails	LSC 7.3.2.2
CEILING HEIGHT:	7 feet 6 inches min.	LSC 7.1.5.1
	6 feet 8 inches above finished floor allowed for protruding objects	LSC 7.1.5.1
DEAD END CORRIDORS:	30 feet when open to Board and Care	LSC 32.3.2.5.4
	50 ft. when serving Business occupancy only	LSC 38.2.5.2.1

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SMOKE ZONES

ZONES:	Required to divide every story in at least two zones	LSC 32.3.3.7.1
Size:	Not to exceed 22,500 sq. ft.	LSC 32.3.3.7.1
	No limit if the zone is an atrium	
Travel Distance:	Max. 200 ft. from any point to a smoke barrier access door	LSC 32.3.3.7.1
SMOKE BARRIER WALL:		
Continuity:	From an outside wall to an outside wall, from a floor to a floor or interstitial platform, from a smoke barrier to a smoke barrier or any combination	LSC 8.5.2.1
Rating:	1 hour rated, smoke resistant	LSC 32.3.3.7.8
	Atrium walls used as smoke barrier may be sprinklered glass per LSC 8.6.7(1)(c)	LSC 32.3.3.7.9
Dampers:	Smoke damper normally required except:	
	fully ducted HVAC systems	LSC 32.3.3.7.9
	Opening is part of an engineered smoke control system	LSC 8.5.5.3
	Continuous air movement and system does not recirculate exhaust or return air under fire emergency	
	Openings in duct limited to a single zone	
	Floor penetrations	LSC 8.5.5.6
	Smoke damper to be Class II and at least 250°F	LSC 8.5.5.2
	Fire damper not required unless the wall is also a "fire barrier"	
Doors:	20 minute rated or 1 ¾" solid wood	LSC 32.3.3.7.13

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Cross Corridor:	Double egress (swing) or horizontal sliding, except where not a required means of egress	LSC 32.3.3.7.15 LSC 32.3.3.7.16
Width:	32" clear	LSC 7.2.1.2.4
Closure:	Self closing or automatic closing with adjacent smoke detector	LSC 32.3.3.7.17
Vision Panel:	Required in cross corridor doors by fire-rated glazing or wire glass in approved frames	LSC 32.3.3.7.18
Latching:	Positive latching is not required	LSC 32.3.3.7.20
Features:	Center mullions prohibited	LSC 32.3.3.7.21
	Rabbets, bevels or astragals required at meeting edges	LSC 32.3.3.7.19
Fire Window:	Permitted when ¾ hour rated	LSC Tbl 8.3.5.4.2 LSC 8.5.4.5
Penetrations:	Shall be sealed to restrict the transfer of smoke	LSC 8.5.6
Joints:	To walls, floors, platforms to restrict the transfer of smoke	LSC 8.5.7
ACCUMULATION SPACE:	15 sq. ft. net per resident within aggregate area of corridors, patient rooms, treatment rooms, lounges, dining or other low hazard use on each side of smoke barrier	LSC 32.3.3.7.11
	6 sq. ft. net per occupant on stories not housing residents	LSC 32.3.3.7.12

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ELEVATORS

APPLICABLE CODE/STANDARD:	ANSI/ASME A17.1-04 "Safety Code for Elevators and Escalators" by the American Society of Mechanical Engineers	LSC 9.4.2 IBC 3001.1
ENCLOSURE		
Rating:	1 hour rated when connecting 3 stories or less	IBC 707.4 LSC 8.6.5
Doors:	1 hour rated in 1 hour walls	IBC Tbl 714.2 LSC 8.3.4.2
Venting:	Required to vent smoke and hot gases in the side of the shaft when serving 3 levels or more	IBC 3004.1 Exc 1
Size:	3½% of hoistway area, 3 sq. ft. min.	IBC 3004.3
Location	Below floor at top of hoistway and open to outside air (directly or through non-combustible duct)	IBC 3004.3
Rating:	Venting duct to be equal to the shaft rating if passing through the elevator machine room	IBC 3004.2
Pressurization:	Not required	---
ELEVATOR LOBBY VESTIBULE:	Not required when opening onto a non-rated corridor	IBC 707.14.1
CAB SIZE (MIN. INSIDE):	Offset door 51" x 68" Center door 51" x 80"	FAS 4.10.9
EQUIPMENT ROOM		
Rating:	Equal to hoistway rating, 1 hour	ESC 2.7.1.1 IBC 3006.4
Door:	3/4 hour rated in 1 hour wall (30 inch x 6 feet min. size)	ESC 2.7.1.1.2 IBC Tbl 7154.4
Ceiling Height:	7 feet clear	ESC 2.7.4.1
Restricted Systems/Equip.:	Only machinery and equipment required for the operation of the elevator shall be permitted in the machine room	ESC 2.7.2

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EMERGENCY OPERATION:		
Phase I: (Recall Operation)	- Emergency recall with On-Off-Reset key switch located in the main lobby within sight of the elevators	ESC 2.27.3.1.1
	- Automatic recall initiated by smoke detectors in lobbies, and machine rooms	ESC 2.27.3.2.1
	- Recall cars to main entrance level; unless alarm is received from main entrance level, then recall is to the alternate floor	ESC 2.27.3.2.3
	- Visual & audible alarms required in each car	ESC 2.27.3.2.6
Phase II: (In-car Operation)	- Emergency in-car operation with Off-Hold-On switch located in each car	ESC 2.27.3.3

FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:	Required throughout when serving a residential Board and Care occupancy with Quick Response or Residential Sprinklers	LSC 32.3.3.5.2
Sprinkler System Supervision:	Required electronically for all control valves, tamper switches and water flow switches	LSC 32.3.3.5.4
Maximum Zone Area:	52,000 sq. ft. for light & ordinary hazards	NFC 13 8.2.1
	To coincide with smoke zone	FPM 6.1.1G
DESIGN CODE/STANDARD:	NFPA 13 "Installation of Sprinkler Systems" 2007 ed.	LSC 9.7.1.1
MANUAL SYSTEMS Standpipes:	Not required	LSC 32.3.3.9 NFC 1 13.2.2.2
PORTABLE FIRE EXTINGUISHERS:	Required throughout a Residential Board and Care occupancies in accordance with NFPA 10 "Portable Fire Extinguishers"	LSC 32.3.3.5.6

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FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Required in a Residential Board and Care occupancy	LSC 32.3.3.4.1
Supervision:	Annunciate alarm to provide for fire department notification	FPM 7.2.G
Maximum Zone Area:	At least 1 per floor and 1 per smoke zone	NFC 72 4.4.6.6.1
AUTOMATIC FIRE DETECTION SYSTEM:	Required when serving sleeping rooms by smoke alarms	LSC 32.3.3.4.7 LSC 32.3.3.4.8
MANUAL FIRE ALARM STATIONS:	Required near each exit and within 200 ft. of any point	LSC 9.6.2 LSC 32.3.3.4.2
SIGNALING DEVICES Audible:	Required throughout	LSC 9.6.3.5
Visual:	Required in public and common areas	LSC 9.6.3.5
	Accessibility sleeping rooms/units to have visual alarms	UFAS LSC 9.6.3.5.1
HVAC SHUT DOWN:	Required on activation of associated duct smoke detectors on HVAC units with > 2,000 cfm	NFC 90A 6.4.2.1
SMOKE DETECTORS:	Required in return air systems with a capacity of 2000 cfm or more, down stream of all air filters and in a serviceable location	NFC 90A 6.4.2.1
	Required in elevator machine rooms	ESC 2.27.3.2
	Required in elevator lobbies on each floor	ESC 2.27.3.2
	Unoccupied rooms containing fire alarm panel	NFC 72-4.4.5

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Corridor:	Required in enclosed corridors and spaces open to corridors	LSC 32.3.3.4.8.1
	Cross-corridor smoke barrier doors held open by magnetic latch	LSC 7.2.1.8.2
Within Sleeping Rooms:	Required in each room used for sleeping purposes and outside the sleeping area in the vicinity of the bedrooms	LSC 32.3.3.4.8.1
	Primary power source to consist of building wiring and battery back-up	IBC 907.2.10.2
	Required to be interconnected within each sleeping room and shall not actuate building fire alarm systems	LSC 9.6.2.9.3 LSC 9.6.2.9.4
ANNUNCIATOR PANEL:	Required (zoning indicator panel) to be located at an approved location	LSC 32.3.3.4.3
SECONDARY POWER:	Required by emergency system with 24 hour capacity, and 5 minutes in alarm	NFC 72 4.4.1.5.3.1
DESIGN CODE/STANDARDS:	NFPA 72 "Protective Signaling Systems" 2007 ed.	LSC 9.6.2.1

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INTERIOR FINISHES & DIMENSIONS

Applied Finishes:	Exempt if < .036 inches thick (wall paper, paint and veneers)	LSC 10.2.1.2
Floor Finish:	Class I or II per NFPA 253 in exit access corridors, stair and exit passageways, DOC FF-1 "pill test" in all other areas, wood and linoleum to have a critical radiant flux of 0.1 W/cm2	LSC 32.3.3.3.3.2 LSC 10.2.7.2
Foam Plastic:	Not allowed as interior finish or trim, unless specially approved	LSC 10.2.4.3
Roof Covering:	Class B minimum, FM Class I or UL Fire-Classified (UL790)	FPM 2.7
Exit Stairs & Passageways:	Class A, flame spread 0-25 smoke developed 450 maximum for interior finishes	LSC 32.3.3.3.2
Exit Access Corridors and Lobbies:	Class B, flame spread 26-75, smoke developed 450 maximum for interior finishes	LSC32.3.3.3.2
Wall and Ceiling:	Class B, flame spread 26-75, smoke developed 450 maximum for interior finishes	LSC 32.3.3.3.2

6.14 General Fire Protection Narrative – Warehouse / Engineering

The Fire and Life Safety Program has been developed to provide a reliable system to protect building occupants, fire fighting personnel, building contents, building structure and continuity of building function. It's intent is to provide a reasonable level of fire safety by reducing the probability of injury, loss of life or building's functional use due to a fire. This can be accomplished by limiting the development and spread of a fire emergency to the room or area of origin and reducing the need for total occupant evacuation.

The design aspects which relate to the fire and life safety of the facility include:

Occupancy - Building function
Exits - Design concept
Structural fire resistance - Type of Construction
Building Compartmentization - Fire areas
Fire detection and Alarm
Fire suppression
Smoke control and exhaust
Fire fighter access and facilities

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6.14.1 Emergency Power - Occupancy

The planned warehouse and engineering facility is a three story free standing building with a below grade connecting tunnel. The facility has three use groups, which creates a mixed occupancy classification. They are:

Storage – This includes facilities used primarily for the storage or sheltering of goods, merchandise or products. The occupancy classification of the first floor storage areas are as an "S-1" (Moderate Hazard Storage) under the International Building Code and as a New Ordinary Hazard Storage occupancy under the Life Safety Code.

General Industrial – This includes facilities in which ordinary and low hazard industrial in which products are manufactured, processed, assembled, finished or repaired and includes facility maintenance shops. The occupancy classification of the first floor maintenance shops is an "F-1" (Moderate Hazard Industrial) occupancy under the International Building Code and as a New General Industrial occupancy under the Life Safety Code.

Business – This includes buildings or portions that are used for the transaction of business other than mercantile and includes offices, and lockers. The occupancy classification of the second floor is a "B" (Business) under the International Building Code and as a New Business occupancy under the Life Safety Code.

6.14.2 Occupancy Load

Occupancy loads are determined based on the gross sq. ft. and an occupancy load factor in sq.ft./person. The occupancy load factor for the storage warehouse occupancy is 500 sq. ft. per person. The occupancy load factor for business (offices, and lockers) and general industrial (maintenance shops) occupancy is 100 sq. ft. per person. The calculated occupancy loads break down as follows:

Floor	Use	Occupancy load
3rd	Storage-Mech.	19
2nd	Offices	108
1st	Storage	64
1st	Industrial	60
Bsmt	Storage	7
	Total	258

6.14.3 Hazard Classification

The content hazard of the facilities varies, with the second story office areas being a light hazard. Light hazards are those where the quantity and /or combustibility of contents is low and fires with relatively low rates of heat release are expected (NFC 13 5.2). Light hazard areas include:

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Office areas

Lockers

Corridors

The bulk of the facility being storage and industrial has a higher quantity and /or combustibility that force them to be considered a higher class hazard. Ordinary Hazard Group 1 include areas where combustibility is low, and quantity of combustible is moderate, stockpiles of combustibles do not exceed 8 feet, and fire with moderate rates of heat release are expected (NFC 13 5.3.1). Ordinary Hazard Group 1 areas include:

Mail room
Tool crib
Clean cart storage & loading
Receiving & Issue
Health hazardous material storage
Mechanical Equipment Rooms

Ordinary Group 2 include areas where quantity and combustibility of contents is moderate, stockpiles do not exceed 12 ft. and fire with moderate rate of heat release are expected (NFC 13 5.3.2). Ordinary Hazard Group 2 areas include:

Medical supply and general storage
Retail storage rooms
General storage of combustible
Loading docks
Trash and recycle rooms

Extra Hazard Group 2 includes areas containing moderate or substantial amounts of flammable and combustible liquids (NFPA 13 5.4.2). Extra hazard group 2 areas include the gas and flammable storage room.

6.14.4 Exits

The facility occupant are primarily mobile staff who are familiar with the facility, egress paths and location of the nearest exit door. The standard life safety and fire emergency response in the associated occupancies is to quickly evacuate the facility The travel distance to a protected exit (enclosed stairway or exterior exit) from any point is limited to 250 feet.

Exits consists of aisles within rooms which shall be maintained to provide access to a corridor, exterior exit or exit stairs. Nonrated exit corridors with unprotected openings are permitted in a fully sprinklered facility. Corridors shall provide two directions of travel to a main exit (stair enclosure or exterior exit), except for allowable dead ends. Dead end corridors shall not exceed 50 feet in the associated occupancies.

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Exit stairs shall be enclosed with 2 hour rated construction with 1 ½ hour rated doors. Stairs shall, where practical, discharge directly to the exterior.

Exterior exits are exits that discharge directly to the exterior and provides a clear unobstructed path to the public way. Access to enclosed exterior spaces are not considered exits. The path to the public way must be such that the exit path does not require exiting past unprotected portions of the building.

Exit signs indicating the direction of exiting will be provided such that all areas within any corridor have an exit sign visible. Exit signs will also be placed at all exit doors (stairs and exterior exits), which are not obviously identifiable as an exit. Exit signs will also be placed at exit access doors (corridor doors) within large open rooms with an occupant load of 50 or more persons.

Exit signs shall be illuminated and provide a directional symbol where appropriate. Each exit sign will be provided with an emergency source of power. The emergency power source shall provide 1 ½ hour of illumination without normal power.

Illumination of the means of egress will be provided with an emergency power source, to provide a minimum of 1 foot candle in the following areas;

a. Exit corridors
b. Elevator lobbies
c. Elevator cabs
d. Administrative areas
e. Main lobby
f. Meeting rooms*
g. Dining room *

* May be reduced to not less than 1/5 foot candles during performances or projections. Means of egress illumination in exit stairs enclosures shall provide a minimum of 10 foot candles.

6.14.5 Building Exposure

The Veterans Affairs Medical Center building site is 100 plus acres with no existing buildings. The proposed placement of the new warehouse and engineering building will be a minimum of 20 feet from other structures planned for the site. This separation distance allows non-rated exterior walls and up to 45 percent of the area to be unprotected exterior openings. The buildings are to be sprinklered throughout. As such, NFPA standard 80A states that no exposure hazard is considered to exist. Reference Sections 5.6.3 and 5.6.4. Therefore, no special provisions are needed, other than separation and sprinklered facilities, for exposure protection.

The warehouse / engineering building will be connected to the hospital via two enclosed grade level passageway and one tunnel. The passageway and tunnel will be fully sprinklered and separated at each end of the passageway with a 2 hour fire barrier wall in accordance with IBC 3104. This separation allow the warehouse / engineering building to be treated as a separate building from the attached hospital.

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6.14.6 Building Construction

The building height and area, based on the 2006 IBC, requires that the mixed occupancy facility be non-rated non-combustible construction with a construction type of Type II-B which is a Type II (000) under NFPA 220. The minimum fire rating is as follows:

Structural frame (columns and beams) - 1 hour rated where supporting the third floor occupancy separation, 0 hour rated otherwise

Floors/Ceiling Assembly - 0 hour rated

Roof/Ceiling Assembly - 0 hour rated

Wall Assembly

- Exterior bearing - 0 hour rated
- Exterior non-bearing - 0 hour rated
- Interior bearing - 0 hour rated
- Interior non-bearing: - 0 hour rated, due to construction type, may require rating based on associated hazard.

6.14.7 Occupancy Separations

The warehouse / engineering building is being considered a mixed occupancy (LSC 6.1.14.3.1). As a mixed occupancy, an occupancy separation is not required between the different occupancy areas.

The function or use within a room may be more hazardous than the overall occupancy classification, requiring a fire rated enclosure. Rated separations will be provided due to associated hazard or use as follows:

Special hazard rooms - 1 hour rated for:

- Wood working shops
- Paint shops
- Health hazardous material storage rooms
- Trash service rooms
- Recycling rooms

Special high hazard rooms - 2 hour rated for:

- Hazardous storage – Gas & flammable storage room
- Trash collection rooms and shafts
- Linen collection rooms and shafts

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Fire dampers will be provided at each duct penetration of walls rated for 2 hours or greater, and fire rated shaft enclosures (NFC 90A-5.3). Fire dampers are also required at transfer grills in 1 hour and above rated assemblies.

Fire-rated doors, frames and hardware will be provided on openings in rated partitions and shafts. Doors will be equipped with closer: where required to remain normally open, with magnetic holders. Doors will be:

1-1 /2 hour fire-rated assemblies in 2-hour shafts and partitions.

1 hour fire-rated assemblies in 1-hour rated shafts and stair enclosures.

3/4 hour fire-rated assemblies in 1-hour partitions designed for occupancy or hazard separations.

Corridor doors do not require a fire resistive rating unless the door is protecting a vertical opening, exit, smoke zone, occupancy or hazardous area.

6.14.8 Building Compartmentization

Hazardous rooms are protected with a rated enclosure with protected opening (see Occupancy Separations).

The final compartmentization is by floor. Each occupied floor is separated from the adjoining occupied floors with a smoke tight assembly.

6.14.9 Vertical Openings

Enclosed vertical openings such as stairs and mechanical chases are enclosed with a 1 hour rated construction with 1 hour rated doors and protected openings. These enclosures shall run continuous from the floor up to the roof and be provided with combination smoke and heat damper where penetrated with ducts.

6.14.10 Interior Finishes

Interior finish, maximum flame spread and smoke developed limits are based on ASTM E-84 fire hazard classification test and will be as follows:

Exits (Enclosed exit stairs, exit passageways):

Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

Exit access corridors and lobbies:

Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

Other occupied rooms and spaces

Class C
Flame spread - 200 maximum

Smoke developed - 450 maximum

Floor Finishes in corridors, enclosed exits and areas open there-to - Class II:

Carpet for corridors will pass DOC FF 1-70 and for critical radiant flux, minimum of 0.50 watts/sq. cm as determined by NFPA 253 - 1990 edition, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source".

Insulation:

Flame spread rating limitation - 25 maximum

Smoke developed limitation - 450 maximum except when isolated by masonry walls or floors.

Combustible foam plastic thermal insulation shall not be used as an interior finish.

6.14.11 Water Supply

The current water flow information for the site water distribution system is not available. Flow tests are to be provided to determine the water and pressures available to the site.

The site will have an on-site potable water storage tank to provide up to 7 day normal demand. This has been estimated between 500,000 gallons to 1 million gallons. The fire protection water will utilize this storage volume with a fire pump to provide the needed pressures. The potable water storage tank will be fed by the county water service and domestic water will be drawn from the tank. In essence, the potable water tank is a break tank.

The preliminary water flow requirements for the sprinkler system and hose stream calculates as follows (assuming worst case warehouse utilizing ESFR sprinklers):

.20	gpm/sq. ft. density (Ordinary Hazard Group 2)
x 2,000	sq. ft. design area (dry pipe system)
400	gpm/design area
+ 500	gpm/hose stream
900	gpm combined sprinkler and hose demand
x 90	minutes (duration of flow)
81,000	gallons total water demand for fire protection
125	gpm/ESFR
x 12	number of ESFR operating
1500	gpm/design area
+ 250	gpm/hose stream
1750	
x 90	minutes
157,500	gallons total water demand for fire protection

The estimated pressure required to provide a 100 psi at the upper hose outlet (hospital / clinic worst case) is as follows:

100	psi at outlet
+ 43	psi (elevation loss) = .432 psi/foot of elevation times 100 feet
+ 25 psi	(allowance for friction loss)
+ 10	psi (allowance for backflow preventer)
178	psi required at base of system riser

A site fire pump rated at 1250-1500 gpm will be required to provide the water demand and pressure to insure proper operation of the site fire protection system. The fire pump will be located in a dedicated 1 hour rated pump room in the energy center and selected to provide the 175 ± psi water pressure. With a large diesel generator to service the emergency systems within the hospital, the fire pump motor can be electric and fed from the emergency generator. The electric motor would need to be 150-200 bhp. Once the taps to the county water main lines are made a more accurate water supply and thus a more accurate pump rating can be determined.

6.14.12 Automatic Fire Suppression

A dry-pipe system or dry type sprinkler heads will be provided in areas subject to temperatures below 40°F, such as dock areas and refrigerated areas. A supervised wet pipe sprinkler system shall be provided throughout the remaining areas of the building including the electrical and telecommunication rooms.

The sprinkler system will be connected to the new fire service loop. Riser pipes will be provided in one of the enclosed exit stairs. A control valve will be provided between the feed main and each riser. Floor control valve assemblies with check valves will be provided in the stair enclosures and fed to zone piping at each floor level.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below.

Light hazard occupancies will be designed to provide 0.10 gpm per square foot over most remote 1,500 square feet with quick response sprinklers.

Ordinary hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet.

Ordinary hazard Group 2 occupancies will be designed to provide 0.20 gpm per square foot over most remote 1,500 square feet.

The sprinkler systems will be separately zoned for each floor. In addition, sprinkler systems protecting special hazards and elevator machine rooms are to be zoned separately. Each sprinkler zone/system will be provided with all necessary valves, control valve tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

General combustible materials stored over 12 feet in height will be protected with Early Suppression, Fast Response (ESFR) ceiling mounted sprinklers. Sprinklers protecting general storage will be designed to protect the materials commodity class stored and storage arrangement (racks, skides, shelves, etc.).

6.14.13 Fire Extinguishers

Portable fire extinguishers shall be located throughout all areas of the buildings in accordance with NFPA 10-2007 Edition. Fire extinguishers will not be provided under this project. Fire extinguisher cabinets and proposed locations for extinguishers on hooks, along with appropriate signage will be provided.

Extinguishers shall also be located in the following specific areas:

a. Near each stair entry.
b. In major mechanical, electrical and telephone equipment rooms
c. Elevator machine rooms
e. Locker rooms
f. Maintenance shops
g. Storage rooms (large)
i. Telephone switch rooms

The class, size and spacing will be as follows:

Class A combustibles (ordinary combustible materials such as wood, cloth and paper):

Maximum travel distance to an extinguisher will be 75 feet. Minimum extinguisher rating will be 2A. Maximum coverage per unit of A will be:

- 3000 square feet in patient rooms, treatment areas and administrative areas.

- 1500 square feet in retail, locker rooms, mechanical rooms, electrical rooms, storage rooms, laundry, maintenance work-shops and kitchen.

Class B combustibles (flammable liquids, oils, gases):

Maximum travel distance to an extinguisher will be 50 feet.

Minimum extinguisher rating will be 1OB.

Class C (energized electrical equipment):

Extinguishers sized and located for Class A and B hazards.

Multi-purpose dry chemical fire extinguishers will be used as they are suitable for use on all three common fire classifications.

Fire extinguishers will be large enough that they cannot be easily concealed and removed from the building. The recommended fire extinguisher size is 3A-30B:C.

Extinguishers will be located in flush mounted cabinets sized to accommodate 2½ gallon pressurized water extinguishers in public areas to prevent damage and

discourage tampering. Extinguishers may be installed on hangers in non-public areas.

6.14.14 Detection, Alarms And Controls

A fire detection and alarm system will be provided throughout the facility in accordance with NFPA 72, 2007 edition and the design criteria.

The fire detection and alarm system (FDAS) will be a microprocessor based, multiplexed device addressable system connected to and capable of communicating with the Site Fire Alarm Notification System located in the Center Energy Plant, and off-site monitoring service.

Manual pull stations will be located in the natural path of escape near exit doors. Pull stations will be so located that no place on any floor will be more than 200 feet from a pull station.

Automatic photoelectric smoke detectors will be located as required by NFPA 72, LSC 101 ASHE A17.1, and NFPA 90A in the following spaces:

Elevator Lobbies

Elevator Machine Rooms

HVAC System Ductwork as required by NFPA 90A

Fire alarm speakers, for fire location announcements and evacuation instructions, will be located so as to be clearly audible in all areas. Visual alarm indicators will be provided in all public areas, and high noise areas.

Supervision of sprinklers:

Position indicator switches on all supply control valves.

Flow switches on each floor and each zone of the sprinkler system.

The FDAS control panel will have visual and audible signals for power failure, open circuit, ground, smoke detector failure and alarm.

Alarm notification by pre-recorded messages will be automatically transmitted throughout the facility. Alarm and evacuation instructions will be given by a manual voice annunciation system. Trouble signals will be automatically transmitted to the central energy plant.

The fire detection and alarm system will have four hour battery standby power and will be connected to the "life safety" power system as described in the electrical section.

The smoke detectors, sprinkler water flow devices and manual pull stations will be electrically interconnected to the system. The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the building. The alarm will be recorded at the central energy plant and local fire alarm control panel and the control functions will be initiated.

Activation of the duct smoke detectors for mechanical air handling units will initiate the fire alarm system, close the compartmentation doors, and shut down the air handler.

6.14.15 Smoke Control

Duct smoke detectors will be installed in all ducted HVAC systems in:

Return air ducts with 2,000 cfm air flow, placed before air is exhausted from building or prior to dilution by outside air.

Main supply air ducts with 15,000 cfm air flow, placed downstream of filters.

Activation of an induct smoke detector will initiate shutdown of the associated air handling unit. Manual emergency stop switch for fans will be provided.

6.14.16 Emergency Power

A level 1 emergency power supply system (EPSS), as defined by NFPA 101, shall be provided and will consist of emergency generators located in the energy center. The EPSS will supply the essential electrical system, which is comprised of the life safety, and equipment branches and serve the following loads:

Life Safety Branch
- Illumination of means of egress
- Exit signs
- Fire detection and alarm system
- Emergency communications systems
- Elevator cab lighting, control, communications, and signal systems.

Equipment Branch
- Elevators
- Fire pump

6.14.17 Fire Department Accessibility

The exterior of the facility shall be sufficiently open so that fire apparatus and/or fire fighters have access to all open sides of the building.

New hydrants shall be provided as part of the fire service loop. Hydrants shall be fed by at least a 6" diameter connection with a road/curb valve at the connection. Hydrants should be spaced at least 40 feet from the building and adjacent fire lanes. Hydrants should be spaced no more than 600 feet apart around the perimeter of the building.

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6.15 Building Description – Warehouse and Engineering Facility

BUILDING:	VA Warehouse and Engineering Facility	
USE & OCCUPANCY CLASSIFICATION:	Mixed Occupancy (non-separated uses)	LSC 6.1.14.3 IBC 302.3.1
	New Business Occupancy "B" - Business – Offices and Lockers	LSC 42.1.1.2 IBC 304.1
	Storage Occupancy "S-1" - Moderate Hazard Storage – Warehouse/Storage	LSC 38.1.1.1 IBC 311.2
	Industrial Occupancy "F-1" - Moderate Hazard Industrial – Maintenance Shops	LSC 40.1.1.2 IBC 306.2
AREA (± sq ft):	1st Floor 45,750 ft^2	
	2nd Floor 10,800 ft^2	
HEIGHT:	2 stories 30 ft. to main roof (estimated)	
SPRINKLED:	The completed building will have a sprinkler system throughout in accordance with NFPA 13	
YARDS/SEPARATIONS:	Open 30 plus feet on three sides, 20± feet on the north side facing the Community Living Center	
SPECIAL FEATURES:	1. The warehouse has a two story high bay space open to the first floor and separated from the second floor occupied spaces. 2. The facility has a gas and flammable storage room. 3. The facility has an environmentally hazardous storage room. 4. An enclosed pedestrian walkway connects to the adjacent hospital building.	

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6.16 Code Summary – Warehouse And Engineering

CONSTRUCTION TYPE:	II (000) non-rated, non-combustible			FPM 2.1.B
	II-B non-rated, non-combustible			IBC Tbl 601 IBC 602.2
ALLOWABLE AREA/FLOOR (ft^2):	-1 61,250	80,500	-1 54,250	
Basic Allowable:	17,500	23,000	15,500	IBC Tbl 503
Sprinkler Increase:	200%	200%	200%	IBC 506.3
Yard Increase[3]:	50%	50%	50%	IBC 506.2
AREA/BUILDING (ft^2):	122,500	161,000	108,500	
ALLOWABLE BUILDING HEIGHT:				
Stories:	4	5	3	IBC Tbl 503
Feet:	75 ft.	75 ft.	75 ft.	IBC 504.2

BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS
The following is based on II-B (000) construction

BUILDING ELEMENT MATERIALS:	Non-combustible non-rated construction	NFC 220
EXTERIOR WALLS		
Bearing walls:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
Non-bearing:	0 hour rated non-combustible construction > 10 ft. fire separation	IBC Tbl 602
Opening Protection:	Not required in sprinkled facility, max. 45% exterior wall openings > 10 ft. fire separation distance	IBC Tbl 704.8 IBC 704.8.1
STRUCTURAL FRAME:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1

[3] Assumes 20 ft. fire separation on all four sides of the building.

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FLOOR:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
ROOF:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
PARTITIONS Bearing & Non-bearing:	0 hour rated non-combustible construction (fire retardant treated wood permitted where fire rating is 2 hour or less)	NFC 220 Tbl 4.1.1
SHAFT ENCLOSURES: Rating:	(Excludes Stair Enclosures) 1 hour rated when connecting 3 stories or less	LSC 8.6.5 IBC 707.4
Opening Protection:	1 hour rated in 1 hour shafts	LSC Tbl 8.3.4.2
Supporting Structure:	Structure (beam, column, walls, etc) supporting rated shafts shall be rated equal to shaft rating	LSC 8.6.2 IBC 706.5
Top & Bottom:	Enclosed with rated construction equal to shaft wall rating or extend to deck above and floor deck below (see code exceptions).	LSC 8.6.4 IBC 707.11 IBC 707.12
Fire Dampers:	Required in ducts and air transfer openings through shaft walls	NFC 90A 5.3.4.6 IBC 716.5.3.1
Smoke Dampers:	Not required in ducts and air transfer openings through shaft walls	NFC 90A 5.3.5 IBC 716.5.3.1

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UNENCLOSED VERTICAL OPENINGS:	Permitted when: Designed as a Communicating space and - occupants not in communicating space have access to exit without entering space - lowest level is street floor - area of communicating space is open and unobstructed - contents are ordinary hazard - connects three (max.) adjacent floor levels - separated from remainder of building with smoke barrier construction <AS>	LSC 8.6.6
	OR - Designed as an atrium	IBC 707.2 Exc 5
	Convenience opening under LSC 8.6.8.2 is not permitted for storage occupancies	LSC 42.3.1

RATED SEPARATIONS

OCCUPANCY SEPARATIONS:	Not required in mixed occupancy provided the most stringent code requirements of the various occupancies apply throughout	LSC 6.1.14.3.2
	Not required as building may be non-separated use group due to construction type	IBC 302.3.1
Accessory Areas:	No separation required if accessory/incidental use to main occupancy, and is ≤ 10% of any floor area	IBC 302.2 LSC 6.1.14.1.3
INCIDENTAL USE AREAS:		
Storage Room:	No requirement for ordinary/moderate combustibles	LSC 8.7
Waste Collection: (Trash & Recycle)	1 hour fire rated	LSC 8.7

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Paint Shops:	1 hour fire rated	LSC 38.3.2.1
Woodworking Shops:	1 hour fire rated	LSC 38.3.2.3
Hazardous Materials:	Environmental; 1 hour fire rated	LSC 8.7
Flammable & Combustible Gases & Liquid Storage:	2 hour fire rated	LSC 8.7

OPENING PROTECTION:

Doors in:

2 hour rated walls	1 ½ hour rated	LSC Tbl 8.3.4.2
1 hour rated walls	1 hour rated for vertical openings (shafts)	LSC Tbl 8.3.4.2
	¾ hour rated elsewhere	
Corridor Wall	No fire rating required, constructed to resist passage of smoke	LSC 38.3.6.1
Fire Dampers:	Required in ducts and air transfer openings through fire barrier walls greater than 1 hour rated	NFC 90A 3.1.1
	Not required in duct penetrations of corridor walls (fire partitions	NFC 90A 3.1.1
Smoke Dampers:	Not required in fire barriers	NFC 90A

EXITS

OCCUPANT LOAD FACTORS:

General Offices, Labs:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1

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General Industrial:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1
Storage:	No requirement; use 500 from IBC for warehouse	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1
Mechanical & Accessory Storage:	300 sq. ft. per occupant (gross)	IBC Tbl 1004.1
ADJOINING ROOMS:	Egress through an adjoining room or space is permitted, provided it: - is accessory to area served - is not a high hazard - provides a discernable egress path - is not a store room, kitchen, closet - is not subject to locking	LSC 7.5.1.6
AREA OF RESCUE:	Not required in sprinklered facility	LSC 7.2.12.1.2
NUMBER OF EXITS From Floors:	Min. of 2 with occupant load ≤ 500 Min. of 3 with occupant load > 500 ≤ 1000	LSC 7.4.1.2 LSC 38.2.4.1
From Rooms: (Exit Access)	Min. of 2 exit access doors required when: a. common path of 75 ft. exceeded in "B" occupancy b. hazardous areas > 200 sq. ft., with an occupant load ≥3 and travel distance > 25 ft. c. > 100 occupants in "B" occupancy and travel distance > 100 ft. d. refrigerated rooms and refrigeration machinery rooms > 1000 sq. ft. f. electrical equipment rooms with equipment > 6 ft. wide and: 1. ≤600 volts, $1,200 amps 2. > 600 volts	 LSC 38.2.4.3 LSC 7.11.4 LSC 38.2.4.3 IBC 1014.4 IBC 1014.5 NFC 70 110.26(C)2 NFC 70 110.33(A)1
EXIT SEPARATION: (And Exit Access)	Remote and a the longest diagonal dimension of the building or area requiring the two exits	LSC 7.5.1.3.3

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TRAVEL DISTANCE TO AN EXIT (MAX.):	250 feet - General Industrial	LSC Tbl 40.2.6
	300 feet - Business "B"	LSC 38.2.6.1
	400 feet - Ordinary Hazard Storage	LSC Tbl 42.2.6
	75 feet - High Hazard Areas	LSC 7.11.1
COMMON PATH:	100 ft max.	LSC Tbl 40.2.5 LSC Tbl 42.2.5 LSC 38.2.5.3.1
	100 ft. max within mechanical equipment rooms	LSC 7.12.1(1)
EGRESS WIDTH FACTOR(S):	0.20 inches per person	LSC 7.3.3.1
EXIT DOORS:		
Swing:	In direction of exit when: - serving a high hazard area - serving $50 people - serving large equipment electrical room	LSC 7.2.1.4.3 LSC 7.2.1.4.2 NFC 70 110.26(C)2 NFC 110.33(A)2
Panic Hardware:	Required where serving an assembly occupancy over 100 occupants, an "H" occupancy, or large equipment electrical room	LSC 7.2.1.5.9 LSC 12.2.2.2.3 NFC 70 110.26(C)2
Size (min.):	32" wide and 80" high min. clear opening with a max. leaf width of 48"	LSC 7.2.1.2.4
EXIT SIGNS:	Required in common corridors, and rooms where 2 means of egress are required	LSC 7.10.1.5.2
	Required where egress path is not immediately visible	LSC 7.10.1.5.1
Power:	Exit sign to be listed with emergency back up power for 90 minutes	LSC 7.9.2.1

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EGRESS PATH ILLUMINATION:	Required at all times the facility is occupied, to provide an average of 1 ft-candle at floor (0.2 ft-candle in auditoriums)	LSC 7.8.1.3
	Exit stair enclosures to be provided with 10 foot-candles (min)	LSC 7.8.1.3(1)
Power:	Required by emergency backup system for 90 minutes	LSC 7.9.2.1
Exterior:	Required at exterior exit discharge doors	LSC 7.8.1.1

STAIRWAYS

EGRESS WIDTH FACTOR(S):	0.3 inches per person	LSC Tbl 7.3.3.1
ENCLOSURES: (Includes exit passageways)	Required around exit stairs and exit passageways	LSC 7.1.3.2.1 LSC 7.2.2.5.1.1
Rating:	1 hour rated "fire barrier" when connecting 3 stories or less	LSC 7.1.3.2.1
Doors:	1 hour rated in 1 hour exit enclosures	LSC Tbl 8.3.4.2
Supporting Structure:	Structure (beam, column, walls, etc) supporting rated exit enclosure wall are to be rated equal to enclosure supporting	LSC 8.2.3.3
Other Openings: (Into stair enclosure or exit passageway)	Openings other than for egress are not permitted except for required ventilation, sprinkler and standpipes, and electrical serving stair enclosure	LSC 7.1.3.2.1(5) & (6)
Smoke Proof or Pressurization:	Not required	LSC 38.2.2.4

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Roof Access:	Not required by a stairway or alternating tread in building of 3 stories or less	IBC 1009.11
Discharge:	To exterior, directly, through rated passageways or vestibules (10' deep max.)	LSC 7.7.1
	A max. of 50% of required exit capacity may egress through areas of the level of discharge provided:	LSC 7.7.2
	1. Egress is free and unobstructed to the exterior and is readily visible and identifiable from the termination of the stair enclosure	LSC 7.7.2.3
	2. The entire level of discharge is separated from areas below with a fire rating equal to the stair enclosure.	LSC 7.7.2.6
	3. The level of discharge is sprinkled throughout or the egress paths separated from the rest of the discharge level with rated construction equal to the required stair enclosure rating	LSC 7.7.2.4
STAIRS		
Materials:	Non-combustible construction	LSC 7.2.2.3.1.2
	Handrails may be of wood	IBC 1009.5
Width:	44 inches min. serving > 50 occupants	LSC 7.2.2.2.1.2(B)
	36 inches min serving ≤ 50 occupants	LSC 7.2.2.2.1.2(A)
	Sufficient in width to handle the calculated occupant load	LSC 7.3.3
Projections		
Handrails:	4½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)

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Trims:	4 ½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)
	No limit when over 80" above	LSC Tbl 7.2.2.2.1(b)
Doors onto Landings:	Half of the required landing width (max.) with door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4
Rise & Run:	7.0 inch max. & 4 inch min. rise & 11 inch min. run with 1½" max. nosing	LSC Tbl 7.2.2.2.1.1(a)
	Riser to be solid, and within 30 degrees of vertical	LSC 7.2.2.3.3.3
Handrails:	Required to be continuous on both sides of stairs	LSC 7.2.2.4.1.2
Height:	34 to 38 inches above stair nosing	LSC 7.2.2.4.4.1
Size:	1-1/4 to 2 inches in diameter	LSC 7.2.2.4.4.6
	If non-circular ≥4" ≤6½" perimeter with 2.25 in^2 max. section	LSC 7.2.2.4.4.6
Clearance:	2-1/4" min. between handrail and other surfaces	LSC 7.2.2.4.5
Termination:	Returned to wall, floor or newel post, & extended horizontally min of 12 inches beyond top riser and slope for one tread width an extend horizontally 12" at bottom riser	FAS 4.9.4(2) LSC 7.2.2.4.4.9 LSC 7.2.2.4.4.10
Baluster/Guard:	Required on open sides, such that a 4 inch sphere will not pass through	LSC 7.2.2.4.5.3
	8" sphere allowed above the 34" height	LSC 7.2.2.4.5.3
Height:	42 inches above adjacent walking surface and stair nosing	LSC 7.2.2.4.5.2

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Head Room:	6 feet 8 inches min. above plane of tread nosing	LSC Tbl 7.2.2.2.1.1(a)
Landings:	12 feet max. vertical height between landings	LSC Tbl 7.2.2.2.1.1(a)
Width:	Equal to stair width	LSC 7.2.2.3.2.2
Length:	Equal to stair width, needs not exceed 4 feet in straight run stairs	LSC 7.2.2.3.2.4
Extension to Roof:	Access to roof is not required by a stair or ladder in a building 3 stories or less in height	IBC 1009.11
Spaces Under Stair & Within Enclosure:	Use not permitted	LSC 7.2.2.5.3
	May be used if separated with a rated assembly equal to shaft enclosure and access is not through an exit	LSC 7.2.2.5.3.2
OTHER STAIR TYPES:		
Winding:	Not permitted for exiting	LSC 38.2.2.3
Circular:	Permitted for exiting	LSC 7.2.2.2.2.1
Spiral:	Permitted for exiting	LSC 38.2.2.3.2

CORRIDORS

PROTECTION		
Walls:	0 hour rated <AS>	LSC 38.3.6.1(3)
Floors:	No special requirement in non-rated corridor	
Ceilings:	No special requirement in non-rated corridor	
Doors:	0 hour rated	LSC 38.3.6.1(3)
Glazed Openings:	No limit in non-rated assembly	LSC 8.4.1

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Ducts:	Fire and Smoke Dampers not required in ducts penetrating non-rated corridor walls	LSC 8.4.6
WIDTH (MIN.):	44 inches minimum	LSC 38.2.3.2
	36 inches when serving a calculated occupant load of 50 or less	LSC 7.3.4.1(2)
PROJECTIONS		
Doors:	Half of the required exitway width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when door is fully open	LSC 7.2.1.4.4
Trim/fixtures:	Not permitted into required exit width except handrails	LSC 7.3.2.2
CEILING HEIGHT:	7 feet 6 inches min.	LSC 7.1.5.1
	6 feet 8 inches above finished floor allowed for protruding objects	LSC 7.1.5.1
DEAD END CORRIDORS:	50 feet <AS>	LSC 38.2.5.2.1

ELEVATORS

Applicable Code/Standard:	ANSI/ASME A17.1-04 Safety Code for Elevators and Escalators by the American Society of Mechanical Engineers	LSC 9.4.2
ENCLOSURE		
Rating:	1 hour fire barrier when connecting 3 stories or less	LSC 8.6.5
Doors:	1 hour rated in 1 hour walls	LSC 8.3.4.2
Venting:	Not required to vent smoke and hot gases when serving 2 levels	IBC 3004.1 Exc. 1

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Pressurization:	Not required	-
ELEVATOR LOBBY VESTIBULES:	Not required when opening onto a non-rated corridor	IBC 707.14.1
CAB SIZE (MIN. INSIDE):	Offset door 51" x 68" Center door 51" x 80"	FAS 4.10.9
EQUIPMENT ROOM Rating:	Equal to hoistway rating, 1 hour	ESC 2.7.1.1.1 IBC 3006.4
Door:	3/4 hour rated in 1 hour wall (30 inch x 6 feet min. size)	ESC 2.7.1.1.2 IBC Tbl 715.4
Ceiling Height:	7 feet clear	ESC 2.7.4.1
Restricted Systems/Equip.:	Only machinery and equipment required for the operation of the elevator shall be permitted in the machine room	ESC 2.7.2.1
EMERGENCY OPERATION: Phase I:	- Emergency recall with On-Off-Reset switch located in the main lobby within sight of the elevators	ESC 2.27.3.1.1 IBC 3003.2
	- Automatic recall initiated by smoke detectors in lobbies, machine rooms and hoistways	ESC 2.27.3.2.3
	- Recall cars to main entrance level; unless alarm is received from main entrance level, then recall is to the alternate floor	ESC 2.27.3.2.4
	- Visual alarm required in each car for fire alarm activation in serving machine room	ESC 2.27.3.2.6
Phase II:	- Emergency in-car operation with Off-Hold-On switch located in each car	ESC 2.27.3.3 IBC 3003.2

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ACCESS:	Area of refuge or horizontal exit not required in fully sprinklered building	LSC 7.2.12.1.2
STAND BY POWER:	Not required to operate elevators serving 3 floors or less	ESC 2.27.2 IBC 3003.1.1

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FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:	Required for allowable area of II-B construction	IBC 403.2
	Required for general storage > 12,000 sq. ft.	NFC 1 13.3.2.25.2
	Required where high pile/rack storage utilized	NFC 1 13.3.2.25.1
Sprinkler System Supervision:	Required electronically for all control valves, tamper switches and water flow switches	LSC 9.7.2.1
Location of Fire Department Connection:	Located to be readily and easily accessible on the street side and approved by building/fire official	NFC 13 6.8.2 IBC 903.3.7
Maximum Zone Area:	52,000 sq. ft. for light & ordinary hazards	NFC 13 8.2.1
DESIGN CODE/STANDARD:	NFPA 13 "Installation of Sprinkler Systems" 2007 ed.	LSC 9.7.1.1
MANUAL SYSTEMS Standpipes:	Not required	LSC 38.3.5 NFC 1 13.2.2.2
PORTABLE FIRE EXTINGUISHERS:	Required throughout in accordance with NFPA 10 "Portable Fire Extinguishers" 2007 ed.	LSC 38.3.5

FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Required throughout with 50 people or more above or below grade level	LSC 38.3.4.1(2)
Supervision:	Annunciate alarm to 24 hour manned location (approved supervising station)	FPM 7.2.G.2

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Maximum Zone Area:	At least 1 per floor with	NFC 72 4.4.6.6.1
AUTOMATIC FIRE DETECTION SYSTEM:	Automatic detectors not required throughout	LSC 38.3.4
MANUAL FIRE ALARM STATIONS:	Required near each exit and within 200 feet of any point	NFC 72 5.13
SIGNALING DEVICES Audible:	Required throughout	LSC 9.6.3.5
Visual:	Required in public and common areas	LSC 9.6.3.5
HVAC SHUT DOWN:	Required on activation of associated duct smoke detectors on HVAC units	NFC 90A 6.4.2.1
SMOKE DETECTORS:	Required in return air systems with a capacity of 2000 cfm or more, down stream of all air filters and in a serviceable location	NFC 90A 6.4.2.1(1)
	Required in common return riser at each floor when capacity is > 15,000 cfm	NFC 90A 6-4.2.1(2)
	Required in elevator machine rooms	ESC 2.27.3.2
	Required in elevator lobbies on each floor	ESC 2.27.3.2
	Unoccupied rooms containing fire alarm panel	NFC 72 4.4.5
ANNUNCIATOR PANEL:	Required (zoning indicator panel) to be located at an approved location	NFC 72 4.4.6.3
SECONDARY POWER:	Required by emergency system with 24 hour capacity, and 5 minutes in alarm	NFC 72 4.4.1.5.3.1
DESIGN CODE/STANDARDS:	NFPA 72 "Protective Signaling Systems" 2007 ed.	LSC 9.6.2.1

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INTERIOR FINISHES

Applied Finishes:	Exempt if < .036 inches thick (wall paper, paint and veneers)	LSC 10.2.1.2
Floor Finish:	Class I or II per NFPA 253 in exit stair and exit passageways, DOC FF-1 "pill test" in all other areas, wood and linoleum are exempt	LSC 38.3.3.3.2
Foam Plastic:	Not allowed as interior finish or trim, unless specially approved	LSC 10.2.4.3
Trim:	Plastic trim permitted when: - density ≥ 20 pcf, - thickness ≤ ½" max., - width ≤ 4" max., - < 10% of wall area, and - flame spread of 75 or less	LSC 10.2.4.3.2
Roof Covering:	Class B min., FM Class I or UL Fire-Classified (UL790)	FPM 2.7
Exit Stairs & Passageways:	Class B, flame spread 26-75 smoke developed 450 maximum for interior finishes	LSC 38.3.3.2.1
Exit Access Corridors:	Class B, flame spread 26-75, smoke developed 450 maximum for interior finishes	LSC 38.3.3.2.1
Wall and Ceiling:	Class C, flame spread 76-200, smoke developed 450 maximum for interior finishes	LSC 38.3.3.2.2
Trim:	Class C when <10% of wall or ceiling area	LSC 10.2.5.1

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6.17 General Fire Protection – Parking Garage

6.17.1 Introduction

The Fire and Life Safety Program has been developed to provide a reliable system to protect building occupants, fire fighting personnel, building contents, building structure and continuity of building function. It's intent is to provide a reasonable level of fire safety by reducing the probability of injury, loss of life or building's functional use due to a fire. This can be accomplished by limiting the development and spread of a fire emergency to the room or area of origin and reducing the need for total occupant evacuation.

The design aspects which relate to the fire and life safety of the facility include:

- Occupancy - Building function
- Exits - Design concept
- Structural fire resistance - Type of Construction
- Building compartmentization - Fire areas
- Fire detection and alarm
- Fire suppression
- Smoke control and exhaust
- Fire fighter access and facilities
- Emergency power

6.17.2 OCCUPANCY

The planned open parking decks are two (2) free standing buildings with eight (8) tiers each. The facility has a single occupancy classification. It is:

- Storage – This includes facilities used primarily for the storage or sheltering of goods, merchandise or products. The occupancy classification is an "S-1" (Moderate Hazard Storage) Open Parking Garage under the International Building Code and as a New Ordinary Hazard Storage occupancy under the Life Safety Code, and an Open Parking Structure under NFPA 88A.

6.17.3 OCCUPANCY LOAD

Occupancy loads are determined based on the gross sq. ft. and an occupancy load factor in sq.ft./person. The occupancy load factor for the S-1 Open Parking Garage occupancy is 200 sq. ft. per person. The calculated occupancy loads break down as follows:

Floor	Use	Occupancy Load	Area/Tier
1st thru 8th	Parking Garage	280	55,9000 sf.
		x 8	
	Total	2,240	

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6.17.4 HAZARD CLASSIFICATION

The facility being storage (parking garage) has a moderate quantity and/or combustibility. Ordinary Hazard Group 1 include areas where combustibility is low, and quantity of combustible is moderate, stockpiles of combustibles do not exceed 8 feet, and fire with moderate rates of heat release are expected (NFC 13 5.3.1). Ordinary Hazard Group 1 area includes open parking garages.

6.17.5 EXITS

The facility occupants are a mix of staff and public, who may not be familiar with the facility, egress paths and location of the nearest exit door. The standard life safety and fire emergency response in the associated occupancy is to quickly evacuate the facility The travel distance to a protected exit (enclosed stairway or exterior exit) from any point is limited to 400 feet with sprinklers throughout.

Exits consists of aisles between cars and along drive, which shall be maintained to provide access to an exterior exit or exit stairs. The parking garage does not have enclosed corridors.

The Life Safety Code requires exit stairs to be enclosed with 2 hour rated construction with 2 hour rated doors, even on open parking garages. Stairs shall, where practical, discharge to the exterior.

Exterior exits are exits that discharge directly to the exterior and provides a clear unobstructed path to the public way. The path to the public way must be such that the exit path does not require exiting into enclosed courtyards or past unprotected portions of the building.

Exit signs indicating the direction of exiting will be provided such that all areas within the access drive have an exit sign visible. Exit signs will also be placed at all exit doors (stairs and exterior exits), which are not obviously identifiable as an exit.

Exit signs shall be illuminated and provide a directional symbol where appropriate. Each exit sign will be provided with an emergency source of power. The emergency power source shall provide 1 ½ hour of illumination without normal power.

Illumination of the means of egress will be provided with an emergency power source, to provide a minimum of 1 foot candle in the following areas;

a. Exit access
b. Elevator lobbies
c. Elevator cabs
d. Main lobby

Means of egress illumination on stairs shall provide a minimum of 10 foot candles.

6.17.6 BUILDING EXPOSURE

The Veterans Affairs Medical Center building site is 100 plus acres with no existing buildings. The proposed placement of the new parking garage will be a minimum of

40 feet from other structures planned for the site. This separation distance allows non-rated exterior walls and up to 100 percent of the area to be unprotected exterior openings. The open parking garage is sprinkled throughout. Therefore, no special provisions are needed, other than separation for exposure protection.

To be considered an open parking structure, there must be 1.4 sq. ft. of exterior opening for every linear foot of exterior wall on each tier. These openings shall be distributed over at least 40% of the perimeter or on opposite walls.

Each parking garage will be connected to the clinic atrium via two (2) enclosed pedestrian walkways on the odd numbered tiers (1, 3, 5, & 7). The walkway will be fully sprinkled and separated at the atrium end and open at the garage, in accordance with IBC 3104. This allows the parking garage to be treated as a separate building from the attached hospital/clinic. Portions of the open parking garage within 10 feet of the adjacent building (atrium) shall be separated with 2 hour construction, except for the pedestrian walkways.

6.17.7 BUILDING CONSTRUCTION

The building height and area, based on the NFPA 88A, requires that the open parking structure be non-rated non-combustible construction with a construction type of Type II-B which is a Type II (000) under NFPA 220. The minimum fire rating is as follows:

Structural frame (columns and beams) - 0 hour rated

Floors/Ceiling Assembly - 0 hour rated

Roof/Ceiling Assembly - 0 hour rated

Wall Assembly

Exterior bearing - 0 hour rated
Exterior non-bearing - 0 hour rated
Interior bearing - 0 hour rated
Interior non-bearing: - 0 hour rated, due to construction type, may require rating based on associated hazard.

6.17.8 OCCUPANCY SEPARATIONS

The open parking structure is being considered a single occupancy (LSC 6.1.14.3.1). As a single occupancy, an occupancy separation is not required.

The function or use within a room may be more hazardous than the overall occupancy classification, requiring a fire rated enclosure. Rated separations will be provided due to associated hazard or use as follows:

Special hazard rooms - 1 hour rated for:

- 500 kVA Transformer Rooms

Fire-rated doors, frames and hardware will be provided on openings in rated walls and shafts. Doors will be equipped with closer: where required to remain normally open, with magnetic holders. Doors will be:

- 1-1 /2 hour fire-rated assemblies in 2-hour shafts and walls.
- 1 hour fire-rated assemblies in 1-hour rated shafts and stair enclosures.
- 3/4 hour fire-rated assemblies in 1-hour walls designed for occupancy or hazard separations.

6.17.9 BUILDING COMPARTMENTIZATION

The open parking structure is designed to vent hot gases and products of combustion through the exterior openings on each tier. As such, the open parking structure does not provide any compartmentation.

6.17.10 VERTICAL OPENINGS

Vertical openings for exit stairs are to be enclosed with a 2 hour rated construction with 1½ hour rated doors and protected openings. These enclosures shall run continuous from the floor up to the roof and be provided with combination smoke and heat damper where penetrated with ducts. Exterior side of the stair may be unprotected non-rated when separated from adjacent buildings by 10 feet or more.

Other vertical openings (ramps, mechanical chases) in the open parking structure need not be enclosed nor rated.

6.17.11 INTERIOR FINISHES

Interior finish, maximum flame spread and smoke developed limits are based on ASTM E-84 fire hazard classification test and will be as follows:

Exits (Enclosed exit stairs):

Class B
Flame spread - 75 maximum
Smoke developed - 450 maximum

Other rooms and spaces

Class C
Flame spread - 200 maximum
Smoke developed - 450 maximum

Insulation:

Flame spread rating limitation - 25 maximum
Smoke developed limitation - 450 maximum except when isolated by masonry walls or floors.

Combustible foam plastic thermal insulation shall not be used as an interior finish.

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6.17.12 AUTOMATIC FIRE SUPPRESSION

Dry-pipe systems will be provided in areas open to the exterior and subject to temperatures below 40°F. A supervised dry pipe sprinkler system shall be provided throughout the garage including the electrical and telecommunication rooms.

The sprinkler system will be connected to the new fire service loop. Riser pipes will be provided in the enclosed exit stairs. A control valve will be provided between the feed main and each riser. Dry pipe valve assemblies with control valve trim and quick opening device will be provided in the stair enclosures to feed each system on each floor level.

Sprinkler systems will be hydraulically designed to provide the densities and design area listed below.

Ordinary hazard Group 1 occupancies will be designed to provide 0.15 gpm per square foot over most remote 1,500 square feet. (Parking spaces and drive access)

The sprinkler systems will be separately zoned for each floor. In addition, dry pipe sprinkler systems shall be zoned to limit the system volume to 750 gallons. Each sprinkler zone/system will be provided with all necessary valves, control valve tamper switch, waterflow alarm switch and drains to make it a separate sprinkler system. The flow and tamper switch will be connected to the fire detection and alarm system.

6.17.13 FIRE EXTINGUISHERS

Portable fire extinguishers shall be located throughout all areas of the structure in accordance with NFPA 10-2007 Edition. Fire extinguishers will not be provided under this project. Fire extinguisher cabinets and proposed locations for extinguishers on hooks, along with appropriate signage will be provided.

Extinguishers shall also be located in the following specific areas:

a. Near each stair entry.
b. In major mechanical, electrical and telephone equipment rooms
c. Elevator machine rooms
d. Storage rooms (large)
e. Transformer Room

Portable fire extinguishers class, size and spacing will be as follows:

Class A combustibles (ordinary combustible materials such as wood, cloth and paper):

Maximum travel distance to an extinguisher will be 75 feet. Minimum extinguisher rating will be 2A. Maximum coverage per unit of A will be:

- 3000 square feet in patient rooms, treatment areas and administrative areas.

- 1500 square feet in retail, locker rooms, mechanical rooms, electrical rooms, storage rooms, laundry, maintenance work-shops and kitchen.

Class B combustibles (flammable liquids, oils, gases):

Maximum travel distance to an extinguisher will be 50 feet. Minimum extinguisher rating will be 1OB.

Class C (energized electrical equipment):

Extinguishers sized and located for Class A and B hazards.

Multi-purpose dry chemical fire extinguishers will be used as they are suitable for use on all three common fire classifications.

Fire extinguishers will be large enough that they cannot be easily concealed and removed from the building. The recommended fire extinguisher size is 3A-30B:C.

Extinguishers will be located, where practical, in flush mounted cabinets sized to accommodate 2½ gallon pressurized water extinguishers in public areas to prevent damage and discourage tampering. Extinguishers may be installed on hangers in non-public areas.

6.17.14 DETECTION, ALARMS AND CONTROLS

A fire detection and alarm system will be provided throughout the facility in accordance with NFPA 72, 2007 edition and the design criteria.

The fire detection and alarm system (FDAS) will be a microprocessor based, multiplexed device addressable system connected to and capable of communicating with the Site Fire Alarm Notification System located in the Center Energy Plant, and off-site monitoring service.

Manual pull stations will be located in the natural path of escape near exit doors. Pull stations will be so located that no place on any floor will be more than 200 feet from a pull station.

Automatic photoelectric smoke detectors will be located as required by NFPA 72, LSC 101 and NFPA 90A in the following spaces:

- Elevator Lobbies
- Elevator Machine Rooms
- HVAC System Ductwork as required by NFPA 90A

Fire alarm horn/strobes will be located so as to be clearly audible in all areas. Visual alarm indicators will be provided in all public areas. All strobes in line of sight to be synchronized.

The fire alarm will supervise sprinkler systems at:

- Position indicator switches on all gate control valves.
- Flow (pressure) switches on each floor and each zone of the sprinkler system.
- Low air pressure within dry pipe systems.

The FDAS control panel will have visual and audible signals for power failure, open circuit, ground, smoke detector failure and alarm.

Alarm notification will be automatically transmitted throughout the facility. Trouble signals will be automatically transmitted to the central energy plant.

The fire detection and alarm system will have four hour battery standby power and will be connected to the "life safety" power system as described in the electrical section.

The smoke detectors, sprinkler water flow devices and manual pull stations will be electrically interconnected to the system. The operation of a single fire / smoke detector, sprinkler or pull station will initiate the audible temporal three signal and visual alarms throughout the building. The alarm will be recorded at the central energy plant and local fire alarm control panel and the control functions will be initiated.

6.17.15 SMOKE CONTROL

The open parking structure is designed with exterior wall openings to vent hot gases and products of combustion to the exterior from each tier. Exit stairs are enclosed providing protection from smoke within the tier.

6.17.16 EMERGENCY POWER

A level 1 emergency power supply system (EPSS), as defined by NFPA 101, shall be provided and will consist of emergency generators located in the energy center. The EPSS will supply the essential electrical system, which is comprised of the life safety, and equipment branches and serve the following loads:

Life Safety Branch

- Illumination of means of egress
- Exit signs
- Fire detection and alarm system
- Emergency communications systems
- Elevator cab lighting, control, communications, and signal systems.

Equipment Branch

- Elevators
- Fire pump

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6.17.17 FIRE DEPARTMENT ACCESSIBILITY

The exterior of the facility shall be sufficiently open so that fire apparatus and/or fire fighters have access to three (3) sides of the building.

New hydrants shall be provided as part of the fire service loop. Hydrants shall be fed by at least a 6" diameter connection with a road/curb valve at the connection. Hydrants should be spaced at least 40 feet from the building and adjacent fire lanes. Hydrants should be spaced no more than 600 feet apart around the perimeter of the building.

6.18 Building Description - Parking Garage

BUILDING:	VA Medical Center Open Parking Garage	
USE & OCCUPANCY CLASSIFICATION:	Staff and Public Parking	
	Open Parking Structure	NFC 88A 3.3.2.3
	Storage Occupancy (Ordinary Hazard)	LSC 42.8.1.5 LSC 3.3.168.15
	"S-2" - Moderate Hazard Storage – Open Parking Garage	IBC 311.3
AREA (± sq ft):	Levels P1 through P8 55,900 ft^2 per Tier per garage	
	Total Building: 447,200 ft^2	
HEIGHT:	8 tiers 64 ft. to P8 tier (estimated)	
SPRINKLED:	This summary is based on the facility being sprinklered throughout	
YARDS/SEPARATIONS:	Open 40 feet plus on all sides, except the south to the corner of the clinic	
SPECIAL FEATURES:	1. The parking garage is an 8 tier open garage with open sidewalls. The top tier being the garage roof	

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6.19 Code Summary – Parking Garage

CONSTRUCTION TYPE:	II (000) non-rated, non-combustible II-B non-rated, non-combustible	NFC 88A 4.7.4 LSC 42.8.1.6 FPM 2.1.B IBC Tbl 601 IBC 602.2
ALLOWABLE AREA/FLOOR (ft^2):	Unlimited open parking garage less than 75 feet in height	NFC 88A 4.7.4
AREA/BUILDING (ft^2):	Unlimited	NFC 88A 4.7.4
ALLOWABLE BUILDING HEIGHT:	75 feet max., no limit on number of tiers	NFC 88A 4.7.4

BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS
The following is based on II-B (000) construction

BUILDING ELEMENT MATERIALS:	Non-combustible non-rated construction	NFC 220
EXTERIOR WALLS Bearing walls:	0 hour rated non-combustible construction ≥ 10 ft. fire separation 2 hour rated < 10 ft separation	NFC 220 Tbl 4.1.1 IBC Tbl 602
Non-bearing:	0 hour rated non-combustible construction ≥ 10 ft. fire separation 2 hour rated < 10 ft separation	IBC Tbl 602
Opening Protection:	Not required with no area limits in and S-2 open parking garage with a fire separation > 10 ft.	NFC 88A 4.1.3 IBC Tbl 704.8
STRUCTURAL FRAME:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
FLOOR:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
ROOF:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1

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PARTITIONS Bearing & Non-bearing:	0 hour rated non-combustible construction (fire retardant treated wood permitted where fire rating is 2 hour or less)	NFC 220 Tbl 4.1.1
SHAFT ENCLOSURES:	(Excludes Stair & Elevator Enclosures) A shaft enclosure is not required when serving an open parking garage	NFC 88A 4.7.5
UNENCLOSED VERTICAL OPENINGS:	Permitted when serving as an automobile ramp in an open parking garage	LSC 42.6.3.1.2 NFC 88A 4.7.5

RATED SEPARATIONS

AREA SEPARATIONS (Fire Walls):	Not required in an unlimited area open parking garage	NFC 88A 4.7.4
OCCUPANCY SEPARATIONS:	No separation required in an single occupancy open parking garage> 10 ft. separation to adjacent buildings	NFC 88A 4.1.3
	2 hour rated occupancy separation required if < 10 ft. to adjacent building or occupancy	NFC 88A 4.1.2
OPENING PROTECTION: Doors in 2 hour walls:	1½ hour rated with max. 100 sq. in of wire glass (33" ht., 10" wd., max.)	LSC Tbl 3.3.4.2
1 hour walls:	¾ hour rated with max., 1,296 sq. in. of wire glass (54" ht., 54" wd., max.)	
Fire Dampers:	Required in ducts and air transfer openings through fire barrier walls greater than 1 hour rated	NFC 90A 3.1.1

EXITS

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OCCUPANT LOAD FACTORS:		
Parking Garage:	200 sq. ft. per occupant (gross)	LSC 42.8.1.7 IBC Tbl 1004.1.1
General Industrial:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1
Mechanical & Accessory Storage:	300 sq. ft. per occupant (gross)	IBC Tbl 1004.1.1
ADJOINING ROOMS:	Egress through an adjoining room or space is permitted, provided it: - is accessory to area served - is not a high hazard - provides a discernable egress path - is not a store room, kitchen, closet - is not subject to locking	LSC 7.5.1.6
AREA OF RESCUE:	Required at stairs and elevators in a sprinklered open parking garage	LSC 7.5.4.1 LSC 7.2.12.1.2
Size	30 inches wide x 48 inches deep not obstructing a means of egress one space per every 200 occupants	LSC 7.2.12.3.1
Separation:	1 hour rated or within stair enclosure	LSC 7.2.12.3.4
NUMBER OF EXITS From Floors:	Min. of 2 with occupant load ≤ 500 Min. of 3 with occupant load > 500 ≤ 1000 Min. of 4 with occupant load > 1000	LSC 7.4.1.2 LSC 42.8.2.4.1

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From Rooms: (Exit Access)	Min. of 2 exit access doors required when: a. hazardous areas > 200 sq. ft., with an occupant load ≥3 and travel distance > 25 ft. b. refrigerated rooms and refrigeration machinery rooms > 1000 sq. ft. c. electrical equipment rooms with equipment > 6 ft. wide and: 1. ≤600 volts, ≥1,200 amps 2. > 600 volts	 LSC 7.11.4 LSC 38.2.4.3 IBC 1014.4 IBC 1014.5 NFC 70 110.26(C)2 NFC 70 110.33(A)1
EXIT SEPARATION: (And Exit Access)	Remote and 1/3 the longest diagonal dimension of the building or area requiring the two exits <AS>	LSC 7.5.1.3.2
TRAVEL DISTANCE TO AN EXIT (MAX.):	400 feet – Open Parking Garage <AS>	LSC Tbl 42.8.2.6
COMMON PATH:	50 ft max.	LSC 42.8.2.5.1
DEAD ENDS:	50 ft. max	LSC 42.8.2.5.2
EGRESS WIDTH FACTOR(S):	0.20 inches per person	LSC 7.3.3.1
ELEVATION CHANGE:	By ramp where offset is less than 21 inches on exit access corridors, exits, or exit discharge	LSC 7.1.7.2
EXIT DOORS: Swing:	In direction of exit when: - serving a high hazard area - serving ≥ 50 people - serving large equipment electrical room	 LSC 7.2.1.4.3 LSC 7.2.1.4.2 NFC 70 110.26(C)2 NFC 110.33(A)2
Panic Hardware:	No required except where serving an assembly occupancy over 100 occupants, an "H" occupancy, or large equipment electrical room	LSC 7.2.1.5.9 LSC 12.2.2.2.3 NFC 70 110.26(C)2
Size (min.):	32" wide and 80" high min. clear opening with a max. leaf width of 48"	LSC 7.2.1.2.4 LSC 7.2.1.2.3.3

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EXIT SIGNS:	Illuminated with directional signs, placed to clearly mark direction to an exit, 100 ft or less to nearest sign	LSC 42.8.2.10
	Required in common corridors, and rooms where 2 means of egress are required	LSC 7.10.1.5.2
	Required where egress path is not immediately visible	LSC 7.10.1.5.1
Power:	Exit sign to be listed with emergency back up power for 90 minutes	LSC 7.9.2.1
EGRESS PATH ILLUMINATION:	Required at all times the facility is occupied, to provide an average of 1 ft-candle at floor (0.2 ft-candle in auditoriums)	LSC 7.8.1.1
Power:	Required by emergency backup system for 90 minutes	LSC 7.9.2.1
Exterior:	Required at exterior exit discharge doors	LSC 7.8.1.1

STAIRWAYS

EGRESS WIDTH FACTOR(S):	0.3 inches per person	LSC Tbl 7.3.3.1
ENCLOSURES: (Includes exit passageways)	Required around exit stairs and exit passageways	LSC 7.1.3.2.1 LSC 7.2.2.5.1.1
Rating:	2 hour rated "fire barrier" when connecting 4 tiers or more	LSC 7.1.3.2.1
Doors:	½ hour rated in 2 hour exit enclosures	LSC Tbl 8.3.4.2
Supporting Structure:	Structure (beam, column, walls, etc) supporting rated exit enclosure wall are to be rated equal to enclosure supporting	LSC 8.2.3.3

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Other Openings: (Into stair enclosure or exit passageway)	Openings other than for egress are not permitted except for required ventilation, sprinkler and standpipes, and electrical serving stair enclosure	LSC 7.1.3.2.1(5) & (6)
Smoke Proof or Pressurization:	Not required	LSC 42.8.2.2.4
Roof Access:	Required by a stairway or alternating tread in building of 4 stories or more	IBC 1009.11
Discharge:	To exterior, directly, r rough rated passageways or vestibules (10' deep max.)	LSC 7.7.1
STAIRS		
Materials:	Non-combustible construction	LSC 7.2.2.3.1.2
	Handrails may be of wood	IBC 1009.5
Width:	4 inches min. between handrails when serving an area of refuge	LSC 7.2.12.2.3
	44 inches min. serving > 50 occupants	LSC Tbl 7.2.2.2.1(B)
	Sufficient in width to handle the calculated occupant load	LSC 7.3.3
Projections		
Handrails:	4½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)
Trims:	4 ½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)
	No limit when over 80" above	LSC Tbl 7.2.2.2.1(b)
Doors onto Landings:	Half of the required landing width (max.) with door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4

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Rise & Run:	7.0 inch max. & 4 inch min. rise & 11 inch min. run with 1½" max. nosing	LSC Tbl 7.2.2.2.1.1(a)
	Riser to be solid, and within 30 degrees of vertical	LSC 7.2.2.3.3.3
Handrails:	Required to be continuous on both sides of stairs	LSC 7.2.2.4.1.2
Height:	34 to 38 inches above stair nosing	LSC 7.2.2.4.4.1
Size:	1-1/4 to 2 inches in diameter	LSC 7.2.2.4.4.6
	If non-circular ≥4" ≤6½" perimeter with 2.25 in^2 max. section	LSC 7.2.2.4.4.6
Clearance:	2-1/4" min. between handrail and other surfaces	LSC 7.2.2.4.5
Termination:	Returned to wall, floor or newel post, & extended 12 inches min horizontally beyond top riser and slope for one tread then extend horizontally 12" at bottom riser	FAS 4.9.4(2) LSC 7.2.2.4.4.9 LSC 7.2.2.4.4.10
Baluster/Guard:	Required on open sides, such that a 4 inch sphere will not pass through	LSC 7.2.2.4.5.3
	8" sphere allowed above the 34" height	LSC 7.2.2.4.5.3
Height:	42 inches above adjacent walking surface and stair nosing	LSC 7.2.2.4.5.2
Head Room:	6 feet 8 inches min. above plane of tread nosing	LSC Tbl 7.2.2.2.1.1(a)
Landings:	12 feet max. vertical height between landings	LSC Tbl 7.2.2.2.1.1(a)
Width:	Equal to stair width	LSC 7.2.2.3.2.2
Length:	Equal to stair width, needs not exceed 4 feet in straight run stairs	LSC 7.2.2.3.2.4

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Extension to Roof:	Access to roof is required by a stair or ladder in a building 4 stories or more in height	IBC 1009.11
Spaces Under Stair & Within Enclosure:	Use not permitted	LSC 7.2.2.5.3
	May be used if separated with a rated assembly equal to shaft enclosure and access is not through an exit	LSC 7.2.2.5.3.2
OTHER STAIR TYPES:		
Winding:	Not permitted for exiting	LSC 42.2.2.3.3
Circular:	Permitted for exiting	LSC 7.2.2.2.2.1
Spiral:	Permitted for exiting when serving < 250 sq. ft. or ≤ 5 occupants	LSC 42.2.2.3.2

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ELEVATORS

APPLICABLE CODE/ STANDARD:	ANSI/ASME A17.1-04 Safety Code for Elevators and Escalators by the American Society of Mechanical Engineers	LSC 9.4.2
ACCESSIBLE:	An accessible means of egress is required where a required accessible floor is 4 stories or more stories or tiers above grade	LSC 7.5.4.7
ENCLOSURE Rating:	2 hour fire barrier when connecting 4 stories or more	LSC 8.6.5
Doors:	1/2 hour rated in 2 hour walls	LSC 8.3.4.2
Venting:	Required to vent smoke and hot gases when serving 3 levels or more	IBC 3004.1
Smoke Proof:	One required when serving 4 stories or more	LSC 7.5.4.8
ELEVATOR LOBBY VESTIBULES:	Not required unless elevator is used for evacuation	LSC 7.2.13.3
CAB SIZE (MIN. INSIDE):	Offset door 51" x 68" Center door 51" x 80"	FAS 4.10.9
EQUIPMENT ROOM Rating:	Equal to hoistway rating (2 hour rated)	ESC 2.7.1.1.1 IBC 3006.4
Door:	1-1/2 hour rated in 2 hour wall (30 inch x 6 feet min. size)	ESC 2.7.1.1.2 IBC Tbl 715.4
Ceiling Height:	7 feet clear	ESC 2.7.4.1
Restricted Systems/Equip.:	Only machinery and equipment required for the operation of the elevator shall be permitted in the machine room	ESC 2.7.2.1

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EMERGENCY OPERATION: Phase I:	- Emergency recall with On-Off-Reset switch located in the main lobby within sight of the elevators	ESC 2.27.3.1.1 IBC 3003.2
	- Automatic recall initiated by smoke detectors in lobbies, machine rooms and hoistways	ESC 2.27.3.2.3
	- Recall cars to main entrance level; unless alarm is received from main entrance level, then recall is to the alternate floor	ESC 2.27.3.2.4
	- Visual alarm required in each car for fire alarm activation in serving machine room	ESC 2.27.3.2.6
Phase II:	- Emergency in-car operation with Off-Hold-On switch located in each car	ESC 2.27.3.3 IBC 3003.2
ACCESS:	Area of refuge or horizontal exit required in non -sprinklered building	LSC 7.5.4
STAND BY POWER:	Not required to operate elevators serving 3 floors or less	ESC 2.27.2 IBC 3003.1.1
	Required on elevators used as an accessible means of egress	IBC 1007.4 LSC 7.2.12.2.4

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FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:	Not required in open parking garages being provided	LSC 42.2.8.3.5
MANUAL SYSTEMS Standpipes:	Required in open parking garage or when the highest story is ≥ 50 ft above lowest fire department vehicle access	NFC 88A 6.4.1
PORTABLE FIRE EXTINGUISHERS:	Not required is storage occupancies or open parking garages, but being provided	LSC 42.8.3.5

FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Not required in open parking garage but being provided	LSC 42.8.3.4.1.2
SMOKE DETECTORS	Required in elevator machine rooms	ESC 2.27.3.2
	Required in elevator lobbies on each floor May be heat detector if lobby unheated	ESC 2.27.3.2
	Unoccupied rooms containing fire alarm panel	NFC 72 4.4.5

INTERIOR FINISHES

Applied Finishes:	Exempt if < .036 inches thick (wall paper, paint and veneers)	LSC 10.2.1.2Exc
Floor Finish:	Class I or II per NFPA 253 in exit stair and exit passageways, DOC FF-1 "pill test" in all other areas, concrete, wood and linoleum are exempt	LSC 42.8.3.3.3.1 LSC 42.8.3.3.3.2
Exit Stairs & Passageways:	Class B, flame spread 26-75 smoke developed 450 maximum for interior finishes	LSC 7.1.4.1
Wall and Ceiling: (A, B & S)	Class C, flame spread 76-200, smoke developed 450 maximum for interior finishes	LSC 42.8.3.3.2.
Trim:	Class C when <10% of wall or ceiling area	LSC 10.2.5.1

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Foam Plastic:	Not allowed as interior finish or trim, unless specially approved	LSC 10.2.4.3
Trim:	Plastic trim permitted when: - density ≥ 20 pcf, - thickness ≤ ½" max., - width ≤ 4" max., - < 10% of wall area, and - flame spread of 75 or less	LSC 10.2.4.3.2
Roof Covering:	Class B min., FM Class I or UL Fire-Classified (UL790)	FPM 2.7
Exit Stairs & Passageways:	Class B, flame spread 26-75 smoke developed 450 maximum for interior finishes	LSC 7.1.4.1
Wall and Ceiling: (A, B & S)	Class C, flame spread 76-200, smoke developed 450 maximum for interior finishes	LSC 42.8.3.3.2.

PARKING GARAGES – GENERAL

CLEAR HEIGHT:	7 ft 6 inches in all vehicle and pedestrian areas (8 ft. 2 inches where serving handicap vans)	LSC 7.1.5.1 IBC 406.2.2 ICC A117.1
GUARDS:	Required on exterior and interior where the vertical drop distance to ground or floor below exceeds 30 inches	LSC 7.1.8
VEHICLE BARRIERS:	Min. of 2 ft in height required at ends of drive lanes and end of parking spaces where elevation changes is > 1 ft.	IBC 406.2.4
EXTERIOR OPENINGS: Distribution:	Distributed over 40% of building perimeter or uniformly over 2 opposing sides min with exterior openings	NFC 88A 4.7.1.2
Opening Area (Total):	Must be 1.4 sq. ft. per foot of perimeter wall on each level or tier	NFC 88A 4.7.1.1
INTERIOR WALLS/	Must be 20 % open & openings distributed	NFC 88A 4.1.3

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COLUMN LINES:	To provide ventilation	
EXTERIOR SEPARATION:	Must be greater than 10 ft. on sides with openings	NFC 88A 4.1.3
CONSTRUCTION:	Non-combustible construction, Type II (000)	NFC 88A 4.7.4
ENCLOSED ROOMS:	Smoke resistant when < 3,000 sq. ft. and used for offices or similar use	NFC 88A 4.2
	2 hour fire barrier	NFC 88A 4.1.2
FUEL DISPENSING:	Not to be preformed in an open parking structure	IBC 406.3.13
HEIGHT & AREA:	Unlimited area and limited to 75 ft in height	NFC 88A 4.7.4
VERTICAL ENCLOSURE:	Not required except at exit stair and elevators	NFC 88A 4.7.5 LSC 7.2.2.5.1.1
VENTILATION:	Not required do to percent of exterior openings required	NFC 88A 5.3.1
SPRINKLERS:	Not required in open parking garage	LSC 42.8.3.5
STANDPIPES:	Not required in open parking structures	NFC 88A 6.4.1
GUARDRAILS:		
Where Required:	At offsets ≥ 30 inches above floor or grade below	LSC 7.1.8
Height:	42 inches minimum	LSC 7.2.2.4.5.2
Rail Design:	Spaces so that a 4 inch sphere will not pass through up to a height of 34 inches and an 8 inch sphere up above 34 inches	LSC 7.2.2.4.5.3
Loads: (also applies to handrails)	50 lbs. per linear foot uniform load applied in any direction at top of rail	IBC 1607.7.1
	200 lbs concentrated load applied at any direction at top of rail	IBC 1607.7.1.1

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6.20 General Fire Protection – Central Energy Plant

6.21 Building Description – Central Energy Plant

BUILDING:	VA Central Energy Plant		
USE & OCCUPANCY CLASSIFICATION:	Industrial Occupancy "F-1" - Moderate Hazard Industrial – Generator, Switch Gear rooms, Mechanical rooms		LSC 40.1.1.2 IBC 306.2
AREA (± sq ft):	1st Floor	45,7950 ft^2	
	Mezzanine	1,290 ft^2	
HEIGHT:	Single story	30 ft. to main roof (estimated)	
SPRINKLED:	The completed building will have a sprinkler system throughout in accordance with NFPA 13		
YARDS/SEPARATIONS:	Open 30 plus feet on all sides		
SPECIAL FEATURES:	1. The single story energy plant has an enclosed mezzanine overlooking the mechanical equipment rooms. 2. The facility will house the site diesel generator and related switch gear that will be supplying the hospital and clinic 3. The facility will house the fire and jockey pump that will feed the site fire water loop.		

6.22 Code Summary – Central Energy Plant

CONSTRUCTION TYPE:	II (000) non-rated, non-combustible	FPM 2.1.B
	II-B non-rated, non-combustible	IBC Tbl 601 IBC 602.2
ALLOWABLE AREA/FLOOR (ft^2):	-1 69,750	
Basic Allowable:	15,500	IBC Tbl 503
Sprinkler Increase:	300%	IBC 506.3
Yard Increase:	75%	IBC 506.2
AREA/BUILDING (ft^2):	69,750 < 45,790 Actual	
ALLOWABLE BUILDING HEIGHT:	3 Stories and 75 ft. max.	IBC Tbl 503 IBC 504.2

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BUILDING ELEMENTS - FIRE RESISTIVE REQUIREMENTS

The following is based on II-B (000) construction

BUILDING ELEMENT MATERIALS:	Non-combustible non-rated construction	NFC 220
EXTERIOR WALLS Bearing walls:	0 hour rated non-combustible construction > 10 ft. fire separation	NFC 220 Tbl 4.1.1 IBC Tbl 602
Non-bearing:	0 hour rated non-combustible construction > 10 ft. fire separation	IBC Tbl 602
Opening Protection:	Not required in sprinkled facility, max. 45% exterior wall openings > 10 ft. fire separation distance	IBC Tbl 704.8 IBC 704.8.1
STRUCTURAL FRAME:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
FLOOR:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
ROOF:	0 hour rated non-combustible construction	NFC 220 Tbl 4.1.1
PARTITIONS Bearing & Non-bearing:	0 hour rated non-combustible construction (fire retardant treated wood permitted where fire rating is 2 hour or less)	NFC 220 Tbl 4.1.1
SHAFT ENCLOSURES:	Not required in single story structures	LSC 8.6.5 IBC 707.4

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RATED SEPARATIONS

OCCUPANCY SEPARATIONS:	Not required in single occupancy	LSC 6.1.14.3.2
Accessory Areas:	No separation required if accessory/incidental use to main occupancy, and is ≤ 10% of any floor area	IBC 302.2 LSC 6.1.14.1.3
INCIDENTAL USE AREAS:		
Storage Room:	No requirement for ordinary/moderate combustibles	LSC 8.7
Diesel Generator Rm.:	2 hour fire rated	NFC 37
Fire Pump Room:	2 hour fire rated	NFC 20
Emergency Power Switch Gear rooms:	2 hour fire rated	NFC 70
OPENING PROTECTION:		
Doors in:		
2 hour rated walls	1 ½ hour rated	LSC Tbl 8.3.4.2
1 hour rated walls	¾ hour rated elsewhere	LSC Tbl 8.3.4.2
Corridor Wall	No fire rating required	LSC 40.3.6
Fire Dampers:	Required in ducts and air transfer openings through fire barrier walls greater than 1 hour rated	NFC 90A 3.1.1
	Not required in duct penetrations of corridor walls (fire partitions	NFC 90A 3.1.1
Smoke Dampers:	Not required in fire barriers	NFC 90A

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EXITS

OCCUPANT LOAD FACTORS:		
General Offices, Labs:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1
General Industrial:	100 sq. ft. per occupant (gross)	LSC Tbl 7.3.2.1 IBC Tbl 1004.1.1
Mechanical & Accessory Storage:	300 sq. ft. per occupant (gross)	IBC Tbl 1004.1
ADJOINING ROOMS:	Egress through an adjoining room or space is permitted, provided it: - is accessory to area served - is not a high hazard - provides a discernable egress path - is not a store room, kitchen, closet - is not subject to locking	LSC 7.5.1.6
AREA OF RESCUE:	Not required in facility	LSC 40.2.2.13
NUMBER OF EXITS		
From Floors:	Min. of 2 with occupant load ≤ 500 Min. of 3 with occupant load > 500 ≤ 1000	LSC 7.4.1.2 LSC 38.2.4.1
From Rooms: (Exit Access)	Min. of 2 exit access doors required when:	
	a. common path of 75 ft. exceeded in "B" occupancy	LSC 38.2.4.3
	b. hazardous areas > 200 sq. ft., with an occupant load ≥3 and travel distance > 25 ft.	LSC 7.11.4
	c. > 100 occupants in "B" occupancy and travel distance > 100 ft.	LSC 38.2.4.3
	d. refrigerated rooms and refrigeration machinery rooms > 1000 sq. ft.	IBC 1014.4 IBC 1014.5
	f. electrical equipment rooms with equipment > 6 ft. wide and: 1. ≤600 volts, ≥1,200 amps 2. > 600 volts	NFC 70 110.26(C)2 NFC 70 110.33(A)1

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EXIT SEPARATION: (And Exit Access)	Remote and 1/2 the longest diagonal dimension of the building or area requiring the two exits	LSC 7.5.1.3.3
TRAVEL DISTANCE TO AN EXIT (MAX.):	250 feet - General Industrial	LSC Tbl 40.2.6
	400 feet - Ordinary Hazard Storage	LSC Tbl 42.2.6
	75 feet - High Hazard Areas	LSC 7.11.1
COMMON PATH:	100 ft max.	LSC Tbl 40.2.5 LSC Tbl 42.2.5
	100 ft. max within mechanical equipment rooms	LSC 7.12.1(1)
EGRESS WIDTH FACTOR(S):	0.20 inches per person	LSC 7.3.3.1
EXIT DOORS:		
Swing:	In direction of exit when: - serving a high hazard area - serving ≥ 50 people - serving large equipment electrical room	LSC 7.2.1.4.3 LSC 7.2.1.4.2 NFC 70 110.26(C)2 NFC 110.33(A)2
Panic Hardware:	Required where serving an assembly occupancy over 100 occupants, an "H" occupancy, or large equipment electrical room	LSC 7.2.1.5.9 LSC 12.2.2.2.3 NFC 70 110.26(C)2
Size (min.):	32" wide and 80" high min. clear opening with a max. leaf width of 48"	LSC 7.2.1.2.4
EXIT SIGNS:	Required in common corridors, and rooms where 2 means of egress are required	LSC 7.10.1.5.2
	Required where egress path is not immediately visible	LSC 7.10.1.5.1
Power:	Exit sign to be listed with emergency back up power for 90 minutes	LSC 7.9.2.1

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EGRESS PATH ILLUMINATION:	Required at all times the facility is occupied, to provide an average of 1 ft-candle at floor (0.2 ft-candle in auditoriums)	LSC 7.8.1.3
Power:	Required by emergency backup system for 90 minutes	LSC 7.9.2.1
Exterior:	Required at exterior exit discharge doors	LSC 7.8.1.1

STAIRWAYS

EGRESS WIDTH FACTOR(S):	0.3 inches per person	LSC Tbl 7.3.3.1
ENCLOSURES:	Not required around egress stairs serving mezzanines	LSC 40.2.4.1.2
Discharge:	May dump onto first floor from mezzanine	LSC 40.2.4.1.2
STAIRS Materials:	Non-combustible construction	LSC 7.2.2.3.1.2
	Handrails may be of wood	IBC 1009.5
Width:	36 inches min serving ≤ 50 occupants	LSC 7.2.2.2.1.2(A)
	Sufficient in width to handle the calculated occupant load	LSC 7.3.3
Projections Handrails:	4½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)
Trims:	4 ½ inches max. at handrail height and below on each side	LSC Tbl 7.2.2.2.1(b)
	No limit when over 80" above	LSC Tbl 7.2.2.2.1(b)

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Doors onto Landings:	Half of the required landing width (max.) with door in any position	LSC 7.2.1.4.4
	7 inches max. when door fully open	LSC 7.2.1.4.4
Rise & Run:	7.0 inch max. & 4 inch min. rise & 11 inch min. run with 1½" max. nosing	LSC Tbl 7.2.2.2.1.1(a)
	Riser to be solid, and within 30 degrees of vertical	LSC 7.2.2.3.3.3
Handrails:	Required to be continuous on both sides of stairs	LSC 7.2.2.4.1.2
Height:	34 to 38 inches above stair nosing	LSC 7.2.2.4.4.1
Size:	1-1/4 to 2 inches in diameter	LSC 7.2.2.4.4.6
	If non-circular ≥4" ≤6½" perimeter with 2.25 in^2 max. section	LSC 7.2.2.4.4.6
Clearance:	2-1/4" min. between handrail and other surfaces	LSC 7.2.2.4.5
Termination:	Returned to wall, floor or newel post, & extended horizontally min of 12 inches beyond top riser and slope for one tread width an extend horizontally 12" at bottom riser	FAS 4.9.4(2) LSC 7.2.2.4.4.9 LSC 7.2.2.4.4.10
Baluster/Guard:	Required on open sides, such that a 21 inch sphere will not pass through	LSC 7.2.2.4.5.3(2)
Height:	42 inches above adjacent walking surface and stair nosing	LSC 7.2.2.4.5.2
Head Room:	6 feet 8 inches min. above plane of tread nosing	LSC Tbl 7.2.2.2.1.1(a)
Landings:	12 feet max. vertical height between landings	LSC Tbl 7.2.2.2.1.1(a)
Width:	Equal to stair width	LSC 7.2.2.3.2.2

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Length:	Equal to stair width, needs not exceed 4 feet in straight run stairs	LSC 7.2.2.3.2.4
OTHER STAIR TYPES:		
Alternating Tread:	Permitted for exiting from equipment platforms	LSC 40.2.2.12 LSC 7.2.11
Circular:	Permitted for exiting	LSC 7.2.2.2.2.1
Spiral:	Permitted for exiting	LSC 40.2.2.3.2

CORRIDORS

PROTECTION		
Walls:	0 hour rated <NS>	LSC 40.3.6
Floors:	No special requirement in non-rated corridor	
Ceilings:	No special requirement in non-rated corridor	
Doors:	0 hour rated	LSC 40.3.6
Glazed Openings:	No limit in non-rated assembly	LSC 8.4.1
Ducts:	Fire and Smoke Dampers not required in ducts penetrating non-rated corridor walls	LSC 8.4.6
WIDTH (MIN.):	44 inches minimum	LSC 42.2.3
	36 inches when serving a calculated occupant load of 50 or less	LSC 7.3.4.1(2)
PROJECTIONS		
Doors:	Half of the required exitway width (max.) door in any position	LSC 7.2.1.4.4
	7 inches max. when door is fully open	LSC 7.2.1.4.4
Trim/fixtures:	Not permitted into required exit width except handrails	LSC 7.3.2.2

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CEILING HEIGHT:	7 feet 6 inches min.	LSC 7.1.5.1
	6 feet 8 inches above finished floor allowed for protruding objects	LSC 7.1.5.1
DEAD END CORRIDORS:	50 feet <NS>	LSC Tbl 40.2.5
	MEZZANINES	
AREA & HEIGHT:	The area of the mezzanine need not be included in the building area	IBC 505.1
	The mezzanine level need not be counted as a story	LSC 8.6.9.1.1
AREA:	1/3 or less (max.) the area of the room to which it opens	LSC 8.6.9.2.1
	Spaces enclosed shall not be counted as part of the open room (i.e. restrooms, closets)	
NUMBER:	No limit on number of mezzanines open to an area as long as aggregate area is not exceeded	LSC 8.6.9.2.2
OPENNESS:	All portions of the mezzanine to be open and unobstructed to room below, except for 42" high walls, columns and posts	LSC 8.6.9.3.1
	Exceptions - Enclosed mezzanines or portions with an occupancy load 10 (1,000 ft^2 at 100 $ft.^2$/person for industrial occupancy)	LSC 8.6.9.3.1
	- Mezzanines with two or more means of egress, one with direct access to an exit	LSC 8.6.9.3.2
EGRESS:	Two means of egress are require from mezzanines	LSC 7.4.1.1
	One means of egress permitted where the travel distance is 50 or less to an exit	LSC 7.4.1.1(2)
Travel Distance:	The travel distance along an open stair used as a means of egress (not an "exit" stair) shall be	IBC 505.3

	included in measuring the allowable travel distance and common paths	
Occupant Load:	The occupant load of a mezzanine shall be added to the room it is open to below, except where direct access to exits are provided from the mezzanine	IBC 1004.6
CONSTRUCTION TYPE:	Mezzanines shall be of a construction type equal to that required for the building	IBC 602.2
CLEAR HEIGHT:	7 ft. minimum clear ceiling height required above and below mezzanine	IBC 505.1

FIRE SUPPRESSION SYSTEMS

AUTOMATIC SYSTEMS:	Required for allowable area of II-B (000) construction	IBC 40.3.2
	Typically not required in industrial occupancies	LSC 40.3.5
Sprinkler System Supervision:	Required electronically for all control valves, tamper switches and water flow switches	LSC 9.7.2.1
Location of Fire Department Connection:	Located to be readily and easily accessible on the street side and approved by building/fire official	NFC 13 6.8.2 IBC 903.3.7
Maximum Zone Area:	52,000 sq. ft. for ordinary hazards	NFC 13 8.2.1
DESIGN CODE/STANDARD:	NFPA 13 "Installation of Sprinkler Systems" 2007 ed.	LSC 9.7.1.1

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MANUAL SYSTEMS Standpipes:	Not required	LSC 40.3.5 NFC 1 13.2.2.2
PORTABLE FIRE EXTINGUISHERS:	Recommended throughout in accordance with NFPA 10 "Portable Fire Extinguishers" 2007 ed.	LSC 40.3.5

FIRE ALARM SYSTEM

FIRE ALARM SYSTEM:	Required throughout with 100 occupants or more	LSC 40.3.4.1
Supervision:	Annunciate alarm to 24 hour manned location (approved supervising station)	FPM 7.2.G.2
Maximum Zone Area:	At least 1 per floor	NFC 72 4.4.6.6.1
AUTOMATIC FIRE DETECTION SYSTEM:	Automatic detectors not required throughout	LSC 40.3.4
MANUAL FIRE ALARM STATIONS:	At least one provided <AS>	LSC 40.3.4.2(3)
SIGNALING DEVICES Audible:	Required throughout	LSC 40.3.4.3.1 LSC 9.6.3.5
Visual:	Required in public and common areas	LSC 40.3.4.1 LSC 9.6.3.5
HVAC SHUT DOWN:	Required on activation of associated duct smoke detectors on HVAC units	NFC 90A 6.4.2.1
SMOKE DETECTORS:	Required in return air systems with a capacity of 2000 cfm or more, down stream of all air filters and in a serviceable location	NFC 90A 6.4.2.1(1)
	Required in common return riser at each floor when capacity is > 15,000 cfm	NFC 90A 6-4.2.1(2)

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	Unoccupied rooms containing fire alarm panel	NFC 72 4.4.5
ANNUNCIATOR PANEL:	Required (zoning indicator panel) to be located at an approved location	NFC 72 4.4.6.3
SECONDARY POWER:	Required by emergency system with 24 hour capacity, and 5 minutes in alarm	NFC 72 4.4.1.5.3.1
DESIGN CODE/STANDARDS:	NFPA 72 "Protective Signaling Systems" 2007 ed.	LSC 9.6.2.1

INTERIOR FINISHES

Applied Finishes:	Exempt if < .036 inches thick (wall paper, paint and veneers)	LSC 10.2.1.2
Floor Finish:	Class I or II per NFPA 253 in exit stair and exit passageways, DOC FF-1 "pill test" in all other areas, wood and linoleum are exempt	LSC 40.3.3.3 LSC 7.1.4.2
Foam Plastic:	Not allowed as interior finish or trim, unless specially approved	LSC 10.2.4.3
Trim:	Plastic trim permitted when: - density ≥ 20 pcf, - thickness ≤ ½" max., - width ≤ 4" max., - < 10% of wall area, and - flame spread of 75 or less	LSC 10.2.4.3.2
Roof Covering:	Class B min., FM Class I or UL Fire-Classified (UL790)	FPM 2.7
Exit Stairs & Passageways:	Class B, flame spread 26-75 smoke developed 450 maximum for interior finishes	LSC 40.3.3.2 LSC 7.1.4.1
Exit Access Corridors:	Class C, flame spread 76-200, smoke developed 450 maximum for interior finishes	LSC 40.3.3.2

RLF ELLERBE BECKET
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Winter Park, Florida 32789
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1001 G Street NW, Ste 1000
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Rooms: (wall and ceiling)	Class C, flame spread 76-200, smoke developed 450 maximum for interior finishes	LSC 40.3.3.2
Trim:	Class C when <10% of wall or ceiling area	LSC 10.2.5.1

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7. HEATING, VENTILATING AND AIR CONDITIONING

7.1 System Descriptions for Functional Spaces

7.1.1 Assumption for HVAC Systems

There are six distinct buildings on the site for the VAMC Orlando:

Central Plant (CEP)
Hospital, Education Center, and Veteran's Benefits Administration
Clinic
Community Living Center (CLC)
Domiciliary (Residential Rehab.)
Warehouse
Parking Garage

Drawings and calculations utilize I-P units.

No renovation in this project. This is a ground up new construction project.

Smoke evacuation systems will be provided for the atrium area in the Hospital building.

Energy Study per DOE Regulations 10 CFR Part 435, "Energy Conservation Voluntary Performance Standards for Commercial and Multi-family High Rise Residential Buildings" will be provided for the selected option.

Site location is in a hurricane area and the Natural Disasters Non-structural Resistive Design Guide will be addressed in the design along with other hurricane area considerations.

The design is intended to comply with LEED Green Building Guidelines for New Construction. This may introduce additional cost into the design and construction process by adding specific documentation and tracking requirements to these processes to insure compliance with USGBC requirements. Likewise it may add cost to construction.

Design Criteria Codes, Standards and Guidelines

HVAC Design Manual, February 2008 - Department of Veterans Affairs, Office of Facilities Management

Guidelines for Design and Construction of Hospital and Health Care Facilities; 2001 Edition, AIA/AAH

Florida Building Code, 2001 Edition
Florida Mechanical Code, 2001 Edition
National Standard Plumbing Code (PHCC), 2006 Edition
NFPA – 13 2002 Edition, National Fire Codes
NFPA – 14 2003 Edition, National Fire Codes
NFPA – 20 2003 Edition, National Fire Codes
NFPA – 24 2002 Edition, National Fire Codes
NFPA – 54 2006 Edition, National Fire Codes

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NFPA – 55 2005 Edition, National Fire Codes
NFPA – 90A 2003 Edition, National Fire Codes
NFPA – 99 2005 Edition, National Fire Codes
NFPA – 211 2006 Edition, National Fire Codes
NFPA – 1963 2003 Edition, National Fire Codes
ASHRAE Standard 90.1-2004; Energy Standard for Buildings Except Low-Rise residential Buildings
ASHRAE Standard 62-2001; Ventilation for Acceptable Indoor Air Quality
Standard 52.1-1992 -- Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General
Ventilation for Removing Particulate Matter
Standard 52.2-1999; Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency
by Particle Size
ASHRAE Standard 15-2001; Safety Code for Mechanical Refrigeration
ASHRAE Handbooks
ASPE Handbooks

7.1.2 Central Energy Plant

A freestanding central energy plant building is proposed to house steam boilers, electric-driven water-cooled centrifugal chillers, associated pumps, tanks, and equipment. The cooling towers are currently planned to be installed above the CEP roof. Steam boilers will fire primarily with utility supplied natural gas and will utilize number 2 grade oil as a redundant fuel source. The central energy plant will serve virtually all of the buildings on the campus. Chilled water and steam will be distributed from the CEP to each building.

The Central Energy Plant (CEP) includes spaces for electrical equipment; primary power and standby power, an engine-generator system, a steam boiler system, a chilled water system, and ancillary spaces for personnel. Chilled water equipment will be separated from the boiler equipment by a fire rated wall. Additional fire rated separations are included between the electrical equipment rooms in accordance with NFPA. The campus fire pumps will be located in a dedicated fire rated room in accordance with NFPA. The CEP building will also include a control room for the plant operator, toilet and locker rooms, office spaces and a storage room. The boiler system control terminal, chiller system BAS terminal and a campus BAS terminal will be located in the CEP control room.

7.1.3 CEP Chilled Water System:

The cooling plant is proposed to utilize electric-driven water cooled centrifugal chillers to generate chilled water for cooling and dehumidification. The water chillers are located on the ground floor level of the CEP; directly accessible to the exterior from grade. The cooling towers are located above the roof on a grillage steel system. The chilled water and condenser water pumps are located in the chiller room. Piping will extend through the chiller room and above the roof at the cooling towers to connect to the equipment.

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The estimated ultimate campus load including the requested future load projection is approximately 7455.45 tons. The design suggests a seven chiller array; with one machine out of the operational rotation. With six chillers to accommodate the peak load, the empirical capacity requirement for each chiller is 1242.5 tons; the design includes seven equally sized chillers, each at 1250 tons capacity. The base load for the campus is anticipated to be in the range of 2743 to 3429 tons. The base load will utilize three chillers operating in the 80 to 90% of full load range.

The present day campus load is approximately 5126.7 tons. Under the current construction project, six of the seven chillers would be installed; one space for a chiller in the CEP has been allocated for the projected future growth. Five of the six chillers will be required to accommodate the present day campus peak load, each operating at 82% of full load. The present day base campus load is in the range of 1993 to 2449 tons. The base load will utilize a minimum of two chillers operating in the 80 to 98% of full load range.

The Joint Venture will continue to analyze the chiller sizes and efficiencies as the project progresses.

The cooling plant is sized for seven 1250 ton water chillers, six of which, would be provided under this construction contract. The six chiller array will maintain one machine out of the operational rotation for redundancy. The chillers will each include an electric-driven centrifugal compressor, evaporator bundle, condenser bundle, solid state motor starter and microprocessor based control system. The heat exchanger bundles will be shell and tube type, equipped with marine water boxes to enable tube access with no disturbance to the connected piping systems. The chiller cooling components will be covered with a two-inch thickness of flexible unicellular insulation.

An energy simulation was conducted to compare traditional primary-secondary pumping verses variable primary pumping (see section 18). The analysis realized an overall energy cost savings of 1% with variable primary pumping. The variable-primary pumping system will be a factory fabricated unit consisting of multiple horizontal split-case centrifugal pumps, variable speed drives for each pump, and an industrial grade programmable logic control system; entirely mounted on a structural steel skid. The package will be installed on a reinforced concrete pad within the chiller plant. The variable-primary control system automatically stages the capacity and number of chilled water pumps to maintain the campus chilled water loop pressure, with the objective of using the least amount of pumping energy. This control system also commands the start and stop of the water chillers based on the monitored chilled water system flow rate and loop temperatures.

In addition to the energy conscious aspects of variable volume pumping, the variable-primary system virtually eliminates chilled water mixing in the decoupler loop. Equipped with an automatic control valve, the decoupler is opened only when necessary to enable minimum flow through the evaporators or prevent an excessive flow through the evaporators during chiller staging anticipation.

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A chilled water setpoint of 42 degrees F with a ΔT of 14 degrees has been established to decrease chilled water pump energy while maintaining a low chilled water coil airside pressure drop characteristic. The chillers have been selected for high efficiency operation to provide a low part-load kW/ton with the available ambient peak condenser water temperature range of 85 entering to 95 degrees F leaving. The chiller integral microprocessor will control the chiller capacity.

The chillers will utilize either R-123 or R-134a refrigerant. Based on the initial loads, a full load efficiency of 0.585 kW/ton and a part load efficiency of 0.497 kW/ton can be obtained. It has been validated that three chiller manufacturers can provide this performance. The chillers will interlock via a LonWorks or Bacnet protocol to the variable-primary pump package control system. In addition, the chiller manufacturer will be required to provide a gateway panel utilizing either Bacnet or LonWorks protocol to communicate to the CEP BAS.

Refrigerant safety devices will be provided in accordance with the requirements of the Safety Code for Mechanical Refrigeration. Each chiller will be fitted with a mechanical refrigerant safety valve; piped to the building exterior. A microprocessor based refrigerant leak detection system will be installed integral to each chiller An emergency exhaust system will be provided and activated in the event of a refrigerant leak.

Cooling towers will be provided to support the heat rejection needs of the water chillers. The cooling tower array is similar to the suggested chiller array; space and grillage steel for a total of seven cooling tower cells has been incorporated into the CEP flat roof design. Under this project, six of the seven cells will be installed; one cell will be maintained out of rotation for redundancy. The cells will each be field erected, constructed of stainless steel, including the sump, hot wells, structure and enclosure. The fill will be PVC corrugated sheet material. The cooling towers will each be equipped with a vertical discharge shaft-drive axial fan, grear-reducer and electric motor. Variable frequency drive motor starters will be provided for each cooling tower fan motor. The cooling tower system will operate based on the common condenser water temperature needs of the chillers. Each cooling tower cell is sized to cool 3,750 gpm from 95 degrees F to 85 degrees F with the requisite ambient wet-bulb temperature target of 80 degrees. High efficiency fans will be used to mitigate sound levels to 60 dba.

A condenser water pump system will be provided for the chillers. The pumping system will be a factory fabricated unit consisting of multiple horizontal split-case centrifugal pumps and constant speed motor starters for each pump, installed on a structural steel skid. The package will be installed on a reinforced concrete pad within the chiller plant. A common condenser water pump piping circuit with automatic motorized valving will allow the rotation of condenser water pumps and cooling tower cells independently. Each cooling tower cell and condenser water pump will be capable of serving any chiller. An automatic two-way bypass control valve will be installed in the condenser water circuit to prevent excessive cooling tower fan cycling. The cooling tower sumps will be interconnected and water level equalized. The common sump will be equipped with dual electronic probe type automatic make-up water level controllers with motorized make-up water control valves. Sump level detection and make-up water introduction will occur at

two locations in the cell bank to enable cells being taken out of service for maintenance. The condenser water return piping circuit will also include and automatic blow down system. Sump overflow piping will be provided at two locations. The condenser water system will be equipped with dual side stream separators and filters to remove solids from the condenser water.

A chemical treatment system will be provided for the condenser water system and will consist of multiple chemical feed pumps, injection assembly, microprocessor based conductivity controller and automatic blow down solenoid valves. A combination of rust-inhibiting chemical, biocide and algaecide will be automatically introduced to the condenser water circuit to minimize scale and biological growth within the tower cells and will also provide corrosion protection. The project specifications will require one-year of chemical treatment service to be provided as part of the construction contract.

The chilled water piping system will be equipped with dual sidestream cartridge filters to capture small particulate. The chemical treatment system for the chilled water system will include a chemical shot feeder for the manual introduction of chemicals.

The aboveground chilled water and condenser water piping is proposed to be schedule 40 black steel with malleable steel threaded and forged steel butt welding fittings for pipe sizes up to and including 12 inch. Standard weight black steel piping with forged steel butt welding fittings will be used for pipe sizes 14 inches and larger. Piping 2 inches and small will be threaded construction with malleable steel threaded fittings. Seamless copper, hard drawn tubing with wrought copper fittings is proposed to be optional for pipe sizes 2 inches and smaller.

Chilled water piping will be insulated with pre-formed cellular glass insulation with a kraft paper vapor barrier adhesive lap jacket. The chilled water pumps will be insulated with cellular glass insulation board; shaped to for a box around the pump volute, covered in a metal reinforced, field applied, kraft paper vapor barrier jacket with sealed lap strips. The expansion tanks and pipeline strainers will be insulated with flexible unicellular material. Except for strainer insulation, the chilled water piping insulation will be externally covered with light gage stainless steel jacketing.

7.1.4 CEP Heating Plant:

A Life Cycle Cost (LCC) Analysis was conducted in accordance with the S2 submission requirements. The study material is provided in sections 13 and 14. The results of the study suggested the use of a high-pressure steam boiler system to provide a heating energy to the campus. The design has progressed with the high-pressure steam boiler system.

The estimated ultimate campus load including the requested future load projection is approximately 86300 lbs/hr. The design includes a five boiler array; with one boiler out of the operational rotation. With four boilers to accommodate the peak load, the empirical capacity requirement for each boiler is 21575 lbs/hr (625 bhp); the design includes five equally sized boilers, each rated to deliver 25875 lbs/hr (750 bhp) capacity. The base load will utilize two boilers operating in the 66 to 83% of full load range.

The present day campus load is approximately 71386 lbs/hr. Under the current construction project, four of the five boilers would be installed; one space for a boiler in the CEP has been allocated for the projected future growth. Three of the four boilers will be required to accommodate the present day campus peak load, each operating at 91% of full load. The base load will utilize a minimum of two boilers operating in the 55 to 70% of full load range.

Similar to the chilled water system, the Joint Venture will continue to analyze the boiler sizes and efficiencies as the project progresses.

The steam system will be equipped with four factory fabricated firetube style steam generators, each with an output capacity of 750 bhp. The boilers are located on the ground floor level of the CEP; directly accessible to the exterior from grade. Each steam generator will be outfitted with a combination natural gas and low sulphur grade #2 fuel oil burner, configured for forced draft combustion. The burners will be trimmed for low NOX operation to minimize environmental impact. The boilers will be equipped with a variable speed forced draft burner blower, a fuel oil pump, an atomization air compressor, modulating feedwater controls and additional combustion safeguard devices. Each boiler will be equipped with triplex independent safety relief valves and a stop-non-return valve at the steam drum outlet. The boilers will be specified to be wet-back design, commercially available from at least two nationally recognized boiler manufacturers. The boilers will also be equipped with dual bottom blowdown connections and a continuous surface blowdown connection.

A flue gas stub-stack will be provided for each boiler. The inner boiler flue gas stack components will be constructed of stainless steel. The stack outer casings will be aluminized steel. The stack will be a double wall insulated type, extending from the boiler outlet through the roof, terminating at a rain cap above the roof level. The base tee of each stack will be equipped with a condensate drain. A flue gas economizer will be provided in each boiler stack. Each economizer will be an ASME pressure vessel, finned tubular type with integral flue gas bypass.

The boilers will be supplied by a condensate/boiler feedwater handling system consisting of a condensate surge tank, condensate transfer pumps, deaerator-feedwater heater and boiler feed pumps.

The condensate storage tank will be a horizontal configuration ASME steel tank with saddles, vented to the atmosphere. The storage tank will be sized to accommodate a 20-minute plant firing rate, and consider condensate return surge flows from the campus. The tank interior will be coated with an epoxy based corrosion resistant lining. The tank will be equipped with an integral elliptical manhole. Make-up water to the steam boiler system will normally be introduced at the condensate storage tank. The make-up water system will provide softened/treated water as a primary service, and non-treated potable water for emergency back-up. Make-up water introduction will be regulated through an automatic control valve in each service, with an electronic probe level controller at the condensate storage tank. Low and high water alarms will be provided. Campus pumped condensate return water and additional CEP low pressure

condensate returns will be piped to the storage tank. Bypass piping will be provided around the condensate storage tank to enable maintenance.

Steam condensate will be transferred to the from the storage tank to the dearator as required to maintain the water level in the dearator tank. The condensate pumps will be multiple-stage centrifugal type; three pumps total, each sized to provide 50% of full flow. The pumps will each be equipped with a recirculating valve and piping to the condensate storage tank. Condensate transfer bypass piping will be installed to enable the deaerator to be removed from service for periodic maintenance.

The deaerator will be a tray type unit, including an ASME horizontal stainless steel tank with saddles. Deaerator water level will be maintained through an electronic probe type water level controller. Low and high level alarms will be provided. An intermediate level setting will enable the emergency introduction of make-up water to the system at this location. Plant steam will be provided to the dearator to maintain the tank fluid temperature. The tank will be equipped with an integral elliptical manhole. The deaerator will also be equipped with dual independent steam safety relief valves, piped to the building exterior. A steam pressure-reducing station will be provided to serve the deaerator. Chemical treatment will be added to the deaerator to encourage oxygen scavenging. Deaerated water will be stored until required by each individual boiler. The tank will be maintained under pressure, but vented to the atmosphere at a rate to allow oxygen dispersion.

An array of four multiple stage centrifugal boiler feed pumps will be provided; one per boiler. The pumps will be connected to a piping manifold and equipped with automatic shutoff valves to enable any pump operation with any boiler. The pumps will each be equipped with a recirculating valve and piping to the deaerator. Boiler feedwater will pass through the flue gas economizers for heat recovery pre-heat. Boiler water level will be maintained by an electronic probe type proportional water level controller. The boiler feedwater valves will be globe-body pattern with a modulating electric actuator and piping bypass.

Boiler blowdown systems will be provided. Each boiler will be equipped with dual globe-body and quick opening knife-gate valves on the drum bottom; fore and aft, and a continuous blowoff valve on the steam drum at the water level. The bottom blowdown piping will extend to a fabricated steel ASME blowoff tank with automatic discharge cooling valve and vent connection. The continuous blowoff piping systems will extend to a blowdown economizer which includes a shell and tube heat exchanger for heat recovery, a flash style blowdown separator, and automatic discharge cooling valve.

Water sample cooler systems will be provide for the boilers and deaerator to enable testing of the water in each boiler, testing of the deaerator and the water softner system. The sample coolers will allow for water specimens to be extracted from each device and cooled to the proper handling temperature. The sample coolers will be integrated to a casework with test sink work area.

Each boiler will be equipped with a chemical feed tank, agitator and pump for chemical introduction to the boiler. The deaerator will be similarly equipped. The chemical feed

piping will be constructed of stainless steel. The chemical feed equipment and sample equipment will be located on the boiler operating level.

A plant steam setpoint of 90 psig is suggested based on pressure requirements of the sterilizer equipment within the Hospital. The steam pressure will be reduced within the Hospital and other buildings to serve lower temperature heating appliances. For purposes of this text, steam at a pressure of 61 to 90 pisig is considered high-pressure, steam greater than 15 psig to a pressure of 60 psig is considered medium-pressure. Steam from 0 to 15 psig is considered low pressure. Steam pressure regulating stations will be installed where required, consisting of isolation valves, pressure regulators, bypass piping with throttling valve and pressure relief valves. Each station will include the criteria requisite 1/3 and 2/3 regulating arrangement.

Steam piping will be constructed of schedule 40 black steel piping with malleable steel threaded and forged steel butt welding fittings. The condensate return, boiler feed water, blowoff and blowdown piping will be constructed of schedule 80 black steel, with extra heavy malleable steel threaded and forged steel butt welding fittings.

Steam, condensate, boiler feed and blowoff piping will be covered with pre-formed fiberglass insulation with a kraft paper adhesive lap jacket. The condensate transfer and boiler feed pumps will be insulated with rigid fiberglass insulation board; shaped to for a box around the pump volute, covered in a metal reinforced field applied kraft paper jacket with sealed lap strips. The condensate storage tank and deaerator will be insulated with rigid fiberglass board material, scored and shaped to match the tank radius, sealed with a field applied kraft paper jacked with sealed lap strips. All field-applied CEP piping and equipment insulation will be externally covered with light gage aluminum jacketing.

A central accessible steam valve header will be provided for equipment isolation. The header will be located at the operating floor level for ease of operation. Each boiler connection will be individually valved for isolation. The steam header will include valved connections for the campus main system, the CEP systems, and the system test muffler.

A mezzanine and catwalk system will be installed above the boilers to enable access to the boiler top components.

The boiler system will be equipped with an industrial grade central plant monitoring and control system. The monitoring system will gather data from the individual boiler combustion control systems, enable aggregate boiler control/modulation, obtain data from the deaerator/boiler feed system and the condensate transfer system. The system will be configured with an operator workstation computer for system interrogation. The workstation will be installed in the plant office. Totalizing flow meters will be provided on the natural gas, fuel oil, and steam related to each boiler. Additionally, steam flow meters will be provided in the plant and campus steam mains.

Steam traps will be provided for all steam-fired equipment. Float and thermostatic traps will be provided for modulating and low-pressure steam equipment and coil loads.

Inverted bucket traps will be provided on high pressure drip locations, bi-mettailc traps will be provided for low-pressure drip locations.

The CEP will be equipped with a heating system to serve the boiler room, chiller room, electrical equipment rooms and auxiliary spaces. The system will include two shell and tube heat exchangers, end-suction centrifugal pumps, and air control specialties. The system will distribute heating water to the CEP AHU, fan coil units and unit heaters. The heat exchanger system will utilize two variable speed base-mounted pumps, each sized to provide 100% of the connected load.. The winter design heating water temperature of 180 °F will be automatically reset downwards corresponding to the outdoor temperature; as the outdoor temperature rises above the winter design temperature of 37°F. The reset temperature will be verified by the AHU and space thermostats though the DDC to verify heating needs.

Chemical treatment equipment will be provided for the heating water piping circuit. The hot water loop will be outfitted with a shot type feeder for bulk chemical injection near the circulation pumps and a sidestream cartridge filter.

7.1.5 CEP HVAC

The boiler room located in the CEP building will be ventilated. Combustion air openings will be provided in the boiler room to comply with applicable codes. A single zone air handling unit with ductwork system will be provided to maintain environmental control of the personnel spaces.

The chiller room, boiler room, fire pump room and engine-generator room will be equipped with propeller type unit heaters with hydronic hot water heating coils. Each unit heater will be equipped with an electric thermostat and modulating control valve.

Mechanical ventilation equipment will be provided in the chiller room, boiler room, fire pump room and engine-generator room. A series of roof exhaust fans will be provided at the inboard area of the chiller room and engine-generator room. Additional exhaust fans with ductwork will be provided at the rear of the chillers; duct drops to the floor level will be provided to comply with ASHRAE-15. The exhaust fans will be controlled to maintain room temperature above the control range of the unit heaters. The chiller room fans will also be capable of automatic emergency activation through the detection of a refrigerant leak. Intake air will be obtained through exterior wall louvers.

Mechanical ventilation equipment will also be provided in the boiler room. A series of supply fans will be provided above the boilers and deaerator. The supply fans will be controlled to maintain room temperature above the control range of the unit heaters. Excess air will be relieved through exterior wall louvers. Combustion air louvers will be provided in accordance with NFPA.

Four-pipe fan coil units will be provided for electrical spaces with temperature and humidity sensitive equipment.

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7.1.6 CEP Fuel Oil System

Fuel oil systems will be required for the emergency generator engines and steam boilers. Each system will consist of multiple below ground fuel oil storage tanks, belowground containment piping, fuel oil transfer pumps, fuel filter systems and aboveground interior piping, Fuel storage assets have been sized to provide seven days of fuel at full equipment fire.

The engine-generator fuel system includes seven 30,000 gallon underground storage tanks. The tanks are connected through containment piping to a triplex transfer pump set; each pump will be rated at 50% of the aggregate engine flow rate. Each engine-generator will be equipped with a day tank. The engines will draw fuel oil from the day day tanks and return unused oil to the underground storage tanks. Each day tank will be equipped with an inlet pressure regulator, triplex Racor type final filter, solenoid valve with bypass and a manual hand pump. Dual filtration systems will also be provided for the underground fuel oil storage tanks. Each system will be a factory packaged unit consisting of a coalescing filter, pump, moisture separator and waste water tank. The systems will draw fuel independently from the transfer pump system; cycling each storage tank in a prescribed order. The fuel systems will each be equipped with a programmable logic controller. A remote filling system will be provided for the fuel oil storage tanks. The system will enable vehicular transport to connect near the loop road and select the tank to be filled. The fueling station will be a factory engineered system including tank selection switches, high level alarms, enclosed in a weatherproof secure cabinet.

The boiler fuel system includes three 25,000 gallon underground storage tanks. The tanks are connected through containment piping to a triplex transfer pump set; each pump will be rated at 50% of the aggregate boiler flow rate. The fuel oil transfer pumps will circulate oil from the storage tanks to an interior 5 psig pressurized loop; boiler will draw from the loop as required. Unused fuel will return to the underground storage tanks. Similar to the engine-generator fuel system, dual filtration systems and a remote filling station will also be provided..

Each fuel oil system will be provided with a microprocessor based fuel oil inventory and leak detection system.

Above ground and interior piping will be schedule 40 black steel with socket welded forged steel threaded fittings. Below ground piping will be a containment system consisting of black steel carrier piping and FRP containment jacketing.

Each below ground fuel oil tank will be constructed of steel; double wall with accessible interstice. The tank exterior will be factory coated with a spray application of FRP. The tanks will be equipped with galvanic cathode protection systems. The tanks will be each be equipped with an interior access manhole with ladder and a containment piping access space for the tank connections.

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7.1.7 Site Heating and Cooling Piping Systems

A District style energy distribution system of below ground piping and valve vaults has been indicated.

Belowground steam and condensate piping will be double wall factory fabricated systems consisting of schedule 40 piping for steam and schedule 80 for condensate black steel carrier piping, mineral wool insulation, an air space, and standard weight spiral welded steel exterior casing with epoxy coating. The system will be dryable/drainable. Reinforced concrete thrust blocks will be used at piping anchor points. The pipe casings will include integral welded steel anchors. The internal carrier pipe will be anchored and guided for thermal expansion towards expansion loop locations. Adequate space will be specified to allow for internal thermal expansion. The casing will be coated with a corrosion resistant compound. Holiday testing of the installed piping will be specified. The piping systems will be pitched to ensure positive condensate drainage to drip locations.

The chilled water piping will consist of schedule 40 carrier piping for pipe sizes up to and including 12 inches, standard weight for sizes exceeding 12 inches. The piping will be factory insulated with a one inch thickness of extruded polyurethane foam and covered with an HDPE exterior jacket.

A galvanic cathodic protection system will be provided for the below ground steam, condensate and chilled water piping. The system will use a series of magnesium anodes, tracer wire and multiple test stations.

Valve vaults are indicated at major junction points in the below ground piping system. The vaults will contain shutoff valves and supplemental condensate return equipment. The vaults will be constructed of cast-in-place concrete; waterproofed, and include and access door for egress and equipment removal. Each condensate return system will include an ASME internally epoxy lined storage tank with electronic probe type level controller, dual multiple-stage centrifugal condensate pumps and associated piping. A flash tank will be provided in each for high pressure drip stations. The vaults will be force ventilated with exhaust fans. Each vault will be equipped with a duplex plumbing drainage sump pump and controller, and grade level fault strobe with identification.

Piping and tanks within the valve vaults will be insulated similar to that noted for above ground piping systems within the CEP.

7.1.8 CEP Engine Generator Exhaust Piping

Engine exhaust piping (including incidental drains) shall be constructed of black steel with forged steel buttwelding fittings for pipe sizes up to and including 12 inches. Engine exhaust piping in excess of 12 inches shall be constructed of standard weight black steel with forged steel buttwelding fittings. Piping, including the mufflers (muffler supplied by the generator manufacturer) will be insulated with two layers of calcium silicate insulation, for a total thickness of 6 inches.

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7.1.9 CEP Emissions Control:

The VAMC Orlando Campus is currently in an attainment compliant area for airborne emissions. There are no known State of Florida restrictions supplemental to Federal regulation regarding equipment and appliances planned for the CEP. Restrictions generally limit the quantities and types of emissions per appliance. EPA certified emissions engine generator units are currently required by State mandate. The engine-generators and boilers will utilize low-sulfur fuel.

It is anticipated that the emissions resulting from the CEP boiler burners will eventually violate State and Federal emissions restrictions, potentially necessitating costly field equipment conversion.

As part of this project, the boilers will be equipped to provide a low emissions impact within the range of practicability, using current technology. The new boilers will be equipped with low NOX high efficiency burners. The anticipated infrequent of use of the engine-generators does not validate the need for supplemental catalytic convertor technology at the engine muffler locations.

7.1.10 Hospital with Clinic, Education Center, and Veteran's Benefits Administration:

HVAC systems provide air to spaces for occupant comfort and well being. HVAC system will be comprised of multiple air handling units with each unit serves a service module. A service module is a space in the Hospital that includes functional space, equipment space, duct space, electrical space and an interstitial service area and typically defines a smoke zone within the Hospital.

Typical unit construction will be a custom double walled unit with dual path ventilation and return, each with air intakes, chilled water cooling coil. Outside air path will also have upstream hot water heating coil. Prefilter bank will be upstream of coils. Plug style direct-drive supply air fan with premium efficiency motor will be used. Dual path preconditioned outside air direct-drive plug fan custom air handling unit is selected. Final filter will be downstream of supply fan, (Surgery, Recovery, ICU and units with HEPA filtration), humidifier, and supply air plenum sections. Units are pre-packaged factory fabricated and assembled for field installation. There will be approximately 27 serving hospital and 20 serving clinic, units that will deliver between 20,000 and 45,000 CFM to the space. The return fan will be inline. Upper limit cfm per AHU is slightly higher for a few AHU's than VA HVAC design guide, however, this exception has been approved by VACO. The air handling units for the clinic are scheduled on the submittal drawings. The list of air handling units for the hospital is as follows:

Hospital

H-AHU-1	38,000 cfm	Serves 1st floor (VBA, Lobby Chaplain)
H-AHU-2	24,000 cfm	Serves 1st floor (EMS, ED)
H-AHU-3	5,000 cfm	Serves 1st floor
H-AHU-4	40,000 cfm	Serves 1st floor (MAS, Biomed, Lockers)

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H-AHU-5	45,000 cfm	Serves 1st floor (Dietetics)
H-AHU-6	45,000 cfm	Serves 1st floor (Radiology)
H-AHU-7	15,000 cfm	Serves 1st floor (Nuclear Medicine)
H-AHU-8	15,000 cfm	Serves 1st floor (PET / CT)
H-AHU-9	15,000 cfm	Serves 1st floor (MRI)
H-AHU-10	36,000 cfm	Serves 2nd and 4th floors (Mental Health Unit #1 and Nursing1)
H-AHU-11	36,000 cfm	Serves 2nd and 4th floors (Mental Health Unit #2 and Nursing 2)
H-AHU-12	18,000 cfm	Serves 2nd floor (Corridor, Staff)
H-AHU-13	39,000 cfm	Serves 2nd floor (Lab)
H-AHU-14	14,000 cfm	Serves 2nd floor (Sleep, Lab)
H-AHU-15	23,000 cfm	Serves 2nd floor (Pharmacy)
H-AHU-16	22,000 cfm	Serves 2nd floor (MAS)
H-AHU-17	10,000 cfm	Serves 2nd floor (Tele, Triage)
H-AHU-18	18,000 cfm	Serves 1st floor (Med, Surgery, Neur Nursing Units)
H-AHU-19	21,000 cfm	Serves 3rd floor (CICU, MICU, SICU)
H-AHU-20	42,300 cfm	Serves 3rd and 4th floors (Corridor, Lobby, Oncall, Rehab)
H-AHU-21	39,000 cfm	Serves 3rd floor (Surgery)
H-AHU-22	36,000 cfm	Serves 3rd floor (Surgery)
H-AHU-23	20,000 cfm	Serves 3rd floor (PACU)
H-AHU-24	45,000 cfm	Serves 3rd floor (Outpatient Surgery, Pre-Op, Offices)
H-AHU-25	16,000 cfm	Serves 3rd floor (SPD)
H-AHU-26	17,000 cfm	Serves 4th floor (IRM)
H-AHU-27	38,000 cfm	Serves 4th floor (Admin)

Air handling units are sized to account for duct air leakage and safety factor per VA design requirements. Load calculation performed using Trace.

Units designed as variable air volume with terminal reheats serve Corridors, Dining rooms, Exam rooms, Kitchens, Patient rooms, and Treatment rooms.

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Units / spaces designed as constant air volume with terminal reheat serve Autopsy suite, Dark room, Dialysis room, ICU, BMT, Isolation rooms, Laboratories, OR, Minor OR, Recovery, SPD, Special Procedure rooms, Smoking rooms, Storage rooms, and Waiting rooms.

Air from units providing 100% outside air to the space they serve will have air to air heat reclaim systems. The reclaim system will prevent cross contamination of the air streams.

Ventilation air or outside air will be introduced to a space to create acceptable indoor air quality for the occupants per VA HVAC Design Manual. Areas served with 100% outside air will be Autopsy Suites, Complete SPD Suite, Laboratories, and Surgery Suites. Other areas are provided with outside air quantities specified by ASHRAE Standard 62, 1-2004 or VA HVAC design guide whichever is more stringent. Care has been taken when designing location of outside air intakes to avoid intake of exhaust outlets, plumbing vents, motor vehicle exhaust, and aviation exhaust.

Air filter efficiencies will comply with test method specified by ASHRAE standard 52.1 and ASHRAE standard 52.2. All air handling units will have final filters located downstream of supply air fans.

Ductwork construction and design considerations will be in accordance with the general rules outlined in latest ASHRAE Guide and Data Books, SMACNA Manuals, and Design Guide Section of Associated Air Balance Council Manual. Supply duct system with total external static pressure 2 inches water gage and greater will be designed for a maximum velocity of 2500 fpm for mains and maximum static pressure 0.25 inch water gage per 100 ft of duct. Static pressure loss and regain will be considered in calculating the duct sizes and supply branch ducts will be sized for a maximum velocity of 1500 fpm. Return and exhaust duct system with total external static pressure less than 2 inches water gage will be designed for a maximum velocity of 1500 fpm for mains and branches and a maximum static pressure 0.10 inch water gage per 100 ft. The minimum duct size will be 8 in x 6 in. Specialty duct systems including fume hood and kitchen exhaust are designed to NFPA and VA HVAC guidelines.

Temperature controls or building automation system, BAS, will be a Direct Digital Control, DDC, system with electronic operators. BAS will monitor and control environmental conditions throughout the building. The BAS will monitor or control space temperature and humidity, outside temperature and humidity, heating water flow and temperature, chilled water flow and temperature, smoke control system, and air handling unit status. This list is representative and not intended to be all-inclusive. The primary BAS workstation will be located in Facility Engineers office in the warehouse building. The secondary BAS workstation will be located on the 4th floor of the hospital in the emergency command area. BAS workstation and will be connected to local control panels located throughout the building. Final selection of BAS system will be discussed and confirmed by the VA.

Hurricane design will be used for these buildings. Hurricane style louver will be used for air intakes.

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7.1.11 Heating and Cooling Water:

Comfort heating water will be generated in the CEP and piped to a dedicated mechanical space in the Hospital building.

Mechanical room in hospital and mechanical room in clinic will each house two horizontal centrifugal pumps and two associated heat exchangers. Space will be allowed for future heat exchanger and pump as allowance for future building expansion needs each sized for 100% of the total flow space to circulate heating water through the building. Pumps will be on variable speed drives to maintain constant pressure in the heating water system.

Heating water system will serve coils in air handling units, reheat coils for zone control, unit heaters and cabinet unit heaters.

There will not be a perimeter heating system. The building envelope will comply with the VA HVAC Guideline and the minimum temperature is above 20 Deg F.

Heating water system will be connected to the BAS to monitor temperatures, flows and alarms.

Aboveground heating water piping will be constructed of schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will be located in service area shafts.

Comfort chilled water will be generated in the CEP and piped through service tunnels to a dedicated mechanical space in the Hospital and in the Clinic.

There will be no chilled water pumps located in each building. Variable flow primarily chilled water pumps will be located in CEP.

Heating water piping between Hospital and Clinic will be interconnected for emergency backup (and to satisfy VA HVAC Design Manual for site requirements) via routing through the tunnel. Valves will be provided for normal isolation.

7.1.12 Cooling Water System will Serve Coils in Air Handling Units:

Cooling water system will be connected to the BAS to monitor temperatures, flows and alarms.

Aboveground cooling water piping will be constructed of schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will be located in service area shafts.

An air-cooled chiller will be provided to serve the lower temperature needs of surgery. The series coil arrangement, as described in February 2008 VA HVAC Design Manual will be used. The downstream coil will be served by the CEP chilled water system. The VA Design Guide requirement to serve ICU from and air cooled chiller, has been waived for this project due to redundancy and emergency power backup of CEP chilled water systems. Mechanical room in hospital and mechanical room in Clinic will each be fed with chilled water from CEP. Chilled water piping between Hospital and Clinic will be

interconnected for emergency backup and to satisfy VA HVAC Design Manual site loop requirements.

7.1.13 Steam and Condensate:

High pressure steam will be generated in the CEP and piped to a dedicated mechanical space in the Hospital building and in the clinic.

Steam will be used to generate potable hot water, steam for HVAC humidification, equipment sterilization, kitchen equipment, and steam gun sets.

There will be a steam to steam heat exchanger (clean steam generator) that uses high pressure steam to generate low pressure steam for HVAC humidification. Low pressure steam will be piped to air handling unit humidifiers.

Steam Gun Sets will be used for wash down of equipment in the trash room, manual cart wash in Dietetics, and manual cart wash in SPD.

Steam pressure reducing station will be used to convert high pressure steam delivered from the CEP to the steam pressures required in the Hospital to comply with VA HVAC Design Manual criteria, high pressure steam will be reduced to respective pressure required with multiple single stage reducing stations; multiple step reducing stations will not be used. A 1/3 – 2/3 capacity will be used for sizing reducing valves for each step. Single by-pass with globe valve will be required will be used for each pressure reduction step.

Aboveground steam and condensate piping will be constructed of schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will be located in service area shafts. Piping will have expansion loops in long horizontal runs to allow for expansion and contraction.

High pressure condensate will be routed to a flash tank.

Duplex condensate pumps with associated control panel with alternator will be used to return condensate from the Hospital and from the Clinic to the CEP.

Steam traps for the low pressure system will be float and thermostatic. Steam traps for the medium and high pressure steam will be inverted bucket type with thermostatic air vent.

7.1.14 Community Living Center (CLC):

Fan coil units (FCU's) were selected to provide individual temperature control for each patient room. The FCU's will provide optimum comfort control and will have the ability to either heat or cool year round. A traditional VAV system was considered however, for effective heating the VAV box turndown would be limited to 50%, thus, decreasing the energy efficiency realized by a VAV system. The system will be comprised of multiple 100% outdoor air handling units serving individual room fan coil units located at each wing. Rooms and room modules will be conditioned by room fan coil units. The room fan coil units are the four-pipe type with heating water coil, chilled water coil and centrifugal fans. Replaceable filters are located at the ceiling return register. Outdoor

air for ventilation of occupants is supplied to the fan coil units by the 100% outdoor air unit. The outdoor air unit supplies conditioned air at a constant air flow rate to fan coils in each room. Each fan coil unit will be provided with a thermostat and fan speed controller. The DDC system will be used to set limits on temperature set points/overrides and provide occupied and unoccupied control.

Ventilation air or outside air will be introduced to a space to create acceptable indoor air quality for the occupants. Areas are provided with outside air quantities specified by ASHRAE Standard 62-2001 or VA HVAC design module whichever is more stringent. Ventilation air will not be less than 15% of the total supply air. Care will be taken when designing location of outside air intakes to avoid intake of exhaust outlets, plumbing vents, motor vehicle exhaust, and aviation exhaust.

Air filter efficiencies will comply with the test method specified by ASHRAE standard 52.1. Air Filtration for air handling units will have 2" pre and 4" intermediate filters located at the upstream side of the supply air fan and the filters will be located in same filter frame.

Ductwork construction and design considerations will be in accordance with the general rules outlined in latest ASHRAE Guide and Data Books, SMACNA Manuals, and Design Guide Section of Associated Air Balance Council Manual. Supply duct system with total external static pressure 2 inches water gage and greater will be designed for a maximum velocity of 2500 fpm for mains and maximum static pressure 0.25 inch water gage per 100 ft of duct. Static pressure loss and regain will be considered in calculating the duct sizes and supply branch ducts will be sized for a maximum velocity of 1500 fpm. Return and exhaust duct system with total external static pressure less than 2 inches water gage will be designed for a maximum velocity of 1500 fpm for mains and branches and a maximum static pressure 0.10 inch water gage per 100 ft. The minimum duct size will be 8 in x 6 in. Specialty duct systems including fume hood and kitchen exhaust are designed to NFPA and VA HVAC guidelines.

Sound and Noise Considerations will be Noise Criteria, NC, levels. NC levels in the table are the maximum level generated by an air inlet or outlet. Inlets and outlets will be selected below NC levels using manufacturers published data to account for duct noises.

Space environmental design conditions will follow the VA HVAC Guideline criteria. Design temperatures are established as a guide for determining energy consumption in the cost analysis. Summer relative humidity is provide as a guide and will not be directly controlled. This humidity level is subject to space and conditions and ventilation levels. Winter relative humidity will be directly controlled in areas with requirements using steam humidifiers.

Temperature controls or building automation system, BAS, will be a Direct Digital Control, DDC, system with electronic operators. BAS will monitor and control environmental conditions throughout the building. The BAS will monitor or control Space temperature and humidity, Outside temperature and humidity, Heating water flow and temperature, Chilled water flow and temperature, Smoke control system, and Air handling unit status. This list is representative and not intended to be exhaustive. The

BAS central control will be located in Engineering Control Center, ECC and will be connected to local control panels located throughout the building. Final selection of BAS system will be discussed and confirmed by the VA.

Hurricane design will be used for this project. Hurricane style louver will be used for air intakes. Roof top equipment will be surrounded by a hurricane shield or equipped with proper hurricane tie downs.

7.1.15 Steam and Condensate:

Steam will be generated in the CEP and piped to a dedicated mechanical space in the CLC building.

7.1.16 Domiciliary:

HVAC systems to provide air for occupant comfort and well being. HVAC systems will be comprised of one air handling unit per floor, with each unit serving the floor on which it is located. Outside air and exhaust / relief air shafts will be provided at each end of each mechanical room to enable all outside air to be drawn into building at the highest elevation, so as to comply with VA physical security manual requirements.

Typical unit construction will be a custom double walled unit with dual path ventilation and return air intakes, each with chilled water cooling coil. Outside air path will also have upstream hot water heating coil. Prefilter bank will be upstream of coils. Plug-style direct drive supply air fan with premium efficiency motor will be used. Dual path (pre-conditioned outside air), direct-drive plug fan custom air handling unit is selected on basis of energy savings and Life Cycle Cost Analysis, toward attaining the goal of target energy savings by executive order.

Air handling units in the Domiciliary will not require final filtration, nor humidification. Units will be custom packaged factory-fabricated and assembled for field installation. There will be four units serving the Domiciliary (one per floor).

R-AHU-1	15,000 cfm	Serves 1st floor (Offices)
R-AHU-2	6,600 cfm	Serves 2nd floor (Offices, Elec.)
R-AHU-3	7,500 cfm	Serves 3rd floor (Resident Rooms)
R-AHU-4	8,800 cfm	Serves 4th floor (Resident Rooms)

Return fans will be inline centrifugal type. Air handling units are sized to account for duct air leakage and safety factor per VA design requirements. Load calculation performed using Trace.

Units designed as variable air volume with terminal reheat. Ventilation air or outside air will be introduced to spaces to create acceptable indoor air quality for the occupants. Areas are provided with outside air quantities specified by ASHRAE Standard 62.1-2004 or VA HVAC Design Manual, whichever is more stringent. Care has been taken when designing location of outside air intakes to avoid intake of exhaust outlets, plumbing vents, motor vehicle exhaust, and aviation exhaust.

Air filter efficiencies will comply with test method specified by ASHRAE Standard 52.1 and ASHRAE Standard 52.2.

Ductwork construction and design considerations will be in accordance with the general rules outlined in latest ASHRAE Guide and Data Books, SMACNA Manuals, and Design Guide section of Associated Air Balance Council Manual. Supply duct system with total external static pressure 2 inches water gage and greater will be designed for a maximum velocity of 2500 fpm for mains and maximum static pressure of 0.25 inch water gage per 100 ft of duct, static pressure loss and regain will be considered in calculating the duct sizes and supply branch ducts will be signed for a maximum velocity of 1500 fpm. The minimum duct size will be 8 in x 6 in. Specialty duct systems including kitchen exhaust are designed to NFPA and VA HVAC guidelines.

Temperature controls or Building Automation System, BAS, will be a Direct Digital Control, DDC system with electronic operators. BAS will monitor and control environmental conditions throughout the building. The BAS will monitor or control space temperature and humidity, outside temperature and humidity, heating water flow and temperature, chilled water flow and temperature and air handling unit status. This list is representative and not intended to be all-inclusive. The primary BAS workstation will be located in the Facility Engineers office in the Warehouse building. The secondary BAS workstation will be located on the 4th floor of the Hospital in the Emergency Command area. BAS workstation will be connected to local control panels throughout the building. Final selection of BAS system will be discussed and confirmed by the VA.

Hurricane design will be used for these buildings, hurricane style louver will be used for air intakes.

7.1.17 Heating and Cooling Water:

Comfort heating water will be generated in the Domiciliary via CEP steam. Utilities entering building will enter below slab in pit with accessible grating at floor level. First floor mechanical room in Domiciliary will house two horizontal centrifugal pumps and two associated heat exchangers each sized at 100% of the total flow to circulate heating water through the building. Pumps will be on variable speed drives to maintain constant pressure in the heating water system.

Heating water system will serve coils in air handling units, reheat coils for zone control unit heaters and cabinet unit heaters.

There will not be a perimeter heating system. The building envelope will comply with the VA HVAC Guidelines and the minimum temperature is above 20 degrees F.

Heating water system will be connected to the BAS to monitor temperatures, flows and alarms.

Aboveground heating water piping will be constructed of Schedule 40 black steel with malleable steel threaded and forged steel butt welded fitting. Piping will be located in service area shafts.

Comfort chilled water will be generated in the CEP and piped through service tunnels to a dedicated mechanical space in the Domiciliary, there will be no chilled water pumps located in each building. Variable flow primary chilled water pumps will be located in the CEP.

7.1.18 Steam and Condensate:

Cooling water system will serve coils in air handling units.

Cooling water system will be connected to the BAS to monitor temperatures, flows and alarms.

Aboveground cooling water piping will be constructed of Schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings, piping will be located in service area shafts.

High pressure steam will be generated in the CEP and piped to a dedicated mechanical space in the Domiciliary building.

Steam will be used to generate potable hot water, and to serve kitchen equipment.

Steam pressure reducing station will be used to convert high pressure steam delivered from the CEP to the steam pressures required in the Domiciliary. To comply with VA HVAC Design Manual Criteria, high pressure steam will be reduced to respective pressure required with multiple single stage reducing stations; multiple step reducing stations will not be used. A 1/3 – 2/3 capacity will be used for sizing reducing valves for each step. Single bypass with globe valve will be required for each pressure reduction step.

Aboveground steam and condensate piping will be constructed of schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will be located within service area shafts. Piping will have expansion loops in long horizontal runs to allow for expansion and contraction.

High pressure condensate will be routed to a flash tank.

Duplex condensate pumps with associated control panel with alternator will be used to return condensate from the Domiciliary to the CEP. Steam traps for the low pressure steam will be float and thermostatic and high pressure steam will be inverted bucket type with thermostatic air vent.

7.1.19 Warehouse:

HVAC systems to provide air for occupant comfort and well being and to provide appropriate storage conditions for warehouse storage supplies. HVAC systems will be comprised of air handling units. The 100% outside air, air handling units will be fitted with air-to-air heat pipe dehumidification. Outside air will be drawn into building at location and elevation to comply with VA physical security manual requirements.

Typical unit construction will be a custom double walled unit with dual path ventilation and return air intakes, each with chilled water cooling coil. Outside air path will also

have upstream hot water heating coil. Prefilter bank will be upstream of coils. Plug-style direct-drive supply air fan with premium efficiency motor will be used. Dual path (pre-conditioned outside air), direct-drive plug fan custom air handling unit is selected on basis of energy savings and Life Cycle Cost Analysis, toward attaining the goal of target energy savings by Executive Order. Air handling units in the warehouse will not require final filtration, nor humidification. Units will be four units serving the warehouse.

W-AHU-1	21,000 cfm	Serves 1st floor
W-AHU-2	10,500 cfm	Serves 2nd floor
W-AHU-3	11,000 cfm	Serves Warehouse (Storage)
W-AHU-4	1,200 cfm	Serves (Mailroom)

Air handling units are sized to account for duct air leakage and safety factor per VA design requirements. Load calculations performed using Trace.

Units designed as variable air volume with terminal reheat.

Ventilation air or outside air will be introduced to spaces to create acceptable indoor air quality for the occupants. Areas are provided with outside air quantities specified by ASHRAE Standard 62.1-2004 or VA HVAC Design Manual, whichever is more stringent. Care has been taken when designing location of outside air intakes to avoid intake of exhaust outlets, plumbing vents, motor vehicle exhaust and aviation exhaust.

Air filter efficiencies will comply with test method specified by ASHRAE Standard 52.1 and ASHRAE Standard 52.2.

Ductwork construction and design considerations will be in accordance with the general rules outlined in latest ASHRAE Guide and Data Books, SMACNA Manuals, and Design Guide Section of Associated Air Balance Council Manual. Supply duct system with total external static pressure 2 inches water gage and greater will be designed for a maximum velocity of 2500 fpm for mains and maximum static pressure of 0.25 inch water gage per 100 ft of duct, static pressure loss and regain will be considered in calculating the duct sizes and supply branch ducts will be sized for a maximum velocity of 15 fpm, return and exhaust duct system with total external static pressure less than 2 inches water gage will be designed for a maximum velocity of 1500 fpm for mains and branches and a maximum static pressure 0.10 inch water gauge per 100 ft. The minimum duct size will be 8 in x 6 in.

Temperature controls or Building Automation System, BAS, will be a Direct Digital Control DDS System with electronic operators. BAS will monitor and control environmental conditions throughout the building. The BAS will monitor or control space temperature and humidity, outside temperature and humidity, heating water flow and temperature, chilled water flow and temperature and air handling unit status. This list is representative and not intended to be all-inclusive. The primary BAS workstation will be located in the Facility Engineers office in the Warehouse Building. The secondary BAS workstation will be located on the 4th floor of the Hospital in the Emergency Command

area. BAS workstation will be connected to local control panels throughout the building. Final selection of BAS system will be discussed and confirmed by the VA.

Hurricane design will be used for these buildings. Hurricane style louver will be used for air intakes.

Heating and Cooling Water:

Comfort heating water will be generated in the Warehouse via CEP steam. Utilities entering building will enter below slab in pit with accessible grating at floor level.

First floor mechanical room in Warehouse will house two horizontal centrifugal pumps and two associated heat exchangers each sized at 100% of the total flow to circulate heating water through the building. Pumps will be on variable speed drives to maintain constant pressure in the heating water system.

Heating water system will serve coils in air handling units, reheat coils for zone control, unit heaters and cabinet unit heaters.

There will not be a perimeter heating system. The building envelope will comply with the VA HVAC Guideline and the minimum temperature is above 20 deg. F.

Heating water system will be connected to the BAS to monitor temperature, flows and alarms. Aboveground heating water piping will be constructed of schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will be located in service area shafts.

High pressure steam will be generated in the CEP and piped to a dedicated mechanical space in the Warehouse building.

Steam will be used to generate potable hot water, and to serve kitchen equipment.

Steam pressure reducing station will be used to convert high pressure-steam delivered from the CEP to the steam pressures required in the Warehouse. To comply with VA HVAC Design Manual Criteria, high pressure steam will be reduced to respective pressure required with multiple single stage reducing stations; multiple step reducing stations will not be used. A 1/3 – 2/3 capacity will be used for sizing reducing valves for each step. Single bypass with globe valve will be required for each pressure reduction step.

Aboveground steam and condensate piping will be constructed of Schedule 40 black steel with malleable steel threaded and forged steel butt welded fittings. Piping will have expansion loops in long horizontal runs to allow for expansion and contraction.

Duplex condensate pumps with associate control panel with alternator will be used to return condensate from the Warehouse to the CEP. Steam traps for the low pressure steam will be float and thermostatic. Steam traps for the medium and high pressure steam will be inverted bucket type with thermostatic air vent.

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7.1.20 Parking Garage

HVAC systems will provide air to spaces for occupant comfort and well being. The HVAC system will be comprised of multiple fan coil units located at each lobby floor. Fan coil units will condition lobbies and toilet rooms. The room fan coil units are the four-pipe type with heating water coil, chilled water coil and centrifugal fans. Replaceable filters are located at the ceiling return register. Outdoor air for ventilation of occupants is supplied to the fan coil units by the 100% outdoor air duct. Each fan coil unit will be provided with a thermostat and fan speed controller. The DDC system will be used to set limits on temperature set points/overrides and provide occupied and unoccupied control.

Ventilation air or outside air will be introduced to a space to create acceptable indoor air quality for the occupants. Areas are provided with outside air quantities specified by ASHRAE Standard 62-2001 or VA HVAC design module whichever is more stringent. Ventilation air will not be less than 15% of the total supply air. Care will be taken when designing location of outside air intakes to avoid intake of exhaust outlets, plumbing vents, motor vehicle exhaust, and aviation exhaust.

Air filter efficiencies will comply with test method specified by ASHRAE standard 52.1and ASHRAE standard 52.2. Air Filtration for air handling units will have pre and final filters located in the upstream side of supply air fan and the filters will be located in same filter frame.

Ductwork construction and design considerations will be in accordance with the general rules outlined in latest ASHRAE Guide and Data Books, SMACNA Manuals, and Design Guide Section of Associated Air Balance Council Manual. Supply duct system with total external static pressure 2 inches water gage and greater will be designed for a maximum velocity of 2500 fpm for mains and maximum static pressure 0.25 inch water gage per 100 ft of duct. Static pressure loss and regain will be considered in calculating the duct sizes and supply branch ducts will be sized for a maximum velocity of 1500 fpm. Return and exhaust duct system with total external static pressure less than 2 inches water gage will be designed for a maximum velocity of 1500 fpm for mains and branches and a maximum static pressure 0.10 inch water gage per 100 ft. The minimum duct size will be 8 in x 6 in. Specialty duct systems including fume hood and kitchen exhaust are designed to NFPA and VA HVAC guidelines.

Sound and Noise Considerations will be Noise Criteria, NC, levels. NC levels in the table are the maximum level generated by an air inlet or outlet. Inlets and outlets will be selected below NC levels using manufacturers published data to account for duct noises.

Space environmental design conditions will follow the VA HVAC Guideline criteria. Design temperatures are established as a guide for determining energy consumption in the cost analysis. Summer relative humidity is provide as a guide and will not be directly controlled. This humidity level is subject to space and conditions and ventilation levels. Winter relative humidity will be directly controlled in areas with requirements using steam humidifiers.

Temperature controls or building automation system, BAS, will be a Direct Digital Control, DDC, system with electronic operators. BAS will monitor and control environmental conditions throughout the building. The BAS will monitor or control Space temperature and humidity, Outside temperature and humidity, Heating water flow and temperature, Chilled water flow and temperature, Smoke control system, and Air handling unit status. This list is representative and not intended to be exhaustive. The BAS central control will be located in Engineering Control Center, ECC and will be connected to local control panels located throughout the building. Final selection of BAS system will be discussed and confirmed by the VA.

Hurricane design will be used for this project. Hurricane style louver will be used for air intakes. Roof top equipment will be surrounded by a hurricane shield or equipped with proper hurricane tie downs.

7.1.21 Life Cycle Cost Analysis

Two systems were considered for the heating ventilating and air conditioning air handling units. The first system is a variable air volume system using hot water for terminal reheat. The primary mover of air is a pre-packaged air handling unit. The second system is variable air volume systems using a separate hot air duct for terminal reheat. The primary mover of air is a pre-packaged air handling unit with two fans one for the hot duct and another for the cold duct.

The systems evaluated are for the programmed areas that do not require more than 50% outside air for occupant ventilation. When comparing the two systems it was identified that the dual duct system had a higher first cost and required more energy to operate over the life of the building.

The recommendation is to use a variable air volume system with hot water for terminal reheat for the heating ventilation and air conditioning systems in the building.

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7.2 Availability of Utilities

The VA campus will be built on a Greenfield site located in the Lake Nona community. Electric, gas, water and sewer utilities will be developed and coordinated throughout the design process. The Orlando Utilities Commission will provide electric, water and sewer to the campus and TECO will provide gas service to the campus.

7.3 Preliminary Heating and Cooling Load Estimates

Design Conditions:

Project location: Orlando Florida

Reference: VA HVAC Design Manual – 1.3.1 and 5.4 Climatic Conditions and ASHRAE

Temperatures:

Heating: 37 Deg F db

Cooling: 94 Deg F db / 76 Deg F wb

Cooling Tower: 79 Deg F wb

Annual Extreme (max/min): 96 Deg F db / 29 Deg F db

Climate Zone: 2A

Building Components for HVAC Load Calculations:

For calculation purposes U-value = 1/R-value and U-value units are BTU / (hr ft^2 Deg F).

The facility will be designed based on ASHRAE Standard 90.1–2004 baseline building design to gather initial building parameters and energy requirements.

Final building design will comply with VA requirement for energy savings outlined in Energy Policy Act of 2005, EPACT 2005.

Roof construction will be insulated entirely above the deck and has a continuous minimum R-value of 15.0.

Above grade walls are steel frame and have a minimum R-value of 13.0.

There are no below grade walls.

Exposed floors are steel frame with concrete and have a continuous minimum R-value of 2.4.

Slab on grade floors are continuous minimum R-value of 7.5 from slab edge in 12".

Wall glass, fenestration, will be less than 40% of the total building walls, has a maximum U-value of 1.22, and maximum SHGC of 0.61 for north facing and 0.25 for all other directions.

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Skylights are glass with curbs, 5% or less than total gross roof, has a maximum U-value of 1.98, and maximum SHGC of 0.19 for all directions.

Heating Ventilation and Air Conditioning, HVAC load envelope design considerations are included in the following table.

Envelope Design Considerations			
Element	**ASHRAE 90.1-2004**	**VA HVAC Guideline**	**Recommendation**
Roof	R-15	R-20	R-20
Walls	R-13	R-7.7	R-15
Floors	R-2.4	R-8.3	R-8.3
Slab on Grade	R-7.5 for 12"	R-5	R-7.5
Windows	U-1.22	U-1.5	U=1.22
SHGC-North	0.61	SC = 0.40	0.61
SHGC-Other	0.25		0.25
Skylights	U-1.98	NR	U=1.98
SHGC-All	0.19	NR	0.19

NR = No requirements listed.

Space environmental design conditions will follow the VA HVAC Guideline criteria. Design temperatures are established as a guide for determining energy consumption in the cost analysis. Summer relative humidity is provide as a guide and will be directly controlled. This humidity level is subject to space and conditions and ventilation levels. Winter relative humidity will be directly controlled in areas with requirements using steam humidifiers.

Refer to Calculations Volumes for preliminary cooling and heating loads.

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8. INTERIOR DESIGN

8.1 Interior Design Concept Narrative

Part B.01/1.1, the Architectural Narrative and Part A.01/1.3, the Project Program, and Part B.18 LEED Narrative provide information pertaining to the interior design scope of work for the Department of Veterans Affairs, Veterans Administration Medical Center in Orlando, Florida. The Architectural Narrative addresses issues such as the goals or mission of the VAMC Orlando, as well as the architectural setting, operational demands, the future expansion. Although not repeated in the Interior Design Narrative, these issues were considered since they influence the development of the interior design concept for the VAMC Orlando project. Unity and integration between the Orlando project team, architecture, engineering and interior design will ensure the success in achieving an appropriate healthcare environment. This healthcare environment will not only be a healing one but one which honors the veterans of Orlando.

8.1.1 Campuswide Interior Design Solution

Based upon information in the Architectural Narrative, the Project Program and the goals of the medical center, the overall interior design solution for the campus shall incorporate the following key elements.

Incorporate interior finishes that achieve the goals and objectives of the Federal Leadership in High Performance Buildings and Sustainable Buildings Memorandum of Understanding and the associated Guiding Principles. Those goals and objectives are:

Reduce the total ownership cost of the facilities;

Improve energy efficiency and water conservation

Provide safe, healthy, and productive built environments; and,

Promote sustainable environmental stewardship.

Incorporating these types of interior finishes will also allow us to achieve our project requirement of a minimum Leadership in Energy and Environmental Design, LEED, rating of Silver.

Similarly, the interior design shall incorporate interior finishes consistent with issues of long-term maintenance, durability, flexibility and suitability to a Veterans Affairs Hospital, per Architectural and Interior Design Manuals and Program Guide PG-18-15, Volume B, *VA Medical Center Projects A/E Submission Instructions for Major New Facilities, Additions, and Renovations.*

To aid in the facility maintenance of finish materials by incorporating finishes with similar maintenance requirements. To also, minimize the amount of different types of finishes required for inventory and storage.

Provide an interior architectural plan that is fully integrated with the design vocabulary and details of the exterior architecture.

Provide an interior design solution that acknowledges the regional culture and the patient population of the Veterans Administration Medical Center Orlando.

Lighting Concepts: The design of lighting including natural, general lighting, ambient, accent and task lighting has significant impact on the character and quality of the interior environment. A multi-layering of different light sources and levels will be integrated into the architecture and interior design to create comfort, better visual acuity, variety and interest.

Artificial lighting will be full-spectrum color light.

General lighting will be primarily indirect and adjusted to a wide range of needs and activity levels.

Lighting levels will be adjustable by dimmers to provide natural daylight and night rhythms.

Cove lighting and wall sconces will provide a soft ambiance along corridors.

Accent lighting will be used to enhance object rendering and create variety and visual cues.

Ample sources of task lighting will be provided at all reception/information stations', nurse stations', control stations' and veteran patient areas.

Access to unfiltered, non-glare daylight will be achieved by the design of terraces and/or balconies.

Veterans' will have the ability to control light levels with the use of non-glare indirect upper lamps and task oriented louver lamps provided at bedside.

Night lighting in veterans' rooms will be provided to allow staff to read charts without disturbing the veteran.

8.1.2 Hospital / Outpatient Clinic Building and CLC Interior Design Solution

The following is in addition to the previously mentioned campus wide information.

Provide an interior design solution that acknowledges the regional culture and the patient population of the Veterans Administration Medical Center Orlando.

Provide a compassionate environment designed to encourage the healing process by:

Promoting family support in the healing process.

Provide places of respite for patients and families.

Provide the appropriate amount of daylight and views.

Providing environments sensitive to acoustic design.

Providing staff amenities that allow them to provide the best care for the patients but also create a positive and supportive work environment.

Provide an interior design solution for the Hospital / Outpatient Clinic building, and CLC that acknowledges physical changes and limitations in the older patient population of the Veterans Administration Medical Center Orlando.

The interior design solution shall consider the following but is not limited to just these criteria:

Increase light levels while reducing glare

Sudden changes in light levels shall be avoided

Address diminished color perception by increasing contrast in color between wall and floor materials

Simple, 1.5" radius handrail for ease of grasp

Acoustical materials to decrease noise pollution

Resilient / softer floor materials to cushion or reduce injury in slip and fall cases

Increase Indoor Air Quality by decreasing the levels of Volatile Organic compound off-gassing that would harm an already compromised respiratory system

Incontinence

Post Traumatic Stress Disorder

8.1.3 Domiciliary Interior Design Solution:

The following is in addition to the previously mentioned campus wide information. Provide a compassionate, inspiring environment that encourages the development of the resident veterans. The interior design shall allow for comfortable yet easily maintainable level of finishes throughout the Domiciliary.

8.1.4 Warehouse Interior Design Solution:

The following is in addition to the previously mentioned campus wide information. Provide an environment that is highly durable and maintainable. The interior design shall allow for comfortable and functional, yet easily maintainable level of finishes throughout the Warehouse.

8.1.5 Central Energy Plant Interior Design Solution

The following is in addition to the previously mentioned campus wide information. Provide an environment that is highly durable and maintainable. The interior design shall allow for comfortable and functional, yet easily maintainable level of finishes throughout the staff areas of this building.

8.1.6 Wayfinding and Maintenance:

Incorporate wayfinding design into the interior design solution for the hospital, outpatient clinics, and CLC by providing the following visual cues: contrasting color application, floor and ceiling patterns, wall murals or design features, lighting design, and

architectural elements. These cues become landmarks to assist in orientation and direction.

Interior signage will be developed in another scope of service but the concepts for the patient room signage has been discussed and approved by the steering committee and will be closely integrated into the wayfinding solution developed in this contract.

Please refer to the Developmental Plans in the drawing set for information on paths of travel and wayfinding nodes in the Hospital / Clinic Building and CLC.

8.1.7 Product Data:

For all buildings on the new VAMC Orlando's campus shall be collected from the Interior Design project user group, including the Bay Pines VA interior designer as well as the *Interior Design Manual for Hospital and Nursing Home Projects, February 2000.* See Attached Schematic Design 2 - Typical Room Finish Schedule for product types and locations.

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8.2 Interior Finish Schedule

Outpatient Clinic / Hospital

Outpatient Clinic / Hospital Common Public Areas

INTERIOR TYPICAL ROOM FINISH SCHEDULE					
Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks

Outpatient Clinic / Hospital

Outpatient Clinic / Hospital Common Public Areas

Entrance Vestibule	Terrazzo - recessed entrance mat, carpet treads	Precast Terrazzo	Curt.Wall, Masonry, Stucco and Decorative Plaster	GWB Painted	
Lobby	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Curt.Wall, Masonry, Stucco, Decorative Plaster with reveals, Acoustic Wood Paneling	GWB Painted, Acoustic Wood ceiling system	Handrail-WD/SST; Custom Wayfinding Imagery: Edgelit cast glass art panels
Arboretum	Terrazzo, epoxy thinset with pattern w/ flush grade plantings	Precast Terrazzo	Curt.Wall, Masonry, Stucco, Plaster and Decorative Plaster	GWB Painted, Wood ceiling system	Handrail-WD/SST
Main Lobby Waiting	Terrazzo, epoxy thinset with pattern, Carpet inset	Precast Terrazzo	Curt.Wall, Masonry, Stucco, Decorative Plaster with reveals, Acoustic Wood Paneling	GWB Painted, Acoustic Wood ceiling system	Handrail-WD/SST; Custom Wayfinding Imagery: Edgelit cast glass art panels, Back Painted Glass Movable Wall System

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Information Desk	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Masonry, Decorative Plaster with reveals, Modular Wall Panel System	GWB Painted, ACT	Millwork: Wood/Metal reveals/ Stone transaction and SSM countertop
Dining and Coffee Shop	Terrazzo, epoxy thinset with pattern, Carpet inset	Precast Terrazzo	Curt.Wall, Masonry, Stucco, Decorative and Acoustical Plaster	GWB Painted, Acoustic Wood ceiling system	Millwork: Wood/Metal reveals /SSM transaction and countertop
Connecting Corridors/ Bridges to Atriums and Clinics and Hospital (All Floors)	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Curt.Wall, Masonry, Stucco and Decorative & Acoustic Plaster	GWB Painted, ACT	Handrail-glass/SST; Custom wayfinding imagery: Edgelit cast glass art panels
Public Elevator and Lobbies	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Decorative Plaster, Modular Wall Panel System (Wood), Cast Glass Art panels	GWB Painted, Acoustic Wood ceiling system	Handrail- WD/SST, Wayfinding Super Graphics
Monumental Stairs	Precast Terrazzo treads and riser	Precast Terrazzo	Curt. Wall, Masonry, Plaster	GWB Painted, Acoustic Wood ceiling system	Handrail-glass/SST
Public Toilets (Multiple)	PCT with pattern	PCT	PCT with pattern	GWB Painted	SSM countertops and toilet partitions

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Elevator Machine Room	Sealed Concrete	Rubber	Paint	Exp, Paint	
Vending Machines	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Decorative Plaster	GWB Painted, ACT	
Recycling	Heat-welded resilient sheet	Integral Cove	Semi-gloss paint	ACT-Cleanable Mylar	

Outpatient Clinic/Hospital Common Staff Areas

Stair	Rubber Treads, Nosing and Riser with abrasive edge insert	Rubber	Paint	Paint	Handrail-Paint
HAC	PCT	PCT	PCT on wet walls w/ semi-gloss paint above	GWB Painted	
Electrical Room	Sealed Concrete	Rubber	Paint	Exposed - Paint	
Communication Room	Sealed Concrete	Rubber	Paint	Exposed - Paint	
Staff Toilet	PCT with pattern	PCT	PCT with pattern wainscot with Paint above	GWB Painted	
Staff Lockers	Heat-welded resilient sheet	Rubber	Paint	ACT	Solid Phenolic Lockers
Toilets (Staff-Multiple)	PCT with pattern	PCT	PCT with pattern	GWB Painted	SSM countertops and toilet partitions

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Shower (Staff)	PCT	PCT	PCT with pattern	Semi-gloss paint	
Soiled Utility, Soiled Holding, and Soiled Linen	Heat-welded resilient sheet	Integral Cove	Semi-gloss paint	ACT-Cleanable Mylar	
Clean Supply and Clean Linen	Heat-welded resilient sheet	Rubber	Paint	ACT	
Staff Lounge	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: Plastic Laminate, SSM countertop
Equipment Storage	Heat-welded resilient sheet	Rubber	Paint	ACT	

Outpatient Clinic

Common Areas

Clinic Waiting/Corridors	Epoxy Terrazzo pattern with Carpet Tile Insets	Precast Terrazzo	Curt.Wall, Masonry, Plaster, Paint, WD Paneling	GWB, Paint, ACT, Metal Suspended Decorative Accent	Motorized Window Shades, Decorative Lighting, Wayfinding Super Graphics
Corridor (Service)	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	GWB, Paint, ACT	Crashrail
Corridor (Patient)	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	GWB, Paint, ACT	Handrail , Wood w/ crashrail below

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Departmental RecePaintion Counter	Carpet Tile	Rubber	Paint	GWB, Paint, ACT	Millwork-Wood/PLAM/SSM at transaction cntr top; Fabric at Tacksurface
Classroom / Training / Info Resource / Multi-purpose / Library	Carpet Tile w/pattern	Rubber	Paint, Acoustical wall panels	GWB, Paint, ACT	Millwork - Wood/PLAM/SSM at transaction cntr top / Smartboards
Distribution	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	

Staff Areas

Service Elevator	Tile and Plank Resilient Flooring	SST	Plastic Laminate w/ Stainless Steel Waintscot	Acrylic lens	Crashrail-SST
Service Elevator Lobby	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	GWB, Paint, ACT	Wall Protection: Crash rails
Coding / Staff Wkrm	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM
Copy / Supply	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM
Conference Room	Carpet Tile	Rubber	Paint, Acoustical wall panels	GWB, Paint, ACT	Smartboards

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Single Office	Carpet Tile	Rubber	Paint	ACT	
Shared Office	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Open Office Admin	Carpet Tile	Rubber	Paint	ACT	Modular Wall (Glass) System
Interview/Billing/ROI	Carpet Tile	Rubber	Paint	ACT	
Patient Advocate	Carpet Tile	Rubber	Paint	ACT	

Treatment Areas

Exam Room	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	GWB, Paint, ACT	Millwork - PLAM/SSM at ctr top
Screen	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Pharmacist (Satellite Pharmacy)	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM
Medication Room	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM
Nurse Station / Physician Extender	Tile and Plank Resilient Flooring w/pattern	Rubber	Paint	GWB, Paint, ACT	Millwork-Wood/PLAM/SSM at transaction & cntr top; Fabric at Tacksurface
Treatment / Minor Procedure / Isolation	Heat-welded resilient sheet	Integral Cove	Paint	ACT-Cleanable Mylar	Casework: PLAM w / SSM counters

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Counseling	Carpet Tile	Rubber	Paint	ACT	
Group Therapy	Carpet Tile	Rubber	Paint, Acoustical wall panels	GWB, Paint, ACT	
Blood Draw	Heat-welded resilient sheet	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	Casework: PLAM w / SSM counters
Linen	Heat-welded resilient sheet	Rubber	Paint	ACT	

Clinical Specialty Areas

Audiology

Audiologist / Speech Pathologist	Carpet Tile	Rubber	Paint	ACT	
Tech	Carpet Tile	Rubber	Paint	ACT	
Speech Analysis	Carpet Tile	Rubber	Paint	ACT	
Hearing Aids	Carpet Tile	Rubber	Paint	ACT	
Audiosuites	Carpet Tile	Rubber	Paint	ACT	

Dialysis

Dialysis including Private Rooms	Heat-welded resilient sheet with pattern	Integral Cove	Paint	GWB, Paint, ACT-Cleanable Mylar	
Patient Lockers	Heat-welded resilient sheet	Integral Cove	Paint	ACT-Cleanable Mylar	
Dialysate Prep	Heat-welded resilient sheet with pattern	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Water Treatment	Heat-welded resilient sheet	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	
Soiled / Clean Process	Resilient Flooring	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	
Occupational Therapy					
Occupational Therapy	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	ACT-Cleanable Mylar	
Kitchen	Tile and Plank Resilient Flooring	Rubber	Paint	ACT-Cleanable Mylar	Wood Cabinetry w/ Quartz countertop
Compensated Work Therapy	Tile and Plank Resilient Flooring w/ pattern	Rubber	Paint	ACT-Cleanable Mylar	
Infusion					
Infusion	Heat-welded resilient sheet with pattern	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	
Tumor Registry	Heat-welded resilient sheet with pattern	Integral Cove	Paint	ACT-Cleanable Mylar	
Vist/Bros	Heat-welded resilient sheet with pattern	Rubber	Paint	ACT	Casework: PLAM
Optometry					
Paintic Nerve	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Laser	Tile and Plank Resilient Flooring	Rubber	Paint	ACT-Cleanable Mylar	Casework: PLAM
Retinal Analyzer	Tile and Plank Resilient Flooring	Rubber	Paint	ACT-Cleanable Mylar	
Ultrasound	Tile and Plank Resilient Flooring	Rubber	Paint	ACT-Cleanable Mylar	
Photography	Tile and Plank Resilient Flooring	Rubber	Paint	ACT-Cleanable Mylar	
Vis Field	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Low Vision Testing	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Pretest / Fit	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Contract OPaintical	Tile and Plank Resilient Flooring / Carpet	Rubber	Paint	GWB, Paint, ACT	Millwork: Wood, Sol. Surf. tops, Adj. Glass Shlvg., Retail type lighting; butt glazed glass perimeter
Dermatology					
Derm Lab	Heat-welded resilient sheet	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	
Phototherapy	Heat-welded resilient sheet	Integral Cove	Paint - Epoxy	ACT-Cleanable Mylar	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Ortho/Physical Therapy					
Cast Room	Heat-welded resilient sheet	Integral Cove	Paint	ACT-Cleanable Mylar	
Physical Therapy / OT Treatment / Cardiopulmonary	Heat-welded resilient sheet	Integral Cove	Paint	GWB, Paint, ACT	
Orthopedic Lab	Heat-welded resilient sheet with pattern	Integral Cove	Paint	ACT-Cleanable Mylar	
Vocational Rehab	Heat-welded resilient sheet with pattern	Integral Cove	Paint	ACT-Cleanable Mylar	
Dental					
Operatory / Hygiene / Surgery / Perio / Endo / Recovery	Heat-welded resilient sheet with pattern	Integral Cove	Paint	ACT-Cleanable Mylar	
Preventative / Hygiene	Heat-welded resilient sheet with pattern	Rubber	Paint	ACT	
Prosth Lab / Ceramics	Heat-welded resilient sheet	Integral Cove	Paint	ACT-Cleanable Mylar	
Instrument Prep	Heat-welded resilient sheet	Integral Cove	Paint	ACT-Cleanable Mylar	
X-ray	Heat-welded resilient sheet	Rubber	Paint	ACT	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Admin					
Auditorium Seating	Carpet Tile w/ pattern	Rubber	Paint, Acoustical Wall Panels	GWB, Paint, ACT / Acoustical Control	Folding Door Panel System, Fabric Wrapped, Smartboard, Projection System
New Employ Orientation	Carpet Tile	Rubber	Paint	ACT	
Controls	Heat-welded resilient sheet	Rubber	Paint	ACT	
Kitchen	Quarry Tile	Quarry Tile	Paint	ACT-Cleanable Mylar	Wood Cabinetry w/ Quartz countertop

Hospital

For additional Hospital / Outpatient Clinic Public and Staff Common Area standards see pages 1-3 of this document.

Hospital Common Areas

ED Waiting	Thinset Epoxy Terrazzo w/ pattern	Precast Terrazzo	Decorative plaster; wood trim	Wood ceiling tiles / GWB Painted/ ACT	Wall Protection: 5" crashrail throughout
Waiting	Terrazzo and Carpet tile with pattern	Wood	Decorative plaster; wood trim	Wood ceiling tiles / GWB Painted/ ACT	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
ED Corridors	Heat-welded resilient sheet w/ pattern; recessed abrasive Entrance Mat at Ambulance Entry	Rubber	Paint	GWB Painted, ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below
Mental Health Corridors	Resilient tile & plank flooring; allow for multiple of each to create pattern	Sol. Surf. Base flush to partition w/reveal	Paint	GWB Painted, Tamper Resisitant Acoustical Panels	Solid surface wall protection with no exposed fasteners
Med Surg Corridors	Resilient tile & plank flooring; allow for multiple of each to create pattern	Rubber	Paint w/ WC accents	GWB Painted, ACT	Wall Protection: wood/acrovyn handrail w/ 5" crash rail below
ICU Corridors	Heat-welded resilient sheet w/ Resilient tile & plank flooring; allow for multiple of each to create pattern	Rubber	Paint w/ WC accents	GWB Painted, ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below
VBA Retail / Display space	Thinset Epoxy Terrazzo w/ pattern w/ Carpet tile insets	Precast Terrazzo	Decorative plaster; wood trim	Wood ceiling tiles / GWB Painted/ ACT	Millwork: Wood, Solid Surface tops, Adj. Glass Shlvg., Retail type lighting; butt glazed glass perimeter

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Credit Union and Travel Offices (Staff Side)	Carpet Tile	Rubber	Paint	GWB Painted, ACT	Millwork: Wood, Solid Surface tops, Security Glass
Credit Union and Travel Offices (Public Side)	Thinset Epoxy Terrazzo w/ pattern	Precast Terrazzo	Decorative plaster; wood trim	GWB Painted, ACT	Handrail-WD/SST; Millwork: Wood, Solid Surface tops, Security Glass
Canteen Retail	Thinset Epoxy Terrazzo w/ pattern	Precast Terrazzo	Decorative plaster; wood trim	Wood ceiling tiles / GWB Painted/ ACT	Millwork: Wood, Solid Surface tops, Adj. Glass Shlvg., Retail type lighting; butt glazed glass perimeter
Canteen Servery	Thinset Epoxy Terrazzo w/ pattern	Precast Terrazzo	Decorative plaster; wood trim, Composite Panels with metal reveals.	GWB Painted/ ACT	Millwork: Glass Tile, Solid Surface tops, Composite Panels with metal reveals.
Patient Registration	Carpet Tile	Wood	Decorative plaster; wood trim	GWB Painted, ACT	Millwork: Solid Surface Tops, Textured glass / Wood screen walls
Recycling	Heat-welded resilient sheet	Integral Cove	Semi-gloss paint	ACT-Cleanable Mylar	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Hospital Patient Areas					
Consult Rooms	Carpet tile	Rubber	Paint	ACT	
ED Exam / Treatment, Isolation Rooms, and Triage	Heat-welded resilient sheet w/ pattern	Integral Cove	Epoxy Paint	ACT	Millwork: PLAM w/Solid Surface. Tops; Cubicle Curtain
Misc. Exam Rooms	Resilient plank flooring	Rubber	Paint	ACT	Millwork: PLAM w/Solid Surface. Tops; Cubicle Curtain
Mental Health Patient Rooms	Heat-welded resilient sheet w/ pattern	Solid Surface. Base flush to partition w/reveal	Paint	GWB Painted	Millwork: Solid Surface w/ no exposed fasteners
Mental Health Patient Bathrooms	PCT	PCT	PCT - full height	GWB Painted	Solid Surface. lavatory enclosure
Mental Health Multi-purpose Room/Dining	Resilient tile & plank flooring; allow for multiple of each to create pattern	Solid Surface. Base flush to partition w/reveal	Paint	GWB Painted	
ICU Patient Rooms	Heat-welded resilient sheet w/ pattern	Integral Cove	Paint	ACT / GWB Painted soffits	Headwall system; crash rail; Cubicle curtain; Millwork: Solid Surface, PLAM.

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
ICU Isolation Rooms and Ante Rooms	Heat-welded resilient sheet w/ pattern	Integral Cove	Paint	ACT / GWB Painted soffits	Headwall system; crash rail; Cubicle curtain; Millwork: Solid Surface, PLAM.
Med/Surg Patient Rooms	Resilient tile & plank flooring	Rubber	Paint	ACT / GWB - Painted soffits	Headwall system; crash rail; Cubicle curtain; Millwork: Solid Surface, PLAM.
Med/Surg Isolation Rooms and Ante Rooms	Heat-welded resilient sheet w/ pattern	Integral	Paint	ACT / GWB - Painted soffits	Headwall system; crash rail; Cubicle curtain; Millwork: Solid Surface, PLAM.
Med/Surg and Hoptel Bathrooms	PCT	PCT	PCT - full height	GWB Painted	Solid Surface Counters
Hoptel Rooms and adjacent Corridors & Vending	Resilient tile & plank flooring	Rubber	Paint	ACT / GWB Painted soffits	Millwork: PLAM w/Solid Surface. Tops; Built-in headboard and wardrobe
Dressing Rooms	Resilient tile flooring	Rubber	Paint	ACT	Millwork: PLAM locker & bench w/ Uphostered Cushion; cubicle curtain

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Diagnostic / Imaging Dept's. Corridors: ED/CT, Non-Invasive Cardiology, PET CT, Radiology, and Radiation Therapy	Resilient tile & plank flooring; allow for multiple of each to create pattern	Rubber	Paint	ACT / GWB Painted soffits	Wall Protection: wood/acrovyn handrail w/ 5" crash rail below
Diagnostic / Imaging Rooms: MRI, CT, Rad, PET CT	Resilient tile & plank flooring	Rubber	Paint	ACT	Backlit nature imagery in wall and/or ceiling panels
Ultrasound	Resilient tile or plank flooring	Rubber	Paint	ACT	
Diagnostic / Imaging DePaint's. misc.rooms: ED/CT, Non-Invasive Cardiology, PET CT, Radiology, and Radiation Therapy	Resilient tile or plank flooring	Rubber	Paint	ACT	
Urinalysis and Phlebotomy Corridors	Heat-welded resilient sheet w/ pattern	Integral	Paint	ACT	
Urinalysis Specimen Rooms	PCT	PCT	PCT wainscot w/pattern; semi-gloss paint above	GWB - semi-gloss Painted	
Phlebotomy Bed Bays	Heat-welded resilient sheet w/ pattern	Integral	Paint	ACT	Cubicle Curtain

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Phlebotomy, Radiology, and Outpatient Waiting	Carpet tile w/ pattern	Rubber	Decorative plaster; wood trim	GWB Painted, ACT	
Linear Accelerators and Simulator	Resilient tile & plank flooring	Rubber	Paint	ACT	Millwork: PLAM w/Solid Surface. Tops; Backlit nature imagery in wall and/or ceiling panels
Gowned Waiting	Carpet tile w/ pattern	Rubber	Decorative plaster; wood trim	Wood ceiling tiles / GWB **Painted**	Interior planting and / or water feature

Hospital Staff Areas

Office (Private)	Carpet tile	Rubber	Paint	ACT	
Open Office	Carpet tile w/pattern	Rubber	Paint	GWB Painted, ACT	
Admin Suites and associated corridors and storage rooms	Carpet tile	Rubber	Paint w/ non-vinyl wallcovering accents	ACT	
Reading, Viewing, or Dictation, and Tech Work Rooms	Carpet tile	Rubber	Paint	ACT	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
ED Communication Station	Heat-welded resilient sheet w/ pattern	Rubber	Paint	GWB Painted, ACT	Millwork: Wheatbd. / Plam / Solid Surface. Counters / St. Stl. Reveals
Mental Health Communication Center	Carpet tile	Rubber	Paint	GWB Painted, ACT	Millwork- GWB partition & security glass surround / Solid Surface. Counters
Med Surg and ICU Communication Centers and Sub Nurse Stations	Resilient tile & plank flooring; allow for multiple of each to create pattern	Rubber	Paint w/ non-vinyl wallcovering accents	GWB Painted, ACT	Millwork: Wheatbd. / Plam / Solid Surface. Counters / St. Stl. Reveals
Conference Rooms, Classrooms, Multi-Purpose Rooms	Carpet tile	Rubber	Paint / Acoust. Wall panels	GWB Painted, ACT	Fabric wrapped acoustical wall panels one wall min. / Whitebd/Tackbd.
Nourish / Pantry and Med rooms	Resilient plank flooring	Rubber	Paint	GWB Painted, ACT	Millwork- PLAM / Solid Surface. Counters
Storage Rooms: Equip, Volunteer, Computer, etc.	Heat-welded resilient sheet	Rubber	Paint	ACT	
Mail Room	Heat-welded resilient sheet	Rubber	Paint	ACT	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Service Elevator	Heat-welded resilient sheet	SST	Plastic Laminate	Acrylic lens	Crashrail-SST
Service Elevator Lobby	Heat-welded resilient sheet	Rubber	Paint	ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below
Service Corridors	Heat-welded resilient sheet	Rubber	Paint	ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below
Service Areas: Pump Room, Biomed Engineering, etc.	Sealed Concrete	Rubber	Paint	Exposed - Paint	
Autopsy, Teaching, Specimen Stg., Cold Rm, and Viewing	Poured Epoxy Flrg.	Integral	Epoxy Paint	GWB - Epoxy Paint	Millwork: Stainless Steel
Decontam Entrance Corridor (to Trauma Elevators)	Heat-welded resilient sheet	Rubber	Paint	GWB Painted ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below
Decon and Shower	Poured Epoxy Flrg.	Integral	Epoxy Paint/ PCT @ Shower Location.	GWB - Epoxy Paint	
Trauma Elevator Lobbies	Heat-welded resilient sheet	Rubber	Paint	GWB Painted, ACT	Wall Protection: 8" crashrail w/ wall guard and 5" crash rail below

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Trauma Elevators	Heat-welded resilient sheet	Integral	Stainless Steel	Lexan	Stainless steel crashrails
Urinalysis and Phlebotomy RecePaintion	Heat-welded resilient sheet w/ pattern	Integral	Paint	ACT	
Cast Room	Heat-welded resilient sheet	Integral	Semi-gloss paint	ACT - Cleanable Mylar	Millwork: Stainless Steel Counters
Mold Room	Heat-welded resilient sheet	Integral	Semi-gloss paint	GWB - Semi-gloss Paint	Millwork: Stainless Steel Counters
Hot Lab	Heat-welded resilient sheet	Rubber	Paint	ACT	Millwork: Stainless Steel Counters
Control Room	Resilient plank flooring	Rubber	Paint	ACT / GWB Painted soffits	
Canteen Dietetics: Tray Assembly, Food Prep, Tray Carts, and Wash areas and connecting corridors	Poured Epoxy Flrg.	Integral	Food service wall panel wainscot w/ semi-gloss paint above	ACT - Cleanable Mylar	Millwork: Stainless Steel Counters
Canteen Dietetics: Non-food, Dry/Emerg., and Ingredients Room	Heat-welded resilient sheet	Rubber	Paint	ACT - Cleanable Mylar	
Pharmacy	Heat-welded resilient sheet w/ pattern	Rubber	Paint	GWB Painted, ACT	Millwork: Solid Surface. Counters at reception windows

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Pharmacy Ante Room, Oncology, Sterile Compounding	Heat-welded resilient sheet	Integral	Paint	ACT - Cleanable Mylar	Millwork: Stainless Steel
Lab	Heat-welded resilient sheet; may also have areas of raised access flooring w/ resilient flooring finish	Rubber	Paint	ACT - Cleanable Mylar	Modular Lab Casework
Blood Bank and associated areas, Sterile Prep, Cytology, Electron Microscopy, and Microbiology	Heat-welded resilient sheet	Integral	Paint	ACT - Cleanable Mylar	Millwork: Stainless Steel; cubicle curtains at Blood Donor Stations.
MAS Kitchens and Workrooms	Resilient tile & plank flooring	Rubber	Paint	ACT	Millwork - PLAM / Solid Surface. Counters
Surgery Department: OR's, Clean Core and all other associated spaces in this area	Heat-welded resilient sheet w/ pattern	Integral	Epoxy Paint	ACT - Cleanable Mylar with hold down clips; GWB Epoxy Paint in ORs.	Millwork: Stainless Steel; Wall Protection: 5" and 8" crashrails

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Pulmonary Med. / Digestive Diseases, and Cardiac Cath DePaints. - including corridors	Heat-welded resilient sheet w/ pattern	Integral	Paint	ACT - Cleanable Mylar with hold down clips	Millwork: PLAM w/Solid Surface. Counters; Wall Protection: 5" and 8" crashrails
Pre-Op Holding, PACU, and adjacent recovery areas, including interior and perimeter corridors	Heat-welded resilient sheet w/ pattern	Rubber	Paint	GWB Painted, ACT	Millwork: PLAM w/Solid Surface. Counters; Wall Protection: 5" and 8" crashrails; cubicle curtains
SPD Cartwash and Sterilization Areas	Poured Epoxy Flrg.	Integral	Semi-gloss paint	ACT - Cleanable Mylar with hold down clips	Millwork: Stainless Steel; Stainless Steel crash rails, corner guards
SPD Dispatch Area	Heat-welded resilient sheet	Integral	Semi-gloss paint	ACT	
IRM Department	Heat-welded resilient sheet w/ pattern; raised access flooring with resilient finish flooring at Main Comp. Rm.	Rubber	Paint	ACT	Modular Computer Lab casework

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Central Energy Plant					
Corridors	Sealed Concrete	Rubber	Semi-gloss Paint	ACT	Wall protection: 5" and 8" crashrails
Mechanical, Electrical Areas	Poured Epoxy Flooring	Poured Epoxy Flooring	Semi-gloss Paint	Exposed	
Staff Toilet	PCT with pattern	PCT	PCT waintscot pattern w/ Paint above	GWB Painted	
Offices / Staff work areas	Tile and Plank Resilient Flooring / Carpet	Rubber	Paint	ACT	
Recycling	Tile and Plank Resilient Flooring / Carpet	Rubber	Semi-gloss paint	ACT-Cleanable Mylar	
Domiciliary (See Hospital for HAC, Storage, Soiled and Clean Linen, Elec / Comm, Toilet Rooms standards)					
Domiciliary Common Areas					
Vestibule	PCT Border; Recessed Entrance Mat system	PCT	Decorative plaster	GWB Painted	
Waiting	PCT	Rubber	Paint; wood trim	GWB Painted, ACT	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Corridors (1st Floor Public and Floors 2-4)	PCT	PCT	Paint	ACT / GWB Painted @ Elevator Lobby only	
Reception	Carpet	Rubber	Paint	GWB Painted, ACT	Millwork-WD / PLAM / Solid Surface. @ Transaction top only
Vending	PCT	PCT	Semi-gloss paint	GWB Painted	
Recycling	Heat-welded resilient sheet w/ pattern	Rubber	Semi-gloss paint	ACT-Cleanable Mylar	

Domiciliary Resident Areas

Classroom / Training / Education / Conference	Carpet	Rubber	Paint / Acoust. Wall panels	GWB Painted, ACT	Fabric wrapped acoustical wall panels one wall min. / Whitbd/Tackbd.
Arts and Crafts / Recreation / Exercise	Linoleum	Rubber	Paint	ACT	
Laundry	PCT	PCT	Paint	ACT	
Multi-Purpose / Kitchenette	Plank Resilient flooring	PCT	Paint	GWB Painted, ACT	Millwork - PLAM / Solid Surface. Counters
Dining	Tile & Plank Resilient Flooring	Rubber	Decorative plaster; wood trim	GWB Painted, ACT	Millwork - PLAM / Solid Surface. Counters

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Lockers	Heat-welded resilient sheet	Rubber	Paint	ACT	Metal lockers
Resident Rooms	Tile & Plank Resilient Flooring	Rubber	Paint	ACT	Millwork - PLAM / Solid Surface. Counters
Resident Toilet / Shower Rooms	PCT, Mosaic	PCT	PCT - full height	GWB Painted	
Exam Treatment / Meds / and Associated Corridor	Heat-welded resilient sheet	Rubber	Paint	ACT	
Staff Areas					
1st Floor Admin Suite, including corridors.	Carpet tile	Rubber	Paint	ACT	
Serving Unit	Poured Epoxy Flooring	Integral	Wall guard wainscot with Semi-Gloss Paint above	ACT	Millwork: Stainless Steel
Bulk Food Carts / Non-Food Storage	PCT	PCT	Semi-Gloss Paint	ACT - Mylar	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Community Living Center					
Common Areas					
Entrance Vestibule	Rubber-Cushioned Impact Resistant Resilient Flooring with recessed entrance mat with carpet treads	Rubber	Curt.Wall, Masonry, Plaster, Modular Wall Panel System	GWB , Paint, ACT	
Lobby	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Curt.Wall, Masonry, Plaster, Modular Wall Panel System	GWB , Paint, ACT	Handrail-WD/SST
Connecting Corridors	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Curt.Wall, Masonry, Plaster	GWB, Paint, ACT	Handrail-WD/SST, Crashrail wall protection
Public Toilets	PCT with pattern	PCT	PCT with pattern	GWB, Paint	SSM on countertops and toilet partitions
Vending Machines	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint	GWB, Paint, ACT	
HAC / Pet / HK	PCT	PCT	PCT on wet walls, Paint (Epoxy)	GWB, Semi-gloss Paint	
Electrical Room	Concs	Rubber	Paint	Exposed, Paint	
Communication Room	Concs	Rubber	Paint	Exposed, Paint	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Staff Toilet	PCT with pattern	PCT	PCT on wet walls, Paint	GWB, Paint	
Team	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	Casework: PLAM
Staff Lockers	PCT	PCT	Paint	ACT	Solid phenolic lockers
Shower (Staff)	PCT moasic w/ abrasive grit	PCT	PCT	GWB, Semi-gloss Paint	
Soiled Utility	Seamless Resilient Flooring	Integral	Paint, Epoxy	ACT-Cleanable Mylar	
Clean Supply	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Equipment	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Recycling	Tile and Plank Resilient Flooring	Rubber	Paint	ACT	
Stor / Luggage/ Euip/ Soil/ G. Stor/ Charge	Tile and Plank Resilient Flooring	Rubber	Paint, Epoxy	ACT-Cleanable Mylar	
Elec / Mech / Trans / Wtr, Heat / Pump	Concs	Rubber	Paint	Exposed, Paint	
Kitchen	Tile and Plank Resilient Flooring	Integral	Wall guard wainscot with Epoxy Paint above	ACT-Cleanable Mylar	Millwork: SST
Dining	Plank Resilient flooring	Rubber	Paint	ACT	Millwork: PLAM w/ Quartz countertop

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
ADL / Clinic /Ther Sup	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint	GWB, Paint, ACT	Casework: PLAM, SSM counters
Administrative Areas					
Conference Room	Carpet Tile	Rubber	Paint	ACT	Smartboard, Motorized Windowshades
Single Office	Carpet Tile	Rubber	Paint	ACT	Motorized Windowshades
Shared Office	Carpet Tile	Rubber	Paint	ACT	Motorized Windowshades
Open Office Admin	Carpet Tile	Rubber	Paint	ACT	Motorized Windowshades
Resident Units					
Corridor (Patient)	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Hardyboard Accents at room entrance, Paint	GWB, Paint, ACT/ Light Monitors (Skylight)	Handrail / Crashrail, Display cabinet at room entrances

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Concierge Desk	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint	GWB, Paint, ACT	Millwork- Wood/PLAM/SSM at transaction and cntr top; Fabric at Tacksurface
TV / Din-Act / Nour	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint, Decorative acrylic accent panels	GWB, Paint, ACT	Handrail / Crashrail, Simulated Fireplace,
Quiet	Cushioned Carpet Tile	Rubber	Paint	ACT	Millwork - Wood Shelving
Exam Room	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint	GWB, Paint, ACT	Millwork - PLAM/SSM at ctr top
Med	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint	ACT	
Private Room	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint, Custom Headwall to conceal Med Gases	GWB, Paint	Overhead Lift, Millwork- PLAM / SSM countertop
Private Tlt	PCTmoasic w/ abbrassive grit	PCT	PCT	GWB, Paint	Overhead Lift, Millwork- PLAM / SSM countertop

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Laundry	Rubber-Cushioned Impact Resistant Resilient Flooring	Rubber	Paint, Epoxy	ACT-Cleanable Mylar	

Warehouse

Corridors	Heat-welded resilient sheet	Rubber	Paint	ACT	Wall protection: 5" and 8" crashrails
Workbench spaces: Electrical, A/C, Paint, Machine Shop, Masonry, Plumbing, and Grounds Maint.	Sealed Concrete	Rubber	Paint	Exposed painted	
Storage rooms / areas, and Clean Linen Carts	Heat-welded resilient sheet	Rubber	Paint	ACT	
Infectious / Hazardous Waste, Trash Collection, Recyclable Waste, Stg. Soiled Linen	Heat-welded resilient sheet	Integral	Paint	ACT - Cleanable Mylar	
2nd Floor Admin Suite, including corridors.	Carpet tile w/ pattern in corridors and open office, Sealed Concrete	Rubber	Paint	ACT, Exposed Painted	

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INTERIOR TYPICAL ROOM FINISH SCHEDULE

Room Name	Floor Material	Base Material	Wall Material	Ceiling Material	Remarks
Chapel					
Nave	Terrazzo, epoxy thinset with pattern	Precast Terrazzo	Plaster, Decorative	Wood Ceiling System w/ sound attenuation, Wood Truss & GWB, Paint	Stainglass or Translucent glass designs
Admin Areas / Offices	Carpet Tile	Rubber	Paint	ACT	
Corridor	Terrazzo - recessed entrance mat, carpet treads	Precast Terrazzo	Paint, Modular Wall System	GWB, Paint, ACT	
Public Toilets (Multiple)	PCT with pattern	PCT	PCT with pattern	GWB, Paint	

General Notes:

1. **All corners to receive 3" full ht. corner guards. End partitions to receive full ht. end cap. Finish material to be C/S Acrovyn or equivalent; wood at public spaces**
2. **All exterior windows to receive integral blinds.**
3. **Interior windows requiring privacy to receive integral blinds.**
4. **Cubicle and IV tracks to be factory applied white aluminum finish.**
5. **Cubicle Curtain Fabric to be 100% Trevira CA or Avora Polyester; 72" wide.**
6. **Solid surface counters at all sink locations, U.O.N.**
7. **Window sills shall be solid surface, U.O.N.**
8. **All wall paint to be satin, U.O.N. and all ceiling paint to be flat, U.O.N.**
9. **WC = non-vinyl wallcovering.**
10. **PCT = Porcelain, throughbody largescale tile.**
11. **ACT = Acoustical ceiling tile; 9/16" grid with tegular edge tile.**

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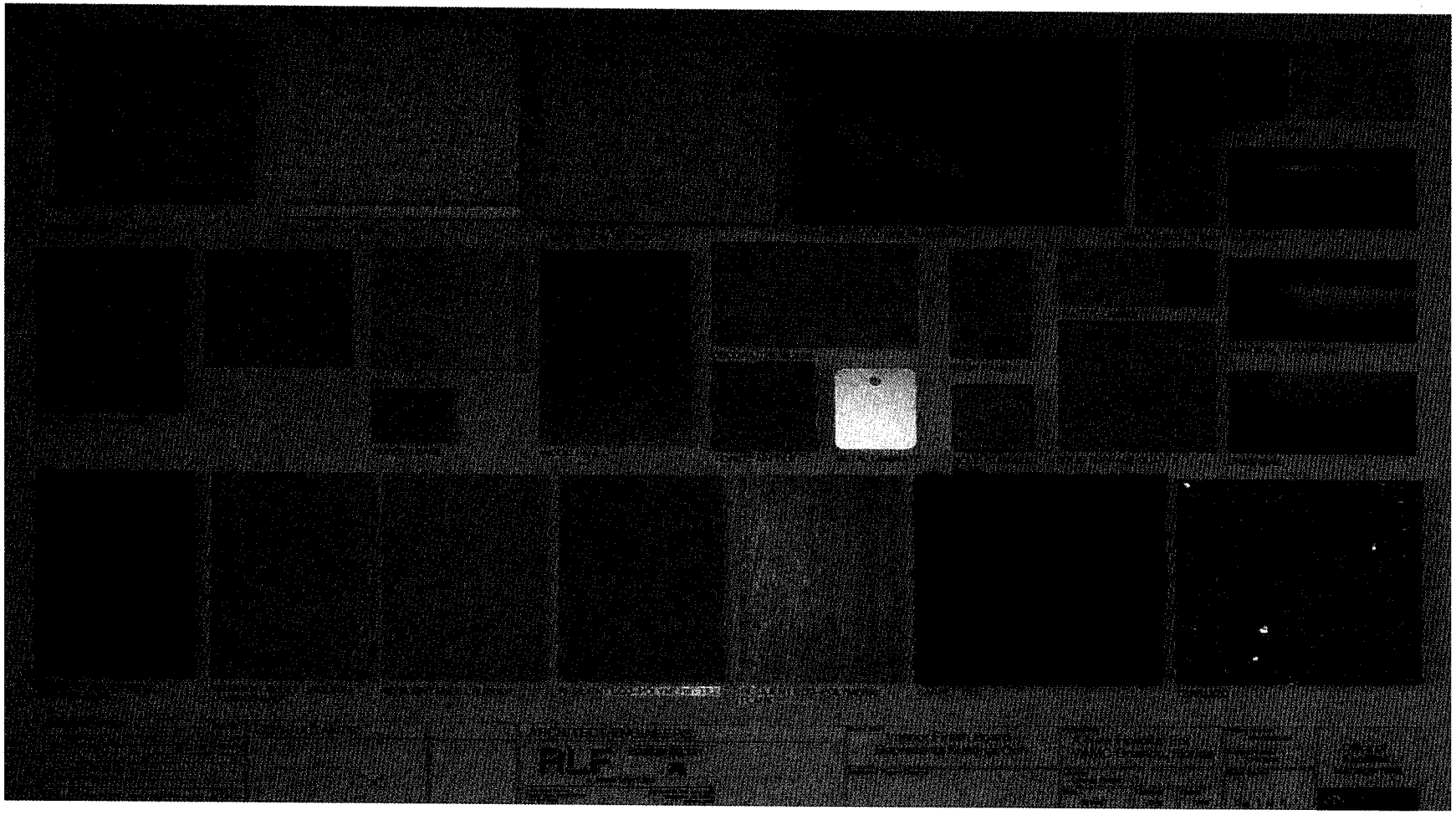
8.3 Interior Finish Board



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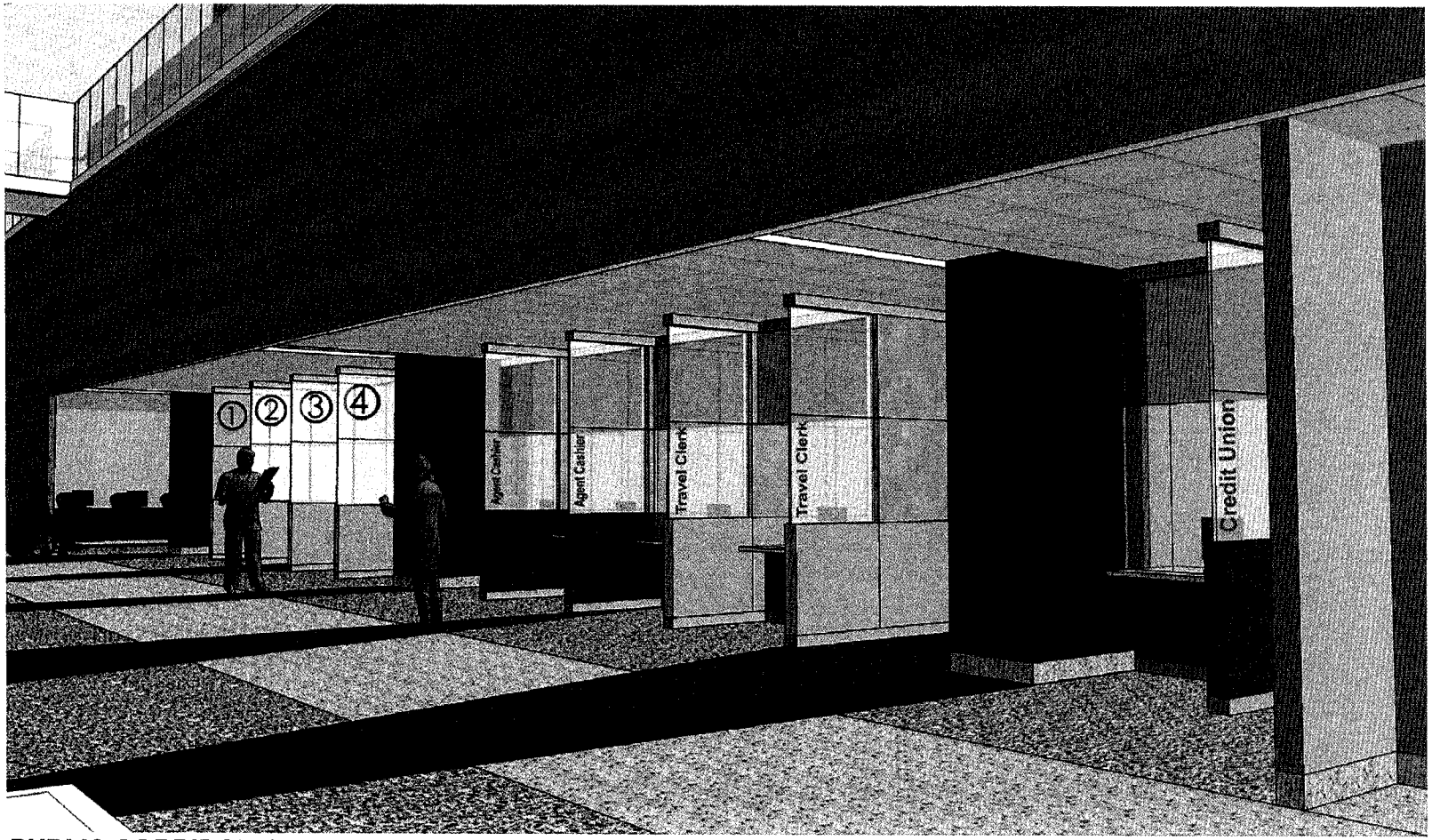
8.4 Interior Sketches



PUBLIC CORRIDOR CONNECTOR • LEVEL ONE

Department of Veterans Affairs, VA Medical Center Projects
A/E Submission for Major New Facilities, Additions, & Renovations

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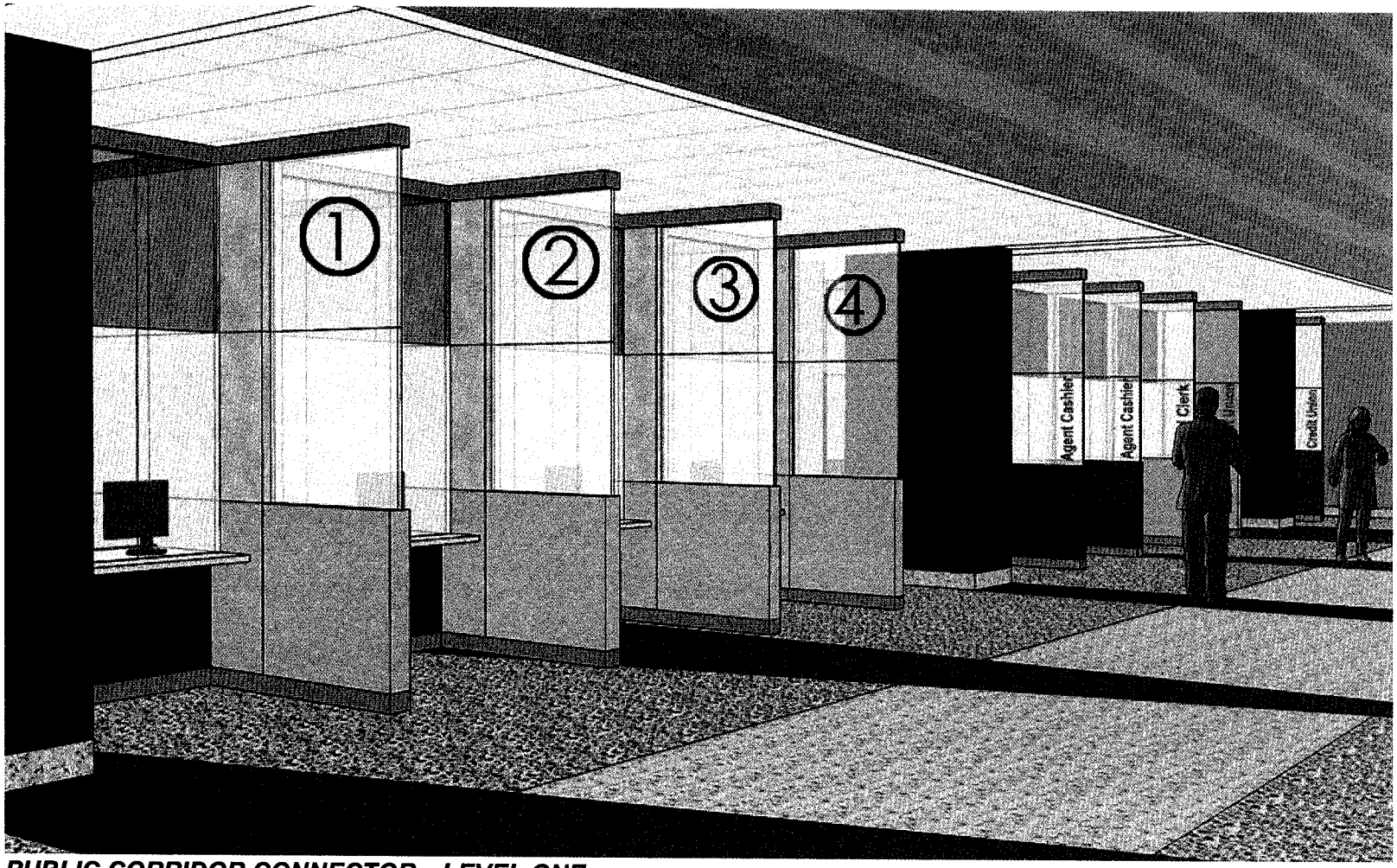

PUBLIC CORRIDOR CONNECTOR • LEVEL ONE

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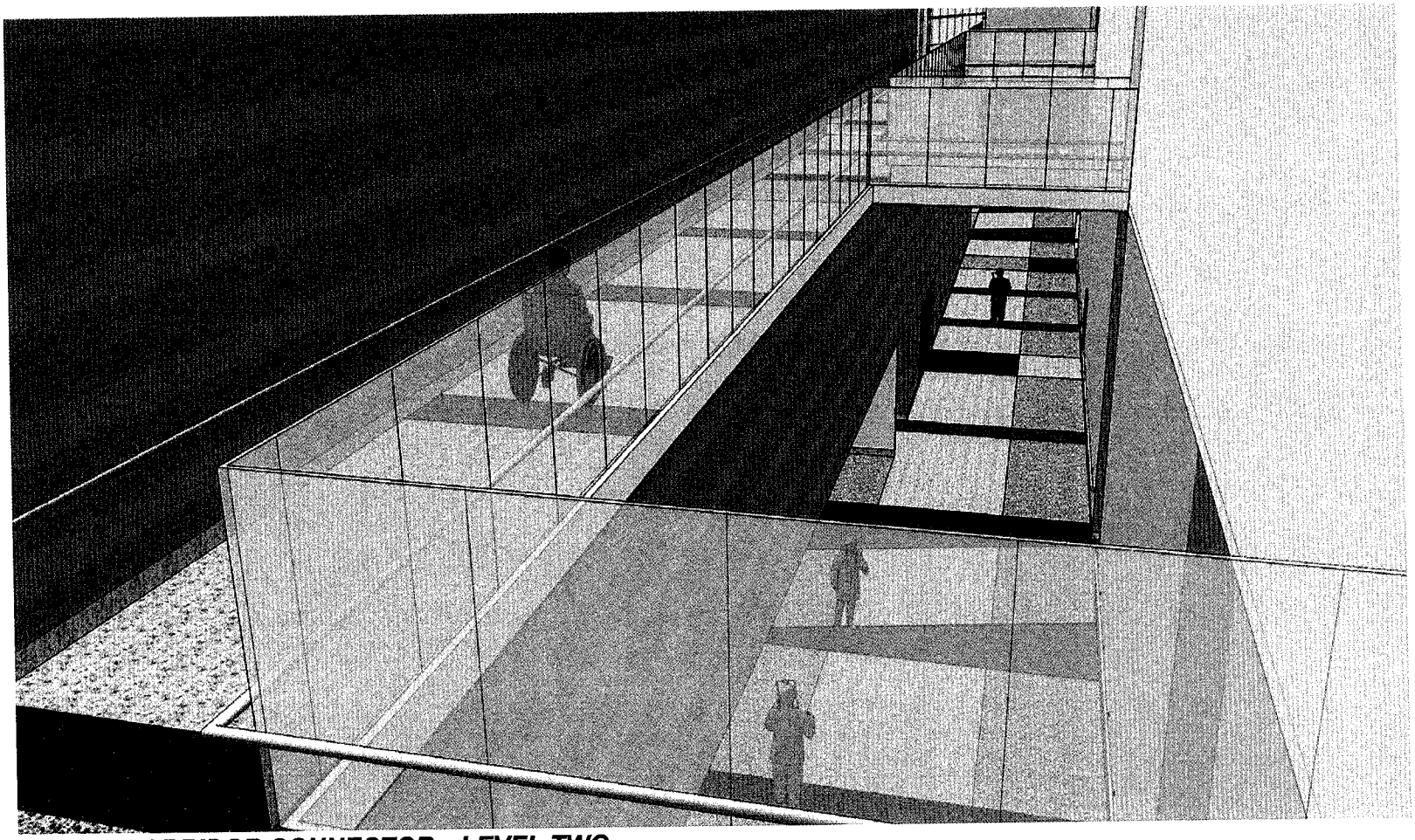

PUBLIC CORRIDOR CONNECTOR • LEVEL TWO

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OUTPATIENT ATRIUM • LEVEL ONE • ENTRANCE

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OUTPATIENT ATRIUM • LEVEL ONE • ELEVATOR LOBBIES

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OUTPATIENT ATRIUM • DINING

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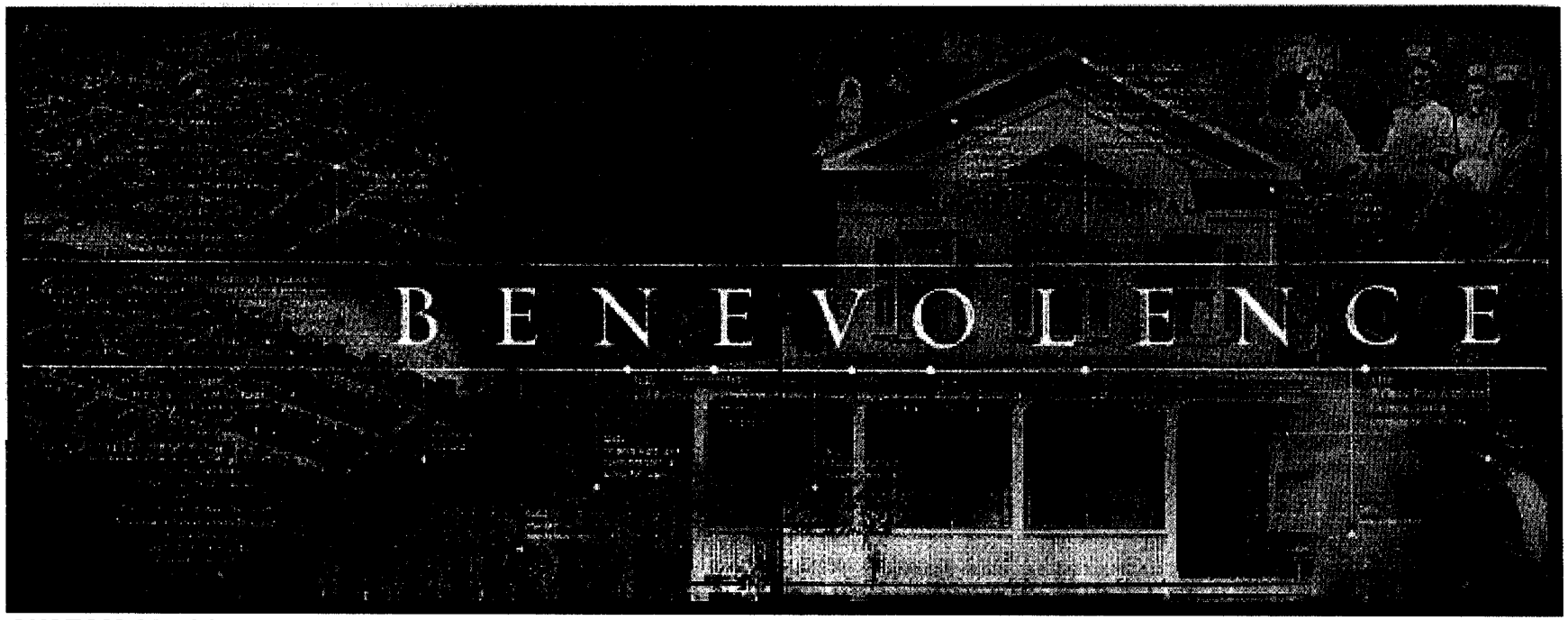

CUSTOM GLASS WAYFINDING IMAGERY • CONCEPT

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OUTPATIENT CLINIC • WAITING / CORRIDOR

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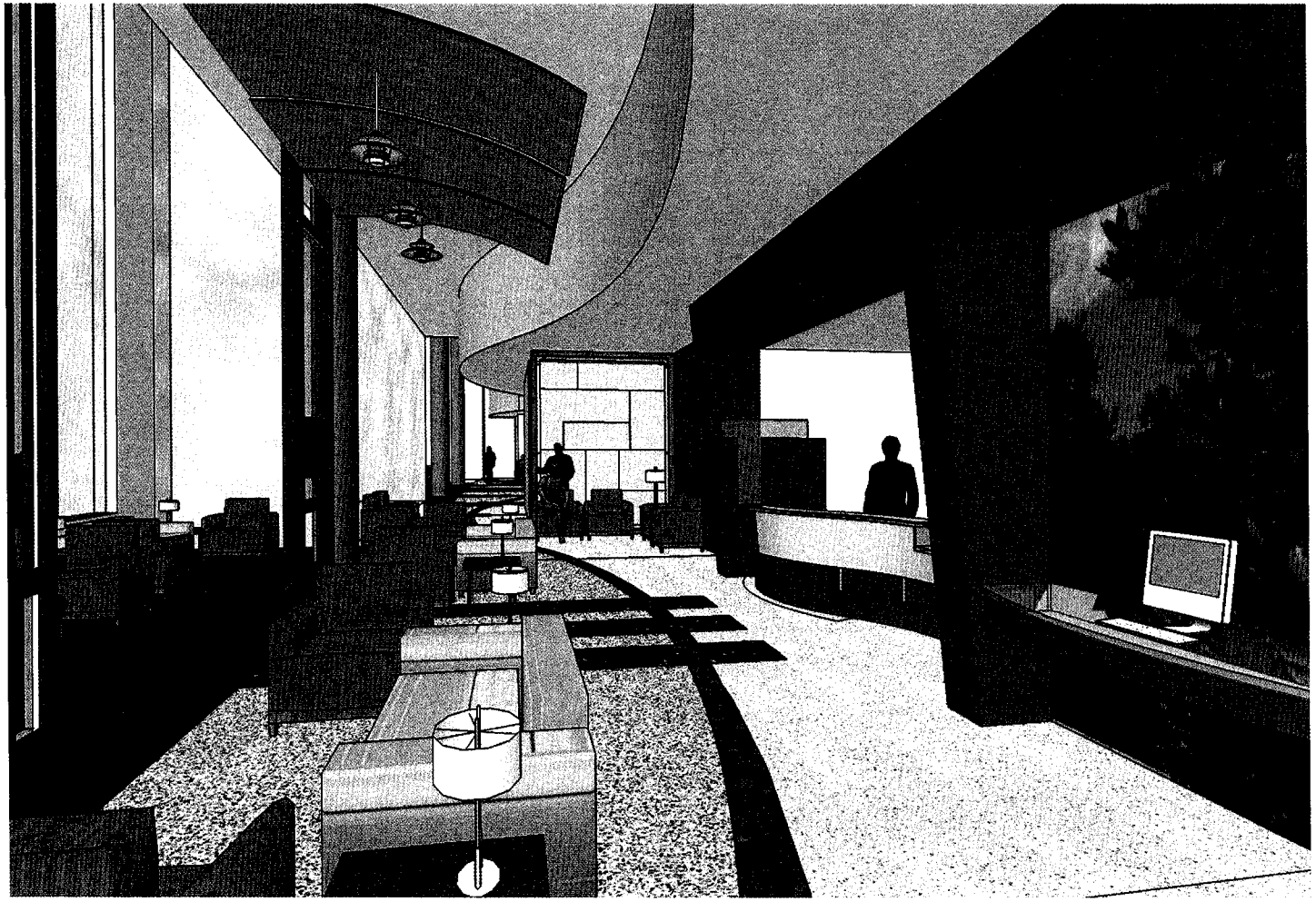

OUTPATIENT CLINIC • RECEPTION DESK • SIDE VIEW

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OUTPATIENT CLINIC • TYPICAL EXAM ROOM • SIDE VIEW PATIENT ZONE

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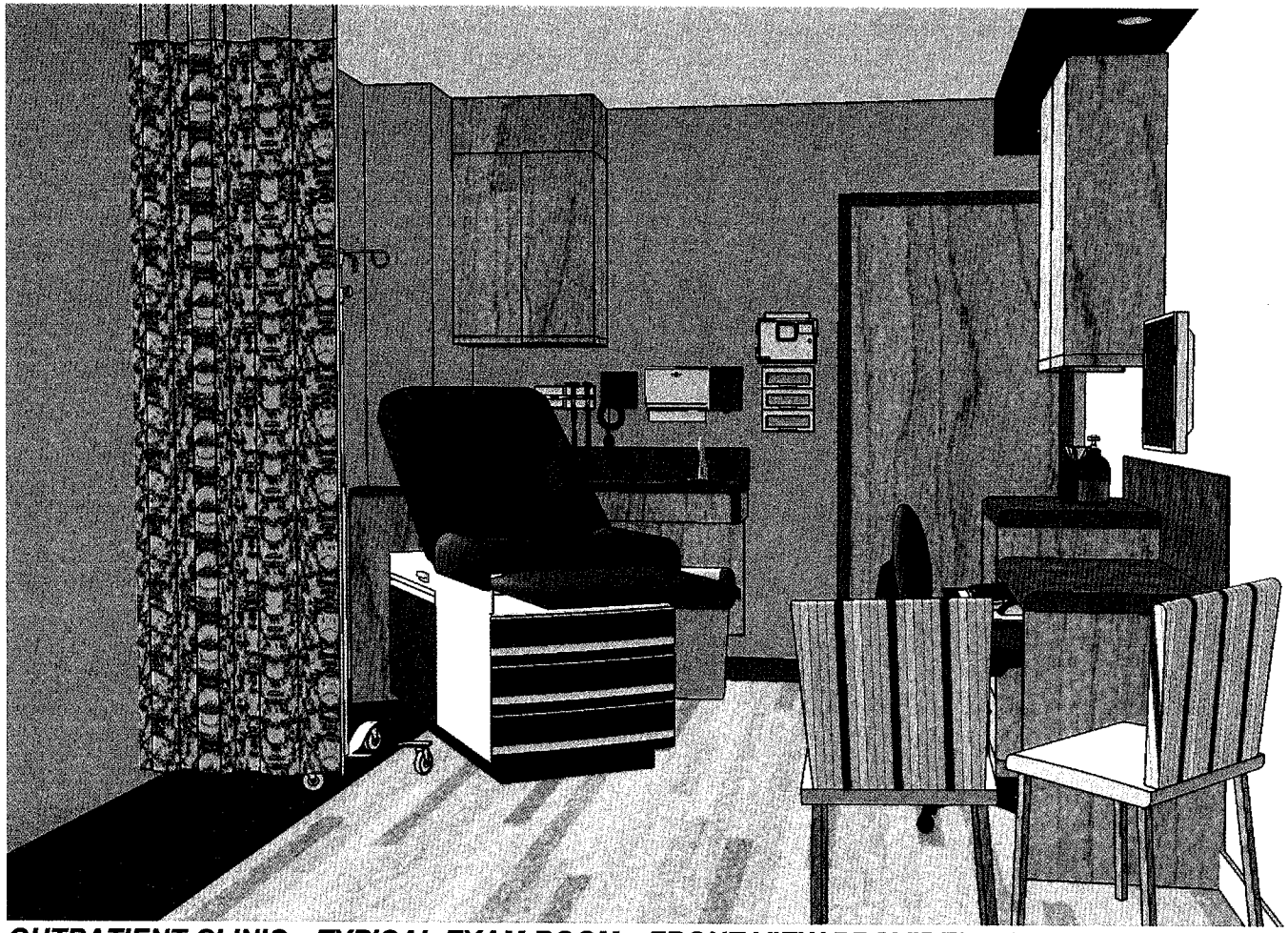

OUTPATIENT CLINIC • TYPICAL EXAM ROOM • FRONT VIEW PROVIDER ZONE

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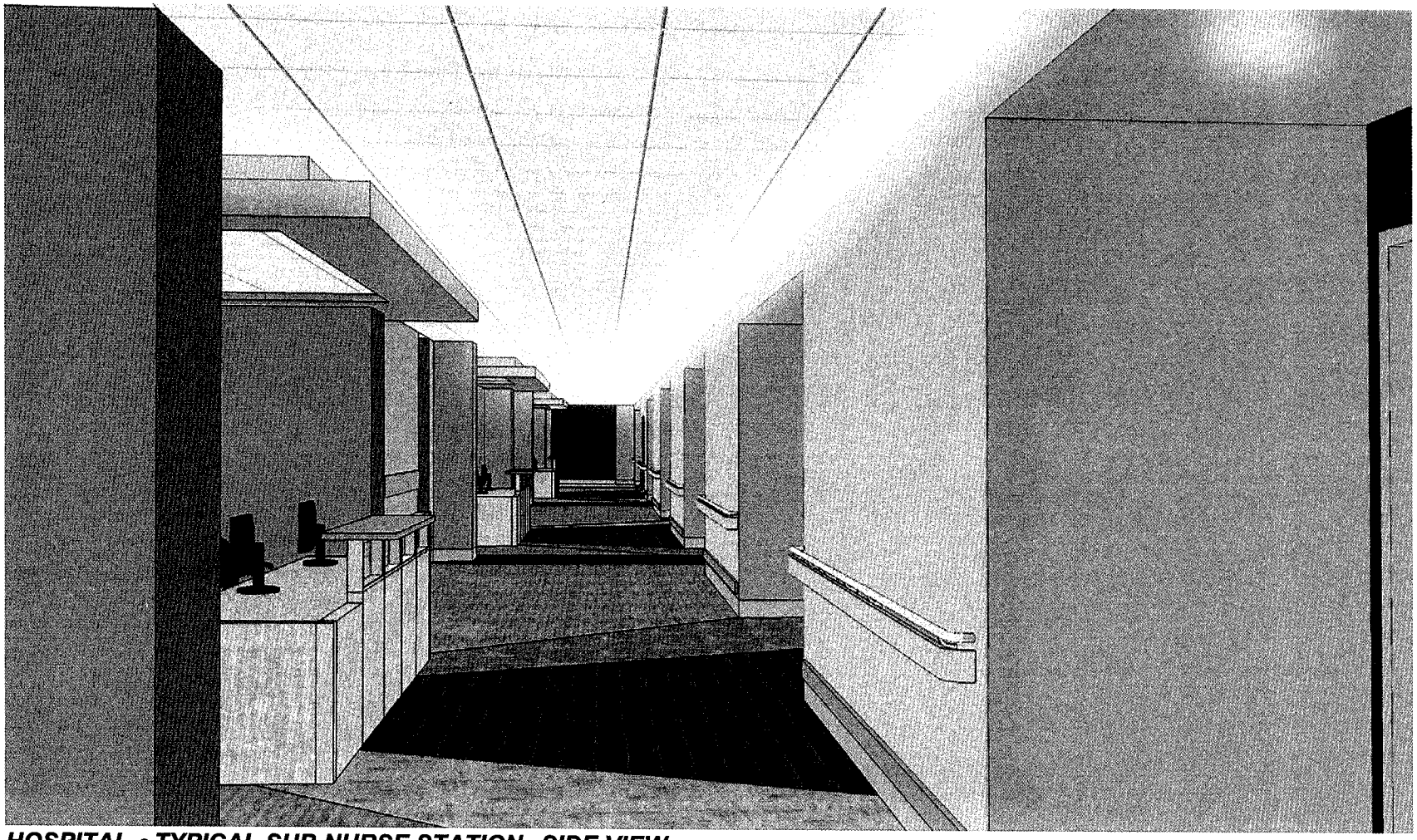

HOSPITAL • TYPICAL SUB NURSE STATION •SIDE VIEW

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HOSPITAL • TYPICAL MEDISURG PATIENT ROOM • FOOTWALL VIEW

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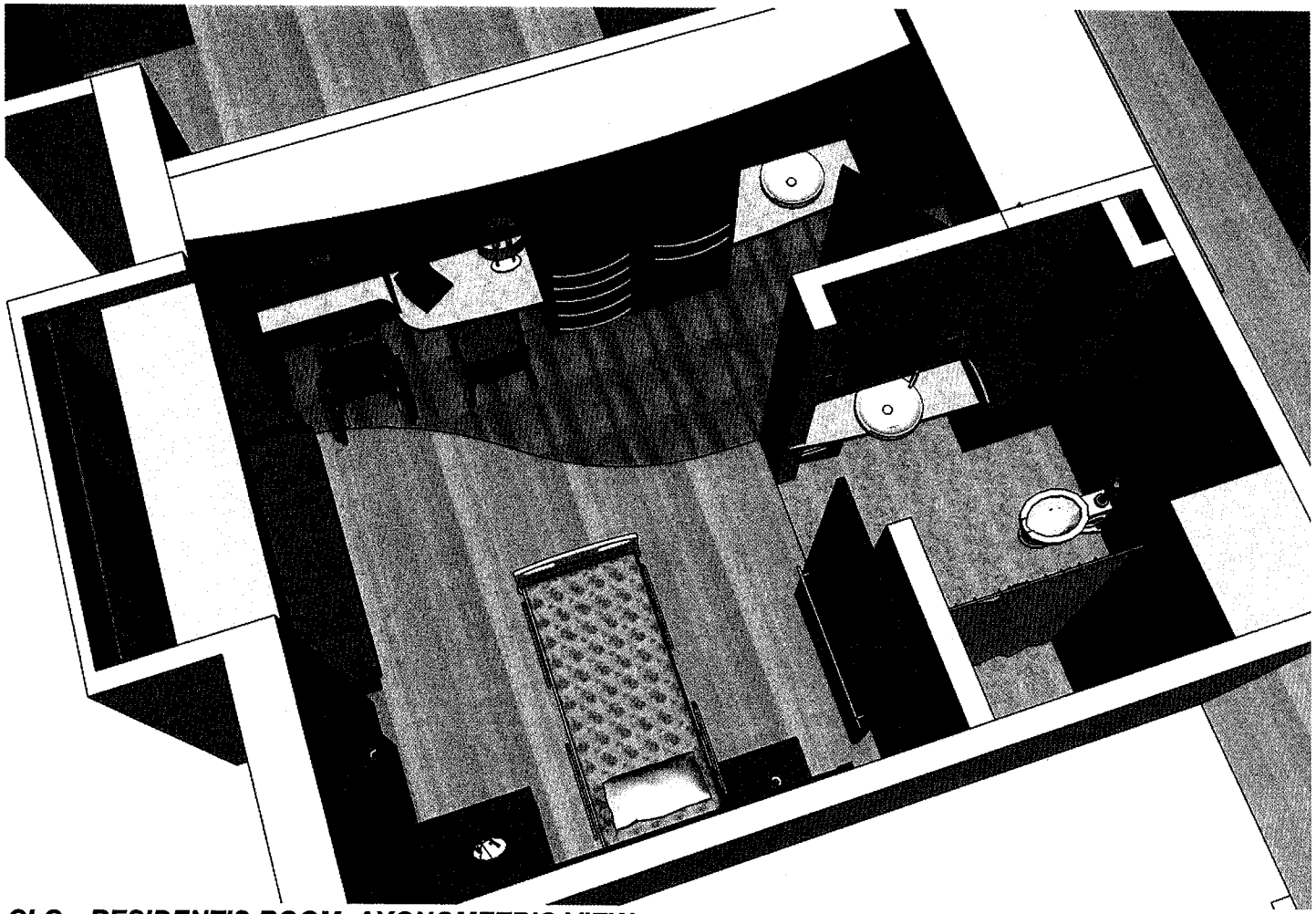

CLC • RESIDENT'S ROOM AXONOMETRIC VIEW

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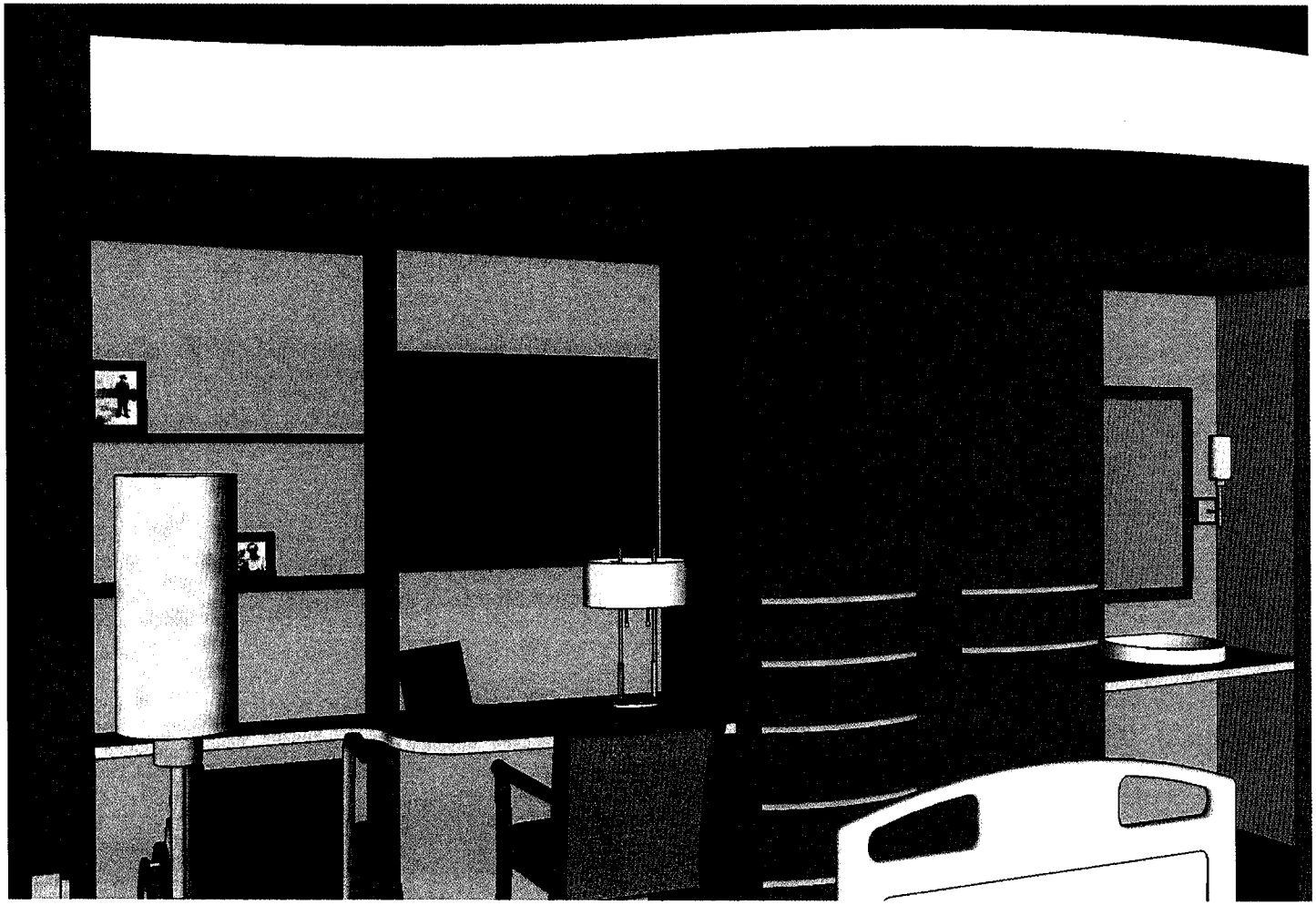

CLC • RESIDENT'S ROOM • FOOTWALL VIEW

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CLC • RESIDENT'S ROOM • HEADWALL VIEW

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CHAPEL • NAVE

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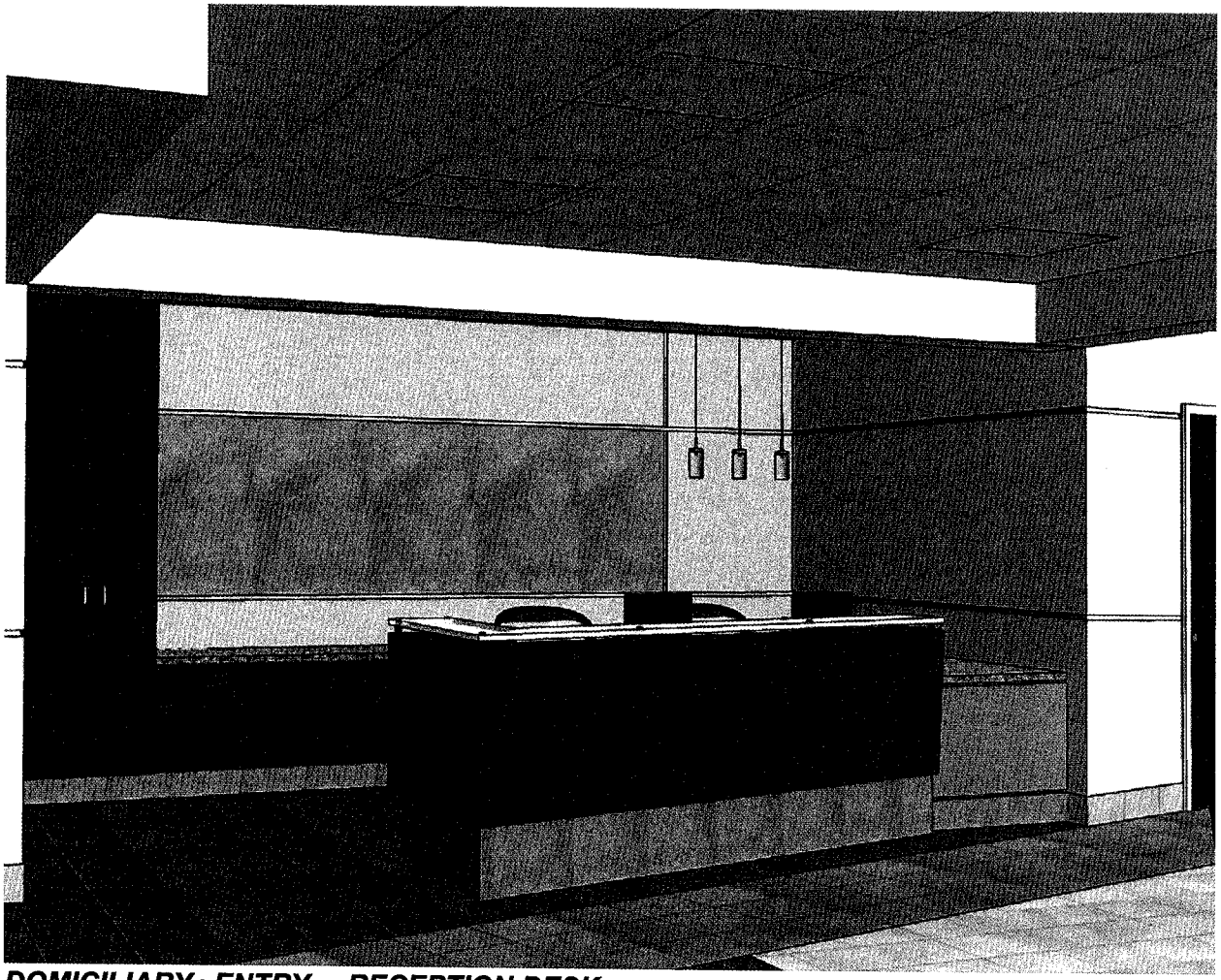

DOMICILIARY• ENTRY • RECEPTION DESK

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DOMICILIARY • ACTIVITY CORRIDOR

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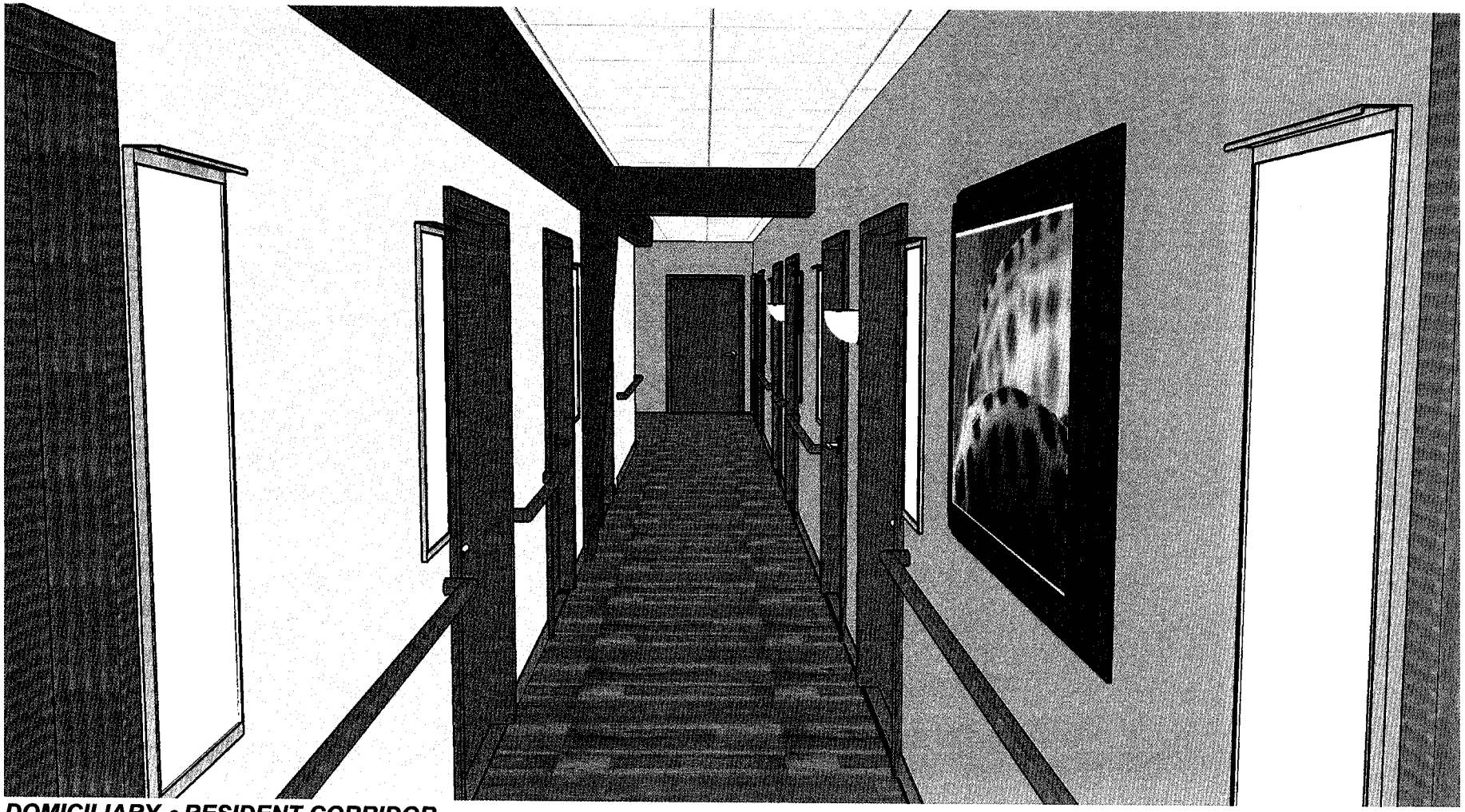

DOMICILIARY • RESIDENT CORRIDOR

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9. PLUMBING

9.1 Plumbing Design Criteria

NFPA 54 – 2006 ANSI Z223.1-2006 National Fuel Gas Code

NFPA 55 – 2005 Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks

NFPA 99 – 2005 Standard for Health Care Facilities

NFPA 101 – 2006 Life Safety Code

National Standard Plumbing Code (PHCC), 2006 Edition

Florida Plumbing Code (2004)

Florida Building Code (2004)

VA Design Guide and Technical Guide

Fire Protection Design Manual Department of Veteran Affairs

VA Hospital Building System Research Study Report

Florida Americans with Disabilities Accessibility Implementation Act (October 1993) as described in Accessibility Requirements Manual, Department of Community Affairs (January 1, 1990)

ASHRAE Standard 90.1-2004; Ventilation for Acceptable Indoor Air Quality

ASHRAE Handbooks

ASPE Handbooks

9.2 Hospital / Clinic Plumbing Design

9.2.1 Domestic Water

Potable water to service laterals will be available from two different directions on the site. Isolation valves, exterior to the building will be provided on each service main. The plumbing code required two domestic water connections for the Hospital/Clinic. Two 6 inch service laterals are proposed to serve the Hospital/Clinic. One 6 inch lateral will enter the building in a mechanical room in the Clinic; the second 6 inch lateral will enter the building in a Hospital mechanical room. Each service lateral will be provided with a 6 inch backflow preventer. The two services will be interconnected in the tunnel to ensure continuous service to the facility.

Two domestic cold water pressure boosters are proposed to provide adequate pressure at the most remote plumbing fixtures and appliances. One pressure booster will be provided in the Clinic and will be sized for the Clinic domestic water load; the second pressure booster will be located in the Hospital and will be sized for the Hospital domestic water load. Each proposed booster pump system will consist of a triplex pump arrangement; each pump sized at 50% of the connected load, with variable speed drives

and microprocessor controller. A traditional hydrostatic tank with constant volume pump system was also considered. The variable speed drives allow elimination of the tank component, and provides substantial energy and maintenance cost savings throughout the life of the equipment.

Water softening equipment will be provided in both the Hospital and Clinic. The water softening equipment will be sized for the respective building they are installed in. The water softening system will be equipped with dual water processing tanks; each with microprocessor based controller, and a brine solution tank. The softener system will provide a steady state of 3 gr/gal hardness.

Domestic water heaters will be provided in the Hospital and Clinic. The water heaters will be sized for the respective building they serve. Three semi-instantaneous, steam fired, domestic water heaters are proposed for both the Hospital and Clinic. The water heaters will be sized at 50% capacity. The temperature at the heaters will be set to provide 140 deg. F. A multiple mixing valve array in both the Hospital and Clinic will provide the distribution of 120 deg F water to the building fixtures and appliances. Booster heaters are proposed to serve the kitchen. Integral booster heaters are anticipated on surgical and dental sterilization equipment.

The application of circulating 145 deg F water through the entire potable hot water piping loop was investigated as a legionella mitigation measure. Anti-scald mixing valves are readily available for fixture applications, but the portion of piping downstream of the mixing valve is vulnerable to legionella growth. The use of a silver-copper ion exchange and chlorine dioxide injection units in the potable water system were also investigated. The chlorine dioxide injection system appears favorable due to findings from recent testing in facilities similar in magnitude to this project, and also due to the simplicity of the process and hardware. The test results indicate effective legionella eradication with no chemical additives or water temperature treatment. In addition, a residual effect maintained the system free of harmful bacteria levels for a considerable period of time with the equipment deactivated. The study information for the silver-copper ion system does not appear to be as effective. The chlorine-dioxide injection technology is proposed. The system will be installed in the CEP to provide legionella mitigation to the site's domestic water system.

Each water heater system will be provided with a hot water supply/return loop. The loop will be provided with a supply temperature of 120 deg. F and a return temperature of 110 deg. F. The domestic hot water return system will be provided with two base mounted end suction centrifugal pumps to maintain constant loop temperature. The water heaters and circulating pumps will be connected to the building DDC system to allow automatic equipment rotation. Potable hot water piping will be routed to provide a maximum of 20 feet between any plumbing fixture or appliance and the circulated main system to limit stagnant water biological growth.

The above ground potable water piping is proposed to be Type L seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the

backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

Reverse osmosis (RO) systems are required in the Hospital and the Clinic. Each reverse osmosis system consists of a skid-mounted factory package unit and includes duplex stainless steel multistage centrifugal high pressure pumps, RO membranes in fiberglass reinforced plastic pressure vessels, flow control valves, automatic system flush on shutdown, control panel mounted flow meters and pressure gages, microprocessor controller package, storage tank, and duplex booster pumps. Reverse osmosis water supply and return piping will be extended to sterilization equipment in the Hospital and to the Dialysis Department in the Clinic. The reverse osmosis water piping is proposed to be schedule 40 PVC pipe and fittings.

9.2.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system manholes exterior to the building. The connection location to the systems on site will be coordinated with the Civil Engineering design. Considering the building geometry, it is anticipated that ten main service laterals will be required; six to serve the Hospital and four to serve the Clinic. The anticipated size of each lateral is 6 inches. Below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the building, will be cast-iron, hubless construction.

An acid waste and vent system for lab areas is anticipated. The acid resistant piping will connect to an acid neutralization sump installed external to the building. It is anticipated that a 4 inch acid waste service lateral will be required. The connection location will be coordinated with the Civil Engineering design. The piping will be a high silicon alloy type. Based on the final equipment layout, if adequate dilution from acidic branch piping to flushed sanitary mains is available, the neutralization sump will be eliminated. Acid waste and vent piping is proposed to be of silicon-iron construction.

Grease waste from the kitchen will be connected to a grease interceptor installed exterior to the building. It is anticipated that an 8 inch grease waste service lateral will be required. The connection location will be coordinated with the Civil Engineering design. Below ground grease waste piping is proposed to be of cast-iron hub and spigot construction.

The roof will drain to a series of primary roof drains and secondary roof drains. The roof conductors serving the primary roof drains will connect to a central below ground rainwater capture system. It is anticipated that ten connections to the main exterior below ground rainwater capture system will be coordinated with the Civil Engineering design; six serving the Hospital and four serving the Clinic. The roof conductors serving the secondary drains will be a separately piped system. The secondary roof conductors will discharge from the building above grade. Per the plumbing code, the primary and secondary roof conductors and associated piping will be based on a rainfall rate of 4.5 inches. Below ground rainwater piping is proposed to be of cast-iron hub and spigot

construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.2.3 Medical Gas

The program indicates the need for centrally piped oxygen, medical air, medical vacuum, nitrous oxide, nitrogen, waste anesthetizing gas evacuation (WAG), laboratory compressed air and laboratory vacuum systems. In addition, the Dental area will require a low vacuum oral evacuation system, a dental high vacuum system, and a dental compressed air system. Zone valve and alarm locations will comply with the requirements indicated in NFPA 99.

The oxygen system will be sized with sufficient capacity to serve the Hospital / Clinic. The oxygen requirement will require an exterior bulk liquid oxygen tank. The oxygen tank will be located on the site, near the warehouse/engineering building. Piping will extend to the Hospital building. An emergency oxygen connection, accessible from the building exterior, will be provided at the Hospital. The system will be equipped with an electronic oxygen purity monitor. The oxygen piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

The nitrous oxide and nitrogen requirements for the facility can be accomplished with duplex gas-cylinder manifold systems. The manifolds and cylinder storage will be located near the Warehouse. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

Medical air is required at multiple locations within the Hospital/Clinic. Comparisons with similar facilities indicate that a multiple compressor system will best suit the project. A triplex compressor system with accumulator, duplex air dryers, duplex pressure regulators, dew point and carbon monoxide monitor will be provided in accordance with NFPA 99. The medical air compressor unit will be located in a mechanical equipment room. The medical air intake will extend vertically through the building and terminate above the roof level. Medical air piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

Medical vacuum will be required in the facility. A central medical vacuum pump system is proposed which consists of a triplex pump arrangement, with a common accumulator tank. The system discharge will terminate exterior to the building. The medical vacuum pump system will be located in a mechanical equipment room. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

A waste anesthetizing vacuum system will be required to serve the Operating rooms and Dental Oral Surgery. A central vacuum pump system, separate from the medical vacuum system is proposed in a mechanical equipment room. The pump unit is a duplex system with an accumulator tank. The system discharge will terminate exterior to the building. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

The oral evacuation system will consist of duplex turbine type blowers, connected to duplex accumulator tanks. Each tank/blower unit will be equipped with an automatic

surge valve for system operation at low loads. Each accumulator tank will be equipped with an electric timer operated, pumped blowdown unit. The system will be connected to an operational panel located within the Dental suite. The oral evacuation equipment will be installed in a dedicated mechanical equipment room. The Oral evacuation piping will be schedule 40 PVC with schedule 40 DWV fittings. Space for a mercury recovery unit near the oral evacuation vacuum accumulator tanks will be provided.

A dental air compressor will also be provided. A duplex compressor system with accumulator, duplex air dryers, and duplex pressure regulators will be provided. The compressor unit will be located adjacent to the oral evacuation system. The air intake will extend vertically through the building and terminate above the roof level. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

A dental high vacuum system is required. The dental high vacuum system will be a factory packaged duplex vacuum pump system with a common accumulator tank. The system discharge will terminate exterior to the building. The dental vacuum pump system will be located in a dedicated mechanical equipment room. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

Laboratory grade compressed air is required at a few locations. A duplex compressor system with common accumulator, duplex air dryers, duplex pressure regulators, dew point and carbon monoxide monitor will be provided in accordance with NFPA 99. The laboratory air compressor unit will be located in a mechanical equipment room. The laboratory air intake will extend vertically through the building and terminate above the roof level. Laboratory air piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

A laboratory grade vacuum system is also required. A central laboratory vacuum pump system is proposed which consists of a duplex pump arrangement, with a common accumulator tank. The system discharge will terminate exterior to the building. The laboratory vacuum pump system will be located in a mechanical equipment room. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

Natural gas will be provided to supply the kitchen and appliances in dental. Two natural gas service laterals will be provided for the Hospital/Clinic. One lateral will enter the building at the Clinic; the second lateral will enter the building at the Hospital. Connection to the main exterior below ground natural gas system will be coordinated with the Civil Engineering design. Below ground natural gas piping is proposed to be of polyethylene construction. Natural gas piping above ground is proposed to be schedule 40 black steel construction.

9.3 Community Living Center (CLC) Plumbing Design

9.3.1 Domestic Water

A system of potable water piping will be provided, connected to the main service serving the site. A 4 inch water service lateral is proposed to serve the CLC. Domestic water piping will enter the building in a mechanical equipment room. The connection location to the system on site will be coordinated with the Civil Engineering design.

Potable water heaters will be required for the CLC. Two potable water heaters are proposed. The heaters are proposed to be the semi-instantaneous, steam fired type. The temperature at the heaters will be set to provide 145 deg F. A multiple mixing valve array at the heaters will provide the distribution of 120 degrees F water to the building fixtures and appliances.

Legionella mitigation will be provided through a chlorine dioxide system installed in the Central Energy Plant.

The water heater system will be provided with two base mounted end suction centrifugal pumps; connected to the potable hot water recirculating system to maintain a constant loop temperature. The water heaters and circulating pumps will be connected to the building DDC system to allow automatic equipment rotation. Potable hot water piping will be routed to provide a maximum of 20 feet between any plumbing fixture or appliance, and the circulated main system to limit stagnant water biological growth.

The domestic hot and cold-water piping will be installed above ceilings and in partition spaces within the building. The above ground potable water piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

9.3.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system manholes exterior to the building. The connection location to the systems on site will be coordinated with the Civil Engineering design. Considering the building geometry, it is anticipated that sixteen service laterals, five sized at 6 inches. And one sized at 4 inches. Below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the building, will be cast-iron, hubless construction.

The roof will drain to primary roof drains secondary roof drains, scuppers and downspouts. The primary roof drains will connect to a central below ground rainwater capture system. Below ground rainwater capture system will be coordinated with the Civil Engineering design. The secondary roof drains will discharge from the building above grade. Below ground rainwater piping is proposed to be of cast-iron hub and spigot construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.3.3 Medical Gas

The program indicates the need for centrally piped oxygen, medical air, and medical vacuum systems. Zone valve and alarm locations will comply with the requirements indicated in NFPA 99.

A bulk oxygen system is located near the Warehouse/Engineering building. Due to site layout, connection to the bulk oxygen system is not feasible. Oxygen will be supplied through a duplex gas-cylinder manifold system. The manifold and cylinder storage will

be located in a dedicated room in the CLC. The system will be equipped with an electronic oxygen purity monitor. The piping will be installed above ceilings and in partition spaces within the building. The oxygen piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

A duplex compressor system with accumulator, duplex air dryers, duplex pressure regulators, dew point and carbon monoxide monitor will be provided in accordance with NFPA 99. The medical air compressor unit will be located in a mechanical equipment room. The medical air intake will extend vertically through the building and terminate above the roof level. The piping will be installed above ceilings and in partition spaces within the building. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

A central medical vacuum pump system is proposed which consists of a duplex pump arrangement, with a common accumulator tank. The system discharge will terminate exterior to the building. The medical vacuum pump system will be located in a mechanical equipment room. The piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

9.4 Domiciliary Plumbing Design

9.4.1 Domestic Water

A system of potable water piping will be provided, connected to the main service serving the site. A 4 inch water service lateral is proposed to serve the Domiciliary. Domestic water piping will enter the building in a mechanical equipment room. The connection location to the system on site will be coordinated with the Civil Engineering design.

Potable water heaters will be required for the Domiciliary. Two potable water heaters are proposed. The heaters are proposed to be semi-instantaneous, steam fired type. The temperature at the heaters will be set to provide 145 deg F. A multiple mixing valve array at the heaters will provide the distribution of 120 degrees F water to the building fixtures and appliances.

The water heater system will be provided with two base mounted end suction centrifugal pumps; connected to the potable hot water recirculating system to maintain a constant loop temperature. The water heaters and circulating pumps will be connected to the DDC system to allow automatic equipment rotation. Potable hot water piping will be routed to provide a maximum of 20 feet between any plumbing fixture or appliance, and the circulated main system to limit stagnant water biological growth.

The domestic hot and cold-water piping will be installed above ceilings and in partition spaces within the building. The above ground potable water piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

9.4.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system manholes exterior to the building. The connection location to the systems on site will be coordinated with the Civil Engineering design. It is anticipated that one main service lateral, sized at 6 inches, will be required. Below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the building, will be cast-iron, hubless construction.

The roof will drain to a series of primary roof drains and secondary roof drains. The primary roof drains will connect to a below ground rainwater capture system. One connection to the main exterior below ground rainwater capture system will be coordinated with the Civil Engineering design. The secondary roof drains will discharge from the building above grade. Below ground rainwater piping is proposed to be of cast-iron hub and spigot construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.4.3 Medical Gas

The Domiciliary does not have a need for centrally piped medical gas systems.

9.5 Warehouse/Engineering Plumbing Design

9.5.1 Domestic Water

Potable water piping will be provided, connected to the main service serving the site. A 3 inch water service lateral is proposed to serve the Warehouse. Domestic water piping will enter the building in a mechanical equipment room. The connection location to the system on site will be coordinated with the Civil Engineering design.

A potable water heater will be required for the Warehouse/Engineering Building. The heater is proposed to be an electric storage tank type. The temperature at the water heater will be set to provide 145 deg. F. A multiple mixing valve array at the heaters will provide the distribution of 120 deg. F water to the building fixtures and appliances.

The water heater system will be provided with a base mounted end suction centrifugal pump; connected to the potable hot water recirculating system to maintain a constant loop temperature. The water heater and circulating pump will be connected to the building DDC system to allow equipment control. Potable hot water piping will be routed to provide a maximum of 20 feet between any plumbing fixture or appliance, and the circulated main system to limit stagnant water biological growth.

The domestic hot and cold-water piping will be installed above ceilings and in partition spaces within the building. The above ground potable water piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

9.5.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system exterior to the building. The connection locations to the systems on site will be coordinated with the Civil Engineering design. It is anticipated that two 6 inch service laterals will be required. Below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the building, will be cast-iron, hubless construction.

The roof will drain to primary and secondary roof drains. The primary roof drains will connect to a central below ground rainwater capture system. Two connections to the main exterior below ground rainwater capture system will be coordinated with the Civil Engineering design. The secondary roof drains will discharge from the building above grade. Below ground rainwater piping is proposed to be of cast-iron hub and spigot construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.5.3 Medical Gas

The program has not indicated the need for centrally piped medical gas systems for the Warehouse/Engineering Building.

9.6 Parking Garage Plumbing Design

9.6.1 Domestic Water

Potable water piping will be provided, connected to the main service serving the site. A 3 inch water service lateral is proposed to serve each Parking Garage. Domestic water piping will enter the building in a mechanical equipment room. The connection location to the system on site will be coordinated with the Civil Engineering design.

Electric, instantaneous water heaters will be provided in multiple locations in the Parking Garage. Potable hot water will distributed to plumbing fixtures within the Parking Garage.

The domestic hot and cold-water piping will be installed above ceilings and in partition spaces within the building. The above ground potable water piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

9.6.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system manholes exterior to the Parking Garage. The connection location to the systems on site will be coordinated with the Civil Engineering design. It is anticipated that one 6 inch main service lateral will be required. For each parking garage below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the garage, will be cast-iron, hubless construction.

The Parking Garage rainwater will drain to a series of parking deck drains. The conductors will connect to a central below ground rainwater system. Considering the geometry of the Parking Garage, two connections to the main exterior below ground rainwater system will be coordinated with the Civil Engineering design for each parking garage. Below ground rainwater piping is proposed to be of cast-iron hub and spigot construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.6.3 Medical Gas

There is not a need for centrally piped medical gas systems for the Parking Garage.

9.7 Central Energy Plant Plumbing Design

9.7.1 Domestic Water

The site will be provided with two 10 inch water connections by Orlando Utilities Commission (OUC). One connection is near the main entrance to the site with the second connection is near the staff/service entrance. Site piping is proposed to be routed to a storage tank located near the CEP. A campus booster pump system is proposed in the CEP to maintain 60 to 65 psig in the campus water system. The campus booster pump system will be supplied from the water storage tank. A 12 inch discharge from the booster pump will be looped around the site, providing water to the fire hydrants and buildings. A 4 inch service lateral will be connected to the 12 inch campus booster pump system to serve the CEP. The proposed skid-mounted booster pump system will consist of a quadraplex pump arrangement; each sized for 1/3 of the connected load, with variable speed drives and microprocessor controller.

A separate potable cold water pressure booster is proposed to provide adequate pressure for mechanical equipment. The proposed booster pump system will consist of a triplex pump arrangement; each pump sized at 50% of the connected load, with variable speed drives and microprocessor controller. A traditional hydrostatic tank with constant volume pump system was also considered. The variable speed drives allow elimination of the tank component, and provide substantial energy and maintenance cost savings throughout the life of the equipment.

Water-softening equipment will be provided to serve mechanical equipment at the CEP. The softener system will lower the hardness value to 3 gr/gal.

A domestic water heater will be required for the CEP. The heater is proposed to be an electric storage tank type. The temperature at the water heater will be set to provide 145 deg. F. A multiple mixing valve array at the heaters will provide the distribution of 120 deg. F water to the building fixtures and appliances.

The water heater system will be provided with an inline centrifugal pump; connected to the potable hot water recirculating system to maintain a constant loop temperature. The water heater and circulating pump will be connected to the DDC system to allow equipment control. Potable hot water piping will be routed to provide a maximum of 20

feet between any plumbing fixture or appliance, and the circulated main system to limit stagnant water biological growth.

Chlorine dioxide source equipment is proposed in the CEP. This equipment will be sized to provide legionella mitigation for the campus water system. Locating the chlorine dioxide equipment in the CEP affords the most economical solution to control legionella. The chlorine dioxide equipment consists of a small pressurized storage tank, and a metered injection pump unit. The injection fitting will be located in the domestic water main at the discharge of the site pressure booster system.

The domestic hot and cold-water piping will be installed above slab and in partition spaces within the building. The above ground potable water piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints. Potable water piping up to the point of the backflow preventer from the point of connection to the Civil potable water piping will be cement lined ductile iron.

9.7.2 Sanitary and Storm

Systems of sanitary sewers and vents will be provided, connected to main sewer system manholes exterior to the building. The connection location to the systems on site will be coordinated with the Civil Engineering design. It is anticipated that two 6 inch main service laterals will be required. Below ground sanitary sewer piping is proposed to be of cast-iron hub and spigot construction. Sanitary and vent piping above ground, interior to the building, will be cast-iron, hubless construction.

The roof will drain to a series of primary and secondary roof drains. The roof conductors serving the primary roof drains will connect to a central below ground rainwater capture system. It is anticipated that one connection to the main exterior below ground rainwater system will be coordinated with the Civil Engineering design. The roof conductors serving the secondary roof drains will discharge from the building above grade. Below ground rainwater piping is proposed to be of cast-iron hub and spigot construction. Rainwater piping above ground, interior to the building will be cast-iron, hubless construction.

9.7.3 Medical Gas

The CEP does not have a need for centrally piped medical gas systems.

Shop air is required at a few locations. A simplex compressor system with an accumulator and pressure regulator will be provided. The shop air compressor unit will be located in a mechanical equipment room. The shop air intake will extend vertically through the building and terminate above the roof level. Shop air piping is proposed to be seamless copper, hard drawn tubing with wrought copper joints.

Natural gas will be provided to supply gas-fired boilers. One natural gas service lateral will be provided for the CEP. Connection to the main exterior below ground natural gas system will be coordinated with the Civil Engineering design. Below ground natural gas piping is proposed to be polyethylene construction. Natural gas piping above ground is proposed to be schedule 40 black steel construction.

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10. SANITARY

10.1 Sanitary Narrative

Sanitary sewage is transported and treated by the City of Orlando, Wastewater Division. The VAMC will collect onsite from the various buildings through a gravity system and pump into the municipal collection system located adjacent to the site. The municipal system has adequate capacity and reliability to ensure seven day uninterrupted service. No on-site storage will be provided. Gravity piping will be PVC SDR 26 pipe with gasket joints.

Manholes will be cast-in-place concrete. Force mains will be PVC, Schedule 40 pipe with solvent welded joints.

Sanitary pumping stations will be duplex, sized to pump peak flow with one pump.

Domestic and Fire Suppression water is provided by the Orlando Utility Commission. The VAMC will be master metered at two connection points adjacent to the site, and include an onsite, looped distribution system to the various buildings and the central energy plant. Private fire hydrants will be provided. Pipe material will be ductile iron with restrained gasket joints for mains and PVC schedule 40 with solvent welded joints for service lines. The municipal water system has adequate capacity and reliability to ensure 7-day uninterrupted service. No on-site storage will be provided. The adjacent land development will provide grey water for non-potable use. Onsite grey water piping will be provided for irrigation and to supplement the chiller make up water.

Site stormwater runoff will be collected by a gravity system and directed to a regional srormwater management system to be provided by the larger development.

10.2 Roof Drainage

Roof drainage will be collected and pumped to a grey water storage tank for use as chiller makeup water. Multiple greywater pumping stations and a separate pressure pipe system will be required to transport the grey water to thee storage tank. Gravity pipe larger than 12-inch will be reinforced concrete with silt tight joints. Gravity pipe 12 inches and smaller will be PVC SDR26 with gasket joints. Storm pressure pipe will be PVC, Schedule 40 with solvent weld joint.

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11. SITE DEVELOPMENT

11.1 Site Planning

A quality campus environment is planned for the VAMC Orlando project. Pedestrian circulation, seating, gathering areas and the creation of shade are primary design considerations for the campus. Conserving existing natural areas and restoring damaged areas will provide habitats and promote biodiversity. Restoring open areas by planting native or adapted vegetation will further promote a healing environment.

11.2 Hardscape

The hardscape will be concrete with aggregate and textured surfacing. Where the elevation changes require retaining walls the design will incorporate garden walls.

Spaces between the buildings will create opportunities for seating, gathering plazas and courtyards. These can be developed into healing gardens that allow for a variation of experiences from private, quiet spaces to more public interactive spaces. Raised planter beds will be utilized to provide the handicap interaction with nature as well as amenities such as water features and container gardens.

Sidewalks will vary in widths. Edges will have a change in texture to help people with low vision to recognize when they are off the path. The primary walks leading to the building entry will be a minimum of 8' wide to accommodate two wheelchairs side by side and for a wheel chair turn-around. The main circulation walks from parking to the primary walks will be 6' wide. A 10' wide security concourse surrounds the entire site allowing maximum visibility and walking areas for pedestrians.

11.3 Landform

The land will be contoured to form bermed landscaped areas to help scale down the building facades and add to the aesthetic value of the campus.

11.4 Planting Design

The plant palette will incorporate native drought-tolerant (Xeriscape) plantings throughout the site. Tree and shrub plantings will be selected for low maintenance, and freeze resistance. The tree plantings will provide needed shade on the hardscape, building areas and parking. The planting design will provide a cost-effective, functional, and visually appealing landscape program.

Trees proposed within the parking islands and the perimeter of the parking area meet LEED requirements for "Reduce Heat Islands". The amount and types of trees chosen in the design meet the 30% of the site's non-roof impervious surface requirement. This includes existing trees to remain. The new trees have been calculated for their shade capability for 5 years of healthy growth.

Trees planted within the hospital parking will be within pervious paving and will have engineered soil as a sub base to aid with growth. Additionally all trees planted adjacent to walks and concrete will have engineered soil to aid with the root growth.

Shade trees will be planted large enough to provide shade within 2 years. Screen shrubs will be planted to screen unsightly service areas.

Planting specifications – Plant sizes at installation

Large trees – 16'- 18' height

Medium trees – 12' height

Palms - 8'- 25' height within AF/TP boundary

Screen shrubs - 6'- 8'

Shrubs – 30" height

Groundcover – 6"-18" height

The planting will be designed and installed in accordance with sound construction and landscaping practices, Presidential Executive Order 13148 of April 21, 2000, Request for Proposal, and local codes. Plant and turf specifications will adhere to ANSI Z60.1 American Standard for Nursery Stock and Guideline specifications for sodding – American Sod Producers Association (ASPA).

An Independent soil analysis performed by a certified soil-testing laboratory will be required in addition to a water filtration and permeability test. Additional topsoil will be introduced to the site as needed for the new planting areas.

All new planting material will be guaranteed for one full year from final acceptance. Landscape maintenance will include general maintenance of plant material and mowing for one full growing season after planting. One growing season is a minimum of 90 days.

11.5 Green Roof / Healing Garden

A green roof / healing garden will provide added greenspace essential to the reduction of building heat radiation. The plant material will consist of various textures to stimulate the human senses. Irrigation will be provided that will allow for extreme conditions of drought and exposure.

11.6 Sod

State Certified Bahia sod will be provided on site within the limits of work. Disturbed areas from construction will be sodded.

11.7 Existing Vegetation

Preservation fencing will be required during construction on all trees to remain. Provide amendments and fertilizers specific for existing trees to prevent stress and shock during construction.

Protective fencing will be used for existing plant material to remain during the construction period. Trees and plant material within the limits of construction will be removed unless otherwise noted. The plant material to remain will be enhanced with

weed fabric, edging, and mulch around their base. A four-foot minimum tree ring from the base of the trunk is required for existing trees unless otherwise noted on plan.

11.8 Irrigation

A new irrigation system will be provided for the site to provide 100% coverage for all new plant material. The plant material selected will be drought tolerant, but will require a stringent watering establishment period as well as supplemental watering during the hot dry months.

A micro-irrigation system will be utilized for the Green Roof / Healing Garden. The micro-irrigation system for the roof garden will utilize potable water and will be on a separate controller from the exterior irrigation system.

The exterior irrigation system will utilize reclaimed water. The system will utilize pressure compensating heads with check valves to minimize overspray and conserve water by equalizing precipitation rates.

The controller will have a central control tied to a weather station that will automatically change running time for zones based on the weather.

There will be a two-wire loop system with a decoder, which will allow for future expansion, more flexibility with phasing and the ability to easily change or add zones.

The use of reclaimed water will require a water analysis to determine the level of treatment.

The irrigation system will be phased which will require coordination during construction to have the As-Built documents provide adequate information for tie-ins and field specific modifications.

11.9 Furniture

Benches, Litter/Ash Receptacles will be located throughout the landscape and at building entries. These will be clustered to accommodate gathering areas. Recycled material for outdoor furnishings will be incorporated.

11.10 Lighting

Landscape lighting will provide aesthetic lighting along the walkways and entrances. The lighting will have enough available foot-candles to provide visually safe walks.

11.11 Local/Regional Materials

The use of local building materials will be emphasized for landscape and irrigation products that are manufactured locally, reducing the environmental impacts resulting from transportation, and supporting the local economy. Utilize building materials that are manufactured regionally within a radius of 500 miles.

11.12 Irrigation system

Water Efficient Landscaping: Limit the use of potable water for landscape irrigation by providing a water efficient irrigation system with the use of reclaim/gray water.

Use of high efficiency irrigation system such as low volume irrigation, moisture sensors, and weather data based controllers.

Stormwater Management: Captured rainwater from impervious areas of the building and the roofs will be used for groundwater recharge, reuse within the CEP or irrigation near entrances.

11.13 Local Codes Regarding Graywater/ Rainwater Use

Orange County Codes: Follow local codes regarding OSDS (On-Site Sewage Disposal System). The use of graywater shall be limited in high water level areas, retention ponds, open drainage systems, Jurisdictional wetland areas, and underdrains.

11.14 Orange County Codes: Follow Guidelines for Graywater Use

11.15 Innovation in Design Credits, Innovative Ideas, Exceedance of LEED

Reduced Site Disturbance: Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity. Restore a minimum of 50% of the remaining open area by planting native or adapted vegetation.

Landscape and Exterior Design to Reduce Heat Islands: Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat. Calculate tree canopy for 5 year growth to provide 30% shade of impervious surface. Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials.

Recycled Content: Incorporate recycled material for outdoor furnishings.

Local/Regional Materials: Increase demand for building products that are manufactured locally, reducing the environmental impacts resulting from transportation, and supporting the local economy. A minimum of 10% of building materials that are manufactured regionally within a radius of 500 miles.

Stormwater Management: Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration and reducing contaminants. Utilize biologically-based and innovative stormwater management features for pollutant load reduction such as constructed wetlands, stormwater filtering systems, bioswales, bio-retention basins, and vegetated filterstrips.

Eliminate curb and gutter and utilizes bioswales and bio-retention basins to capture the runoff.

11.16 Identify Alternative Hardscaped Surfaces

Utilize surfaces such as turf block, permeable pavers with gravel, and gravel to increase permeability wherever possible.

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11.17 Plant Palette

Use of Xeriscape plants approved by local code. Provide shade using native or climate tolerant trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation.

Increase planting bed size to reduce grass areas. Planting beds require less water consumption.

Large Canopy trees shall be chosen for shade factor.

11.18 Geotechnical Report

Nodarse & Associates performed preliminary geotechnical exploration and geotechnical engineering evaluation for the site with field exploration in October 2008. Based on the results of this exploration and prior knowledge of the area, we offer this summary of findings and general conclusions:

The general soil stratigraphy of the site comprised loose to medium dense, clean sandy soils extending to depths between 26 and 30 feet below the existing ground surface in most boring locations. Medium dense to very dense, cemented, slightly silty fine sand considered hardpan was encountered in some borings locations at depths between 5 and 7 feet and extended to an average depth of 11 feet below existing grade. The sandy soils were underlain firm to very stiff clays and medium dense silty sands with shells typical of the Hawthorn Group of Central Florida, extending to termination depth of 100 feet in the deep borings.

Groundwater was observed at depths between 3.0 and 5.0 feet below the existing ground surface during the field drilling in mid-September 2008, with average groundwater levels between 3.0 and 4.0 feet. We estimate that the normal high seasonal water table will be at a depth of 12 inches or less below existing ground surface.

The soil conditions are generally considered suitable for support of structures up to 6 stories for the project site using conventional shallow foundation systems with an estimated allowable bearing capacity ranging between 3000 and 4000 pounds per square foot (psf). Higher bearing capacity may be achievable subject to modification of the soils, embedment depth and foundation size.

Based on the estimated seasonal high water table, we anticipate the stormwater facility on the site will be wet pond and may require underdrains or bleed down device to recover the volume.

We anticipate fill material to achieve minimum separation between the bottom of the base of the pavement and the top of the estimated seasonal high water table.

See Appendix for Geotechnical Report dated October 2008.

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12. SPACE PLANNING

12.1 Space Programs and Area-Accounting Reports

The space planning process and the means to account for the use of the area as authorized by the Veterans Administration Central Office (VACO) is a four-fold process as detailed below and in Appendix A.

12.1.1 Department of Veterans Affairs, Space Planning Program

The AE was provided copies, in both electronic and printed format, of the *Department of Veterans Affairs, Space Planning Program*. The 189 page report is included under Tab 1, Appendix A. It details, Chapter by Chapter, the authorized net area required for the functional spaces. The bases of the required net areas are the responses to staffing and program data questions detailed at the head of each chapter; but it's the list of functional spaces and the sum of the areas which are the cornerstones of the AE's space planning efforts.

On pages 5 through 7, the *Space Planning Program* summarizes the net and department gross areas Chapter by Chapter and then calculates the Total Net, Total Department Gross, and Total Facility Gross areas as follows:

Total Net Area:	593,415 NSF
Total Department Gross Area:	857,995 GSF [1]
Total Facility Gross Area:	1,158,293 GSF [2]

[1] *This equates to an average department-net-to-department-gross area factor of approximately 44.5%.*
[2] *This equates to department-gross-to-facility-gross area factor of 35%.*

However, we believe there is an error in the sum of the total net area inasmuch as both the department net area and the department gross area for VBA are listed as 17,635 SF on page 7. According to the VBA *Program Worksheet*, pages 184 through 187, the sum of the net areas is 10,228 SF. VBA then adds area for two grossing factors, "Circulation" and "Loss", to bring the department gross area to the 17,635 SF. The 7,407 SF difference between 10,228 NSF and 17,635 DGSF is the sum of the areas of the grossing factors. So the Total Net Area for the facility should be listed as 586,008 NSF (7,407 less than 593,415).

These, we believe, are the corrected summaries:

Total Net Area:	586,008 NSF
Total Department Gross Area:	857,995 GSF [3]
Total Facility Gross Area:	1,158,293 GSF [4]

[3] *This equates to an average department-net-to-department-gross area factor of approximately 46.4%.*
[4] *This equates to department-gross-to-facility-gross area factor of 35%.*

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12.1.2 The Original Program For Design

The second portion of the Space Planning process is the conversion of the *Space Planning Program* into a database which could be linked to the Revit-produced building model to take advantage of the BIM software for tracking the area.

The Microsoft Excel spreadsheet version of the *Space Planning Program* , which was non-relational data, was imported into Microsoft Access as relational data. By incorporating the existing electronic data, the AE was able to bring in all the original data with little opportunity for the end result to change; and the summaries remain the same:

Total Net Area:	586,008 NSF
Total Department Gross Area:	857,995 GSF
Total Facility Gross Area:	1,158,293 GSF

Since the key to tracking the programmed area in the plans is the relationship of data in one set with data in another, it's key to have a data code on which the relationship can be built. The *Space Planning Program* already implies such a code in the combination of the Chapter (or Department) Number and the line item number of each functional space within the department. The only caveat to this system is that resulting Line Numbers should be consistent in the number of characters to produce the cleanest consistent relationships among data entries. We recommended a six character Line Number since most Chapters are three characters (100, 316, etc.) and since at least one Chapter (262) had more than 99 functional space types.

Examples:

Chapter 262, *Ambulatory Care - Primary*; Line 101, *Medication Room* = 262101

Chapter 316, *Dialysis Center*; Line 8, *Clean Utility Room* = 316008

Now, when those same numbers appeared in the Revit plans, there will be a relationship established which will report the plan deviation from the program. Additionally, Revit accounts for each instance, by plan room number, of each of those Line Numbers if the quantity is greater than one.

The architects created Department Codes for those for which we found none: Emergency Care (500), Hoptel (510), Infection Control (520), Occupational Health (530), Union (540), and Veterans Benefits Administration (VBA); and we sorted the Chapters first by Function (Inpatient Programs, Outpatient Treatment, Clinical Services, Support Services, VBA Regional Office) as we had seen in the *Space Planning Program*, but then by Chapter number rather than alphabetically by name.

The architects further refined the data to allow planners the ability to add SEPS room codes, guide plate references, and grouping formats. These particular functions exceed the requirement for tracking the area but will provide flexibility and a link to SEPS data in the next phases of project development.

The document which resulted is the *Original Program For Design* (a.k.a. "*The PFD*") included under Appendix A, Tab 2.

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12.1.3 The Planning Program For Design

The third portion of the Space Planning process required the AE to shift some of the original programmed area among the departments. The reasons varied from simple support for unprogrammed but required functions by area from spaces no longer required but programmed to the support of an entire department, i.e., Radiation Therapy, which was not approved within the 1,158,293 GSF.

Additionally, the AE required a means to understand the programmed areas broken down by building in order to understand the campus concept.

The resultant is the *Planning Program For Design* (a.k.a. "*Planning PFD*"), included under Appendix A, Tab 3, in which we can see the breakdown of area by each building and track the shift of areas from the original department into the department which will use the area. This provided a programmer's picture of the proposed size of the buildings and a more accurate division of the area into functional departments.

A very important aspect of shifting any programmed area is that the factor at which the net area is grossed up in the original department must move with it into the functional department or else the summary totals would be affected.

Example:

Department 252, Nuclear Medicine, has a department-net-to-department-gross area factor of 50% (a multiple of 1.5). Department 238, the Director's Suite, has a factor of 30% (a multiple of 1.3). The Director's Suite included the area for the Radiation Officer; but, functionally, that area would be planned within the Nuc Med Department. The AE needed to know the approximate department gross area to allot for Nuc Med, so the 120 NSF of the office programmed in Department 238 but planned in Department 252 could be moved there, but only with its original 30% factor. Thus, no matter how much area moved or how many shifts would be made, we could always track the summaries to be:

Total Net Area:	586,008 NSF
Total Department Gross Area:	857,995 GSF
Total Facility Gross Area:	1,158,293 GSF

This process proved to be one of the most important aspects of the effort as user group after user group swapped space to create the *Planning PFD* which more accurately resembled the functional project; and it was the means through which we gathered the required area to support Radiation Therapy.

In the process of shifting area, we needed a means to deposit area for use elsewhere until we had a full list of space needs. Space Bank was born to be that depository. The *Planning PFD* tracks each deposit and withdrawal of area, always tempered by its original department grossing factor, like a bank with varying interest rates on its deposits. Today, the balance of Space Bank stands again at 0, as it should be, all of its deposits having been distributed to support functional programs throughout the Medical Center.

The *Planning PFD* is sorted similarly to the two documents which preceded it, with a level added to sort first by Building, then by Function, and then by Department Number. Each Department is presented with its original list of Line Numbers and its original sums of area. But, if a change was made by shifting area in (as a deposit) or out (as a withdrawal), then there's a yellow Planning Adjustments report which follows it, details the areas added or removed, and provides adjusted department functional totals. These are the totals against which we measure the department gross areas in the plans since these are the functional departments.

12.1.4 Application of the Program and Accounting of the Net and Gross Area

12.1.4.1 Planning

The final (and most intense) aspect of the space planning process is the planning itself and the comparison of the plans against the program. Through five rounds of user group meetings and several interim intercessions, we developed the schematic plans of this submittal. Each room in the plans includes a tag with important data as follows:

Line 1: Plan Room Number.

This was assigned automatically by Revit without duplication in any single model as an accounting measure. Later we'll add Architectural room numbers which better coordinate with wayfinding and Construction Document format. For now, Revit's numbering system suffices for us to distinguish similar rooms from one another.

Line 2: Room Name

The room name in plan represents the actual function; this doesn't always coincide with the room name in the PFD for the Line Number.

Line 3: Programmed Area / Planned Area

The first number is the area as authorized, and the second is the actual area of the room in plan. The goal is to plan each space within 5% of the authorized area and, where that's not possible, to provide a comment to substantiate the conditions.

Line 4: Line Number

As described above, the Line Number is the combination of the Chapter number and the line item from the original Space Planning Program. This is the most important line in the tag as it's the link in the relationship of planned data to programmed data.

Line 5: Substantiating Comment

This line is hidden in the plans because of its small font and, usually, long content; it's the place to substantiate a planned deviation from PFD greater than 5%. The comment is shown in the Net Area Tabulations Report detailed next in this section.

All the tags are gathered into the Room Schedules of the Revit models, and the data is exported to the Access database for processing. Although Revit can perform many of the calculations we need, it currently doesn't have a means to create reports like Access or other database software; and Revit is encumbered by the calculation process, which slows it (and aggravates the planners).

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12.1.4.2 Net Area Accounting

Under Appendix A, Tab 4 we have the Net Area Tabulations Report (affectionately known as NATs for reasons you can imagine). The NATs are sorted similarly to the *Original PFD* under Tab 2, first by Function, then by Chapter number. Since the comparison of planned net area to programmed has little reference to its place in a building or a particular department, we didn't impose sorting by building or by functional departments; those have more bearing on gross area. For this report, we held the format of the original programming documents to make comparison of those original lines as clear as possible against the planned lines.

The format of the report includes the original data under the green column, including the Line Number, the Programmed Room Name, the Programmed Quantity, the Programmed Net Area Each, and the Programmed Net Area Total (Quantity x Net Area Each). At the end of each Chapter, you'll find the sum of the net area matches the original Department Net Area Total.

Chapter by Chapter, Line Number by Line Number, the planned data is reported under the adjacent blue column. It's further defined by Plan Room Number, Plan Room Name, Planned Net Area Each, and Planned Net Area Total.

Plan Room Number includes Revit's automatically assigned room numbers preceded by a code to help us locate the room in the plans. The code is the combination of a Letter Code for the building in which the room is planned and the floor level on which it's located. The codes for the buildings are: **D** for Domiciliary, **H** for Hospital / Clinic, **N** for CLC / **C** for Chapel, and **W** for Engineering / Warehouse.

When the Programmed Quantity matches the Planned Quantity, it's possible to calculate the area difference on a one-to-one basis and to provide a calculation of the deviation for each entry. When either the Program Quantity exceeds the Planned Quantity or vice versa, it's not equitable to perform a comparative calculation on a one-to-one basis; so it's undertaken on a total-to-total basis. Negative differences are shown in red font, positives in black. Those which exceed 5%, either negative or positive, are shown in bold font in their respective color. If the deviation is greater than 5%, the substantiating comment is printed in the same color as the difference. (We applied similar rules to those of the DoD for this process, as much for the sake of time through production of this submittal as for prudence. Small spaces programmed at 50 NSF or less which exceed the 5% rule are left without a comment if the deviation is not ridiculously high, the basis of that judgment being that even a small difference on a small space could show an excessive deviation and such tight parameters on small spaces lend little to maintaining the area budget.)

Examples:

262036 was programmed as 1 @ 200 NSF and planned as Room H1-669 @ 205 NSF (that's the Hospital / Clinic building, 1st Floor). The calculation is a one-to-one type showing a 5 NSF difference and a positive deviation of 2.5% in standard black font.

262044 was programmed as 1 @ 50 NSF and planned as Room H1-793 @ 39 NSF. The calculation is a one-to-one type showing a -11 NSF difference and a negative deviation of 22.0% in bold red font. Even though this space is one of those programmed at 50 NSF or less, 22% is a rather high percentage and deserving of a substantiating comment. So the comment appears also in red font.

262051 was programmed as 1 @ 915 NSF and planned in five separate rooms on two floors of the Hospital / Clinic: H1-14 @ 103 NSF, H1-822 @ 283 NSF, H1-823 @ 177 NSF, H1-824 @ 177 NSF, and H2-713 @ 177 NSF. It's not practical to compare each of the five to the original 915 NSF as the results would be misleading. So the sum of them, 917 NSF, is compared and found to be 2 NSF beyond. Its 0.2% positive deviation is shown in standard black font.

262095 was programmed as 8 @ 250 NSF and planned as 10 @ 200 NSF each. Although the sum of the programmed and the planned are equal, a 0.0% deviation, this is not a one-to-one type comparison; and so the calculation is made as a total-to-total.

Those are enough examples, I think you see the point. There are multiple other types of one-to-many and many-to-one results, but the concept of reporting them is similar. One thing more: when a substantiating comment is similar among many planned rooms of the same Line Number, for clarity's sake (and to save paper) we let the comment read through just one of them. It'll be clear when you see one.

There's a Chapter-by-Chapter summary at the end of the report which compares the total programmed 586,008 NSF (there's that number again) to the total planned.

12.1.4.3 Gross Area Accounting

Now for the Gross Area Tabulations Report (GATs) under Appendix A, Tab 5. This report and the accompanying Department Plans under Tab 6 reflect the transition of the program from the original *Space Planning Program* through the *Planning PFD* and into the *Schematic Plans* of this submittal.

The GATs Report is sorted first by Building, then Function, then Chapter number to illustrate the programmed and planned sizes of the various buildings and to calculate the actual planned department-gross-to-building-gross factors.

The structure of the GATs Report is set up as follows:

Building-by-Building, Function-by-Function, then Chapter-by-Chapter it lists the original programmed Department Gross Areas of the *Space Planning Program* under the green column. The sum of these is the original Total Department Gross Area of 857,995 GSF; and, at its original 35% factor (1.35 multiple), the Total Facility Gross Area shows as the authorized 1,158,293 GSF.

Then in the adjacent orange column, we have the Department Gross Areas of the *Planning PFD*, the document under Tab 3 which accounts for all the shifts in area among the occupants. All those re-aligned Department Gross Areas illustrate real functional departments as discussed earlier, and the sum of them remains 857,995 GSF; the 35% factor follows to maintain the programmed Total Facility Gross Area at 1,158,293 GSF.

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The actual planned Department Gross Areas are adjacent to that under the blue column, and the diagrams under Tab 6 are the Department Plans which illustrate those numbers. These areas and those of the Total Building Gross Area of each building are exported directly from the Revit model similarly to the export of the net area data. In the summary of each building, there's the calculated actual department-gross-to-building-gross area factor.

Finally, under the yellow column, are the deviation calculations, including the difference in GSF and as a percentage of the Planned as compared to the Re-aligned. Unlike net area, where the percent difference has heavy bearing on usable space within a room, in gross area, the difference indicates efficiency as compared to the department grossing factor. So an acceptable spread of deviation is naturally wider than in the NATs.

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13. STEAM DISTRIBUTION (OUTSIDE)

13.1 Heat Energy Distribution

Heat generation systems will be required to serve the facilities planned for the VA Orlando Hospital campus. The design effort to date has visualized a District style heating system including a central boiler plant and transmission piping to each building. The heating system life cycle cost study included three alternatives; a high pressure steam (HPS) boiler system, a low pressure steam (LPS) boiler system, and a high temperature hot water (HTW) boiler system. Included in each heating system alternative was a transmission piping system. The HTW heating system indicated the best LCC value in the heating system study and for purposes of this study it has been included.

The HTW system is configured with a two-pipe hydronic supply and return transmission piping arrangement. Supply and return water are provided to each building. The normative supply temperature is approximately 400 degrees F. The return water is anticipated to be in the range of 250 degrees F.

Parallel to the exterior heat energy transmission systems are cooling energy transmission systems and a private fire suppression water service main. These additional piping systems also extend to the Hospital / Clinic, Home, Domicilliary building, and Engineering Building/Warehouse. A series of piping valve vaults has been established to enable sectionalizing the utility feeds for emergency shutdown, maintenance, and component replacement. The study model included space for these additional utilities respectively in the costs for tunnel work, trench work and excavation.

The use of building crawl spaces, tunnels and basement spaces integral to campus facilities was considered for the transmission piping in the tunnel concept.

13.2 Transmission System Report

Three heat energy transmission system alternatives were developed for study. The first suggests a below ground tunnel type pipe enclosure (HTW-TN). The piping would be field-fabricated and insulated; installed on an accessible support system. Areas were established in the layout to accommodate thermal expansion loops, pipe guides and anchors. The second option uses a shallow trench type piping enclosure (HTW-TR). In this alternative, the piping would be field fabricated, insulated and metallic jacketed; installed on an accessible support system with similar pipe expansion treatment. The third alternative includes direct buried, factory insulated piping (HTW-DB). The piping system would include internal primary piping, insulation, an exterior welded steel conduit/casing, and interior air space; fully drainable and dryable. Factory insulated pipe expansion loops and pipe anchors are included. A realistic study period of 50 years was used in each of the models.

The HTW-TN alternative provides the greatest level of installation integrity. It does however, require the greatest capital investment. The soil composition at this geographical location requires the tunnel to be a cast-in-place concrete enclosure; substantially waterproofed with all penetrations effectively sealed. The valve vaults and pipe expansion spaces would be integrated to the tunnel configuration. Access spaces;

removable vault top slab sections, manholes with ladders and stairways to the tunnel bottom have been included in the study model. The tunnel system also requires mechanical ventilation. Sump pumps were included as the depth from grade to the tunnel bottom would not enable gravity drainage. In order to minimize general construction costs, where the tunnel can be integrated to the substructure of a building, this has been included. The HTW-TN concept provides the greatest protection for the piping systems. It is anticipated that the piping system can effectively remain in service well in excess of 50 years.

The HTW-TR option provides a somewhat decreased level of piping protection as compared to the tunnel concept. The construction and acquisition costs are however, substantially less. Similar to the tunnel, a shallow cast-in-place concrete trench with lift-off top slab sections was modeled. Similar valve vaults and pipe expansion spaces were integrated to the trench layout. Valve vault access, manholes with ladders to the vault bottom have been included. Each vault also requires mechanical ventilation. Sump pumps would be required at each valve vault locations. Based on experience with lift-off top slab trench design, the layout is not fully sealed as compared to a tunnel; the metal jacketing included on the piping systems will provide a secondary means of pipe and insulation protection. Similar to the tunnel concept, the trench alternative will enable the piping systems to remain in service in excess of 50 years.

The HTW-DB system is the most fundamental type of exterior heat energy pipe installation. The construction and acquisition costs are the lowest of the three alternatives. This application uses factory constructed, engineered pre-insulated and cased piping products. The requirement for valve vaults remains; most similar to the HTW-TR concept. The piping would be configured with direct buried expansion loops, bends and pipe anchors. The piping would be pitched to enable casing drainage to valve vaults. Cathodic protection would also be required, consisting of sacrificial anodes, tracer wiring and multiple test stations. Dielectric isolating flange kits would be required at each piping penetration into a valve vault and building. This type of system is vulnerable to damage and corrosion. A properly engineered and installed system may last up to 50 years, but the model includes a realistic provision for replacement of portions of the piping during this period.

The LCC study indicated the following ranking:

System	LCC cost ($)
HTW-TN	7,553,723
HTW-TR	7,254,592
HTW-DB	7,586,496

The HTW-TN and HTW-TR ranking occurs primarily based on capital investment costs. The general construction costs for the tunnel system are essentially greater than a trench system. The maintenance and replacement costs for each are virtually identical. Unless there is a need for the use of a tunnel in other program purposes; materials management or logistics, the tunnel option although quite desirable is often difficult to

validate. Due to the partial sharing of some of the general construction costs in the tunnel option; spaces below buildings incorporated into the tunnel design, the LCC difference between the two results in the trench system being approximately 4% less than the tunnel.

The HTW-DB system indicated the highest life cycle cost. Although the installation costs are least of the three alternatives, the anticipated maintenance and replacement costs are higher. Experience has indicated that a properly engineered and installed HTW-DB system is a viable alternative. However, unless available investment capital is limited, the direct buried system is best avoided.

Based in this analysis, the trench concept is recommended.

13.3 Life Cycle Cost Analysis

Data from the DOE 2 energy analysis calculations was used to compare system life cycle costs (LCC). The LCC study process validates the mechanical system proposed. The software used for the LCC portion of the exercise is the "Life Cycle Cost in Design" program, written and supported by the BLAST Support Office at the University of Illinois, Urbana. A copy of the LCC calculation printout is included in the Appendix of this document.

13.4 Piping Calculations

The pipe sizes used in the study models were based on accumulated flow rates for the loads anticipated for each building. A supply temperature of 400 degrees F and a return water temperature of 250 degrees was used to generate the flow rates. The maximum water velocity used for pipe sizing is 8 fps. The HTW system will utilize variable volume pumping; the minimum water velocity is expected to be above 2 fps. Pipe sizes are indicated on the mechanical Site Plan illustrations. Detailed pressure drop calculations will be included in future design submittals.

13.5 Site Plans

A site plan has been developed for each of the transmission system concepts. These are included in the Appendix of this document.

13.6 Soil Conditions

A site reconnaissance has not yet been performed for the project as the appropriate site has not yet been validated. Earth conditions in the Central Florida area are relatively consistent. It is anticipated that subsurface conditions will reveal a predominance of slightly silty fine sands with some areas consisting of sandy clay. Sands are usually loose to a depth of approximately 20 feet, progressing towards a medium density below this point. Occasional limestone is often encountered as well.

Groundwater can vary depending on proximity to surface waters. Soil saturation is usually in the range of three to the ten foot level.

Detailed information through soil boring and analysis will be included in future submittals when the site becomes validated.

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14. STEAM HEAT GENERATION

14.1 Steam Loads and Categories

A heat generation system will be required to serve the facilities planned for the VA Orlando Hospital campus. Heat energy is required for essential building heating, and potable water generation. Process heat loads related to the Food Service operation, Sterilization equipment and Humidification equipment are planned to be accommodated through either point-of-use steam generation equipment or alternative fuel sources.

Consensus thought visualized a District style heating system including a central boiler plant and transmission piping to each building. A life cycle cost study was conducted to validate the appropriate system. The study included three alternatives; a high pressure steam (HPS) boiler system, a low pressure steam (LPS) boiler system, and a high temperature hot water (HTW) boiler system.

Heat Energy Loads and Categories

Data from the Hospital / Clinic DOE 2 block load energy analysis calculations was used to compare system life cycle costs (LCC). In addition, historical energy consumption data from facilities similar in magnitude; unique to the Central Florida Healthcare market, was applied for the remaining buildings on site. Detailed load calculations will be provided at future submittal intervals.

14.2 Life Cycle Cost Analysis

Three alternatives were modeled for the heating systems analysis; a high pressure steam (HPS) boiler system, a low pressure steam (LPS) boiler system, and a high temperature hot water (HTW) boiler system. Included in each heating system alternative was a transmission piping system. The software used for the LCC portion of the exercise is the "Life Cycle Cost in Design" program, written and supported by the BLAST Support Office at the University of Illinois, Urbana. A copy of the LCC calculation printout is included in the Appendix of this document.

14.2.1 High Pressure Steam – Alternative 1

Heating system alternative number one included a traditional central high pressure steam boiler plant (HPS). The normative steam range for HPS systems is at a point above 60 psig, to approximately 125 psig. The modeled system consists of three equally sized scotch-marine firetube steam generators, deaerator, boiler feed pumps, condensate storage tank and pumps, boiler blowoff and boiler blowdown equipment. The HPS system would serve the campus heating systems; shell and tube heat exchangers, and instantaneous potable water heaters. A steam pressure setpoint of 125 psig was used which is conducive to instantaneous type water heating equipment. Steam and condensate transmission piping would be required to connect the boiler plant to each building on campus.

Each steam generator would be outfitted with a combination natural gas/number two fuel oil burner with IRI gas/oil valve train, configured for forced draft combustion. The boilers included modulating feedwater controls and additional combustion safeguard devices.

Each boiler requires dual independent safety relief valves, and a stop-non-return valve at the steam drum outlet. Each boiler would be equipped with an individual stub-stack; constructed of stainless steel.

The boiler system requires support from a central condensate return/boiler feedwater handling system. The system includes a condensate surge (storage) tank, condensate transfer pumps, deaerator/feedwater heater with storage tank, and boiler feed pumps. The condensate storage tank; sized for a minimum 20 minute maximum plant firing rate, would be a horizontal configuration factory fabricated steel tank, vented to the atmosphere. Tank sizing also considered condensate return surge flows from the campus. The make-up water to the condensate storage tank would provide softened/treated water as a primary service, and non-treated cold water for emergency back-up. Multiple-stage centrifugal pumps were modeled for condensate transfer to the deaerator.

The deaerator storage tank was also modeled to include a 20 minute plant firing rate. Plant steam would be required by the dearator to liberate oxygen and pre-heat the boiler feedwater; a steam pressure-reducing valve was included to maintain deaerator pressure. Chemical treatment was included for the deaerator system. The dearator would also be equipped with emergency make-up water control valves and float control switches. Multiple-stage centrifugal boiler feed pumps were modeled for boiler feedwater. An electronic proportional water level control valve installed on each boiler would maintain the boiler water levels. Chemical treatment was also included for boiler corrosion control and priming.

A boiler blowdown system was included consisting of slow and quick opening valves on each boiler, and a blowdown separator with automatic discharge cooling valve. A separate boiler blowoff economizer system was also considered utilizing surface blowoff effluent from each boiler. Sample coolers for the boiler system and deareator were included.

The steam piping would be constructed of schedule 40 black steel with malleable steel and forged steel buttwelding fittings. Pipe sizes 12 inches and above would be standard weight. The condensate piping, blowdown piping and blowoff piping would be constructed of schedule 80 black steel with extra heavy malleable steel and forged steel buttwelding fittings. Class 300 valve, fitting and piping products would be used in all HPS and HP condensate applications. The piping would be insulated with either calcium silicate or fiberglass insulation. Chemical feed and boiler/feedwater sample piping would be constructed of stainless steel. A main steam-piping valve header would be located where accessible on the mezzanine or floor for ease of operation.

Post transmission, the steam pressure would be reduced within the buildings to serve the hydronic heat exchangers. Steam pressure regulating stations were included where required, consisting of isolation valves, external pneumatic pilot operated pressure regulator, bypass piping with throttling valve and pressure relief valve. Each building would be equipped with a condensate return tank and multiple-stage centrifugal condensate return pumps.

The plant model also included an industrial grade, plant central monitoring and control system. The system would be modular PLC based with an operator workstation located in the plant office. The system would include modulating boiler control, boiler rotation, stack effluent monitoring, deareator control, and condensate return control.

14.2.2 Low Pressure Steam - Alternative 2

The second heating system alternative included a conventional central low pressure steam boiler plant (LPS). Low pressure steam is defined as including system pressures up to 15 psig. The system consists of boilers similar to the HPS combination; three equally sized units, boiler feed pumps, condensate storage tank, and boiler blowdown equipment. The LPS system would serve the campus heating systems; shell and tube heat exchangers, and potable water heaters. The potable water heaters in this alternative however, would be tank type as instantaneous heaters of the magnitude required are not compatible with a LPS system. Steam and condensate transmission piping would be required to connect the boiler plant to each building on campus.

The boilers would be typical of that described for the HPS system except that stop non-return valves would not be included.

The boiler system would be supplied by a central condensate return/boiler feedwater handling system. The system included a condensate surge (storage) tank and boiler feed pumps. The condensate storage tank; sized for a minimum 20 minute maximum plant firing rate, would be a horizontal configuration factory fabricated steel tank, vented to the atmosphere. Tank sizing also considered condensate return surge flows from the campus. The make-up water to the condensate storage tank would provide softened/treated water as a primary service, and non-treated cold water for emergency back-up. Multiple-stage centrifugal pumps were modeled for boiler feed service. Chemical treatment was also included for boiler corrosion control and priming.

A boiler blowdown system was modeled consisting of slow and quick opening valves on each boiler, and a blowdown separator with automatic discharge cooling valve.

The steam piping would be constructed of schedule 40 black steel with malleable steel and forged steel buttwelding fittings. Pipe sizes 12 inches and above would be standard weight. The condensate piping and blowdown piping would be constructed of schedule 80 black steel with extra heavy malleable steel and forged steel buttwelding fittings. The piping would be insulated with either calcium silicate or fiberglass insulation. Chemical feed piping would be constructed of stainless steel. A main steam-piping valve header would be located where accessible on the mezzanine or floor for ease of operation.

A plant steam setpoint of 15 psig is would enable a limited amount of campus transmission capability. Steam pressure reducing valves would not be required within the buildings. Each building would be equipped with a condensate return tank and multiple-stage centrifugal condensate return pumps.

The plant model also included an industrial grade, plant central monitoring and control system. The system would be modular PLC based with an operator workstation located

in the plant office. The system would include modulating boiler control, boiler rotation, stack effluent monitoring, and condensate return/boiler feedwater control.

14.2.3 High Temperature Water – Alternative 3

Heating system alternative number three included a high temperature hot water heating plant (HTW). A supply water temperature of 400 degrees F and return water temperature of 250 degrees F was used. The system consists of three equally sized forced circulation watertube high temperature boilers, centrifugal water circulating pumps, dynamic expansion tank, make-up water tank and accessories. The HTW system would serve the campus heating systems; shell and tube heat exchangers, and instantaneous potable water heaters. Hot water supply and return transmission piping would be required to connect the boiler plant to each building on campus.

Each boiler would be outfitted with a combination natural gas/number two fuel oil burner with IRI gas/oil valve train, configured for forced draft combustion. The boilers include modulating water temperature control and additional combustion safeguard devices. Each boiler required dual independent safety relief valves. Each boiler would be equipped with an individual stub-stack; constructed of stainless steel.

Minimum flow through the high temperature water boilers is essential and variable volume flow through the transmission piping is highly desirable. The boiler system was configured with a variable-primary pumping system complete with an automatic bypass valve and air separator. Each boiler would be equipped with industrial grade differential pressure sensor/transmitters to enable the minimum boiler flow rate. Although a minimum flow turn-down point would be established through the variable frequency drive motor starters on the campus circulating pumps, an automatic bypass valve would enable a secondary means of boiler low-flow protection.

The dynamic expansion tank would be an inert gas-charged type. The tank would be sized to accommodate the system volume, including a reserve volume for pump surety, plus freeboard volume. An additional overflow/make-up water tank and pumps would be required. Chemical treatment was included for the system. The make-up water tank would also be equipped with make-up water control valves, float control switches, and duplex multiple-stage centrifugal pressure pumps.

Single-stage end suction centrifugal system circulating pumps were modeled for the system.

A boiler blowdown system was included consisting of slow and quick opening valves on each boiler and a blowdown separator with automatic discharge cooling valve.

The high temperature water piping would be constructed of schedule 80 black steel with extra heavy malleable steel and forged steel buttwelding or socket-welding fittings. The piping would be insulated with either calcium silicate or fiberglass insulation. A main hot water piping valve header would be located where accessible on the mezzanine or floor for ease of operation.

The plant supply water temperature of 400 degrees F is compatible with the instantaneous potable water heaters. The 400 degrees F corresponds approximately to 250 psig which is well below the design threshold of Class 300 valve, fitting and piping products normally applied to this type of system. High temperature water would be piped directly to each hydronic hot water heat exchanger and instantaneous potable water heater. Each heat exchanger and potable water heater would be equipped with an automatic two-way control valve for capacity control.

The plant model also included an industrial grade, plant central monitoring and control system. The system would be modular PLC based with an operator workstation located in the plant office. The system would include modulating boiler control, boiler rotation, stack effluent monitoring, expansion tank monitoring, and make-up water control.

14.3 Summary

The HPS system is commonly applied to this type of campus. High pressure steam requires minimal electrical transport energy. It does however require extensive make-up water of which pre-heating to diminish boiler thermal stress and corrosion control is also required. It is anticipated that 70% of the steam would be returned in the form of condensate water. The condensate is returned at a relatively high temperature; in the range of 180 degrees F. The condensate must be heated in the deaerator to above the boiling point to enable oxygen removal for corrosion control and provide the pre-heating. The 30% of make-up water and the related energy to provide the pre-heat work impose a substantial additional load on the boiler system. Treatment of the boiler feed water with chemicals for oxygen removal is possible, but the deaerator is nevertheless required for thermal protection. The additional boiler capacity required for pre-heating and the cost of the deaerator are additive system costs. The HPS system is however, capable of effective low-cost energy transmission; campus-wide, due to simple pressure differentials.

The LPS system is normally applied to domestic applications; within a building, versus a campus distribution system. The maximum system pressure of 15 psig clearly limits the transmission distance. Calculations revealed that through the modeled layout, with a 15 psig plant pressure, using ASHRAE steam pipe sizing guidelines, a steam pressure of approximately 8 psig would result at the furthest connected appliance. This, coupled with a 3 to 5 psig appliance control valve pressure drop in addition to other associated valve train accessories would limit the effective pressure at the appliance steam bundle to less than 5 psig. Where this appears empirically satisfactory, when surge periods occur, the boilers would simply not be able to effectively maintain an appropriate pressure. The other concern is that the system leaves no safety factor for future campus expansion or facility modification. Regarding the high capital investment, even though this system does not employ a deaerator as the potential for boiler thermal stress is not as great, the steam piping costs are higher due to the larger sizes required.

The HTW system is commonly applied to campus sizes similar to and in excess of the scope of this project. The boiler technology is slightly more sophisticated, but the inherent safety and simplicity of a two-pipe hydronic layout favors this system. Boiler

thermal protection and make-up water are not concerns as the system uses a closed-loop design normally requiring no make-up water. The need for chemical treatment is diminished with a closed loop system. There are no steam trap type devices to maintain with this system. There are fewer pumps required; building condensate pumps are eliminated. This system does however require more electrical transport energy than its steam system counterparts.

The issue of licensed Power Plant operators, was a talking point during initial project development. The market for individuals with this skill level is limited, making this a somewhat premium commodity. The LPS system does not require licensed operators due to its low operating pressure, the HPS and HTW systems do. A central plant of the magnitude planned for this project requires 24 hour/day, in-plant surveillance and attention. Even with a LPS system, chemical treatment for instance requires periodic checking; at least three times per day is recommended to ensure long boiler and piping life. The study included the premium required for staffing the HPS and HTW systems with licensed Power Plant operators versus basic plant level maintenance personnel.

A breakdown of the LCC results is as follows:

System	LCC cost ($)
HPS	19,528,850
LPS	19,404,870
HTW	19,509,340

Even though the LPS system maintains the highest construction and acquisition cost and the highest major repair and replacement cost, it indicated the lowest LCC due primarily to the premium staffing requirements of the HPS and HTW systems. The LPS system is however, not practically applicable to this campus layout. It should be avoided.

The HTW system ranked second in LCC favor due to its operational simplicity. The HPS system ranked highest in LCC and it should be noted that the fuel energy required to provide the deaeration work forces the boiler sizing increment into a capacity which was greater than the LPS and HTW system boiler sizes.

The study recommends the HTW system. The design is currently indicating the HPS system as it is a common application, and the construction cost is more conservative than its LPS and HTW counterparts. It is recommended that discussion continue regarding the boiler plant application into final resolution.

14.4 Life Cycle Cost Analysis – Equipment for Heat Recovery

Heat recovery equipment for the central boiler plant setting commonly involves the improvement of combustion efficiency, or the capture of other waste heat in the process. Two types of active heat recovery were considered in the study alternatives.

The first is flue gas energy recovery. This application usually consists of flue-gas to water heat exchanger unit installed in the boiler stack. The unit consists of cased finned

tube elements connected to inlet and outlet headers. Stack flue gas is normally within the temperature range of 450 degrees F. Recovery rates equivalent to 150 degrees F of flue gas temperature are possible with this technology correlating near to 4% of improved boiler energy efficiency. Flue gas economizers are commonly applied to steam boilers; feedwater and/or make-up water can easily be preheated through this process.

The HPS and LPS study models included the performance of a flue gas economizer at each boiler. The HTW system did not include this technology as it is not applicable to the lower flue gas temperatures encountered with high temperature hot water boilers.

An additional heat recovery option was considered for the HPS system; a boiler blowoff economizer. Surface blowoff is required on HPS boilers as a thermal stress countermeasure. Since this technology is applicable only to HPS systems, and the blowoff flow rate is anticipated to be very low, the alternative was not considered for study.

14.5 Data on Emissions

The proposed VA Hospital campus is currently in an attainment compliant area for airborne emissions. With the use of natural gas and number two fuel oil as fuels, there are no known restrictions regarding the boilers planned for the central plant. Restrictions generally limit the quantities and types of emissions per appliance. Low emissions engine generator units are currently required by State mandate.

It is anticipated that the emissions resulting from the plant boiler burners will eventually violate State and Federal emissions restrictions, potentially necessitating costly field equipment conversion.

It is suggested that the boilers and engine generators for this project be equipped to provide a low emissions impact within the range of practicability, using current technology. The new boilers will be equipped with low NOX high efficiency burners. The generator engines will be equipped with low emissions combustion technology.

14.6 Selection of Equipment and Sizes

Refer to Section 7 for a detailed description of the boiler plant equipment capacities.

14.7 Site Plan

Site plans have been developed for transmission system concepts. These are included in the Appendix of this document.

14.8 Central Energy Plant Plan

A floor plan of the Central Energy Plant is included in the drawing set potion of this submittal.

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15. STRUCTURAL SYSTEMS

15.1 Overview

15.1.1 General

This Part of the Narrative describes the proposed structural framing systems for six distinct buildings at VAMC – Orlando. The design criteria, structural system selections and options are discussed. The purpose of the structural design is to provide a load supporting / resisting framework that is compatible with the architecture and that will permit the needed mechanical and electrical installations. This Part is a statement of the current design directions that serves as the basis for budget estimating and support for further discussions of the project goals and objectives.

15.1.2 Structural Framing Systems

Optional Structural Framing Systems being considered for six new buildings, including Hospital / Clinic, CLC, Domiciliary, Central Energy Plant, and Parking Garage, will have at least two of the following elements.

Reinforced concrete flat slab

Reinforced concrete flat plate

Reinforced concrete one-way joists and beams

Precast prestressed concrete slabs and beams

Post tensioned concrete slabs and beams

Structural steel frame

Composite steel and concrete floor decks

Steel joists and roof decks

Light gage metal stud

15.1.3 Definitions

ACI American Concrete Institute

AISC American Institute of Steel Construction

ASTM: American Society for Testing and Materials

UBC: Uniform Building Code

PSI: pounds per square inch

MPH: miles per hour

NFPA: National Fire Protection Association

PSF: pounds per square foot

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15.1.4 Design Criteria

Codes and Standards. Design criteria for the structural analysis and design of this building will be based upon the following Codes and Standards:

IBC-2006 Edition

ACI 318 Building Code Requirements for Reinforced Concrete, 2002 Edition

AISC Manual of Steel Construction-Allowable Stress Design, 9th Edition

AISC Hollow Structural Sections, Connections Manual

AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts.

PCI Design Handbook, 5th Edition

VA Design Manuals and Guidance on the Technical Information Library

Design Live Loads

Operating- and Exam-Rooms and Labs	80 PSF *
Private Rooms and Wards	60 PSF *
Corridors	100 PSF
Corridors above 1st floor	80 PSF
Offices	70 PSF *
Lobbies	100 PSF
Administrative Services	80 PSF
Clinical and Support Services	80 PSF
Kitchen and Dining Areas	100 PSF
Pharmacy and Retail	100 PSF
Loading Docks and Platforms	250 PSF
Maintenance and Repair Shops	150 PSF
Garage	40 PSF
Interstitial Space	25 PSF
Light Storage Areas	125 PSF **
Heavy Storage Areas	250 PSF**
Mechanical Areas	150 PSF **
Roofs designed as future floors	80 PSF *
Future Roofs not designed as future floors	20 PSF
Including 20 PSF Partition Load	

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** or Equipment Load if Heavier

**** A pathway has been defined for the future installation of an MRI camera.

Lateral Loads

For Wind

Basic Wind Speed: 110 MPH

Exposure: C

Importance Factor I = 1.15

For Seismic

1.0 Second spectral Response Acceleration S1 = 0.046 g

0.2 Second spectral Response Acceleration Ss = 0.113 g

Occupancy Category for Hospital Building IV

Occupancy Category for Other Buildings III

Seismic Design Category for Hospital Building C

Seismic Design Category for Other Buildings B

Response Modification Factor R = 3

Deflection Amplification Factor Cd = 2.5

15.1.5 Structural Materials

Concrete Materials

Concrete for foundation and wall footing f'c = 3000 psi

Concrete for floor slab, concrete beam and column f'c = 4000 psi

Concrete for slab on grade f'c = 4000 psi

Precast concrete f'c = 5000 psi

Light weight concrete fill for steel floor deck f'c = 4000 psi

Concrete Reinforcement

Deformed Reinforcing Bars ASTM A 615 Grade 60

Welded wire fabric mesh ASTM A 185

Structural Steel

Rolled W shapes ASTM A992

Other shapes, plates and bars ASTM A36

Cold formed hollow structural sections ASTM A500, Grade B

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Steel pipe	ASTM A53, Grade B	
Anchor Bolts	ASTM F1554	
Bolts		ASTM A325

15.1.6 Future Expansion Affecting Structural Systems

Vertical Expansion. Some structures will be designed for vertical expansion at future determined locations. Gravity loads due to the future expansion will be considered in the design of the foundations and columns. The present lateral system elements will also be designed for future vertical expansion.

Horizontal Expansion. Structure is not designed for future horizontal expansion.

15.1.7 Foundation Systems

A formal soils report has not yet been issued so the schematic phase design assumptions are based on the preliminary soils report prepared by Nodarse & Associates dated October 24, 2006.

15.1.8 Overview.

Based on the recommendations and analyses in the preliminary soil report a shallow foundation system has been studied.

15.1.9 Spread Footings

Allowable bearing pressure = 4000 PSF.
Minimum width for wall footing = 2 feet.
Minimum width for spread footing = 3 feet.
Minimum bottom-of-footing depth below adjacent finished grade is 2-0".

15.1.10 Foundation Wall Construction

Wall Construction
Minimum wall thickness = 12 inches.
Equivalent fluid pressures at basement walls: 50 PSF.
Equivalent fluid pressures at cantilever retaining walls: 40 PSF.

15.1.11 Slabs On Grade

Standard Slab on Grade: 4000 psi, low-slump, large aggregate concrete, 5-inches thick, with non-structural fibrous reinforcing.

Place slab directly on vapor barrier over compacted subgrade.

Support reinforcing fabric on approved chairs that will not damage vapor barrier

15.1.12 Structural Framing Options For Six New Buildings

Hospital / Clinic Building: This is a five-story high building including its penthouse roof. An interstitial space consists of concrete floor supported by steel beams will be hung from its main structural framing above for each floor therefore additional dead and live

loads caused by the interstitial space have been considered. Two typical structural bays have been studied for this building and their options are summarized as follows.

For a 32' x 32' typical structural bay.

Option A1 - Structural Steel Framing System: The floor framing system consists of a 3" deep steel floor deck acting compositely with a 3.25" thick light weight concrete; This slab with a total thickness of 6.25" is supported by steel beams, girders and columns. The roof framing system consists of a 3" deep roof deck supported by the steel beams girders and columns. The size of spread footing for this option is 15'-6" x 15'-6" x 3'-2" reinforced with 17-#10 bars each way. Steel braced frames will provide the most economical stability solution to this system. Please refer to the attached sketches SKA1-1 Thru SkA1-4 for details.

Option A2 - Reinforced Concrete Flat Slab System: The floor and roof framing system consists of a 10.5" thick concrete slab with drop panels except the mechanical floor's 11" thick. The thickness of drop panel is 6" at roof framing, 7.5" at floor framing and 9" at the mechanical floor framing. The size of spread footing for this option will be 19'-6" x 19'-6" x 3'-10" reinforced with 25-#10 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKA2-1 Thru SkA2-4 for details.

Option A3 - Wide Module One-Way Joists and Beams System: The floor and roof framing system consists of 53" wide modules with a 4.5" thick concrete slab on top of a 20" deep rib beam except it is a 24" deep rib beam at the mechanical floor. The typical girder is 36" wide by 24.5" deep at the floor and roof framing while at the mechanical floor the size of the girder is 36" wide by 28.5" deep. The size of spread footing for this option will be 19'-0" x 19'-0" x 3'-10" reinforced with 23-#10 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKA3-1 Thru SkA3-4 for details.

For a 32' x 28' typical structural bay.

Option A4 - Structural Steel Framing System: The floor framing system consists of 3" deep steel floor deck acting compositely with a 3.25" thick lightweight concrete. Steel beams, girders and columns support this 6.25" thick slab. The roof framing system consists of a 3" deep roof deck supported by the steel beams, girders and columns. The size of spread footing for this option will be 14'-6" x 14'-6" x 3'-0" reinforced with 15-#10 bars each way. Please refer to the attached sketches SKA1-1 Thru SkA1-4 for details.

Option A5 - Reinforced Concrete Flat Slab System: The floor and roof framing system consists of a 10" thick concrete slab with drop panels. The typical thickness of drop panel shall be 6" except it is 9" thick at the mechanical floor. The size of spread footing for this option will be 18'-0" x 18'-0" x 3'-8" reinforced with 20-#10 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKA5-1 Thru SkA5-4 for details.

Option A6 - Wide Module One-Way Joists and Beams System: The floor and roof framing system consists of 53" wide modules with a 4.5" thick concrete slab on top of a

20" and 16" deep rib beam, respectively. The depth of the rib beam at the mechanical floor is 24". The typical girder is 36" wide by 24.5" and 20.5" deep at the floor and roof framing while at the mechanical floor the size of the girder is 36" wide by 28.5" deep. The size of spread footing for this option will be 18'-0" x 18'-0" x 3'-8" reinforced with 21-#10 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKA6-1 Thru SkA6-4 for details.

15.1.13 Community Living Center (CLC)

Roof trusses supported by concrete block walls has been proposed for this one story high building. The roof trusses will be designed by the manufacture as per our performance specification so no sketches have been furnished for the following two options.

Option B1 – Light Gage Steel Trusses System: This option is composed of the light gage steel trusses spacing at 6' on center spanning 50' between bearing block walls to support the 1.5" deep steel roof decks. The 8" thick CMU walls reinforced with #4 @ 24" will be used as the load bearing walls to support the trusses as well as to act as the shear walls for lateral stability. The continuous concrete wall footing will be 2'-0" wide by 1'-0" thick reinforced with #4 @12" each way.

Option B2 – Structural Steel Trusses System: This option is composed of the Vulcraft SLH long span steel joists spacing at 6' on center spanning 50' between bearing walls to support the 1.5" deep steel roof decks. The 8" thick CMU walls reinforced with #4 @ 24" will be used as the load bearing walls to support the steel beams as well as to act as the shear walls for lateral stability. The continuous concrete wall footing will be 2'-0" wide by 1'-0" thick reinforced with #4 @12" each way.

Option B3 – Wood Trusses System: This option is composed of the wood trusses spacing at 2' on center spanning 50' between bearing walls to support the 0.75" thick plywood. The 8" thick CMU walls reinforced with #4 @ 24" will be used as the load bearing walls to support the steel beams as well as to act as the shear walls for lateral stability. The continuous concrete wall footing will be 2'-0" wide by 1'-0" thick reinforced with #4 @12" each way.

15.1.14 Domiciliary

The maximum typical structural bay of 24'-0" by 17'-4" has been studied for this four story high building and three different structural systems have been studied which are summarized as follows.

Option C1 - Structural Steel Framing System: The floor and roof framing system consists of 2" deep steel floor deck acting compositely with a 3.25" thick lightweight concrete. Steel beams, girders and columns support this 5.25" thick slab. The size of spread footing for this option will be 7'-0" x 7'-0" x 1'-6" reinforced with 7-#7 bars each way. Please refer to the attached sketches SKC1-1and SKC1-2 for details.

Option C2 - Reinforced Concrete Flat Plate System: The floor and roof framing system consists of an 8" thick concrete slab supported by 24" square concrete columns. The size of spread footing for this option will be 8'-6" x 8'-6" x 2'-0" reinforced with 8-#8 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKC2-1and SKC2-2 for details.

Option C3 - Reinforced Concrete Flat Slab System: The floor and roof framing system consists of a 7" thick concrete slab with 4" thick drop panels. The size of spread footing for this option will be 9'-0" x 9'-0" x 2'-0" reinforced with 9-#8 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKC3-1 and SKC3-2 for details.

15.1.15 Central Energy Plant

This plant includes two types of one-story high buildings, a 29'-6" tall electrical building and a 29'-6" tall mechanical building with a mezzanine level for offices. Since heavy MEP piping loads will be hung form the roof structures, an additional 40 psf live loads have been considered.

Option D1 – Steel Joist System for Electrical Building: This option is composed of the 36LH8 steel joists spacing at 6' on center spanning 43' between bearing walls to support the 1.5" deep steel roof decks. The12" thick CMU walls reinforced with #6 @ 16" or the 8" thick concrete tilt-up walls with #5 @ 12" will be used as the load bearing walls to support the steel joists as well as to act as the shear walls for lateral stability. The continuous concrete wall footing will be 3'-0" wide by 1'-2" thick reinforced with #4 @12" each way. Please refer to the attached sketches SKD1-1 and SKD1-2 for details.

Option D2 – Structural Steel System for Electrical Building: This option is composed of the W21x44 steel beams spacing at 8' on center and spanning 43' between bearing walls to support the 1.5" deep steel roof decks. The12" thick CMU walls reinforced with #6 @ 16" or the 8" thick concrete tilt-up walls with #5 @ 12" will be used as the load bearing walls to support the steel beams as well as to act as the shear walls for lateral stability. The continuous concrete wall footing will be 3'-0" wide by 1'-2" thick reinforced with #4 @12" each way. Please refer to the attached sketches SKD2-1 and SKD2-2 for details.

Option D3 – Structural Steel System for Mechanical Building: This option is composed of 1.5" deep steel roof decks supported by the W16x26 steel beams spacing at 7'-3" on center. The W10x54 steel columns will support the W24x55 girders spanning 29'-0". The size of spread footing for this option will be 4'-0" x 4'-0" x 1'-0" reinforced with 5-#5 bars each way. Steel braced frames will provide the most economical stability solution to this system. Please refer to the attached sketches SKD3-1 and SkD3-2 for details.

Option D4 – Steel Joist System for Mechanical Building: This option is composed of 1.5" deep steel roof decks supported by the 26K5 steel joists spacing at 5'-9" on center. The W10x54 steel columns will support the W24x55 girders spanning 29'. The size of spread footing for this option will be 4'-0" x 4'-0" x 1'-0" reinforced with 5-#5 bars each

way. Steel braced frames will provide the most economical stability solution to this system. Please refer to the attached sketches SKD4-1 and SkD4-2 for details.

15.1.16 Warehouse/Engineering

This is a building consists of a three-story high engineering building and a one-story warehouse. The typical bay being studied is 32'-0" by 32'-0" and three and two different options have been studied for the engineering building and warehouse, respectively.

Option E1 – Steel Joist System for Engineering Building: This option is composed of floor steel joists spacing at 4' on center to support the 1" deep form decks with a 2.5" thick concrete slab on top of it and the roof steel joists spacing at 5'-4" on center sporting the 1.5" deep roof deck. The W10x60 steel columns will support the wide flange steel girders spanning at 32'-0". The size of spread footing for this option will be 9'-6" x 9'-6" x 2'-0" reinforced with 10-#8 bars each way. Steel braced frames will provide the most economical stability solution to this system. Please refer to the attached sketches SKE1-1 thru SkE1-4 for details.

Option E2 - Structural Steel Framing System for Engineering Building: The floor framing system consists of a 3" deep steel floor deck acting compositely with a 3.25" thick light weight concrete with a total slab thickness of 6.25" supported by steel beams, girders and columns. The roof framing system consists of a 3" deep roof deck supported by the steel beams girders and columns. The size of spread footing for this option will be 9'-6" x 9'-6" x 3'-0" reinforced with 10-#8 bars each way. Please refer to the attached sketches SKE2-1 Thru SkE2-4 for details.

Option E3 - Wide Module One-Way Joists and Beams System for Engineering Building: The floor and roof framing system consists of 53" wide modules with a 4.5" thick concrete slab with a typical 16" deep rib beam except it is a 20" deep rib beam at the mechanical floor. The typical girder is 36" wide by 20.5" deep at the floor and roof framing while at the mechanical floor the size of the girder is 36" wide by 24.5" deep. The size of spread footing for this option will be 13'-0" x 13'-0" x 3'-0" reinforced with 11-#10 bars each way. Cast-in-place concrete shear walls are the most feasible lateral option for this system. Please refer to the attached sketches SKE3-1 Thru SkE3-4 for details.

Option E4 – Steel Joist System for Warehouse Building: This option is composed of roof steel joists spacing 5'-4" on center to sport the 1.5" deep roof deck. The W10x45 steel columns will support the wide flange steel girders spanning at 32'-0". The size of spread footing for this option will be 4'-0"" x 4'-0" x 1'-0" reinforced with 4-#4 bars each way. Steel braced frames will provide the most economical stability solution to this system. Please refer to the attached sketches SKE4-1 and SkE4-2 for details.

Option E5 - Structural Steel Framing System for Warehouse Building: The roof framing system consists of a 3" deep roof deck supported by the steel beams girders and columns. The size of spread footing for this option will be 4'-0" x 4'-0" x 1'-0" reinforced with 4-#4 bars each way. Please refer to the attached sketches SKE5-1 and SKE5-2 for details.

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15.1.17 Parking Garage

Two feasible structural systems have been studied to meet the institutional parking need. The footing is designed for a 4-story tall structure plus a future one-story high vertical expansion.

Option F1 – Precast, Prestressed Concrete System: For a typical bay size of 60'-0" by 30'-0", this framing system consists of a 10'-0" wide by 26" deep pre-topped double tee spanning 60' supported by a 8" thick by 6'-8" tall exterior spandrel beam and a 3'-4" wide by 3'-0" deep interior inverted tee beam and a 24" by 24" Precast concrete column. The spread footing for the column will be 18'-0" x 18'-0" x 3'-8' reinforced with 21-#10 bars each way. The 10" thick precast concrete shear walls shall function as the lateral bracing system. Please refer to the attached sketches SKF1-1 thru SKF1-3 for details.

Option F2 – Cast-In-Place, Post-Tensioned Concrete System: For a 60'-0" by 30'-0" typical bay, this framing system consists of a 8" thick post-tensioned concrete slab supported by a 20' wide by 36" deep post-tensioned beam spanning 60' connected to a 24" by 24" concrete column. The spread footing for the column will be 19'-6" x 19'-6" x 3'-10' reinforced with 26-#10 bars each way. The post–tensioned concrete moment frame shall be the most economical lateral bracing system. Please refer to the attached sketches SKF2-1 and SKF2-2 for details.

15.1.18 Interstitial Floor / Hospital and Clinic

The interstitial floor framing shall be hung from the building floor framing above it with a two-hour fire-rating requirement for this floor framing.

The floor framing consists of a 2" deep, 18 gage floor deck acting compositely with a minimum 3.25" thick light weight concrete supported by W6 beams and steel tubing hangers.

No fireproofing is required for all the steel members above the interstitial space' floor framing.

A review comment from NIKA Technologies Inc. has suggested using a 3.25" thick vermiculite or perlite concrete to replace the 3.25" thick lightweight concrete. As long as this system can meet the two-hour fire rating requirement, this light weight framing system can further reduce the self weight of interstitial floor.

15.1.19 Progressive Collapse Framing System

Progressive collapse is defined as the spread of an initial local failure from element to element resulting in the collapse of the large part of a structure a. When the loss of an exterior column may result in the destruction of a large portion of a building, the exterior beams shall be designed to redistribute the loads to the adjacent columns in the event one of the exterior columns between first and second floor is damaged. This Alternate Load Path Method ensures that the floor above and adjacent to the damaged column does not fall into the failure zone and is required for all buildings of three stories or higher. It is important to note that the surviving floors may sustain damage; however,

the extent of the damage will be limited so rescue personnel will be able to gain access and evacuate the damaged area.

To meet the design requirements for progressive collapse, all the exterior beams shall be designed as continuous beams. If a steel framing is selected, all exterior steel beam column joints shall be moment connections and all exterior concrete beams shall have top and bottom bars if a concrete framing is selected. Three different options for the exterior columns' spacing have been proposed for this project to accommodate different buildings' bay size.

To keep the perimeter columns' spacing the same as the interior columns'.

To add one additional column at mid-span of each typical bay so the perimeter columns' spacing will become half of the interior columns'.

To add one additional column at one-third span of each typical bay so the perimeter columns' spacing can be reduced.

15.1.20 Blast Analysis

Blast analysis and design will be performed in accordance with the soon to be released Physical Security Design Manual Chapter 6. Design is to be based on a standoff distance of 50 feet with blast pressures and impulse being calculated using CONWEP.

Walls, roof structure and exterior wall mullions may suffer damage but deformations must remain within specified limits. Glass fragments may not land any further than 10 feet within the building.

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16. BUILDING SYSTEM COMMISSIONING

16.1 Introduction

The Department of Veterans Affairs (VA) is committed to commissioning the new mechanical and electrical systems required for the reliable, safe, and secure operation of Veterans Affairs Medical Center (VAMC). This process will verify that systems are complete and functioning properly upon project completion and that the VAMC staff has appropriate system documentation and training.

Commissioning consists of systematically documenting that specified components and systems have been installed and started up properly and then functionally tested to verify that systems are complete and functioning properly upon project completion and that the VAMC staff has appropriate system documentation and training. In addition, owner-personnel training will be verified and final project Operation & Maintenance (O&M) documents will be reviewed for completeness.

This document is intended to be a roadmap for the parties involved in the Commissioning process. The document will explain the systems to be commissioned, the process activities, the procedures to follow throughout the commissioning process, and the roles and responsibilities for each party involved. The commissioning activities will begin during the design phase of the project and proceed through the warranty period.

Abbreviations

(i) Operations and Maintenance (O&M)
(ii) VAMC Project Manager (PM)
(iii) VAMC Facilities Management Department Staff (FMD)
(iv) Design Professionals (D)
(v) Construction Manager (CM)
(vi) Installation Contractors (CONTR)
(vii) Testing, Adjusting & Balancing Contractor (TAB)
(viii) Commissioning Authority (CA)
(ix) Request for Information (RFI)
(x) Design Development Documents (DD)
(xi) Construction Documents (CD)
(xii) Commissioning (Cx)
(xiii) Construction Manager (CM)
(xiv) Functional Performance Test (FPT)
(xv) System Readiness Checklist (SRC)
(xvi) Corrective Action Notice (CAR)
(xvii) Quality Control (QC)

16.2 Project Description

The Department of Veterans Affairs is constructing a major regional medical center on a 65-acre Greenfield site in Orlando Florida. The project consists of nine buildings and associated site improvements.

Hospital Building: The Hospital building will be a 4-story structure with an Emergency Department, Psychiatric unit, Intensive Care Unit, 4 Medical-Surgical units, and associated support spaces.

Diagnostics & Treatment Building: The Diagnostics & Treatment building will be a 4-story building housing Dietetics, Radiology/Imaging, Operating Suites, Laboratories, Administration and associated support spaces.

Clinic: The facility will include a 4-story clinic building to provide out-patient services, pharmacy, education and associated support spaces.

Domiciliary: The Domiciliary will be a 3-story structure with facilities to provide housing for transitional patients. The facility will include living, recreation, dining, and sleeping space.

Nursing Facility: The Nursing facility will provide skilled nursing facilities for 120 patients. The facility will include patient rooms, nursing/support areas, administration, physical therapy, occupational therapy, dining and associated supports space.

Warehouse: A central warehouse will provide linen support, material receiving, storage, and distribution services. This facility will also provide engineering and housekeeping support space.

Parking Garage: The parking garage will provide parking for patients, staff and visitors.

Guard/Security Facilities: Site access will be controlled by Security Access facilities.

Central Energy Plant: A Central Energy Plant will provide electrical power, emergency power, central steam generation and central chilled water production equipment to support the center.

16.3 Systems To Be Commissioned

16.3.1 Hospital

i) Building Envelope
ii) Vertical transportation
iii) Air Handling Unit Systems
iv) Dehumidification Systems
v) Heating Hot Water System
vi) Domestic Hot Water System
vii) Fire Protection System
viii) Condensate Return System
ix) Toilet Exhaust Fan System
x) General Exhaust Fans
xi) Steam System
xii) Medical Gases
    (1) Compressed Air
    (2) Vacuum
    (3) Nitrous Oxide

(4) Nitrogen
(5) Oxygen
xiii) Central Building Automation System
(1) 75% point to point sample testing
xiv) Normal Power single ended transformer
xv) ATS systems
xvi) Switchboards LVDO
xvii) Distribution Panel LVDO
xviii) Emergency, Critical, and life Safety power system (including simulated power outage test)
xix) Panel Board (15%)
xx) Dry Type Transformers (5%)
xxi) Lighting Control
(1) Site Lighting
(2) Public Spaces
(3) Corridor Lighting
(4) Occupancy Sensors
xxii) Fire Alarm System with Central Monitoring
(1) 50% field device verification testing
(2) 100% system interface testing
xxiii) Nurse Call system
xxiv) Building Security
(1) Door Locks
(2) Monitors
(3) Panic Buttons
(4) CCTV System
(5) Paging and Intercom

16.3.2 Diagnostics & Testing

1. Building Envelope
2. Vertical transportation
3. Air Handling Unit Systems
4. Dehumidification Systems
5. Heating Hot Water System
6. Lab Ventilation Terminal Units
   i) Lab Supply Air Valve with Reheat Coil
   ii) Lab Exhaust Air Valve
   iii) Lab Hood Exhaust Air Valve
7. Domestic Hot Water System
8. Fire Protection System
9. Condensate Return System
10. Toilet Exhaust Fan System
11. General Exhaust Fans
12. LAB Exhaust System

13. Steam System
14. OR Air Handling Systems
15. Radiology/Imaging cooling systems
16. Central Building Automation System
    i) 75% point to point sample testing
17. Normal Power single ended transformer
18. ATS systems
19. Switchboards LVDO
20. Distribution Panel LVDO
21. Emergency, Critical, and life Safety power system (including simulated power outage test)
22. Panel Board (15%)
23. Isolated Power Units
24. Dry Type Transformers (5%)
25. Lighting Control
    i) Site Lighting
    ii) Public Spaces
    iii) Corridor Lighting
    iv) Occupancy Sensors
26. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing
    ii) 100% system interface testing
27. Nurse Call system
28. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom
29. Computer Rooms
    i) Computer room HVAC systems
    ii) UPS Systems

16.3.3 Clinic

1. Building Envelope
2. Vertical transportation
3. Air Handling Unit Systems
4. Heating Hot Water System
5. Domestic Hot Water System
6. Fire Protection System
7. Condensate Return System
8. Toilet Exhaust Fan System
9. General Exhaust Fans
10. Steam System
11. Waste Neutralization System

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12. Stair Pressurization
13. Central Building Automation System
    i) 75% point to point sample testing
14. Normal Power single ended transformer
15. ATS systems
16. Switchboards LVDO
17. Distribution Panel LVDO
18. Emergency, Critical, and life Safety power system (including simulated power outage test)
19. Panel Board (15%)
20. Dry Type Transformers (5%)
21. Lighting Control
    i) Site Lighting
    ii) Public Spaces
    iii) Corridor Lighting
    iv) Occupancy Sensors
22. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing
    ii) 100% system interface testing
23. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom

16.3.4 Domiciliary

1. Building Envelope
2. Vertical transportation
3. Air Handling Unit Systems
4. Heating Hot Water System
5. Domestic Hot Water System
6. Fire Protection System
7. Condensate Return System
8. Toilet Exhaust Fan System
9. General Exhaust Fans
10. Steam System
11. Central Building Automation System
    i) 75% point to point sample testing
12. Normal Power single ended transformer
13. ATS systems
14. Switchboards LVDO
15. Distribution Panel LVDO
16. Emergency, Critical, and life Safety power system (including simulated power outage test)

17. Panel Board (15%)
18. Dry Type Transformers (5%)
19. Lighting Control
    i) Site Lighting
    ii) Public Spaces
    iii) Corridor Lighting
    iv) Occupancy Sensors
20. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing
    ii) 100% system interface testing
21. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom

16.3.5 Nursing Facility

1. Building Envelope
2. Vertical transportation
3. Air Handling Unit Systems
4. Heating Hot Water System
5. Domestic Hot Water System
6. Fire Protection System
7. Condensate Return System
8. Toilet Exhaust Fan System
9. General Exhaust Fans
10. Steam System
11. Central Building Automation System
    i) 75% point to point sample testing
12. Normal Power single ended transformer
13. ATS systems
14. Switchboards LVDO
15. Distribution Panel LVDO
16. Emergency, Critical, and life Safety power system (including simulated power outage test)
17. Panel Board (15%)
18. Dry Type Transformers (5%)
19. Lighting Control
    i) Site Lighting
    ii) Public Spaces
    iii) Corridor Lighting
    iv) Occupancy Sensors
20. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing

ii) 100% system interface testing
21. Nurse Call system
22. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom

16.3.6 Warehouse

1. Building Envelope
2. Vertical transportation
3. Air Handling Unit Systems
4. Dehumidification Systems
5. Heating Hot Water System
6. Domestic Hot Water System
7. Fire Protection System
8. Condensate Return System
9. Toilet Exhaust Fan System
10. General Exhaust Fans
11. Steam System
12. Central Building Automation System
    i) 75% point to point sample testing
13. Normal Power single ended transformer
14. ATS systems
15. Switchboards LVDO
16. Distribution Panel LVDO
17. Emergency, Critical, and life Safety power system (including simulated power outage test)
18. Panel Board (15%)
19. Dry Type Transformers (5%)
20. Lighting Control
    i) Site Lighting
    ii) Public Spaces
    iii) Corridor Lighting
    iv) Occupancy Sensors
21. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing
    ii) 100% system interface testing
22. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom

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16.3.7 Security Facility

1. Miscellaneous HVAC Units
2. Central Building Automation System
   i) 75% point to point sample testing
3. Panel Board (15%)
4. Fire Alarm System with Central Monitoring
   i) 50% field device verification testing
   ii) 100% system interface testing
5. Building Security
   i) Door Locks
   ii) Monitors
   iii) Panic Buttons
   iv) CCTV System
   v) Paging and Intercom

16.3.8 Parking Garage

1. Vertical transportation
2. Panic Buttons
3. Emergency Lighting
4. Fire Alarm System
5. Fire Protection System
6. Ventilation System

16.3.9 Central Plant

1. Steam Boiler System
2. Electrical Centrifugal Chillers
3. Cooling Towers
4. CHW Pumping Systems
5. Fire Pump
6. Condensate Return System
7. Compressed Control Air
8. Steam System
9. Toilet Exhaust Fan System
10. General Exhaust Fans
11. Central Building Automation System
    i) 75% point to point sample testing
12. Diesel Engine Generator
13. Paralleling switchgear
14. Normal Power electrical equipment
15. ATS system
16. Switchgear - MV Distribution
17. Switchboards LVDO
18. Distribution Panel LVDO

19. Emergency, Critical, and life Safety power system (including simulated power outage test)
20. Lighting Control
    i) Site Lighting
    ii) Corridor Lighting
    iii) Occupancy Sensors
21. Fire Alarm System with Central Monitoring
    i) 50% field device verification testing
    ii) 100% system interface testing
22. Building Security
    i) Door Locks
    ii) Monitors
    iii) Panic Buttons
    iv) CCTV System
    v) Paging and Intercom

16.4 Construction Phase Commissioning

It is anticipated this project will be constructed in phases with each major building constituting a phase. It is also likely that separate contracts may be awarded to different construction teams for each phase. The VAMC has indicated the desire for phases to be completed on a staggered schedule to facilitate relocation and move-in activities.

The Commissioning Authority will align commissioning activities with the construction schedule for each construction phase. Regular Commissioning Progress meetings will be held for each construction phase. These meetings are a forum to review progress and to discuss issues affecting installation, coordination, startup, and testing of the systems to be commissioned. Meeting attendees should include the Commissioning Authority, VAMC Project Manager, Construction Manager, mechanical, electrical, plumbing, controls and TAB subcontractors. Design team members, especially the MEP designers are also encouraged to attend.

It is anticipated these meetings will be held quarterly during the early stage of construction. Once the building has come out of the ground and the exterior shell is being constructed, the meetings will be held on a monthly basis. As the mechanical, electrical and plumbing systems are being installed, it is likely the commissioning meetings will be held bi-weekly.

The Commissioning Authority will witness selected equipment startups for mechanical, electrical and plumbing components. The purpose will be to observe any issues that may arise that would affect equipment or system operations.

The Commissioning Authority will conduct periodic Field Observations to review construction progress, overall quality of workmanship, and to review maintenance access to equipment. The CA will issue a Field Observation Report following each visit.

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The report will describe any specific observations that are found. The specific observations will be tracked on the Commissioning Master Issues Log.

The VAMC Project Manager, Construction Manager, installing sub-contractors and the design team (as necessary) should review the Field Report and determine the most appropriate resolution for the issue. The CA will assist in determining the resolution as requested. The status of issue resolution will be a primary topic of discussion at the Commissioning Progress meetings.

The Commissioning Authority will prepare System Readiness Checklists that the installing sub-contractors will complete to document equipment and systems are complete and ready for testing.

The Commissioning Authority will also prepare detailed Functional Performance Test plans that will provide detailed step-by-step procedures that will be used to verify system operations under all operating conditions. These test procedures will be issued to the Construction Manager, Design Team, VAMC Project Manager and the Controls contractor, the TAB contractor and the installing sub-contractors for review and comment. The reviews should focus on the ability to implement the steps, especially the control systems adjustments, necessary to perform the test. The reviewers should also note any procedures that would damage the equipment or system.

The installing sub-contractors are encouraged to use the Functional Test Plans as a tool for pre-testing the equipment and systems prior to the "official" functional testing. This will allow early detection and resolution of problems.

The CA will assist the Construction Manager is scheduling equipment training. The CA will review training plans prepared by the CM and the installing sub-contractors.

The CA will conduct enhanced systems training for VA FMD personnel. This training will focus on the system operation, design criteria, and troubleshooting of systems level issues. It is anticipated that the enhanced systems training will be conducted just prior to functional testing to facilitate participation of the VA FMD personnel in the testing activities.

It is the expectation that Functional Testing will demonstrate that the systems perform in accordance with design criteria, construction documents and VAMC requirements. Functional testing pre-requisites are that the system components and equipment are completely installed, all required power connections are complete, all required control connections and control functions are operational, and that required air and hydronic testing and balancing has been completed. When required by construction specifications, third-party testing must also be complete and required test reports have been submitted to the CA for review.

Functional testing of each system to be commissioned will be conducted by the Commissioning Authority. The CA will direct the testing; the installing sub-contractors, controls contractor, and TAB contractor will assist the CA by operating the equipment, adjusting the control system and performing measurements in accordance with the

Functional Test Plan. The VAMC FMD staff is encouraged to assist in the testing as an additional training opportunity.

Issues and/or failures detected during the Functional Performance Testing will be documented on the test plan, on Field Observation reports and on the Master Issues Log. Installing sub-contractors, controls contractor, and/or TAB contractor will be responsible for correcting each issue and reporting the corrective action to the CA. The CA will document the corrective action on the Master Issues Log. The need for re-testing will be determined by the CA.

Any re-testing required as the result of system or equipment failure due to equipment malfunction, not being prepared for testing, or other reasons outside the control of the CA will be scheduled and performed at the convenience of the CA. It is likely that the costs of re-testing will be back-charged to the Construction Manager, installing sub-contractor, controls contractor and/or TAB contractor.

Upon completion of all commissioning activities, including resolution of all issues on the Commissioning Master Issues Log, the CA will prepare and issue the Final Commissioning Report. This report will include the final version of the Commissioning Plan, copies of all Commissioning Meeting Minutes, Commissioning Field Observation Reports, System Readiness Checklists, Functional Performance Test results, and the Commissioning Master Issues Log. The report will also include blank copies of the Functional Test Plans for use by VAMC FMD for future re-commissioning activities.

The following sections provide more detailed explanation of the commissioning team, roles and responsibilities, and the process work flow.

16.5 Commissioning Team

The Commissioning Team shall consist of representatives from the following parties involved in the design and construction of this facility. The time at which individual members join the team and the level of their participation during the different phases of the project will vary from member to member.

i) VAMC Project Manager (PM)

ii) VAMC Facilities Management Department Staff (FMD)

iii) Design Professionals (D)

iv) Construction Manager (CM)

v) Installation Contractors (CONTR)

vi) Testing, Adjusting & Balancing Contractor (TAB)

vii) Commissioning Authority (CA)

16.6 Scope & Team Member Responsibilities

The following is an outline of team member responsibilities in each major phase of the commissioning process. These responsibilities are meant to be limited to those tasks

related to the commissioning process and are not intended to be representative of each team member's contractual responsibilities for other aspects of this project.

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
VAMC Project Manager	(1) Review Design Intent Document. (2) Review CD design documents. (3) Review and approve test procedures, training plans, and technical specification.	1. Review and comment on any revisions to the Design Intent Document prepared by the design professionals.	(1) Remain informed as to the status of commissioning activities with respect to project completion and turnover to the VAMC Facilities Management Department staff.	1. Withhold final payment to contractors until seasonal/deferred testing is successfully completed. 2. Participate in 10 month review meeting.
VAMC Facilities Management Department Staff	1. Provide input to the design professionals and commissioning firm regarding accessibility, safety, maintainability, control system options, etc. 2. Review Design Intent Document. 3. Review CD design documents. 4. Work with the commissioning firm to identify training needs for the specified equipment.	1. Periodically visit the construction site to become familiar with the components as they are installed and prior to being concealed. 2. Communicate with the commissioning firm any concerns regarding system installation. 3. Review comments on equipment/system submittals and coordination drawings with the commissioning firm.	1. Participate in the scheduling of equipment and systems training sessions. 2. Participate in the equipment and systems training programs. 3. Perform random field spot-check (10% sample) of TAB report data under the direction of the commissioning firm 4. Witness, to the greatest extent possible, the functional performance tests performed by the	1. Participate in seasonal/deferred testing to the greatest extent possible. 2. Maintain "as-commissioned" proper operation of the building systems. 3. Maintain records of problems or concerns associated with the systems during normal operation. 4. Meet with the design/construction team at the 10-month mark to present the

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
VAMC Facilities Management Department Staff– cont'd	5. Work with Commissioning Firm to identify O&M documentation needs. 6. Review test procedures, system readiness checklists, O&M documentation, and training requirements. 7. Provide electronic equipment data (for use in populating Duke's computerized maintenance management system) submission format requirements for inclusion in the bid specification.		contractors and overseen by the commissioning firm. 5. Populate the computerized maintenance management system (CMMS) with the equipment data collected from the installing contractors. 6. Populate the CMMS with the required preventive maintenance tasks, schedules, and work orders.	problems and concerns. 5. Document any change in building operation or use required by building occupants.
Design Professionals	1. Meet with the owner in order to define the design criteria for the systems being commissioned.	1. Update Design Intent Document to reflect any changes made to the systems being commissioned during	1. Review test and balance report. 2. Respond to requests for information and/or disputes with respect to	1. Be available to consult on the results of the seasonal and deferred functional performance test results.

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
(D) **Design Professionals (D) – cont'd**	Document these criteria in quantifiable/verifiable terms in the Design Intent Document. 2. Prepare CD design documents and present to project stakeholders for review, comment, and approval. These documents shall include, but not be limited to, the areas listed for review by the Commissioning firm. 3. Review and incorporate the commissioning specification prepared by the Commissioning Firm into the bid documents. 4. Coordinate the commissioning specification	the construction phase. 2. Coordinate comments on equipment/system submittals and coordination drawings with the commissioning firm. 3. Develop Systems Narratives for input to the Equipment and Systems O&M manuals to be compiled by the Commissioning Firm. 4. Review equipment training plans. 5. Conduct a monthly review of all field red-line drawings in conjunction with the construction manager. 6. Provide information to complete System Manual.	design intent during the functional performance testing process. 3. Prepare final Design Intent Documents and submit to the commissioning firm for inclusion in the final commissioning report. 4. Prepare electronic as-built drawings from the field red-lines.	2. Participate in 10 month review meeting.

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
	requirements with the Division 1-16 specification sections in cooperation with the Commissioning firm.			
Construction Manager (CM)	1. Provide input to the design professionals regarding constructability and possible alternative approaches to certain design issues. 2. Provide cost estimating input as required for analysis of various system options. 3. Review test procedures, training plans, and technical specification. 4. Work with the commissioning firm to incorporate commissioning	1. Copy all Meeting Minutes to the Commissioning Firm for informational purposes. 2. Copy, upon request, Architectural Supplemental Instructions (ASI), Proposal Requests (PR), Change Orders (CO), and fully executed RFI's to the Commissioning Firm for informational purposes. 3. Provide the Commissioning Firm with schedule updates at least monthly. 4. Provide the Commissioning Firm	1. Schedule equipment training sessions with the installation contractors for the convenience of the trainees. 2. Witness and manage the process of completing system readiness checklists. Submit fully executed system readiness checklists to the commissioning firm for review and approval prior to the start of functional performance testing. 3. Submit field red-line drawings to the design	1. Assist in coordinating the participation of the necessary installation contractors in the seasonal and deferred functional tests. 2. Coordinate the correction of deficiencies identified as being either warranty items or items under the original construction contract. 3. Participate in 10 month review meeting.

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Construction Manager (CM) – cont'd	activities and milestones into the master construction schedule.	with copies of all equipment/system submittals, submittals, and coordination drawings associated with systems being commissioned (as pre-selected by the commissioning firm). These shall be distributed at the same time as the distribution to the design professionals. 5. Participate in regularly scheduled commissioning coordination meetings. 6. Review the installation contractors' field red-lined record drawings for accuracy and completeness on a monthly basis and prior to each wall/ceiling closure. 7. Consolidate and manage the equipment	professionals. 4. Witness all testing directed and documented by the commissioning firm (functional performance tests). 5. Oversee the correction of deficiencies identified by the commissioning firm.	

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Construction Manager (CM) – cont'd		O&M manual preparation process by the installation contractors. Submit the equipment O&M manuals to the commissioning firm for inclusion in the Systems O&M manual. 8. Consolidate and manage the equipment data (for use in populating VAMC's computerized maintenance management system) submission process by the installation contractors. Submit the data files to the commissioning firm for review and transfer to VAMC. 9. Manage the equipment training plan submittal process by the installation contractors. Submit training plans to		

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Construction Manager (CM) – cont'd		the commissioning firm for review. 10. Conduct a monthly review of all field red-line drawings in conjunction with design professionals. 11. Coordinate the witnessing of equipment cleaning, testing, & startup procedures (as specified in Division 15 and 16) with VAMC FMD and the Commissioning Firm. 12. Coordinate the witnessing of pre-wall and ceiling close-up inspections with Duke and the Commissioning Firm. 13. Provide information to complete System Manual.		

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Installation Contractors (CONTR) **Installation Contractors**	1. No Requirements.	1. Participate in regularly scheduled commissioning coordination meetings. 2. Mark up the field red-lined record drawings to reflect installation modifications made in the field. 3. Submit equipment O&M manuals to the construction manager. 4. Submit equipment data (for use in populating VAMC's computerized maintenance management system) files to the construction manager. 5. Submit equipment training plans to the construction manager. 6. Review and comment on the final detailed functional performance test procedures developed by the	1. Schedule equipment training sessions for the convenience of the trainees. 2. Complete system readiness checklists and submit to the construction manager prior to the start of functional performance testing. 3. Set up functional performance test trend logs and monitoring data under the commissioning firm's direction. 4. Participate in testing directed and documented by the commissioning firm (functional performance tests). 5. Correct all deficiencies identified by the commissioning firm.	1. Set up deferred functional performance test trend logs and monitoring data under the commissioning firm's direction. 2. Participate in seasonal and deferred functional tests. 3. Address outstanding warranty issues and tasks identified as being under the original construction contract.

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
(CONTR) – cont'd		commissioning firm based on the approved equipment/system submittals and submittals. Provide feedback as to the efficiency of the procedures and possible alternate approaches to achieving the same results. 7. Provide information to complete System Manual.		
Testing, Adjusting & Balancing Contractor (TAB)	1. No Requirements.	1. Provide input into master scheduling process with regards to timing and duration of test and balancing procedures. 2. Participate in regularly scheduled commissioning coordination meetings.	1. Submit test and balance execution plan prior to commencing balancing work. 2. Submit test and balance report.	1. No defined activities at this time.
	1. Coordinate the	1. Attend the Pre-Bid	1. Provide cursory review	1. Analyze deferred

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Commissioning Authority (CA)	commissioning activities per the Commissioning Plan. 2. Review and comment on Design Intent Document prepared by the design professionals. 3. Identify commissioning activities and milestones to be included in the construction schedule. Work with the construction manager to incorporate commissioning into the master schedule. 4. Perform focused design reviews of the drawings and specifications at 100% DD, 50% CD,	Meeting to present the highlights of the Commissioning process and specifications to the bidding contractors. 2. Attend the Preconstruction Conferences to present the highlights of the Commissioning process and specifications to the contractors and subcontractors and to schedule the formal Commissioning Kickoff Meeting. 3. Conduct the Commissioning Kickoff Meeting with all Commissioning Team members, including all responsible contractors and subcontractors. This meeting will formally present a detailed	of CAD as-built drawings for completeness and legibility. 2. Facilitate the scheduling of equipment training sessions provided by the installation contractors. 3. Review test and balance execution plan. 4. Review test and balance report concurrent with the design professionals. 5. Collect and review contractor-completed system readiness checklists prior to commencing functional performance testing on each system. 6. Analyze functional performance test trend	functional performance test trend logs and monitoring data to verify performance. 2. Direct and document required seasonal or deferred testing and deficiency corrections. 3. Return to the facility at the 10-month mark into the warranty period. Interview VAMC FMD Staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. ***Required for Additional Commissioning LEED***

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Commissioning Authority (CA) – cont'd	and 95% CD. 5. Prepare written evidence of Design Review in accordance with LEED™ V.2.2 E & A Credit 3 – Additional Commissioning Credit. ***Required for Additional Commissioning LEED Credit.*** 6. Develop a draft commissioning specification prior to the 100% submission for inclusion in Division 1 of the 100% design submission. 7. Facilitate the definition of VAMC's operations & maintenance equipment training requirements. 8. Develop final	overview of the process as defined in the Commissioning Plan and in the Commissioning Specification section of the Construction Documents. 4. Coordinate and direct the commissioning activities, per the Commissioning Plan, in a logical, sequential, and efficient manner using standardized protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, and technical expertise. 5. Review and comment on any revisions to the Design Intent Document prepared by the design	logs and monitoring data to verify performance. 7. Direct, witness, and document functional performance tests performed by the installing contractors. Coordinate retesting, as necessary, until satisfactory performance is achieved. 8. Maintain a master deficiency and resolution log. Provide to the VAMC project manager written progress reports and test results with recommended actions. 9. Compile and maintain organized and complete commissioning record books. 10. Prepare an indexed	***Credit.*** 4. Amend final commissioning report to include warranty phase activities.

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Commissioning Authority (CA) – cont'd	commissioning specification for inclusion in Division 1. 9. Have the commissioning specifications approved by the designers, project manager, and VAMC for inclusion in the 100% Design Package. 10. Coordinate the commissioning specification, O&M documentation, and training requirements with the design professionals' Division 1-16 specification sections.	professionals. 6. Conduct and document regularly scheduled commissioning coordination meetings. 7. Review equipment/system submittals and coordination drawings applicable to systems being commissioned for compliance with commissioning needs, concurrent with the design professionals' reviews. Submit review comments to the design professionals. 8. Review system submittals to verify that the building will meet owner's project requirements relating to environmentally responsive characteristics.	systems O&M manual to be delivered with the commissioning report. ***Required for Additional Commissioning LEED Credit.*** 11. Submit a final commissioning report to the Duke project manager.	

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Commissioning Authority (CA) – cont'd		***Required for Additional Commissioning LEED Credit.*** 9. Review construction documents to ensure that commissioning is adequately specified and to verify that each commissioned system or assembly meets the owner project requirements relative to functionality, sustainability, system cost, indoor environmental quality, and local environmental impacts. Written evidence must be documented in accordance with LEED™ V.2.2 E & A Credit 3 – Additional Commissioning Credit. ***Required for Additional Commissioning***		

TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
Commissioning Authority (CA) – cont'd		***LEED Credit.*** 10. Review equipment O&M manuals applicable to systems being commissioned. Submit review comments to the construction manager. 11. Compile Systems Manual. ***Required for Additional Commissioning LEED Credit.*** 12. Review additional construction phase documentation, e.g., ASI's, RFI's, PR's, Change Orders, meeting minutes, other correspondence, etc., only as required to plan and perform commissioning tasks. 13. Perform site visits, in conjunction with commissioning meetings, to observe		

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
		component and system installations. 14. Attend selected planning and job-site meetings to obtain information on construction progress. 15. Review equipment training plans prepared by the installation contractors. 16. Review equipment data (for use in populating VAMC's computerized maintenance management system) files and transfer to Duke upon acceptance. 17. With necessary assistance and review from installing contractors, prepare final functional performance test		

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TEAM MEMBERS	DESIGN PHASE	CONSTRUCTION PHASE	ACCEPTANCE PHASE	WARRANTY PHASE
		procedures for each system to be commissioned, based on the approved equipment/system submittals and submittals. This will include energy management control system trending and manual functional testing. 18. Compile and maintain organized and complete commissioning record books.		

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PROCEDURE FLOW CHART	PAGE
a) Design Review Procedure	29
b) Draft Commissioning Specification Section	30
c) Commissioning Specification Coordination	31
d) Schedule Commissioning Activities	32
e) Shop Drawing Review	33
f) As Built Drawings	34
g) Coordination Drawing Review	35
h) Operations and Maintenance Manuals	36
i) Review Cx Related Submittals from Contractors	37
j) Witness Contractor Performance of Division 15 and 16 Cleaning, Testing, and Equipment Startup Procedures	38
k) Equipment Training	39
l) Systems Training	40
m) Test and Balance	41
n) System Readiness Checklists	42
o) Commissioning Testing	43
p) Ten Month Warranty Checkup	44

LEGEND

PM: VAMC Project Manager
FMD: VAMC Facilities Management Department Staff
D: Design Professionals
CM: Construction Manager
CONTR: Installation Contractors
TAB: Testing, Adjusting & Balancing Contractor
QC: QA/QC Contractor
CA: Commissioning Authority
(Small Letters): Refers to Procedure Flow Chart in Section 3

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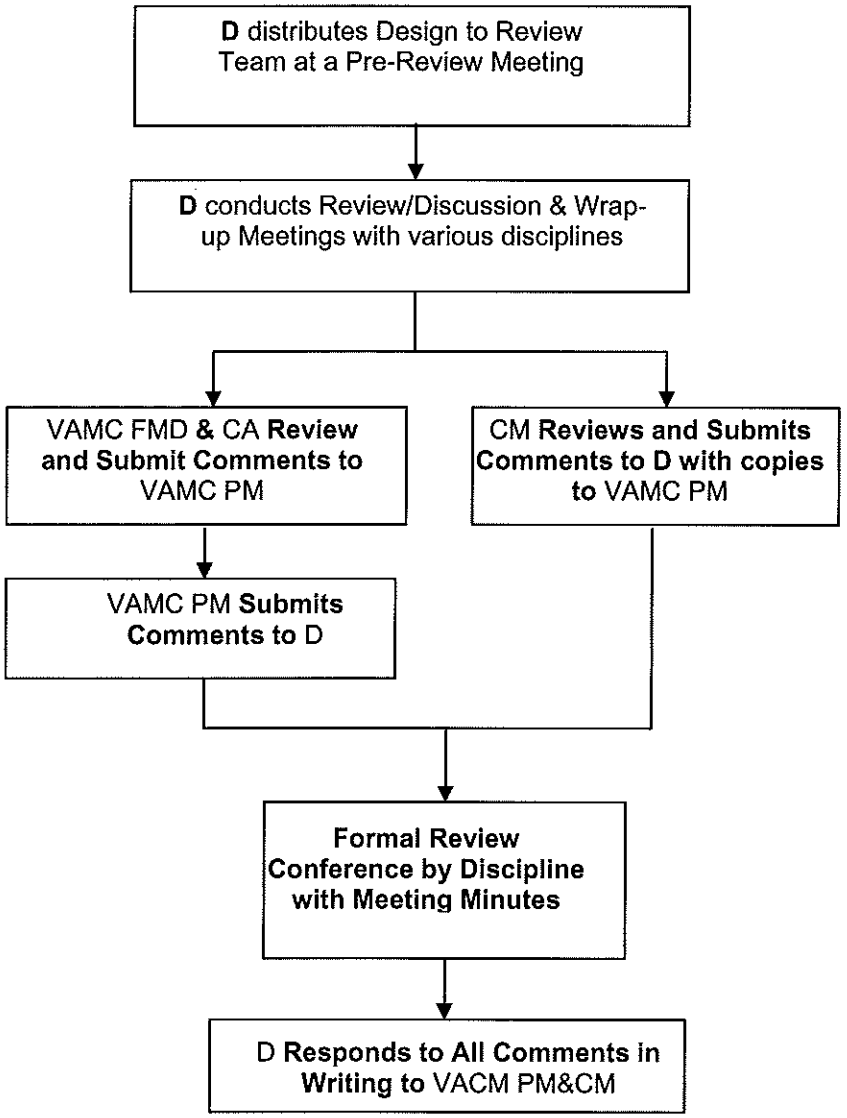
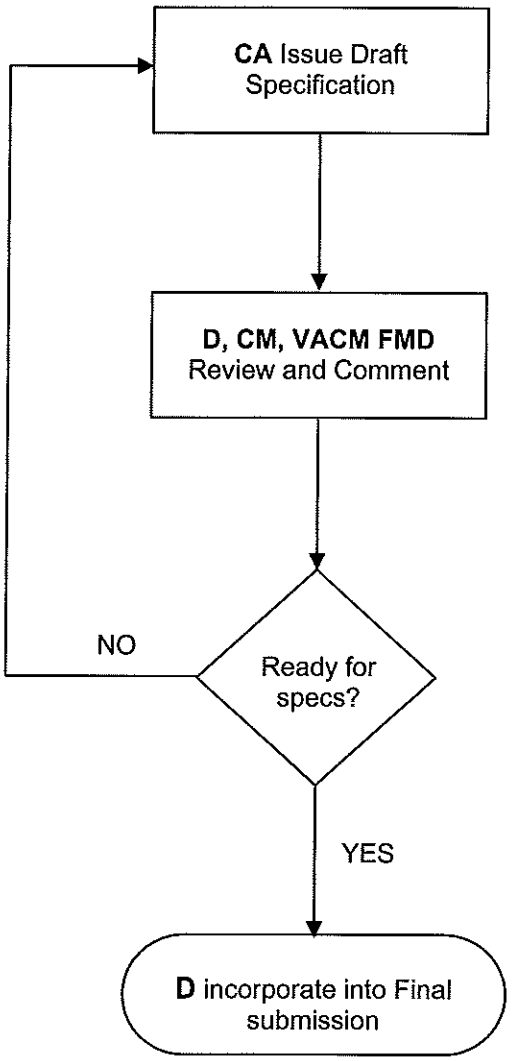
a) Design Review Procedure



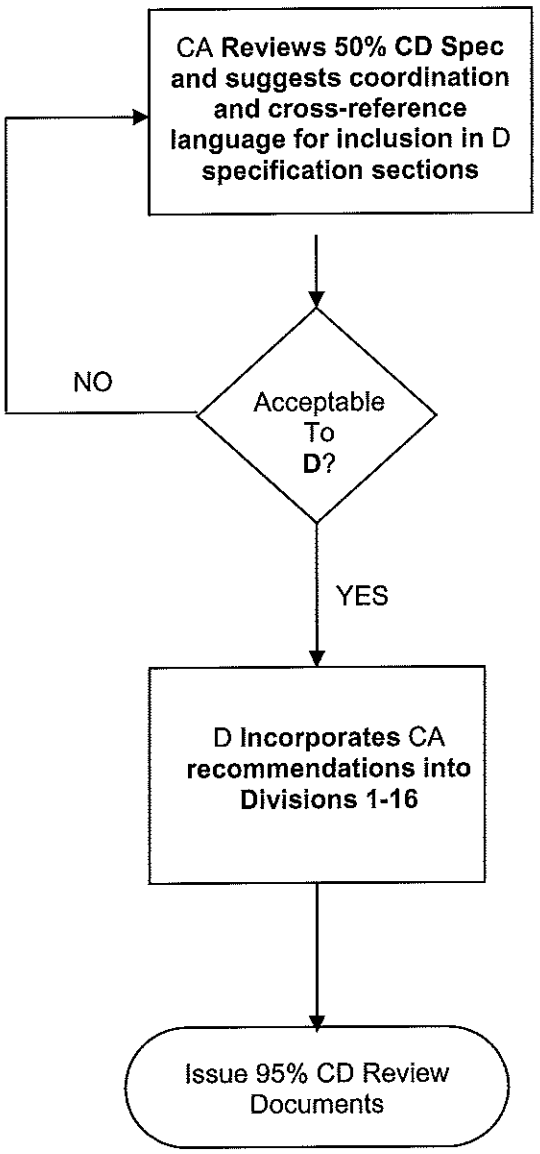
May 14, 2007

b) Commissioning Specification Section



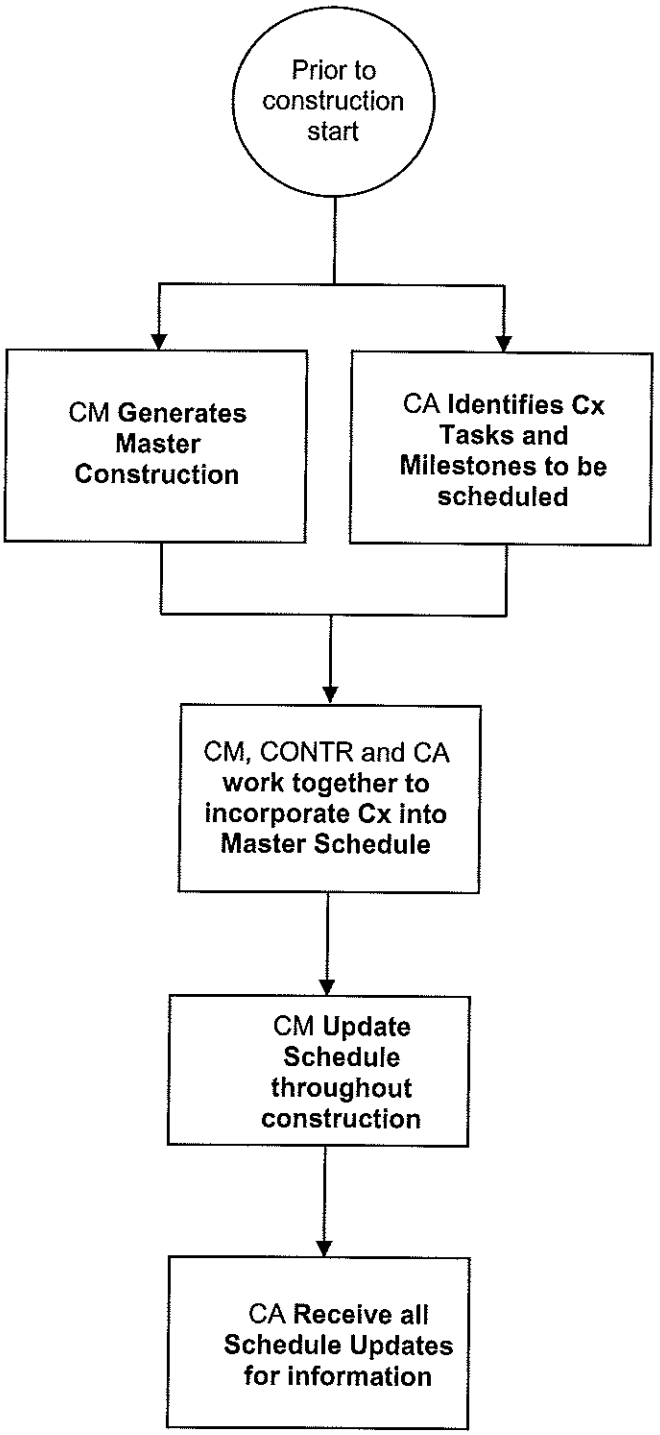
May 14, 2007

c) Commissioning Specification Coordination



May 14, 2007

d) Schedule Commissioning Activities



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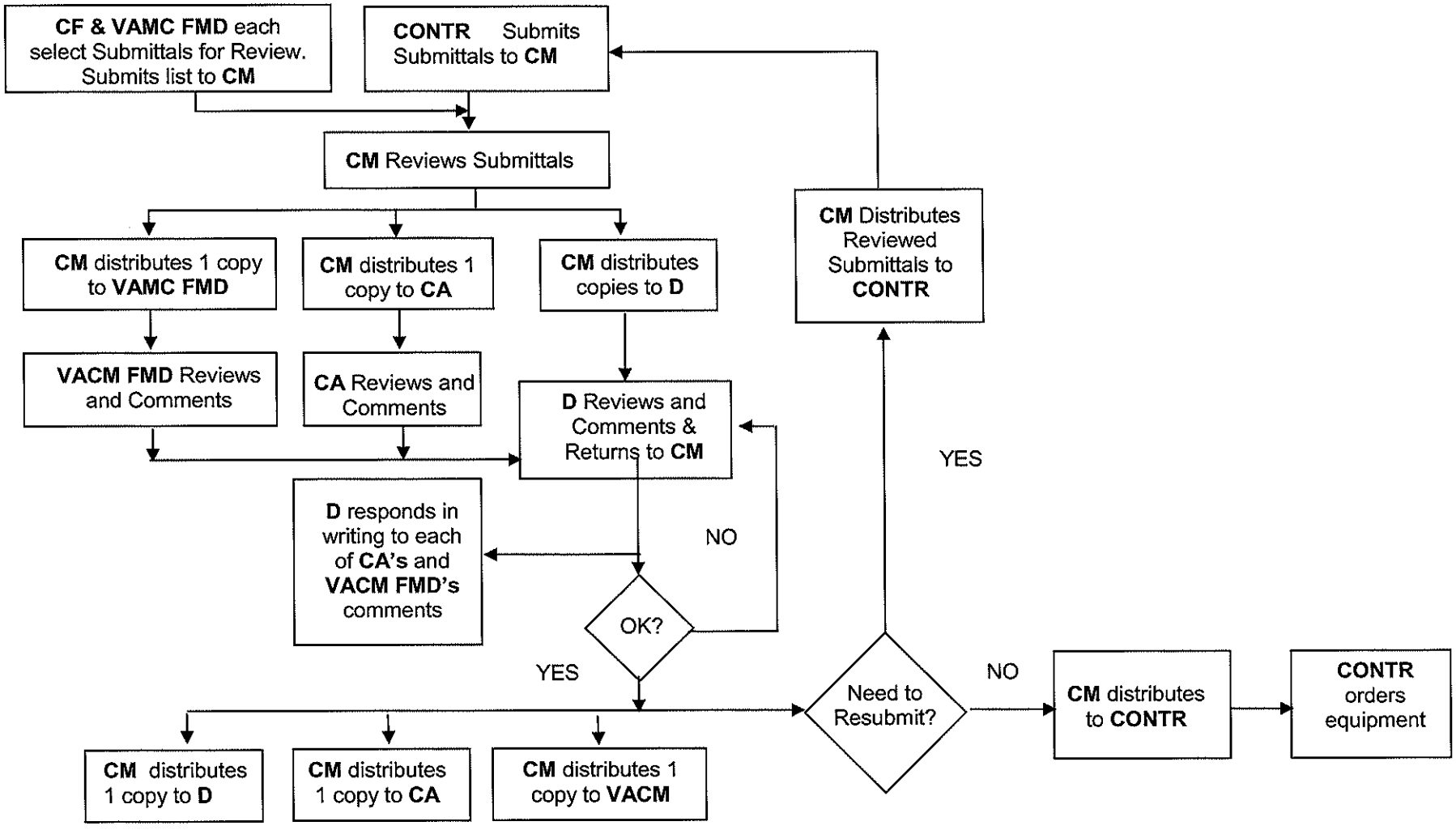
e) Equipment/System Submittal Review (Commissioned Equipment Only)



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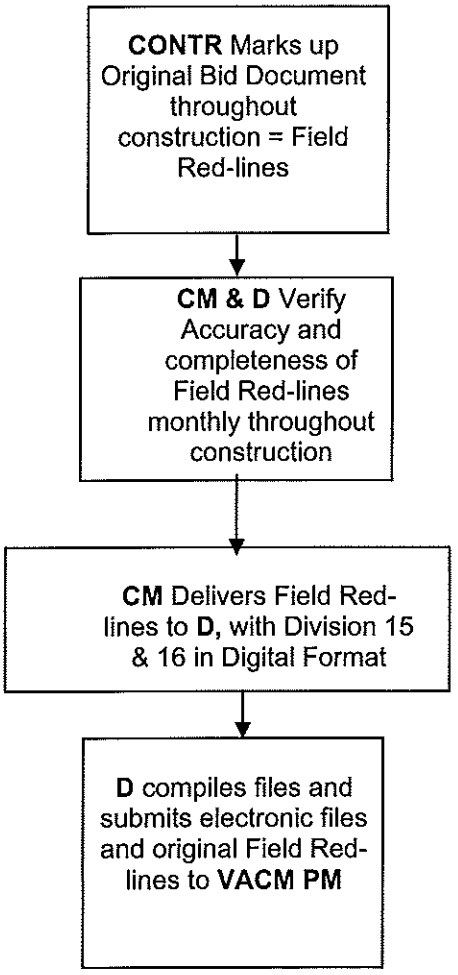
f) As Built Drawings



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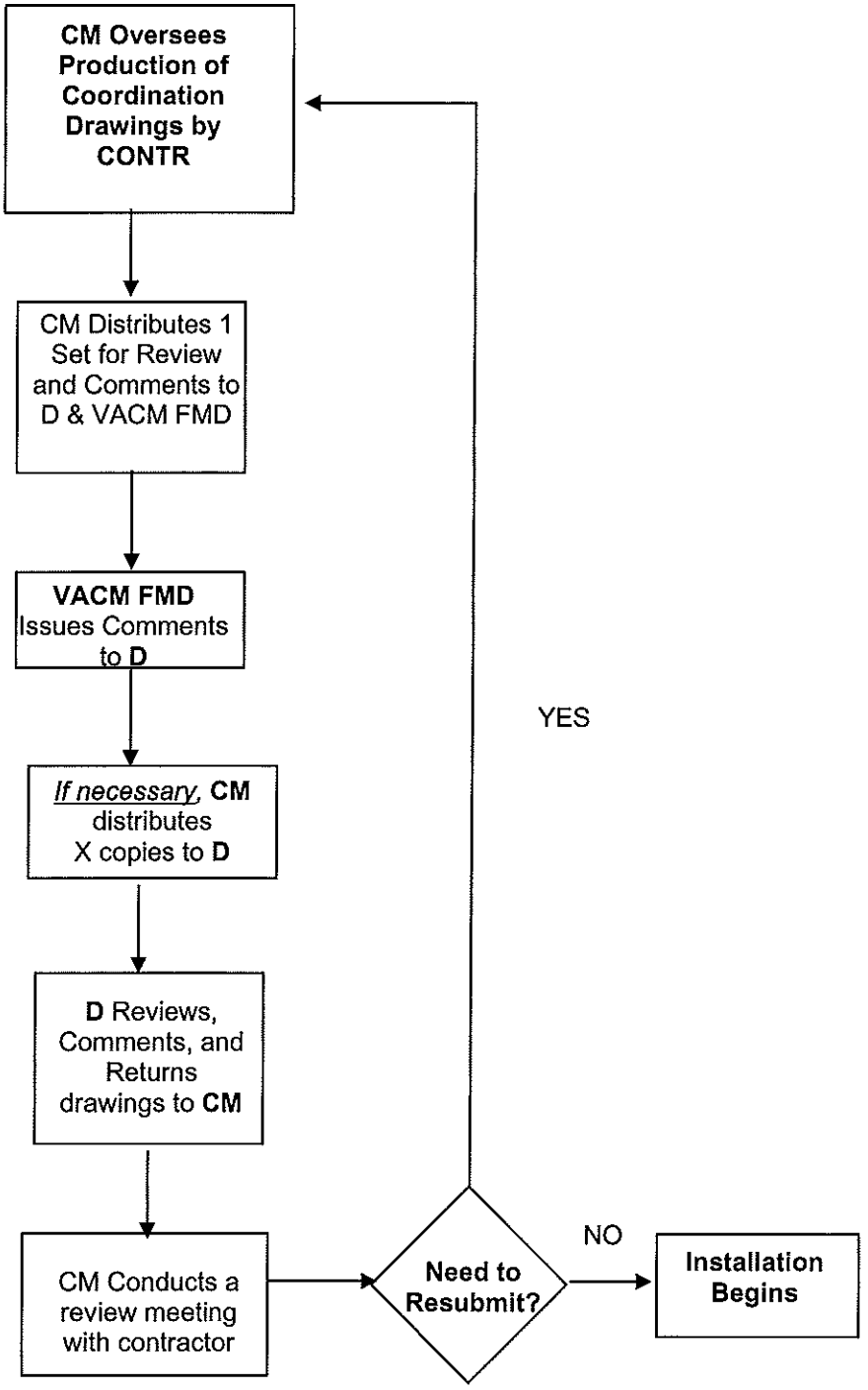
g) Coordination Drawing Review



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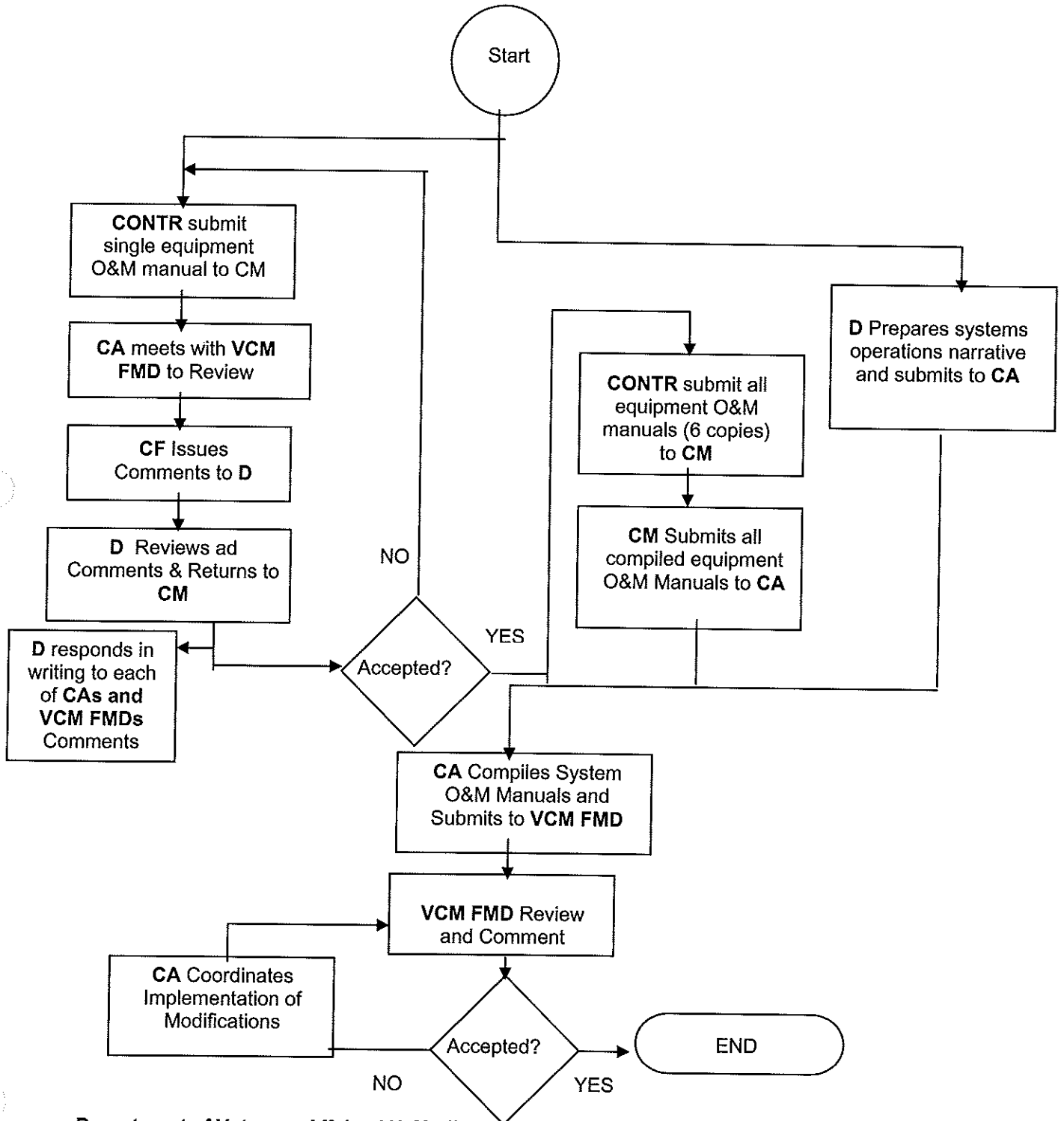
h) Operations and Maintenance Manuals



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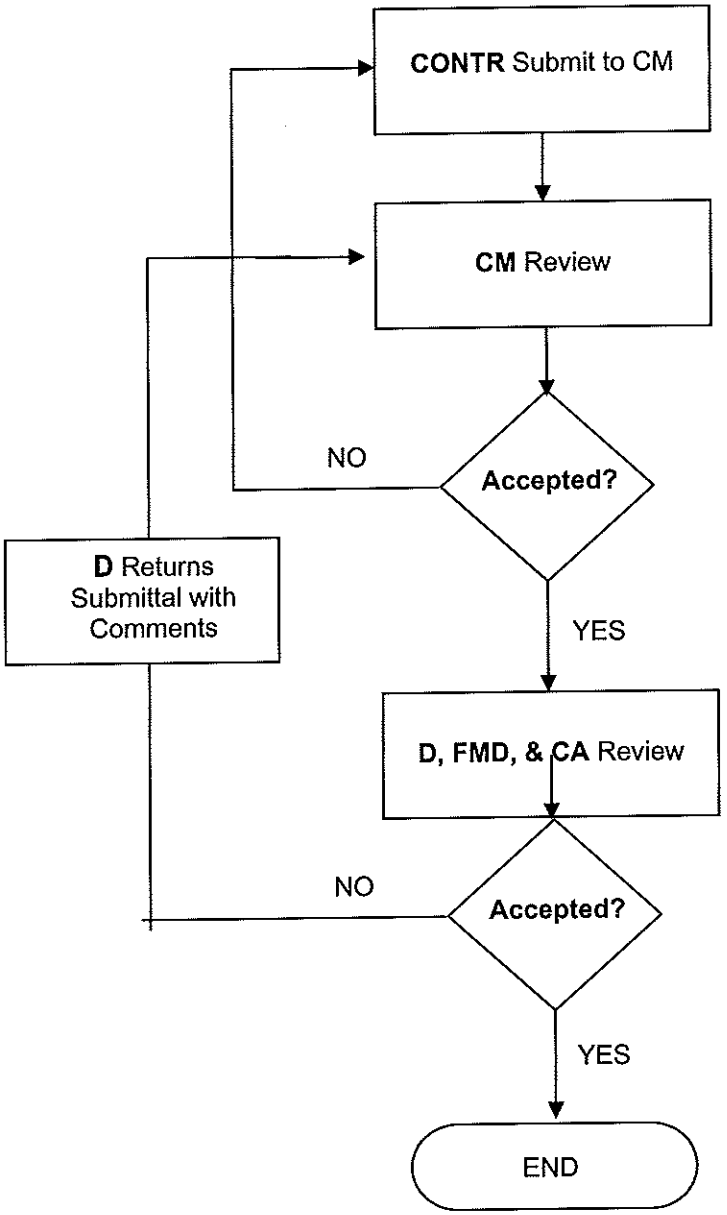
i) Review Cx Related Submittals from Contractors



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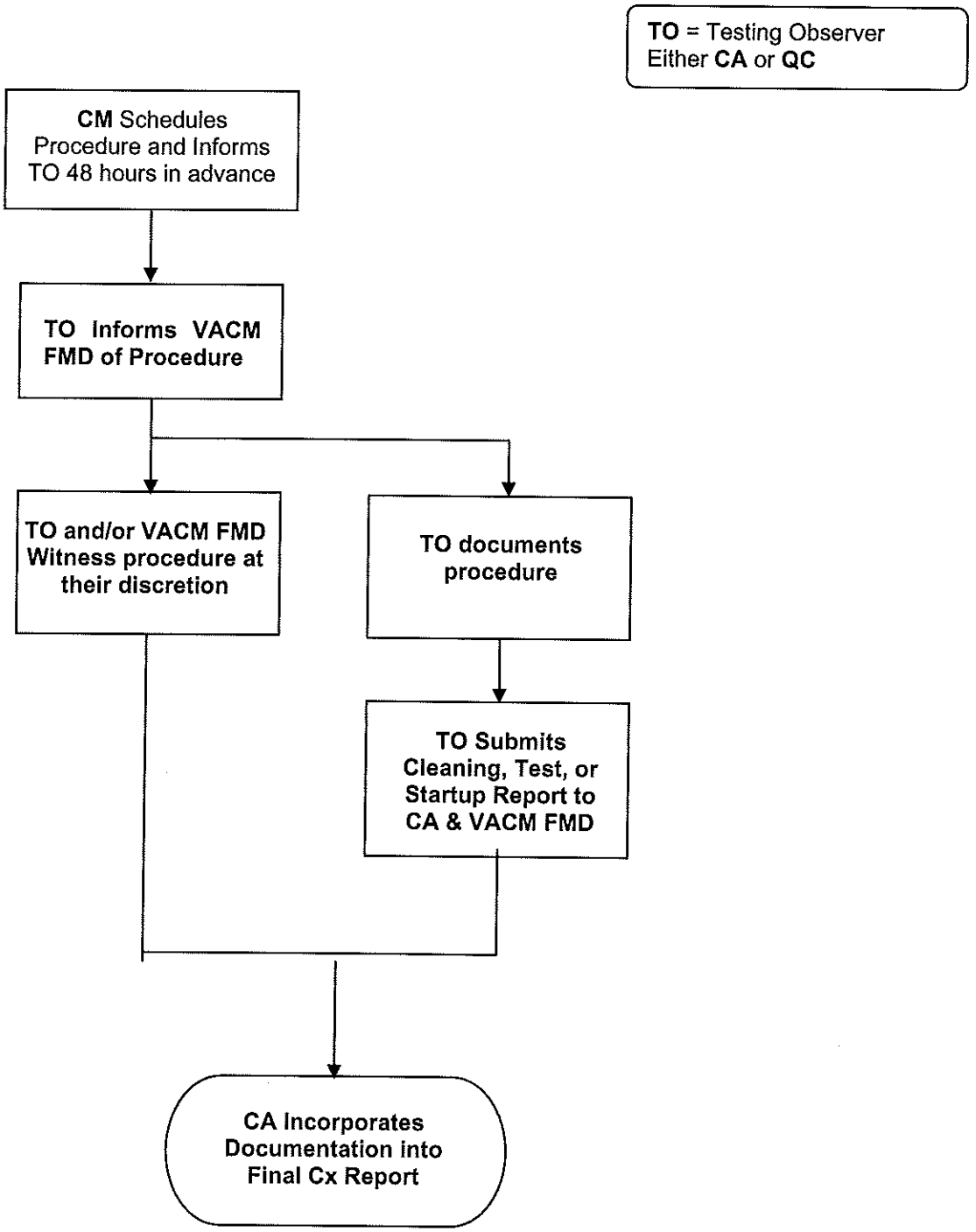
i) Witness Contractor Performance of Division 15 and 16 Cleaning, Testing, and Equipment Startup Procedures



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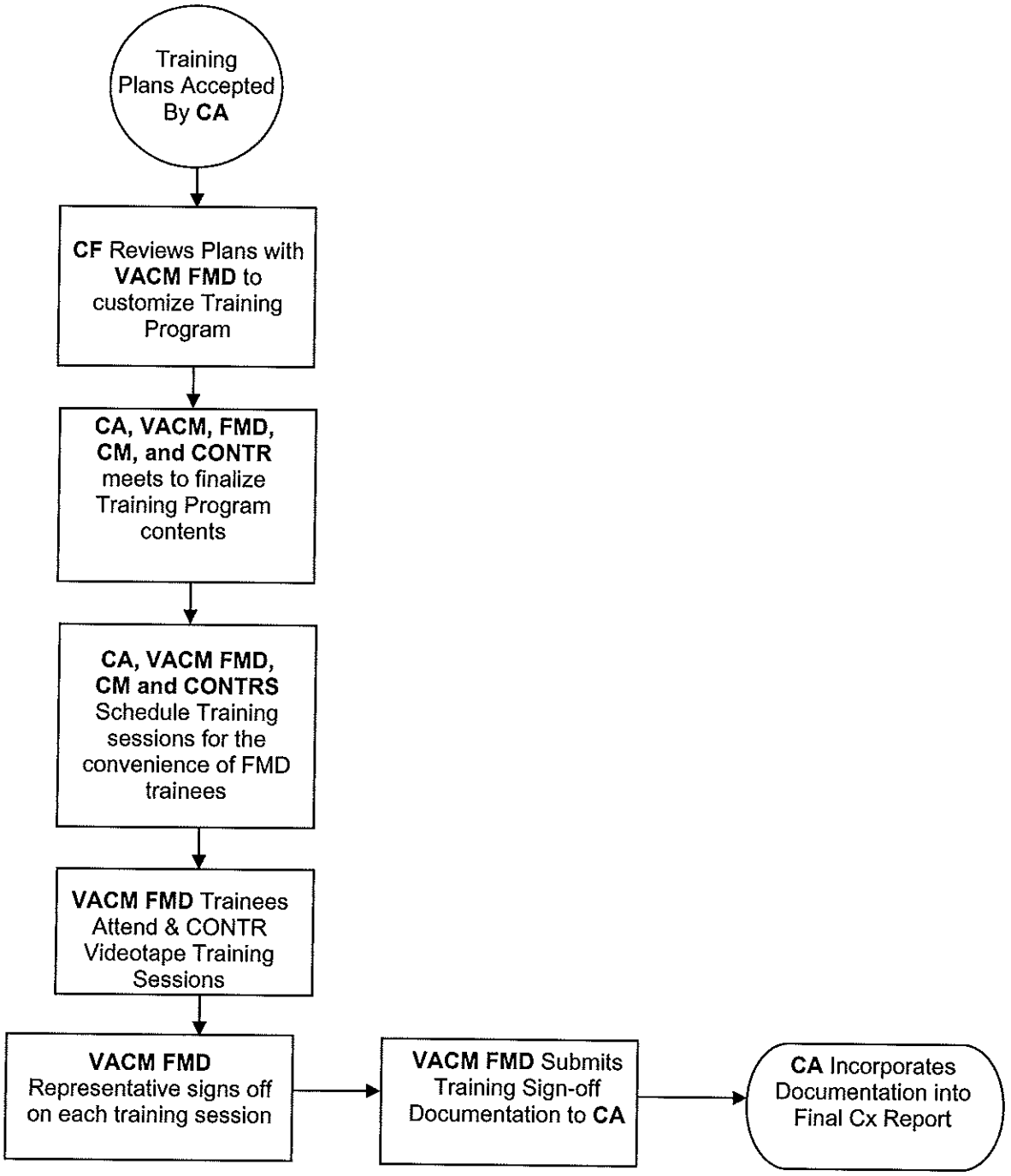
k) Equipment Training



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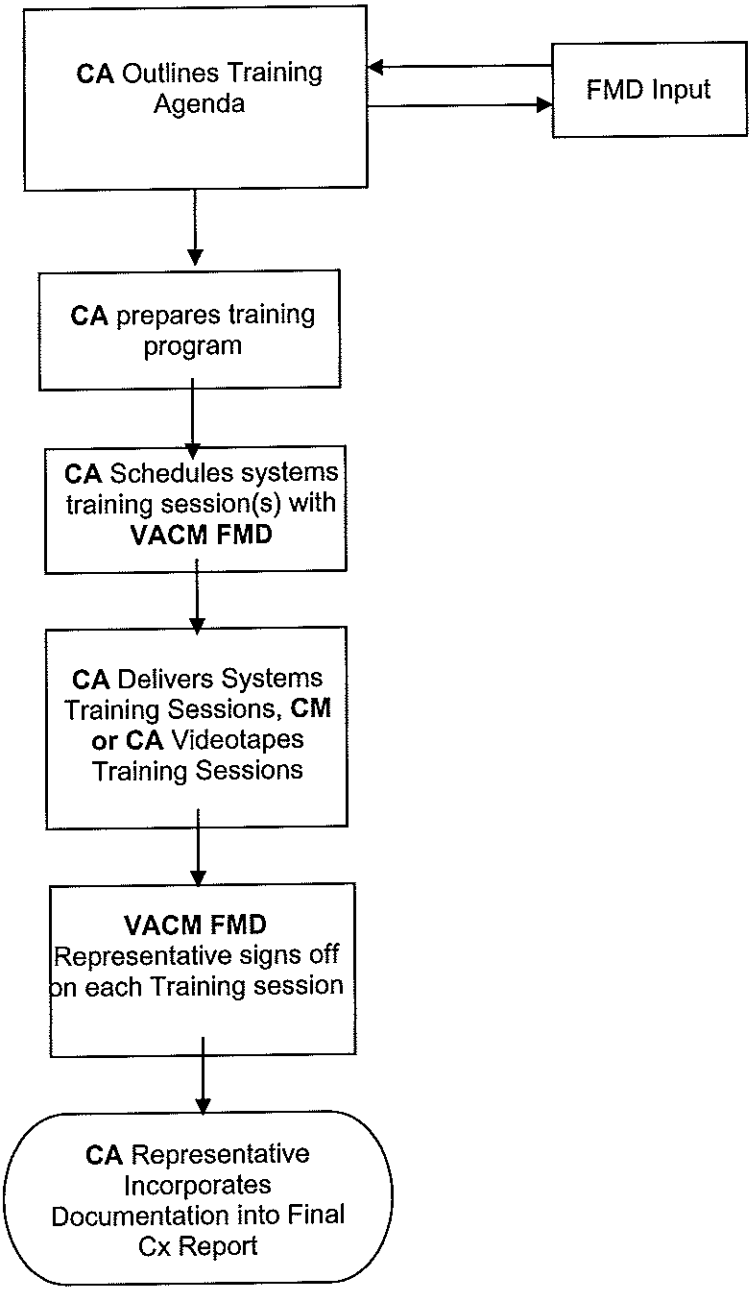
I) Systems Training



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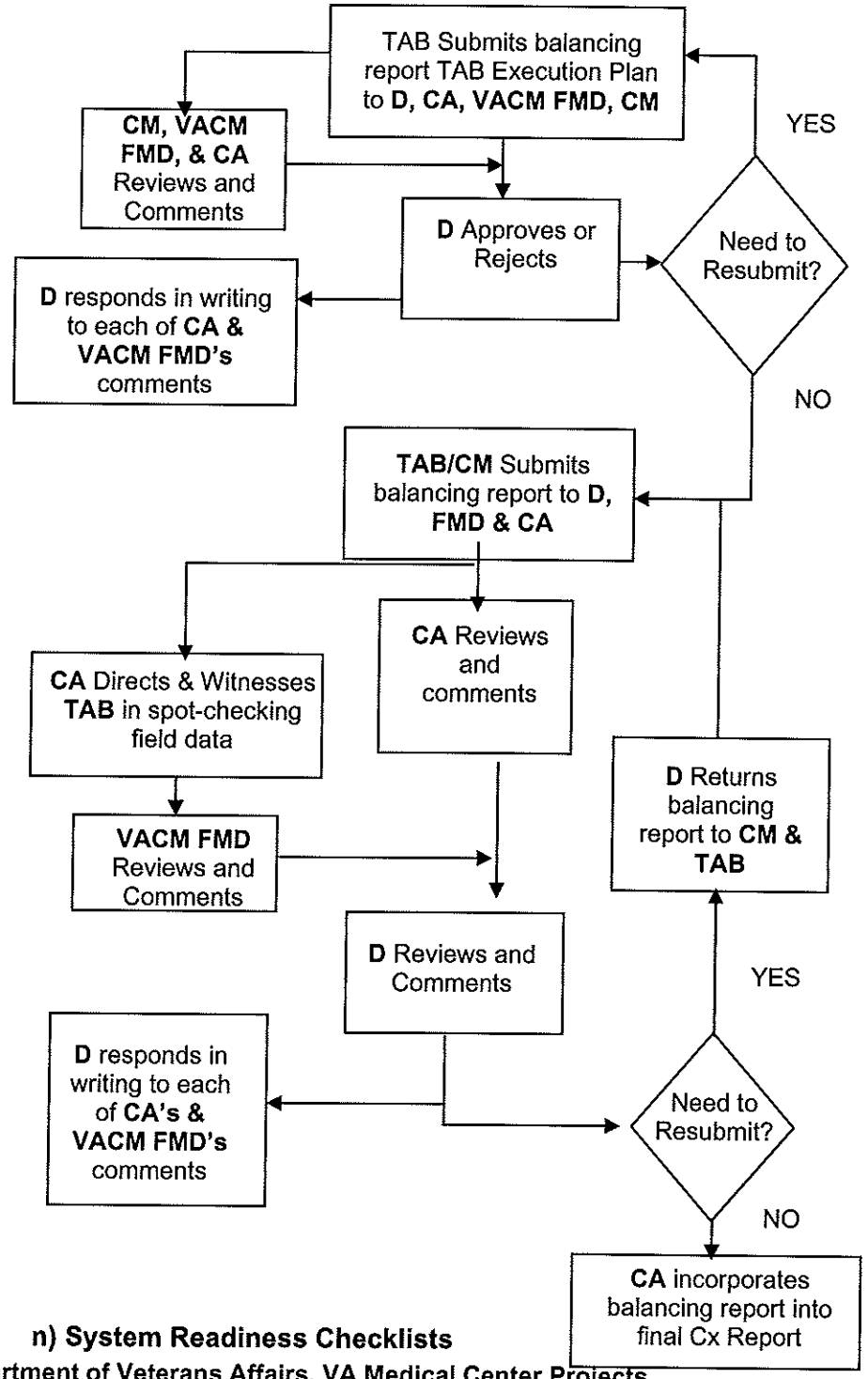
m) Test and Balance



n) System Readiness Checklists

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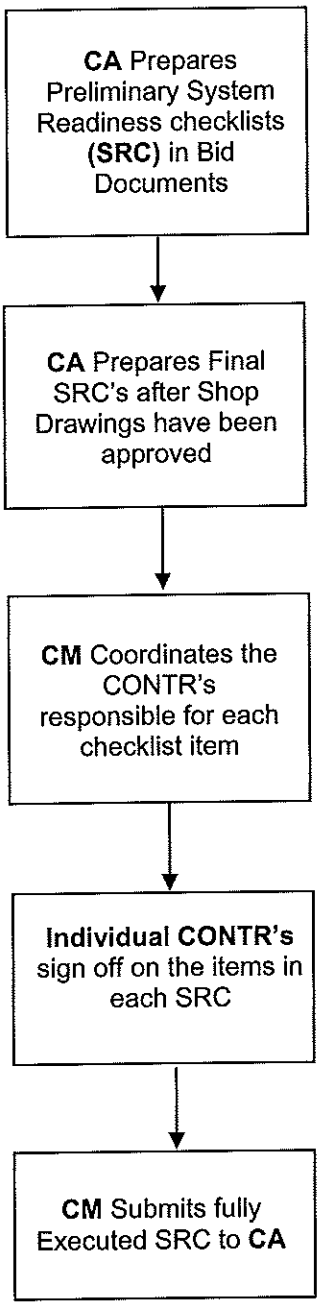
CA Prepares Preliminary System Readiness checklists **(SRC)** in Bid Documents
CA Prepares Final SRC's after Shop Drawings have been approved
CM Coordinates the CONTR's responsible for each checklist item
Individual CONTR's sign off on the items in each SRC
CM Submits fully Executed SRC to **CA**

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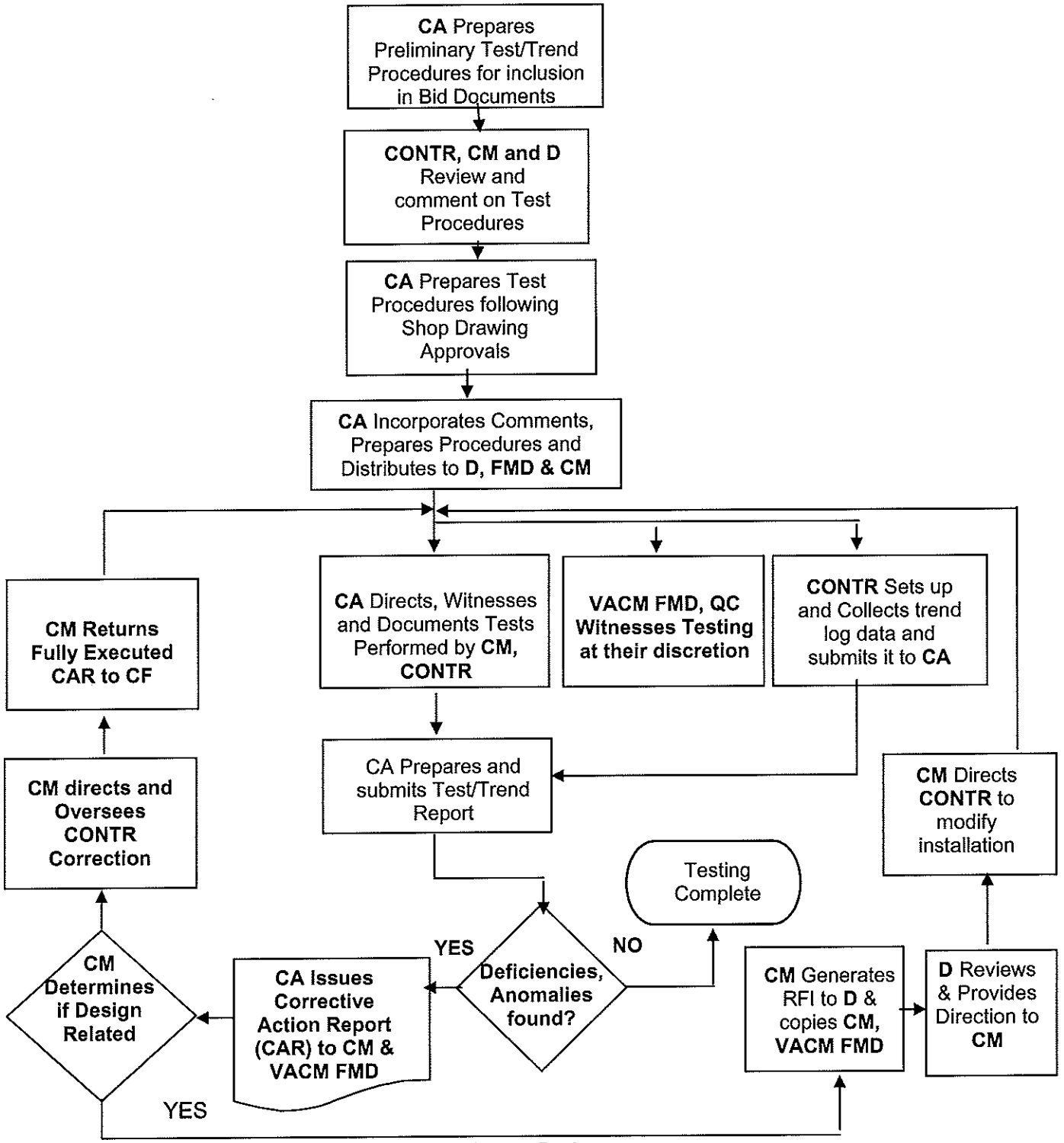
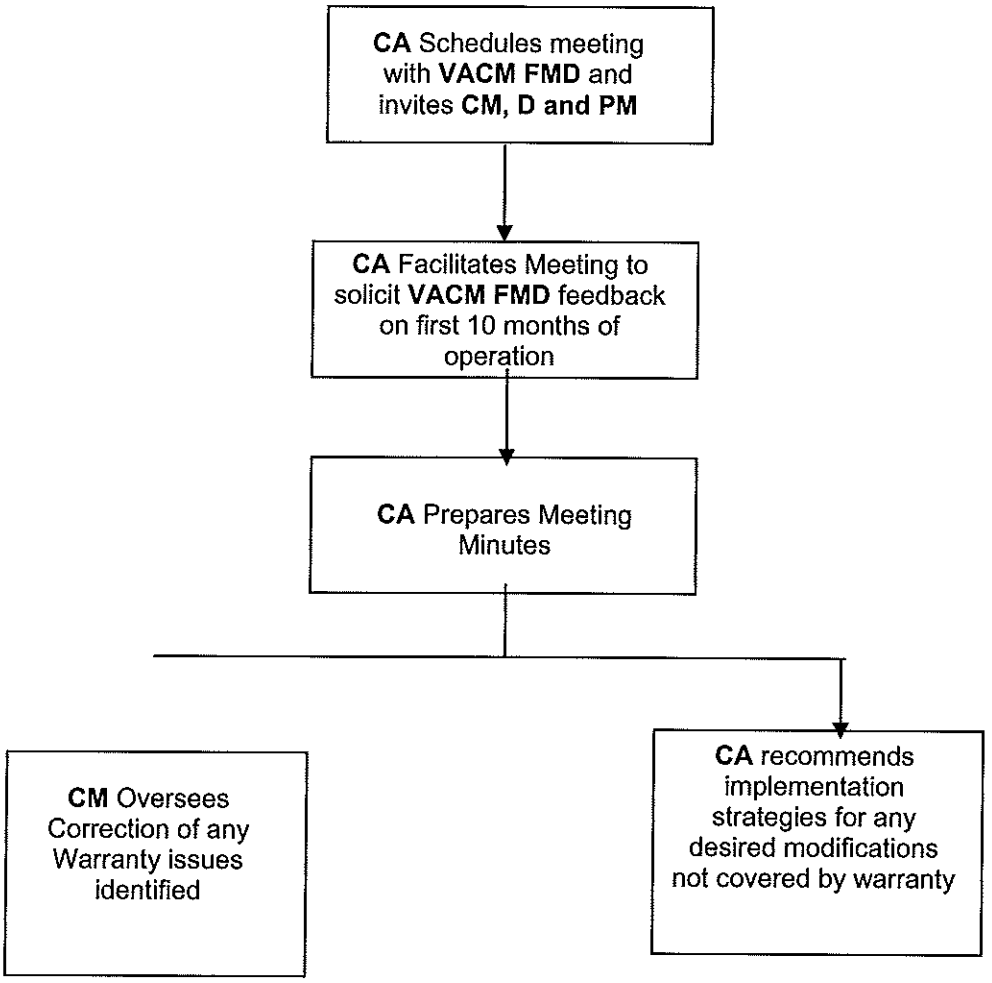
o) Commissioning Testing



May 14, 2007

p) Ten Month Warranty Checkup



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17. PROJECT QUALITY AUDITS

17.1 Narrative of Project Audit Process

The S2 drawings, specifications, cost estimate, and design narratives were reviewed by an independent team of professionals representing each discipline engaged in the design of the new facilities. The comments were written, published, and discussed by the reviewers and the affected team members during the course of the submission production. The reviewers used the Veterans Administration Design Guidelines and Veterans Administration Reviewer's Checklists, American Institute of Architects Guidelines for Healthcare Construction, professional expertise, and other quality standards as a basis for evaluating the submission. This internal process will streamline the review and approval process for this S2 Design Submission.

General: A quality audit will be conducted on the design, approaches, recommendations, application or interpretation of code requirements or supporting design analyses and calculations to support the client's design objectives.

17.2 There are six distinct buildings on the site for the VAMC Orlando:

134 Bed Hospital with Clinic, Education Center and Veterans Benefit Administration
120 Bed CLC
30 Bed Domiciliary
Warehouse
Parking Structure
Central Energy Plant.

17.3 List of Quality Standards

Multi-disciplined QA/QC reviews of planning and design documents will be performed to ensure compliance with applicable Federal, State, and local codes, standards and design criteria at various submissions. Reviews will be conducted for conformance with, but not limited to:

VA Master Specifications
VA HVAC Design Guides
ANSI/ASME Standards
ASHRAE Standards
VA Electrical Design Guides
NFPA 70 – National Electrical Code
NFPA 72 – National Fire Alarm Code
NFPA 99 – Standard for Health Care Facilities
NFPA 110 – Standard for Emergency and Standby Power Systems
NEC
IEEE
VA Plumbing Guide
NFPA 13 -Sprinkler Systems
VA Architectural Design Manual
VA Room Finishes, Hardware and Door Schedule
VA Standard Details

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VA Fire Protection Design Manual
NFPA 101 - Life Safety Code
International Building Code (IBC)
OSHA
JCAHO

November 3, 2008

18. SUSTAINABLE DESIGN

18.1 LEED Certification

18.1.1 Introduction

The Veteran Affairs (VA) hospital complex planning staff, together with the entire project design team, are committed to a design that is functional, attractive, easy to operate and maintain, and is responsive to energy efficiency and environmental (sustainable) design principles. The U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) rating system and the American Society of Healthcare Engineers' (ASHE) Green Guidelines for Healthcare (GGHC) are being used to guide the identification of viable sustainable design strategies that will be integrated into the planning, design, construction and operation of the new hospital being planned in Orlando, FL. LEED Certification at the Silver level will be pursued, but is not the sole driving force in selecting and integrating viable sustainable design strategies. Additionally, the ASHE Green Guidelines for Healthcare will assist the project team in identifying appropriate sustainable design, construction and operation solutions for this healthcare facility.

As the design progresses, Architectural Energy Corporation (AEC) will continue to manage the process of preparing and submitting the LEED Certification application to the USGBC for LEED Certification of the new VA Hospital in Orlando, Florida. The project team, together with the VA, conducted a conference call to discuss the feasibility assessment of the schematic design. The LEED feasibility assessment evaluated the status of LEED credits integrated into or potentially achievable in the proposed (S-2) schematic design. The study highlighted successful sustainable design strategies integrated into the schematic design solution, identified opportunities for additional LEED credits, and estimated potential soft costs associated with the pursuit of LEED Certification.

The LEED Scorecard has been prepared, identifying the LEED credits the Project Team has targeted for the project. This LEED Scorecard, and associated task list, is used as a guide for the remainder of the design and construction process, with specific responsibilities assigned to Project Team members for each targeted LEED credit. In order to address the project's LEED Certification, AEC will continually revise the LEED Scorecard and task list to reflect design decisions and progress as the design of each associated VAMC building progresses. AEC oversees this entire effort, ensuring that the selected energy efficiency and sustainable design strategies are fully integrated into the design documentation (plans and specifications) and that the required documentation substantiates compliance with the LEED credit criteria, and is properly prepared and entered into the LEED-Online application system.

18.2 General Recommendations

18.2.1 LEED-NC v2.2 Rating System

The LEED for New Construction and Major Renovation (LEED-NC) rating system was designed primarily for new commercial office buildings. However, this rating system has

been used by LEED practitioners for many other building types as well. LEED-NC addresses design and construction activities for both new buildings and major renovations of existing buildings and is intended to assist in the creation of high performance, healthy, durable, affordable and environmentally sound commercial and institutional buildings.

18.2.2 Achieving LEED Certification

Achieving formal certification requires the project team to compile documentation showing compliance with credit requirements. Again, while general requirements were highlighted in the AEC feasibility assessment, specific requirements are provided in the LEED-NC v2.2 Reference Guide. Responsibility for documentation associated with each LEED credit being pursued has been assigned to a specific member of the Project Team. This process and resulting assignments will include the General Contractor. Typically, in a LEED project pursuing formal certification, the key responsible parties for completing supporting credit documentation include the architect, civil engineer, landscape architect, electrical engineer, plumbing engineer, mechanical engineer, contractor, and owner.

The project has been registered under the LEED-NCv2.2 rating system, and the process has been initiated to invite all responsible team members to join the project through LEED-Online.

Since the VA Medical Center project consists of multiple buildings, the project will be pursuing LEED Certification using a "campus application." Data regarding the design of all buildings on the campus will be combined and submitted to USGBC as one LEED Design Submittal. Likewise, data regarding the construction of all buildings on the campus will be combined and submitted to USGBC as one LEED Construction Submittal. All of the buildings on the campus will receive one combined LEED Certification from USGBC.

18.2.3 Contract Documents

Both the specifications and drawings will need to include LEED requirements. Typically, when project manuals are distributed, AEC recommends including a LEED Requirements section in Division One that outlines the basic requirements. Division One will need to include the commissioning requirements as well. In addition to language in Division One, AEC recommends inserting applicable LEED language in every section to which it applies. Example language has been provided to the appropriate members of the project team.

18.3 LEED Schedule

AEC recommends following the schedule outlined below to achieve formal LEED certification for the VAMC project:

18.3.1 Early Design

Research feasibility of credits to be pursued by identifying costs/ design issues. Currently being completed by AEC and project team.

18.3.2 During Design

Incorporate LEED requirements into drawings and specifications.

Collect design documentation from design team.

Submit design documentation to the USGBC for preliminary review.

18.3.3 During Construction

Incorporate LEED required construction procedures.

Collect documentation for construction credits.

Assemble construction documentation from General Contractor.

18.3.4 Owner Occupancy

Submit construction documentation to the USGBC for final review and official LEED certification award.

18.4 LEED Costs

The costs associated with documentation and implementation of LEED credits can be divided into two categories. The "Documentation Costs" are soft costs resulting from the responsible design team members' time to produce the required documentation to substantiate credit compliance. Costs associated with designing to the credit requirements and incorporating requirements into the construction documents must be estimated by the design firms. AEC will provide credit requirements and suggested strategies for credit achievement, but cannot provide estimates of the required design time. In addition, the "Hard Costs" are costs that will either need to be estimated by the contractor/ cost estimator or are already included in the schematic design. If there are specific products/ materials needed for credit compliance and they are not already included in the design, they have been identified for the design team and are to be incorporated into the design as soon as possible.

18.5 LEED-NC v2.2 Scorecard

The LEED Scorecard below indicates AEC's assessment of the project under the LEED-NC v2.2 rating system. Credits in the "Yes" column are those that have been determined to be readily achievable with design integration and appropriate documentation. Credits in the "Maybe" column are those that the current design solution does not preclude, but calculations, pricing and further analysis will need to be done by the Project Team to determine if they are feasible. Credits in the "No" column are either precluded by the site, building type, or design solution, or have been determined not practical for this project.

Achieving a basic LEED Certified rating under the LEED-NC v2.2 rating system requires at least 26 points. Silver level requires a minimum of 33 points. The scorecard below, based on the decisions made early on in design development, shows that the project could has the potential to achieve up to 46 points. As the design progresses and design

decisions are made, AEC will guide the team in evaluating which of these 46 points will be achieved in order to meet the LEED Silver certification goal.

LEED® - NC v2.2

Project Name: Veterans Affairs Medical Center
Project # 06-166
Date: 10.17.08
Level Pursuing: Silver

ARCHITECTURAL ENERGY CORPORATION
Integrated Engineered Solutions

Y	M	N	Sustainable Sites		Responsible Party[1]
Y			Prerequisite 1	Construction Activity Pollution Prevention	Civil Engineer
	X		Credit 1	Site Selection	Civil Engineer
		X	Credit 2	Development Density & Community Connectivity	
		X	Credit 3	Brownfield Redevelopment	
	X		Credit 4.1	Alternative Transportation: Public Transportation Access	Architect
X			Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	Plumbing/Architect/Landscape
	X		Credit 4.3	Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles	Architect
	X		Credit 4.4	Alternative Transportation: Parking Capacity	Architect
		X	Credit 5.1	Site Development: Protect or Restore Habitat	
	X		Credit 5.2	Site Development: Maximize Open Space	Civil Engineer/Lanscape Architect
	X		Credit 6.1	Stormwater Design: Quantity Control	Civil Engineer
	X		Credit 6.2	Stormwater Design: Quality Control	Civil Engineer
X			Credit 7.1	Heat Island Effect: Non-Roof	Architect
X			Credit 7.2	Heat Island Effect: Roof	Architect
X			Credit 8	Light Pollution Reduction	Electrical/Lighting Engineer
X			*Credit 9*	*Connection to the Natural World: Place of Respite*	*GGHC*
X			*Credit 10.1*	*Community Contaminant Prevention: Airborne Releases*	*GGHC*
	X		*Credit 10.2*	*Community Contaminant Prevention: Cost Analysis*	*GGHC*
4	7	3	**14 Possible**		

Y	M	N	Water Efficiency		Responsible Party[1]
Y			*Prerequisite 1*	*Potable Water Use for Equipment Cooling*	*GGHC*
X			Credit 1.1	Water Efficient Landscaping: Reduce by 50%	Landscape Architect
		X	Credit 1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	
	X		Credit 2	Innovative Wastewater Technologies	Plumbing Engineer
X			Credit 3.1	Water Use Reduction: 20% Reduction	Plumbing Engineer
X			Credit 3.2	Water Use Reduction: 30% Reduction	Plumbing Engineer
	X		*Credit 4.1*	*Process Water Use Reduction: Measurement & Verification*	*GGHC*
	X		*Credi4.2*	*Process Water Use Reduction: Low or No Water Use Building System Eq*	*GGHC*
3	1	1	**5 Possible**		

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Y	M	N	Energy and Atmosphere		Responsible Party[1]
Y			Prerequisite 1	Fundamental Commissioning of the Building Energy Systems	Commissioning Agent
Y			Prerequisite 2	Minimum Energy Performance	ME/EE/Architect/Energy Modeler
Y			Prerequisite 3	Fundamental Refrigerant Management	Mechanical Engineer
X			Credit 1.1	Optimize Energy Performance, 10.5% new, 3.5% existing	ME/EE/Architect/Energy Modeler
	X		Credit 1.2	Optimize Energy Performance, 14% new, 7% existing	" "
		X	Credit 1.3	Optimize Energy Performance, 17.51% New 10.5% Existing	
		X	Credit 1.4	Optimize Energy Performance, 21% New 14% Existing	
		X	Credit 1.5	Optimize Energy Performance, 24.51% New 17.5% Existing	
		X	Credit 1.6	Optimize Energy Performance, 28% New 21% Existing	
		X	Credit 1.7	Optimize Energy Performance, 31.5% New 24.5% Existing	
		X	Credit 1.8	Optimize Energy Performance, 35% New 28% Existing	
		X	Credit 1.9	Optimize Energy Performance, 38.5% New 31.5% Existing	
		X	Credit 1.10	Optimize Energy Performance, 42% New 35% Existing	
		X	Credit 2.1	On-Site Renewable Energy: 2.5%	
		X	Credit 2.2	On-Site Renewable Energy: 7.5%	
		X	Credit 2.3	On-Site Renewable Energy: 12.5%	
X			Credit 3	Enhanced Commissioning	Commissioning Agent
X			Credit 4	Enhanced Refrigerant Management	Mechanical Engineer
	X		Credit 5	Measurement & Verification	Owner/Commissioning Agent
		X	Credit 6	Green Power: 35%	
	X		*Credit 6.1*	*Energy Supply Efficiency: 10%*	*GGHC*
	X		*Credit 6.2*	*Energy Supply Efficiency: 15%*	*GGHC*
	X		*Credit 6.3*	*Energy Supply Efficiency: 17%*	*GGHC*
	X		*Credit 6.4*	*Energy Supply Efficiency 18%*	*GGHC*
X			*Credit 7*	*Medical Equipment Efficiency*	*GGHC*
3	2	12	**17 Possible**		

Y	M	N	Materials and Resources		Responsible Party[1]
Y			Prerequisite 1	Storage & Collection of Recyclables	Architect/Owner
Y			*Prerequisite 2*	*Mercury Elimination*	*GGHC*
		X	Credit 1.1	Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	
		X	Credit 1.2	Building Reuse: Maintain 95% of Existing Walls, Floors & Roof	
		X	Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural Elements	
X			Credit 2.1	Construction Waste Management: Divert 50% From Disposal	Contractor
	X		Credit 2.2	Construction Waste Management: Divert 75% From Disposal	Contractor
		X	Credit 3.1	Materials Reuse: 5%	
		X	Credit 3.2	Materials Reuse: 10%	
X			Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Contractor/Architect
	X		Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Contractor/Architect
X			Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Locally	Contractor/Architect
	X		Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Locally	Contractor/Architect
		X	Credit 6	Rapidly Renewable Materials	
X			Credit 7	Certified Wood	Contractor/Architect
		X	*Credit 8.1*	*PBT Elimination: Dioxins*	*GGHC*
X			*Credit 8.2*	*PBT Eliminiation: Mercury Use in Equipment*	*GGHC*
X			*Credit 8.3*	*PBT Eliminiation: Lead & Cadmium*	*GGHC*
		X	*Credit 9.1*	*Furniture & Medical Furnishings: Resource Reuse*	*GGHC*
		X	*Credit 9.2*	*Furniture & Medical Furnishings: Materials*	*GGHC*
		X	*Credit 9.3*	*Furniture & Medical Furnishings: Manufacturing, Transportation, & Recyc*	*GGHC*
	X		*Credit 10*	*Copper Reduction*	*GGHC*
X			*Credit 11.1*	*Resource Reuse: Design for Flexibility*	*GGHC*
	X		*Credit 11.2*	*Resource Reuse: Minimize Materials*	*GGHC*
4	3	6	**13 Possible**		

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Y	M	N	Indoor Environmental Quality		Responsible Party[1]
Y			Prerequisite 1	Minimum IAQ Performance	Mechanical Engineer
Y			Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Architect/Owner
X			Credit 1	Outside Air Delivery Monitoring	Mechanical Engineer
	X		Credit 2	Increased Ventilation	Mechanical Engineer
X			Credit 3.1	Construction IAQ Management Plan: During Construction	Contractor/Mechanical
X			Credit 3.2	Construction IAQ Management Plan: Before Occupancy	Contractor/Mechanical
X			Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	Contractor
X			Credit 4.2	Low-Emitting Materials: Paints & Coatings	Contractor
X			Credit 4.3	Low-Emitting Materials: Carpet Systems	Contractor
X			Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	Contractor
X			Credit 5	Indoor Chemical & Pollutant Source Control	Mechanical/Architect
	X		Credit 6.1	Controllability of Systems: Lighting	Electrical/Lighting Engineer
	X		Credit 6.2	Controllability of Systems: Thermal Comfort	Mechanical Engineer
	X		Credit 7.1	Thermal Comfort: Design	Mechanical Engineer
X			Credit 7.2	Thermal Comfort: Verification	Owner
	X		Credit 8.1	Daylight and Views: Daylight 75% of spaces	Architect/Daylight Engineer
		X	Credit 8.2	Daylight and Views: Views for 90% of Spaces	
X			*Credit 8.1a*	*Daylight and Views: Daylight for Occupied Spaces: 34-48% flr win 15'*	*GGHC*
X			*Credit 8.1b*	*Daylight and Views: Daylight for Occupied Spaces: 38-57% flr win 15'*	*GGHC*
X			*Credit 8.1c*	*Daylight and Views: Daylight for Occupied Spaces: 42-64% flr win 15'*	*GGHC*
X			*Credit 8.2*	*Daylight and Views: Building Orientation*	*GGHC*
		X	*Credit 8.3*	*Daylight and Views: Views for Occupied Spaces*	*GGHC*
X			*Credit 8.4*	*Daylight and Views: Lighting and Circadian Rhythm*	*GGHC*
	X		*Credit 9*	*Acoustic Environment*	*GGHC*
9	5	1	15 Possible		

Y	M	N	Innovation & Design Process		Responsible Party[1]
X			Credit 1.1	Innovation in Design, As approved by USGBC	All
X			Credit 1.2	Innovation in Design, As approved by USGBC	All
X			Credit 1.3	Innovation in Design, As approved by USGBC	All
X			Credit 1.4	Innovation in Design, As approved by USGBC	All
X			Credit 2	LEED® Accredited Professional	AEC
5	0	0	5 Possible		

	0 - 25	Insufficient
	26 - 32	Certified
	33 - 38	Silver
	39 - 51	Gold
	52 - 69	Platinum

Project Points	Maybe
28	18
Certified	

Project Notes:
Credits in italicized text are Green Guides for Healthcare credits and do not 'count' in the total project points.

[1]Party responsible for documenting credit compliance.

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18.6 Energy Analysis

18.6.1 Introduction

Section 18.6 summarizes the work performed by Architectural Energy Corporation during the S2 Phase in developing a DOE-2 energy model of the building to evaluate energy saving design alternatives. The current model does not include the nursing home, the domiciliary, or the atrium of the main hospital, which will be evaluated in future work.

To adhere to EPACT 2005, a 30%-lower than ASHRAE 90.1-2004 annual energy cost target has been established by the VA. Should this target not be able to be met cost effectively, lower targets will be established until a cost-effective solution is realized. In addition, a 30% cost savings will earn the project 6 points under LEED-NC Energy & Atmosphere Credit 1.

Figure 18-1 compares the estimated energy costs by energy end-use for the ASHRAE Baseline and the Proposed Design. The simulation analysis predicts the annual energy costs for the ASHRAE Baselines to be $3.34/sf/year ($2,712,000/year) and energy use of kBtu/sf/year. For the Proposed Design, the analysis predicts annual energy costs of $3.01/sf/year ($2,448,000/year) and energy use of 174 kBtu/sf/yr. Thus, the proposed design demonstrates an annual energy costs savings of approximately 10%.

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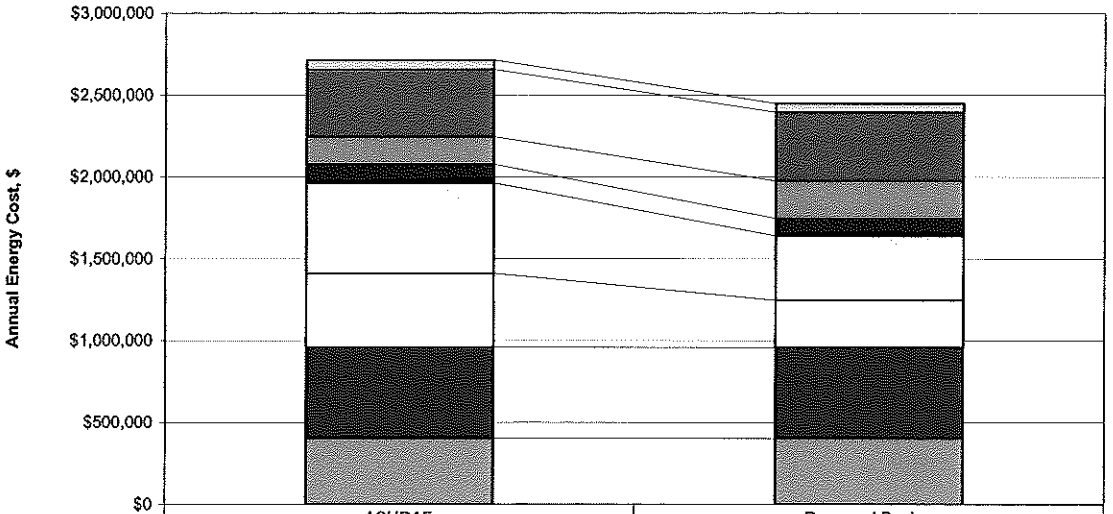

	ASHRAE	Proposed Design
DHW	$56,452	$53,085
Fans	$410,113	$418,629
Pumps	$169,009	$229,431
Tower	$113,457	$106,255
Cooling	$552,481	$392,502
Heating	$451,712	$289,195
Process Loads	$555,389	$555,414
Area Lighting	$403,060	$403,004

Figure 18-1: Proposed Design versus ASHRAE Baseline Energy Costs

The Proposed design shows improvements over the ASHRAE Baseline in the following areas:

- Increased roof insulation
- Low conductance windows
- Dual path variable air volume system
- High efficiency variable-speed chiller
- Variable speed drive cooling tower fans
- High efficiency boiler

Several energy conservation measures (ECMs) were evaluated to determine their impact on annual energy costs. These savings from the ECMs are shown in Figure 18-2. All percentage savings values are based on annual whole-building energy costs relative to the Proposed Design model.

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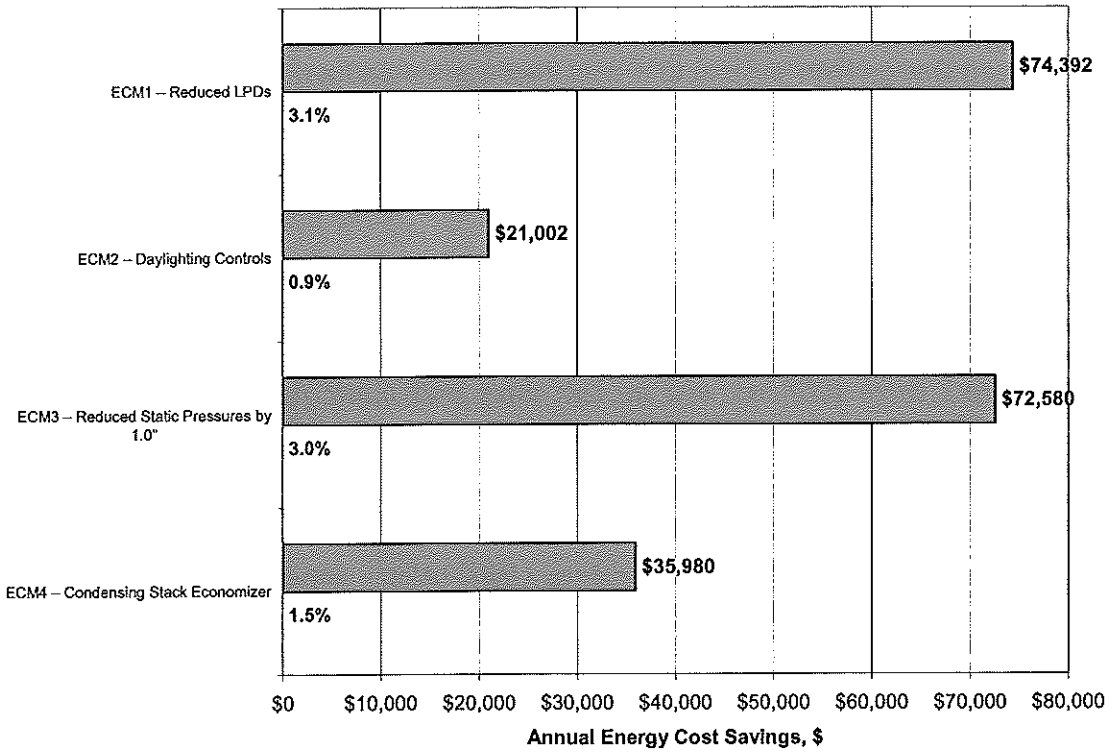

Figure 18-2: Annual Energy Cost Savings of Energy Conservation Measures

The results from the ECM analysis show the following:

- Reducing lighting power densities by 20% from ASHRAE values and implementing daylighting controls could reduce annual energy costs in the building by approximately $95,400/yr or 4%.
- High ventilation requirements result in high costs for fan operation. A low static pressure system design decreases costs (a 1.0 inch reduction would save approximately $73,000 or 3.0%.
- Utilizing a condensing stack economizer on the steam boiler flue could save approximately $36,000/yr or 1.5% .

18.6.2 Mechanical Systems Studies

Several mechanical systems of particular interest to the team were studied to evaluate their impact on annual energy costs. These studies include:

- Distribution system types
- Distribution system fan options
- Surgery suites outside-air study
- Plant - primary-only pumping
- Plant – hot-water condensing boilers

The distribution system study of system types compared the performance of the Proposed Design VAV system to a dual duct system and a dual path system. The study determined total annual building energy savings of 28.3% and 5.5% for the dual duct and dual path system, respectively. Both systems help to reduce overcooling and reheating that occurs with the traditional VAV system due to dehumidification and high ventilation requirements. The dual path system is currently incorporated into the proposed design.

The energy cost impacts of several HVAC fan options was considered. The current design utilizes an internally mounted, Belt Drive (BD) Double-Width Double-Inlet (DWDI) type fan in the HVAC units. Additional options considered include the DWDI type fan with Direct Drive (DD) as well as belt drive and direct drive options for a plenum mounted Single-Width Single-Inlet (SWSI) type fans. The SWSI option is more efficient than the DWDI option. The simulation analysis predicted electrical costs savings of about $80,000/year and $90,000/year for the SWSI belt drive and direct drive fans, respectively. This range of savings represents ~ a 3% decrease in annual energy costs.

Under the VA Standards, Air Handling Units (AHU) serving Operating Rooms are required to be provided ventilation through 100% Outdoor Air (100% OA) units. The current design for these areas consists of (2) 34,000 cfm constant volume AHUs with a runaround heat recovery loop to temper the ventilation air for both heating and cooling. This study compares the current design to systems which will provide 20% OA which do not require a heat recovery loop. The results are summarized in **Table 18-1** below.

Table 18-1: Surgery Suites Outdoor Air Savings

Measure	100% OA	20% OA	Savings
Electric Demand	$399,158	$394,337	$4,821
Electric Consumption	$2,064,118	$2,049,340	$14,778
Natural Gas	$660,279	$660,371	($92)
Total	**$3,123,555**	**$3,104,048**	**$19,507**

For the plant studies, two options were considered: 1) VSD primary-only pumping for the chilled water 2) hot-water condensing boilers. The primary only pumping showed 1% whole-building energy cost savings compared to the Proposed Design with primary-secondary pumping. The hot-water condensing boilers showed some savings but these may diminish if the utility plant is located further away from the building than assumed

18.6.3 Solar Domestic Hot Water

As part of the S2 analysis, the energy cost savings from solar thermal energy was considered. For this analysis, hourly profiles were examined which accounted for

incoming water temperature and hourly demand for hot water. Based on typical use, the average hot water load was estimated to be about 17, 800 gallons a day.

The analysis considered two sizes of systems 120 and 220 - 4 foot x 10 foot collectors. The collectors are assumed to be flat-plate and mounted at a 27°tilt, facing south. The storage tank size was assumed to be 2 gallons per ft2 of collector area which corresponds to a 9,800 or 18,000 gallons. The cylindrical storage tank would have approximate dimensions of 12 ft diameter by 10 ft high and 16 ft diameter by 10 ft high, respectively.

Based on this analysis the installed cost varies from $367,200 to $673,200 depending on system size. The annual energy cost savings for each are $26,560 and $39,800 representing a 13.8 year and 16.9 year payback, respectively. The results are summarized in Table 18-2.

Table 18-2: Solar Thermal System Analysis Summary

Solar System Size	Estimated Cost	Annual Savings	Simple Payback
120 4'X10' Collectors	$367, 200	$26,558	13.8
220 4'X10' Collectors	$673, 200	$39,837	16.9

18.6.4 Energy Analysis Summary

The energy analysis of the current proposed design indicates that its estimated energy costs are 10% lower energy costs than the minimally-compliant ASHRAE 90.1-2004 building. Based on S2 modeling, it appears more savings could be achieved from additional design improvements. For example, improving lighting efficiency and fan design may increase the current proposed design savings from 10% to about 15%. However, the project will be challenged to meet the 30% lower than ASHRAE performance target. The energy model of the VA Medical Center will be refined in the Design Development Phase. As part of this, energy efficiency opportunities will continue to be considered and the energy savings assessed to support design team decisions and life-cycle costing analysis.

18.7 Summary of Energy Modeling Results

This section of the report presents the building energy performance of the Proposed Design model compared to the ASHRAE Baseline model, an analysis of numerous energy conservation measures (ECMs) evaluated for consideration, and the energy performance of the building if the package of ECMs is implemented.

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18.8 Proposed Design Energy Modeling Results

18.8.1 Proposed Design Results

Based on assumptions outlined in the previous section, modeling results for the Proposed Design are presented in Figure 18-3, Figure 18-4, and Figure 18-5, showing a breakdown of annual energy costs by end use, annual utility costs by type, and energy consumption by end use, respectively. The Proposed Design model predicts an annual energy cost of $2,596,565 per year or $3.19/sf/year, consuming an estimated 190.8 kBtu/sf/yr. The high process and plug loads of the hospital are the largest end use of electricity. Also of note is the relatively high percentage of energy devoted to heating, considering the warm climate of Orlando. This is primarily reheat energy resulting from high hospital ventilation requirements and the overcooling and reheating associated with the single duct system design. These high ventilation requirements dictate the design air flowrate to many of the zones,. The high air flow requirements also result in high energy use and costs associated with fans.

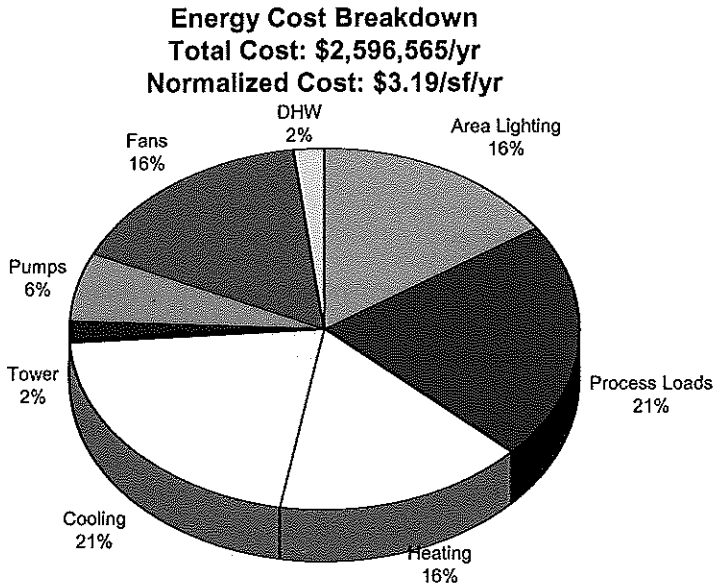

Figure 18-3: Annual Energy Costs by End-Use[1]

[1] *Actual energy consumption and costs of the building are highly dependent upon the building's actual operation. Energy modeling results are best utilized for making performance comparisons between energy conservation measures, or proposed building designs to selected benchmarks. Actual building energy use and costs will be based on many factors that may not be represented in energy modeling, including: quality of construction, actual plug loads, actual building schedules, and the behaviors of*

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Energy Cost Breakdown
Total Cost: $2,596,565/yr
Normalized Cost: $3.19/sf/yr

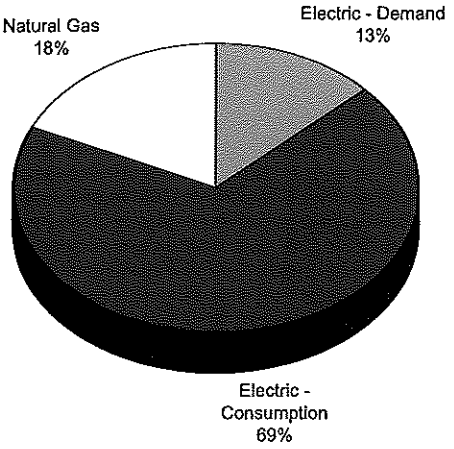

Figure 18-4: Annual Costs by Utility

Energy Breakdown
Total Consumption: 155,042 MBtu/yr
Normalized Consumption: 190.8 kBtu/sf/yr

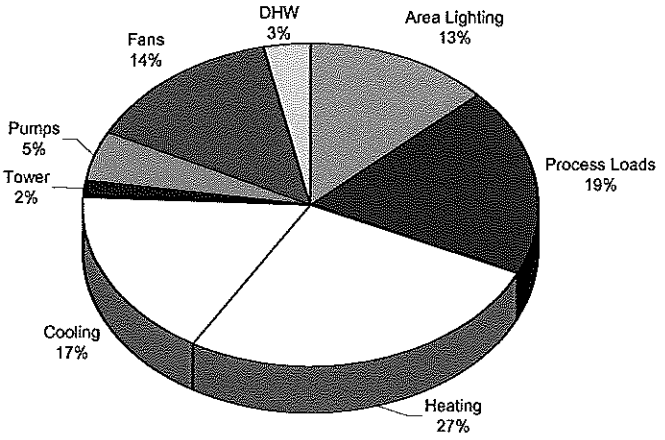

Figure 18-5: Annual Energy Use by End Use

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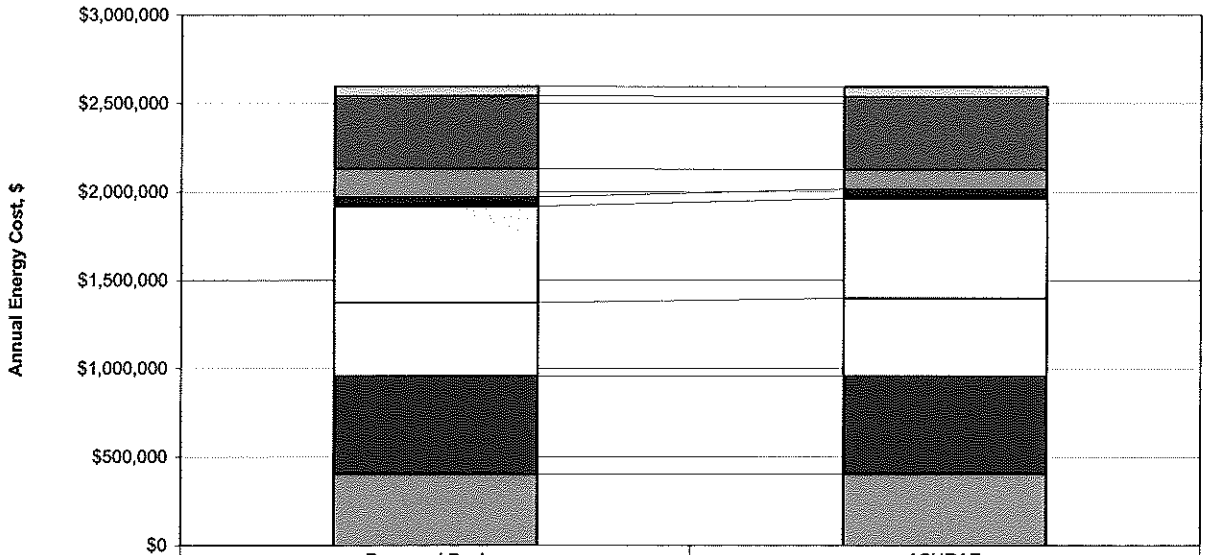
Proposed Design versus ASHRAE Baseline

Modeling results for the Proposed Design compared to the ASHRAE Baseline are presented in Figure 18-6. Based on current modeling assumptions, the Proposed Design has essentially the same annual energy costs as the ASHRAE Building.



	Proposed Design	ASHRAE
DHW	$52,992	$56,350
Fans	$413,259	$411,980
Pumps	$160,695	$110,494
Tower	$50,964	$52,572
Cooling	$546,107	$565,017
Heating	$414,959	$439,904
Process Loads	$554,630	$554,714
Area Lighting	$402,934	$402,922

Figure 18-6: Proposed Design versus ASHRAE Baseline Energy Costs

18.9 Description of Potential Energy Conservation Measures

The following ECMs have been evaluated for improving energy performance of the currently defined Proposed Design:

ECM1 – Reduced Lighting Power Densities

In addition to reducing electricity consumption, energy efficient lighting emits less heat and decreases cooling loads. It is currently assumed that the proposed building's final electrical lighting designs will yield lighting power densities (LPDs) compliant with ASHRAE 90.1-2004 maximum values or the Green Guide for Health Care suggested

values. This ECM considers the energy savings associated with reducing LPDs by 20% from ASHRAE maximum values through use of high-efficiency fixtures.

ECM2 – Daylighting Controls

Daylighting controls for all appropriate perimeter spaces (laboratories, offices, the library, lobbies and corridors) were modeled for ECM2. This simulation assumed continuous control of the perimeter row of electric lights (assumed 15 ft zone) using closed-loop control with a 50 footcandle (fc) sensor setpoint for the offices, a 30 fc setpoint for offices, and a 30 fc setpoint for the waiting rooms, corridors, and patient rooms.

ECM3 – Variable Speed Chiller Control

Installing a VSD on the chiller compressor allows the unit to run at lower speed at part-load conditions, thereby yielding a lower compressor kW/ton rating than would be achieved by standard inlet vanes. ECM3 quantifies the savings associated with installing VSDs on all chillers of the central plant.

ECM4, ECM5, ECM6 – Reduced Static Pressures

Several strategies can be incorporated into the mechanical design to reduce system static pressure and associated fan energy. These include up-sizing AHU casing size, increasing duct size, reducing coil rows, having plenum returns rather than ducted returns, and installing relief fans rather than return fans. As a parametric analysis, total static pressure for all AHUs was reduced from 6 in WG to 5.5, 5.0, and 4.5 in WG for ECM4, ECM5, and ECM6, respectively.

ECM7 – Enthalpy Wheel for 100% OA System Energy Recovery

Currently the Proposed Design assumes a run-around loop for the exhaust air energy recovery on the 100% outdoor air systems. It may be possible to utilize an enthalpy wheel to recover the latent component of the energy. Although cross-contamination was an issue with older technology enthalpy wheels, through the use of better seals, a purge sector and molecular sieve, cross-contamination can be reduced to less than a tenth of 1%. The purge sector blows exhaust air from the wheel media before it rotates into the supply air duct. Molecular sieves prevent molecules larger than a specific size from being absorbed into the desiccant of the wheel. This new technology has made enthalpy wheels suitable for sensitive environments such as chemical laboratories and hospitals. This ECM assumes the replacement of the run around coil with an enthalpy wheel having a total effectiveness (sensible and latent) of 80%.

ECM8 – Condensing Stack Economizer

Although further refinement of the model is needed regarding reheat and domestic hot water loads, based on initial modeling, the boiler plant will need to be of appreciable size to meet the reheat loads dictated by the high ventilation requirements of the hospital spaces. If the domestic hot water load is appreciable upon revision of the energy model, a stack economizer on the flue of the boiler plant may be a cost effective means of reducing energy consumption associated with heating. This type of economizer is designed to capture the heat of condensation and utilize it to preheat makeup water or

condensate or domestic hot water. For this ECM, it was assumed that this measure could potentially increase total combustion efficiency from approximately 85% to 95%. This measure would require the addition of coils in the flue at each boiler, significant alteration in flue vent pipe design, a heat exchanger for feed water and condensate preheating, pump(s) and connecting piping.

ECM Package

The ECM Package considers implementing all the above ECMs (ECM5, a reduction of 1 inch WG in total static pressure, was assumed for the reduced static pressure measure). In modeling these measures together, the dynamic interaction between them is taken into account in predicting the total energy use and savings for the measures together.

18.10 Modeled Results of Energy Conservation Measures

The Proposed Design building energy model was modified to include each individual ECM, as well as the package of ECMs implemented. **Figure 18-7** shows the annual energy savings for each ECM and the package of ECMs. For the package, the reduced fan static pressure of 1" is assumed.

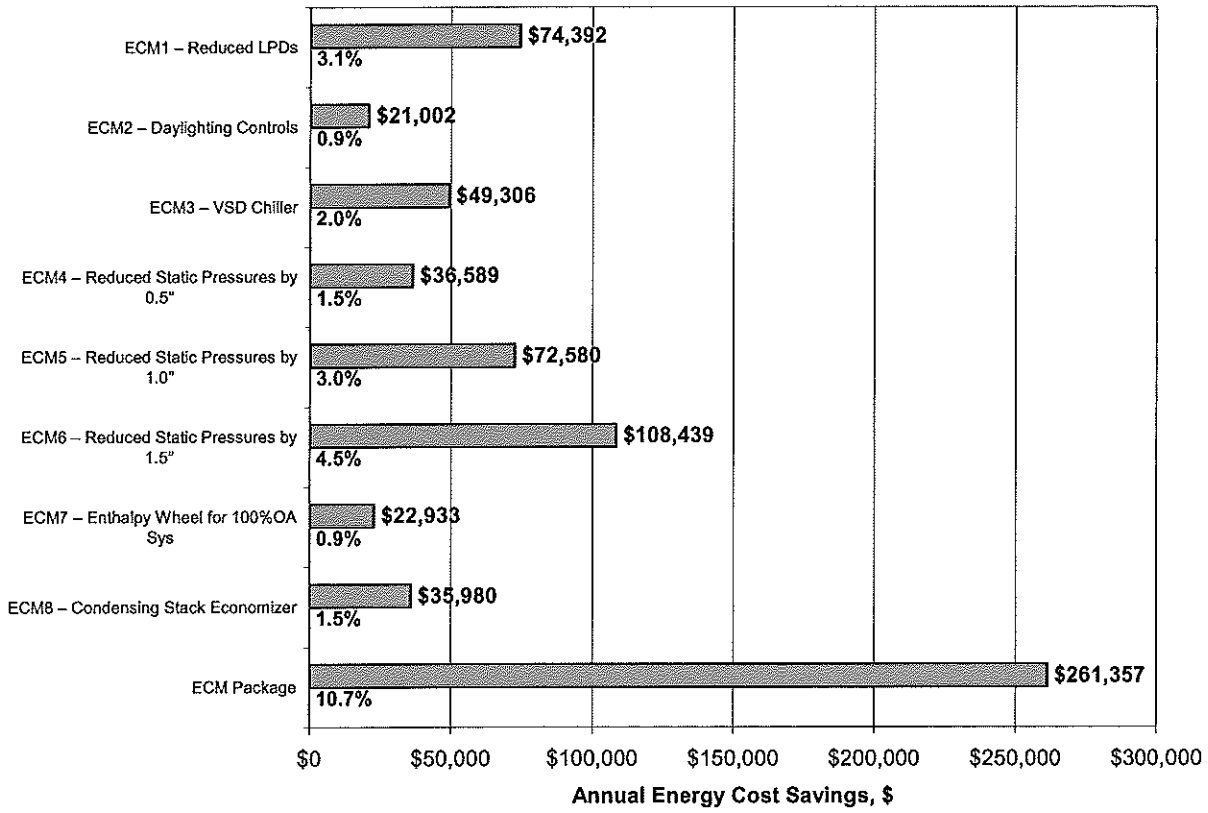


Figure 18-7: Annual Energy Cost Savings of Energy Conservation Measures

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18.11 System and Plant Measures

In addition to the ECMs, several design alternatives for air handling systems and plant equipment were investigated for the medical center. These options include:

a. Dual duct system design

b. Dual path system design

c. Variable speed primary pumping

d. Hot water condensing boilers

These design alternatives do not adhere to prescribed mechanical systems outlined in the VA HVAC Design Manual for new VA hospitals. Thus if the economics of these options look promising, permission will be sought from the VA to incorporate them into the design.

18.11.1 Dual Duct System

Dual-fan, dual-duct systems have central secondary recirculation. One central fan supplies cooled primary ventilation (outside air and return air). Another central fan supplies neutral/warm secondary ventilation (return air only).

The advantages of a dual-duct system is that it is energy efficient while assuring an acceptable humidity levels at all ventilation air volumes. It can reduce over cooling and reheat requirements through use of a neutral air stream compared to a single duct system. The disadvantage of a dual duct system is that two duct runs are required, which is more costly and requires more shaft space.

18.11.2 Dual Path System

In a dual-path system, outside air is treated separately from secondary return air. A dedicated outside air coil provides the latent (dehumidification) cooling, while a separate dedicated return air coil provides the sensible (temperature control) cooling. The two air streams are completely separate and not mixed until properly conditioned. The layout of a typical dual-path HVAC system is presented in Figure 18-18-8.

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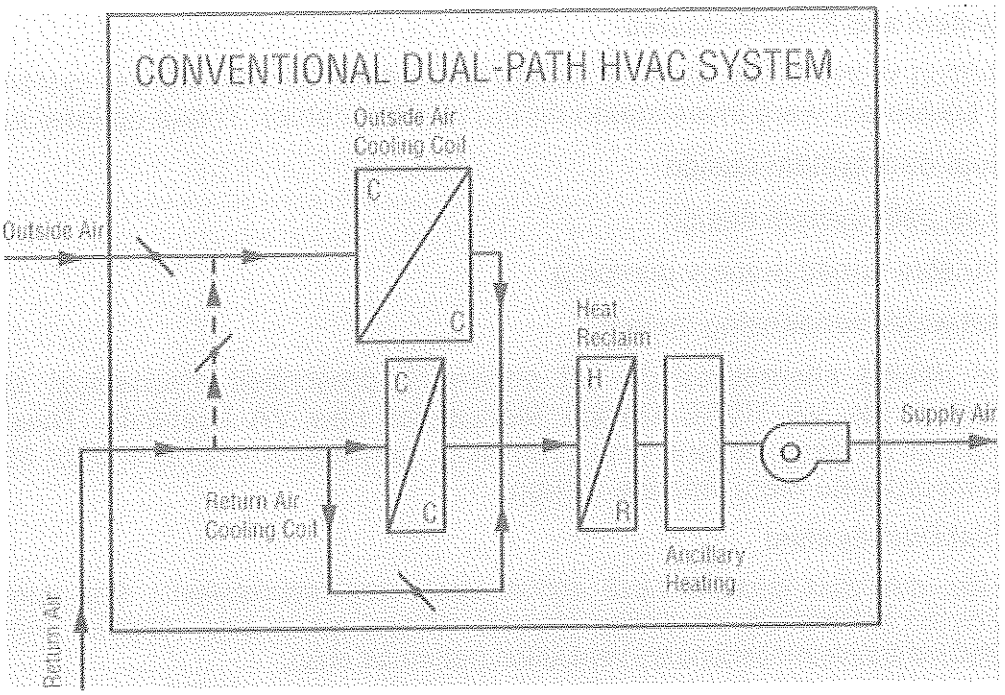

From the Consolidated Energy Solutions, Inc. website at: http://www.cesgetexcited.com/dualpath.htm

Figure 18-9: Dual-Path HVAC System

The advantages of a dual path HVAC system are that it provides good control of outdoor air quantity and humidity control of supply air. It can eliminate some overcooling and reheat although not to the extent that a dual duct system can.

18.11.3 Variable Speed Primary Pumping

Variable primary flow pumping can reduce the costs of installing and operating chilled water system because it requires fewer pumps. In addition, the pumping head is reduced due to the elimination of the primary-secondary heat exchanger. Implementing requires the addition of a bypass line and two-way modulating valve.

18.11.4 Hot-Water Condensing Boiler

Hot-water condensing boilers tend to have higher equipment efficiencies than steam boilers since more heat is extracted from the combustion gases. The higher efficiency may be offset by pumping energy requirements, especially in central utility plants with long piping runs to the hot-water load at the building.

18.12 Modeled Results of Alternative System and Plant Designs

The DOE-2 simulation program was used to evaluate the energy savings potential of the alternative system and plant designs. To evaluate the potential savings from the system alternatives, a typical HVAC system was selected for a detailed evaluation. The analysis focused on a single system since savings are dependent on system size and zoning.

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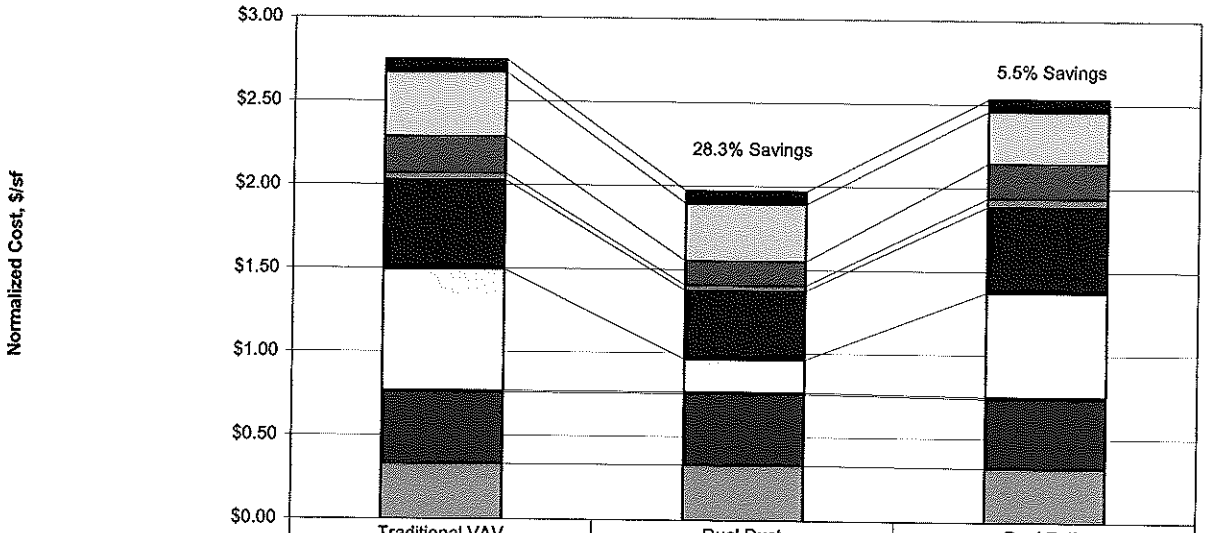
The typical system serves four zones (patient rooms, nursing station, offices, corridor) totaling 20,000 square feet. The savings determined from the systems analysis are presented in Figure 18-10. The systems analysis projects that the total energy costs are $2.75/ft2, $1.97/ft2, and $2.53/ft2 for the VAV, dual duct, and dual path systems, respectively. The analysis shows a large savings potential for the dual duct system and measurable savings for the dual path system. Both systems reduce overcooling and reheat – however the dual duct system does this to a far greater extent than the dual path. Nevertheless, the dual path requires less shaft space and less duct length than the dual duct and shows decreased energy costs compared to the traditional VAV.



	Traditional VAV	Dual Duct	Dual Path
DHW	$0.08	$0.08	$0.07
Fans	$0.38	$0.34	$0.31
Pumps	$0.22	$0.15	$0.21
Tower	$0.04	$0.03	$0.05
Cooling	$0.53	$0.41	$0.51
Heating	$0.72	$0.20	$0.63
Process Loads - Natural Gas	$0.01	$0.01	$0.01
Plug Loads - Electricity	$0.43	$0.43	$0.42
Area Lighting	$0.33	$0.33	$0.32

Figure 18-10: Alternative HVAC System Savings

The simulation results for the alternative plant systems are presented in **Figure 18-11**. The whole-building hospital model was used for this analysis. The variable speed primary pumping on the chilled water loop shows lower annual energy costs compared to a constant volume primary – variable speed secondary configuration. The hot-water condensing boiler shows some savings compared to the steam boiler. In the analysis, the hot water pumping head is assumed to be 120 feet. If this head increases due to the utility plant location changing, the savings may become negilible.

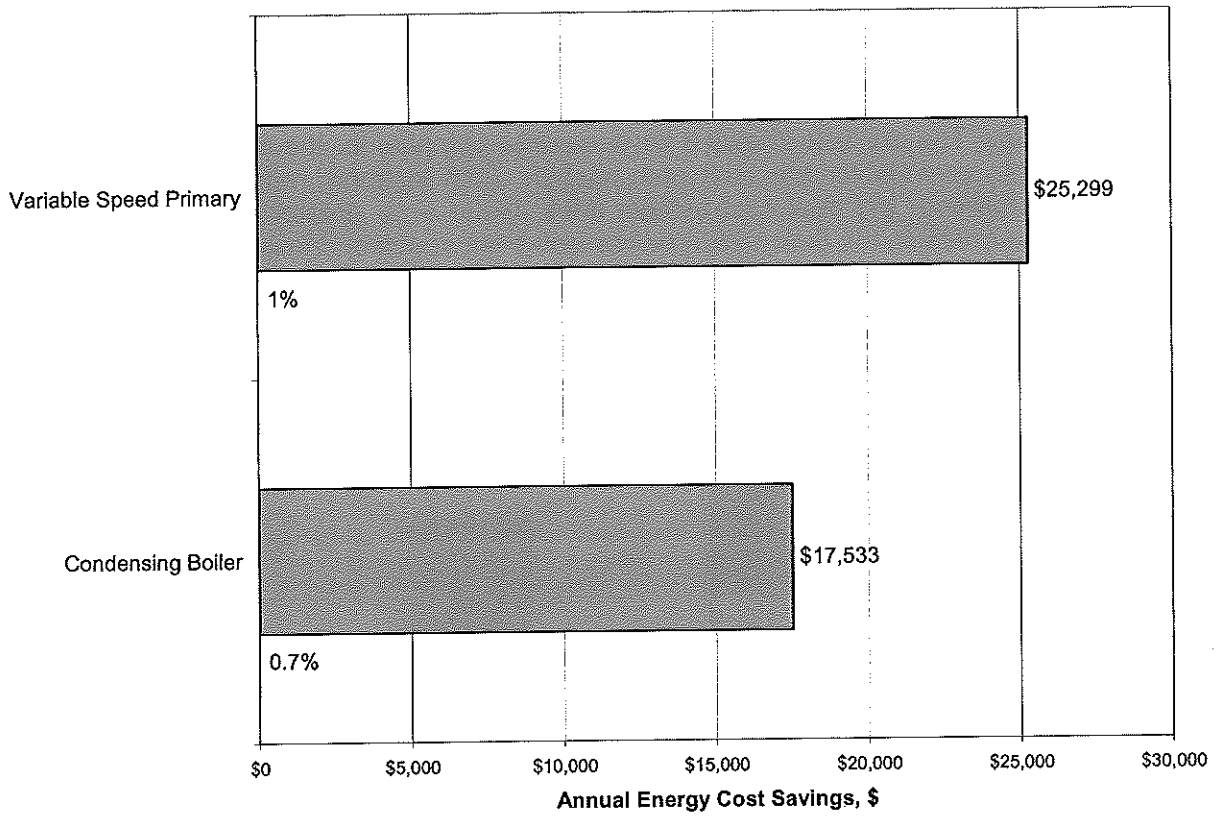


Figure 18-11: Alternative Plant System Savings

18.13 Additional Energy Efficiency Strategies for Consideration

18.13.1 Dual Minimum Position VAV

Minimum airflows during occupied periods are determined by AIA guidelines. The AIA and ASHRAE hospital guidelines allow reductions in airflow when zones are unoccupied, however this exception is not commonly utilized in hospitals. The guidelines do not quantify these minimum airflows, except to note that pressure relationships must be maintained where required.

The application of this strategy to a hospital in St. Louis is discussed in a paper by Robert Cox, P.E. published in the ASHRAE IAQ 2004 proceedings. AEC contacted the author and discussed his choices of hardware and obtained some references of hospitals where the concept has been employed.

The greatest savings from this measure would be in surgery areas, because of the high design airflows. The ORs, in particular, will be unoccupied for a significant number of hours each week.

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18.13.2 Heat Recovery Chiller(S)

Modular heat recovery chillers located in the hospital could transfer heat from the CHW to the HW loops and possibly DHW preheat. The hospital will require year-around cooling and heating (reheat), which is a perfect opportunity for chiller heat recovery. However HW can only be heated to a maximum of 140°F by a heat recovery chiller, with 130°F allowing more efficient operation. Without separate loops or different terminal devices, heat recovery to reheat is probably limited to 55-70% of the year, depending on the HW reset schedule.

Hardware: Additional chiller(s) with their own small primary pump is required. Dedicated, (possibly ventilated) floor area (estimated 300 sf). Additional piping, valves and pipe connections.

Software/operation: Programming of controls to maximize operation.

Design effort: Additional components as noted.

Opinion of probable costs: Chiller and piping: $1000/ton. Extra-row reheat coils: $0.20/cfm. Space: $150/sf x 200 sf. Design: 20%.

Chillers from the following manufacturer have been used in dedicated heat recovery applications.

Multistack Corp.

365 South Oak Street, West Salem, WI 54669

Phone: (608) 786-3400

Fax: (608) 786-3450

http://www.multistack.com/products.asp

18.13.3 Stack Economizer

A "stack economizer" typically uses the 500°F flue gas heat to preheat makeup water or condensate, decreasing the flue gas temperature to 300°F, just over the temperature where condensation occurs. Compatible stack economizers should be available from boiler and stack component suppliers. Concern has been raised about the potential for condensation; proper control can eliminate this at the expense of some efficiency.

Hardware: Install coil in flue at each boiler. Add heat exchanger for feed water and condensate preheating. Add pump(s) and connecting piping.

Software/operation: Controls to prevent over-cooling of flue gases and condensation.

18.13.4 Condensing Stack Economizer

This type of economizer is designed to capture the heat of condensation, so can increase total combustion efficiency to up to 97%. In addition to the components above, additional requirements are a significant alteration in flue vent pipe design and a modest HW pipe loop to the hospital.

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Hardware: Secondary condensate corrosion-resistant flue serving all boilers. Flue gas heat exchanger sized for one boiler at full load. Low-temperature HW loop to building for DHW preheat or other loads. Associated HX. Heat exchanger for feed water and condensate. Pump(s) and connecting piping. CUP space and hospital mechanical room space.

Software/operation: Controls for HX.

Further information:
Sidel USA Systems
PO Box 1868
Atascadero, CA 93423
Telephone: 805-462-1250 or
800-668-5003

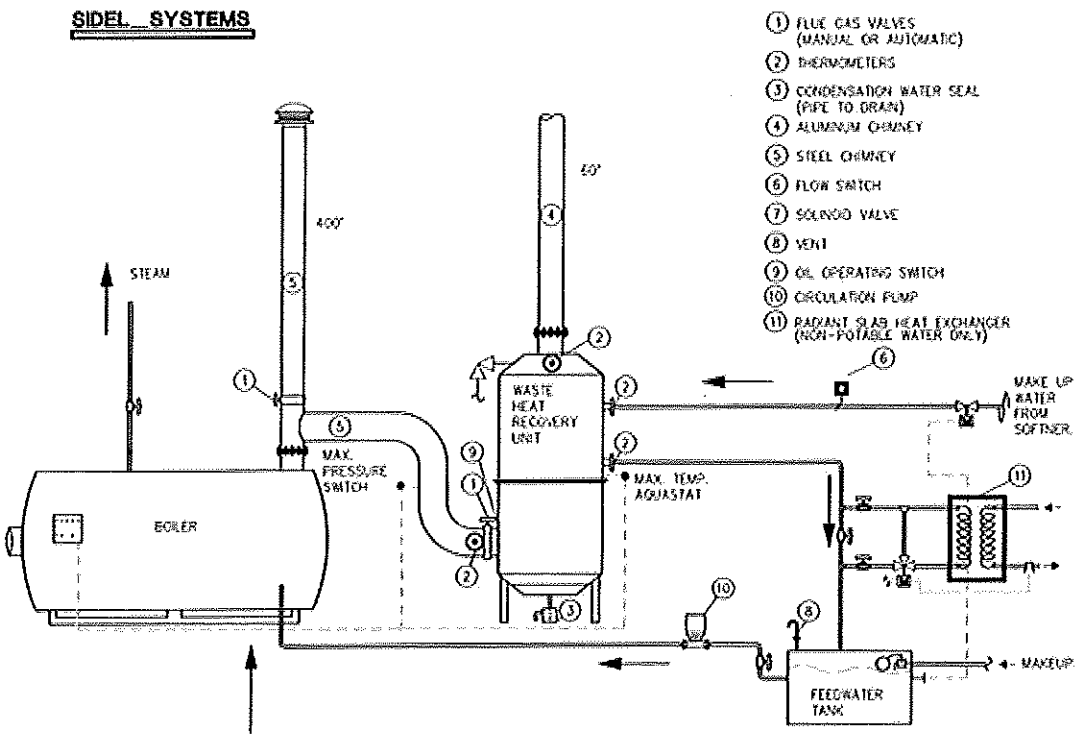

Figure 18-12: Sidel economizer system diagram

Kemco Systems
11500 47th Street, North
Clearwater, Florida 33762
Telephone: 800-633-7055
Fax: 727-573-2323

Future Work: The impact of the unit on flue pressure drop will be investigated to understand if there is an impact on fan size and energy use.

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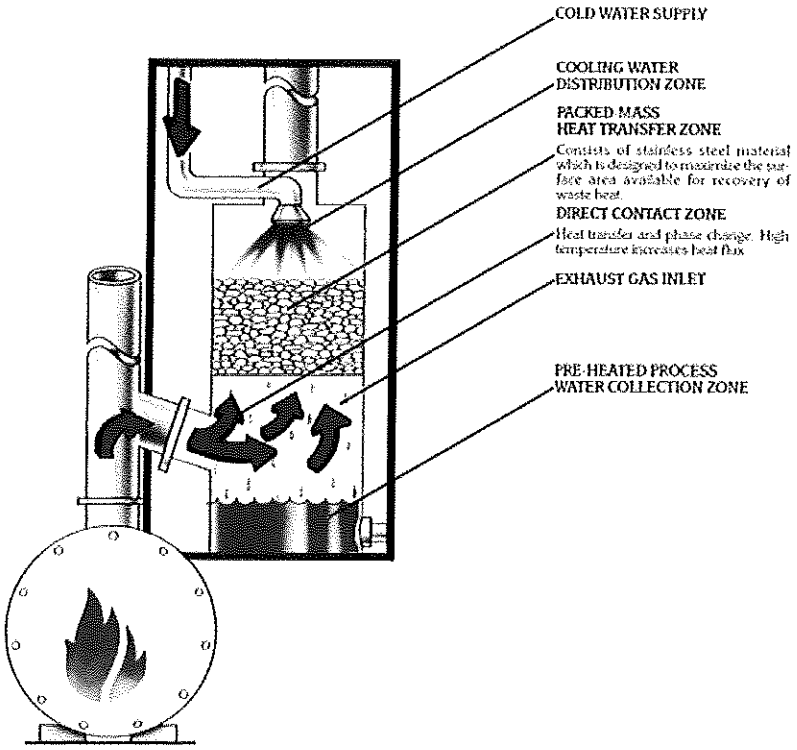

Figure 18-13: Kemco spray stack economizer

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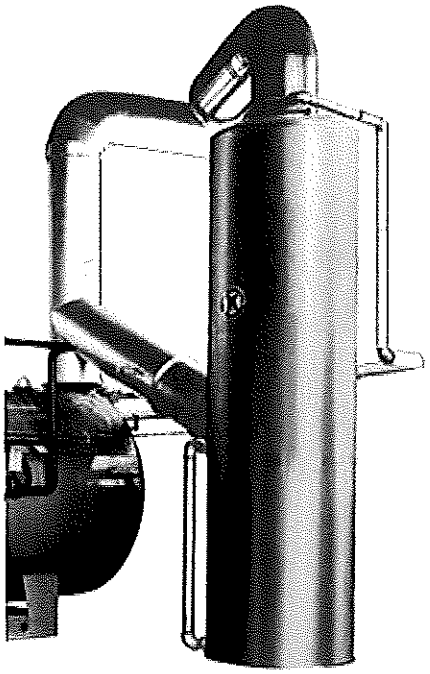

Figure 18-14: Kemco spray stack economizer

18.14 Other Hospital Experience

18.14.1 Veterans Administration

Currently and historically, the standard design for Veterans Administration hospitals calls for two-speed AHUs for each operating room. When the OR is not in use, a simple wall switch changes the fans to low speed reducing the airflows by about half. The VA standard design is somewhat more conservative than that prescribed by the AIA guidelines as it is a 100% OA system with 20 ac/hr during occupied periods. Satish Sehgal at VA-DC (202.565.5032) verified this information.

18.14.2 Rex Hospital - Raleigh, NC

The ORs have dual-position VAV dampers on supply and return. The ORs have only been in use for three months but the facilities staff reports the system is "straightforward, controlling well, makes sense, solid." Mike Raynor, the facilities director (919-784-3100) provided the information.

18.14.3 Genesis Medical Center, Davenport, IA

The ORs have dual-position VAV dampers on supply and return. The ORs have been in use for about a year and the facilities staff reports "The system doesn't give us any problems. A little scheduled maintenance may be needed, as with anything. Don't be

afraid to go with them." Steve Langy, the facilities director (563-421-1000) provided the information.

18.14.4 The Anheuser Busch Eye Institute at Saint Louis University

Supposedly, the ORs have had dual-position VAV dampers since 1993. Main number is (314-256-3200). We have yet to get a response from their facilities staff.

18.14.5 Health Sciences Center - Winnipeg, Manitoba

Phoenix supply and exhaust valves are being installed in operating rooms in this hospital renovation. It has not yet been occupied. Dan Stark, the Phoenix representative at Air Purification Co. in Denver provided the control diagrams.

18.15 Conclusions

Based on the S2 Phase energy analysis of the new VA Medical Center, the following conclusions can be made:

1. The current Proposed Design model predicts an annual energy cost of $2,597,000 per year or $3.19/sf/year, consuming an estimated 191 kBtu/sf/yr. This performs as well as the ASHRAE Baseline in terms of annual energy costs. Daylighting, shading devices, and reduced lighting power densities are not currently included in the Proposed Design.
2. The VA Hospital has a relatively high percentage of energy costs devoted to heating, considering the warm climate of Orlando. This is primarily reheat energy, which is needed because of the high ventilation requirements of many of the hospital spaces the need for dehumidification, and the limited opportunity to reset supply air temperatures with a single-duct supply air system.
3. Reducing lighting power densities by 20% from ASHRAE 90.1-2004 minimally-compliant values and implementing daylighting controls in appropriate spaces could reduce annual energy costs in the building by approximately 4% ($95,400/yr).
4. High ventilation requirements also result in high cost and energy use associated with fans. Energy analysis shows that every 0.5 inch reduction in total system static pressure results in approximately 1.5% savings in annual energy costs. Therefore, a 1.5 inch reduction would save approximately $108,500 per year (4.5%).
5. Based on current assumptions for heating and domestic hot water loads, utilizing a condensing stack economizer on the boiler flue could save approximately $36,000 (1.5%) in annual energy costs.
6. Installing variable speed drives on the chiller compressors shows a 2% annual energy savings ($49,000/yr) based on current modeling assumptions.
7. Based on current modeling assumptions, the ECM Package would save approximately $261,357 per year, which is approximately 10.7% lower than the ASHRAE Baseline.
8. Measures to reduce reheat energy (such as a dual path HVAC configuration), and fan energy (such as up-sizing AHU casing size, reducing duct runs, and reducing coil

rows) are important strategies for further examination given the high energy use of these items in the facility.

9. Two HVAC system alternatives studied show notable energy cost savings. Based on a system-level analysis, savings of 28.3% and 5.5% were shown for a dual duct and dual path system, respectively. Both systems help to reduce overcooling and reheating that occurs with the traditional VAV system due to dehumidification and high ventilation requirements.
10. Two plant design alternatives studied show some energy cost savings. The variable speed primary chilled water pumping lowers energy costs by 1% compared to a primary-secondary loop configuration. Installing a hot-water condensing boilers instead of steam boiler also show some savings but these may diminish if the utility plant is located further away from the building.

18.16 Future Work

In the Design Development and Construction Documents phases of the project, the energy model will be refined to represent the building as depicted in the architectural and mechanical drawings and specifications released during in the Design Team's Design Development and Construction Documents deliverables. To update the model, refinements will be made to initial assumptions regarding of building layout, internal gains, schedules, construction, and mechanical system. In addition to these modifications, other energy efficiency strategies will be investigated, including:

1. Overhangs or shading devices
2. Dual minimum position VAV
3. Dual path air system configuration
4. Heat recovery chiller
5. Condensing stack economizer
6. Photovoltaics
7. Lighting control strategies
8. HVAC control strategies
9. Other ECMs and design alternatives arrived at as the design progresses

18.17 Daylighting Analysis

18.17.1 Introduction

During Schematic Design, daylighting analysis for the Veterans Affairs Medical Center focused on introducing general daylighting and shading issues to help guide programming decisions and initial stages of façade design. Conceptual strategies were also proposed to respond to building orientation and Orlando's unique climate (Section 18.3.2 below). An initial mass modeling study was performed to investigate solar exposure and shading present on each of the four building elevations, and is briefly summarized in Section 18.3.3. Lastly, Section 18.3.4 discusses specific spaces within the building that are targeted for detailed analysis in Design Development, and introduces preliminary daylighting and shading strategies that may be appropriate.

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18.18 General Strategies

18.18.1 Glazing Specification

In appropriate locations, external vertical glazing will be split into a daylight window and a view window to allow fine tuning of glazing specifications based on function.

Vision glazing (located below 7'-6") is the primary aperture for providing occupants with a visual connection to the outdoors. As such, glare control and view preservation are paramount. External shading devices that are properly sized to eliminate the need for blinds will allow views to be maintained throughout the day.

Daylight glazing (located above (7'-6") is the primary aperture for harvesting daylight into the space, particularly beyond the 10'-0" perimeter zone. Because the Daylight glazing is not the primary view aperture, daylight redirection devices such as lightshelves and optical louvers may be considered to enhance daylight penetration. In some locations, translucent panels may be appropriate to diffuse incident sunlight.

Glazing specification will be tuned based on function and orientation. Vision glazing requires a moderate to low visible light transmittance given its location in the primary field of view. Daylight glazing, however, can utilize higher visible light transmittance given its location above the primary field of view, as long as it is properly shaded from direct sun using light redirection/shading devices. In both cases, a high light to solar heat gain ratio is desired.

18.18.2 Architectural Integration

Wherever possible, daylighting and shading elements will be carefully integrated with architectural, structural and mechanical systems. Such integration reduces initial costs, and reduces risk for being eliminated during value engineering. Examples include integrating lightshelves with HVAC ducts, using external columns as vertical shading fins, and cantilevering floor plates to provide shading to floors below.

18.18.3 Climate Responsiveness

The Orlando climate presents many challenges and opportunities for introducing daylight into the building. With a hot and sunny climate year-round, daylight harvesting must be balanced with shading and solar control.

External shading is the most critical strategy demanded by Orlando's climate. Shading direct sun on the *outside* of the glazing is necessary to maintain occupant comfort and minimize cooling loads. Furthermore, external shading elements should be designed to be effective year-round, including winter months when sun angles are extremely low. AEC will help facilitate the optimization of external shading devices in Design Development.

The sunny climate also presents many opportunities for introducing daylight throughout the building. Optical daylight louvers are available that reflect daylight deep into the occupied zone from perimeter glazing locations. Tubular Daylighting Devices (TDDs) offer a means to harvest both diffuse and direct daylight through the roof (and interstitial space) into spaces below.

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18.18.4 Orientation Sensitive Design

Shading devices, light redirection devices and glazing specifications will be tuned by orientation to account for the different sun angles present on each facade. The east and west elevations, for example, experience extremely low sun angles during the mornings and afternoons, respectively. Shading devices that provide "full cutoff" (shading of all solar altitude angles) are necessary in such locations.

North elevations experience relatively little exposure to direct sun and therefore require minimal shading effort. Northern façades can be relatively transparent (with higher window-to-wall ratios possible) compared to other orientations.

South elevations experience the most prolonged exposure to direct sun and require shading devices that provide full shading throughout the year, including winter. A low window-to-wall ratio is appropriate for south, east and west orientations to minimize cooling loads and costs associated with shading larger apertures.

18.18.5 Mass Modeling

A simple mass model study was performed to study solar exposure and shading on various facades of the building. Quicktime animations will be uploaded to the ProjectDox website that show hour-by-hour shading of the views illustrated below.

18.18.6 West elevation

Figure 18-18-1515 shows the shading present on the west façade of the building at three representative times of the year: Winter Solstice 3:30 PM, Equinox 3:30 PM and Summer Solstice 2:30 PM. These are the times of each season when the atrium begins to receive direct sun on the west façade.

The images also begin to demonstrate the effectiveness of the overhang above the south-facing Mental Health Patient Rooms on the second floor. Full shading is achieved during the Equinox and Summer, but not in the Winter.

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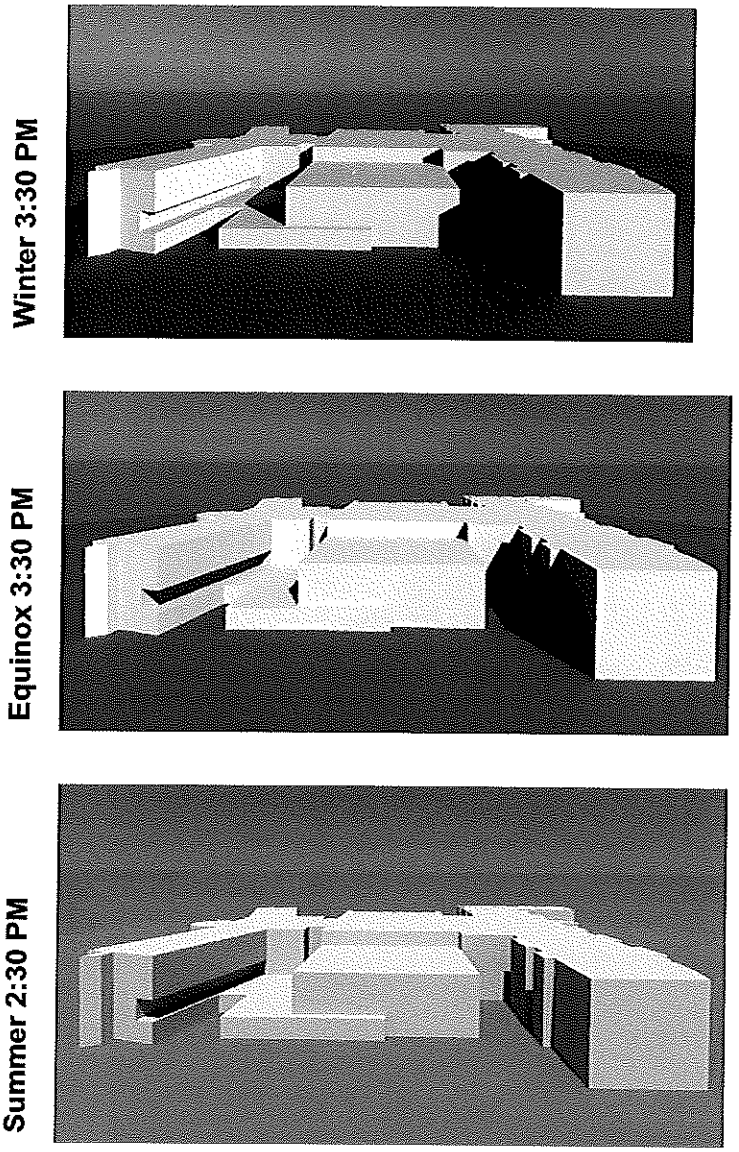

Figure 18-18-15: West façade shading animation

South Elevation (Clinic wing)

Figure 18-18-166 illustrates the shading present on the south façade of the clinic wing at 8:30 AM for the three different "solar seasons" (winter, equinox, summer). The images are intended to illustrate how the protruding blocks provide some shading to the inset portions of the façade. Glazing would benefit from being located in the inset locations

where additional shading is present. See Quicktime animations for shading present during other times.

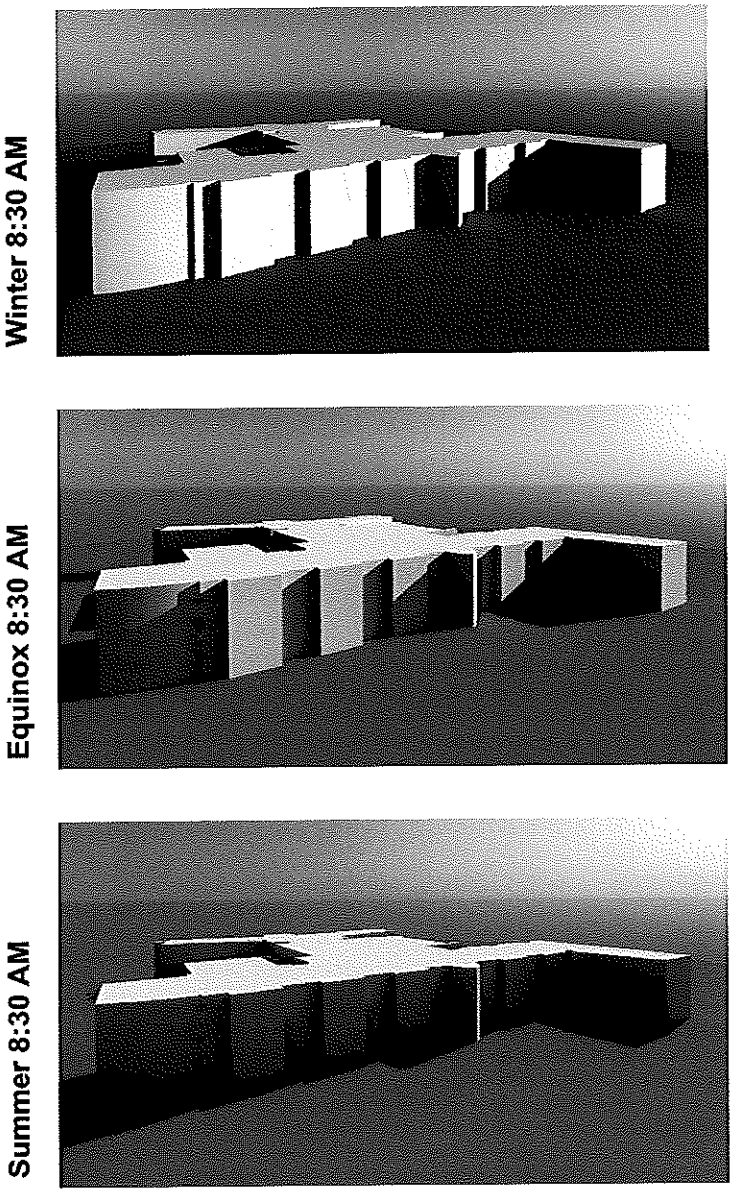

Figure 18-18-16: South façade shading animation

North Elevation (In-Patient wing)

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Figure 18-18-17 demonstrates the occurrence of direct sun on the north façade during summer mornings. Similar solar exposure will be present on the north-northwest façade of the In-Patient wing's eastern half during summer afternoons. Although the duration of solar exposure is relatively short, external shading elements such as vertical fins should be considered.

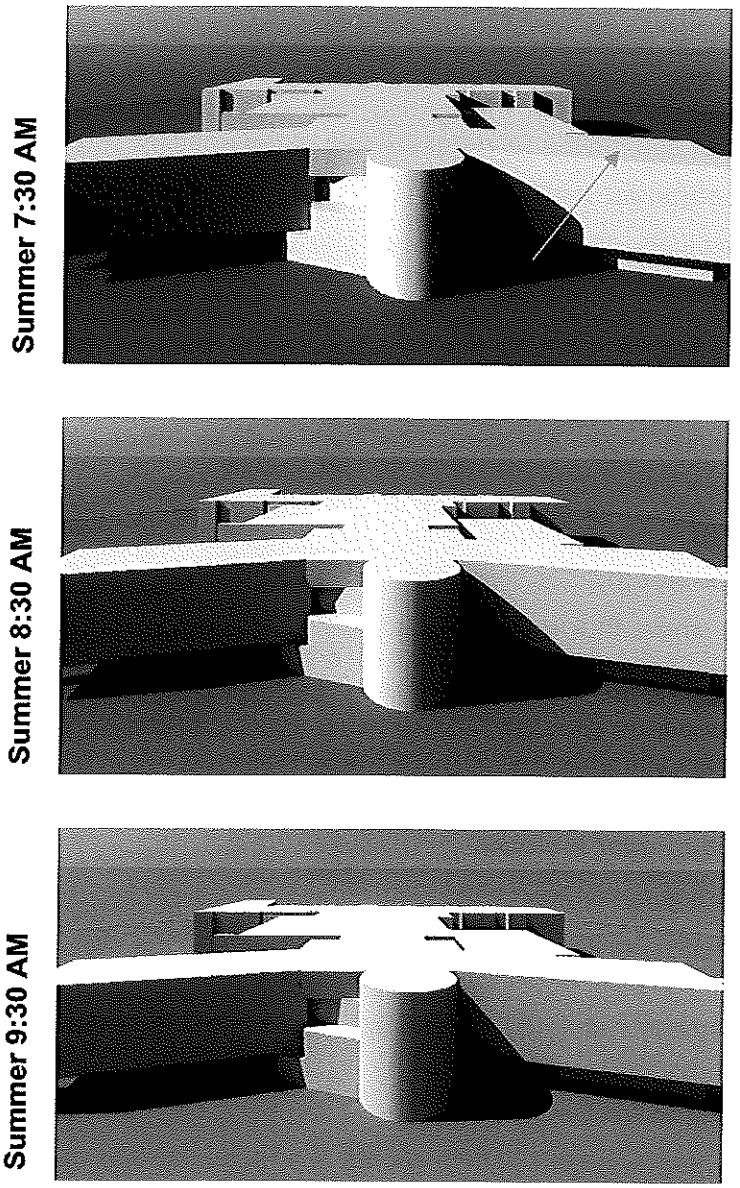

Figure 18-18-17: North façade shading animation

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18.19 Areas for Future Study

The following spaces are targeted for detailed daylight modeling and shading studies during Design Development. Other spaces may be considered in lieu of, or in addition to, the ones below based on discussions with the Design Team.

18.20 Enclosed Offices (all orientations)

Private offices exist in nearly all locations in the building, including the in-patient wing, out-patient clinic wing, and the main hospital block. Several representative offices will be modeled to demonstrate the daylighting and solar control issues associated with different orientations and functional requirements of the spaces.

18.20.1 Strategies to consider include:

Enclosed offices typically do not require large glazing areas to achieve sufficient daylight saturation. Strategically placed punched windows provide daylight and views to the small offices while limiting solar heat gains.

In larger enclosed offices, a continuous daylight window (in addition to punched view windows) will be considered to supply daylight deeper into the space.

Solar control devices such as overhangs, lightshelves, operable or static louvers, external scrim, and internal shades will all be considered.

18.21 In-Patient Wing

18.21.1 Typical Patient Room

Research studies show that daylight in patient rooms aids in recovery and reduces stress. Quality of light, visual comfort and access to views are the key drivers in daylighting for patient rooms (more so than *quantity* of light). A well-placed punched window with appropriate glazing characteristics and glare control may be, in some cases, more successful than a wall of glass that is often too bright and frequently shaded by interior blinds.

18.21.2 Strategies to consider include:

Study punched versus continuous windows

Full glare control is required; a variety of external options will be considered that maintain access to views as much as possible.

Blackout control is likely required. Double internal shades for glare control and blackout control may be appropriate.

18.22 Mental Health Patient Room

The south facing mental health patient rooms are recessed into the in-patient wing on the second floor. As such, they will be shaded from steep sun angles. Studies will be performed to determine the optimum cantilever length of the floor above, and demonstrate if additional shading is necessary

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18.23 Out-Patient Clinic Wing

18.23.1 Physician's office

The physician's offices are located on the north side of the out-patient clinic wing. Given their northern orientation, solar control will not be a significant problem for these spaces. The goal for these spaces will be to maximize diffuse daylight transmittance into the office as far as possible.

18.23.2 Strategies to consider include:

High perimeter ceiling height with high daylight/clerestory glazing placement.

Slope ceiling down from the perimeter towards the back of the space.

High Tvis glazing.

Various window configurations will be considered.

18.24 Waiting room

Shared Waiting Rooms are located on the south side of the out-patient clinic wing on all floors. These spaces will likely have large, south facing windows that will require careful attention to shading. Borrowed daylight will be introduced into adjacent rooms where appropriate (classrooms, reception area, offices, etc).

18.24.1 Strategies to consider include:

Recess glazing between protruding sections of the façade to provide partial shading during mornings and afternoons, as well as facilitate placement of horizontal elements.

Slope the glazing out from the floor with intermediate louvers or overhangs to provide solar control without oversized external devices.

If floor-to-floor glazing is desired, the interstitial space may recede to allow greater daylight penetration. Sloping the ceiling will benefit illuminance uniformity on the ceiling and daylight reflection to the occupied zone below.

Optical daylight louvers in the upper portion of the window to reflect daylight deeper into the space.

18.25 Hospital Wing

18.25.1 Recovery Area

The Prep/Recovery area is an interior core zone located on the western side of the third floor. This portion of the third floor has access to the roof because the fourth floor is limited to the eastern half of the building. Skylights will be considered to introduce daylight into the Prep/Recovery area that would not otherwise have access to daylight as a core space.

18.25.2 Strategies to consider include:

Tubular Daylighting Devices (tubular skylights) that harvest both skylight and direct sunlight and diffuse it to the space below. Tubular skylights are capable of tunneling

through deep plenum spaces without losing significant lighting efficiency. A large portion of the solar heat gains are also trapped within the skylight tube.

18.26 Fourth Floor Open Office

The open office located on the fourth floor is a core space without access to perimeter windows. Various skylight configurations will be considered to introduce diffuse daylight into this space.

18.26.1 Strategies to consider include:

Tubular Daylighting Devices (tubular skylights) that harvest both skylight and direct sunlight and diffuse it to the space below.

North facing light monitors that harvest diffuse daylight without admitting solar heat gains

18.27 Atrium

The four-story Atrium is located between the Out-Patient Clinic wing and the Hospital block and features east and west facing glazed facades. Daylighting studies will be performed that investigate the requirement of shading devices on the east and west facades, as well as potential for sharing daylight with adjacent spaces.

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19. FOOD SERVICE

19.1 Design References

2005 FDA Food Handling code

1979 VA Handbook 7610 (224) Nutrition and Foodservice

1986 VA Handbook 7610 (206) Veterans Health Administration – Canteen Service

19.2 Dietetics Food Service – Design Objectives

A. Select equipment with efficient energy and natural resource usage for contribution to LEED goals and reduction of operating costs.

B. Select equipment which is durable and easily maintainable.

C. Integrate Dietary with Retail Foodservice under single management with combined operations.

D. Design staff cafeteria as a respite from work areas and a destination for clients.

E. Locate dining area for multi-use as waiting space and meeting space.

F. Make allowance for outdoor dining space easily accessible from the Food Court.

G. Make foodservice easily available and attractive for outpatients by placement within the facility.

H. Foodservice will be primarily on permanent ware to minimize solid waste from foodservice; and yet allow for single-service ware for carry-out and emergency

I. Incorporate electrolyzed water for cleaning and sanitation without chemicals.

J. Select equipment for maximum mobility and flexibility to allow future changes without serious disruption of service.

19.3 Dietetics Food Service – Design Criteria

19.3.1 Basic Planning numbers

In-patient beds	138 beds
CLC	118 beds
Domiciliary	60 beds
Out-patient visits	519,235 per year; 1997 estimated per day
Staff	1898 total / 1790 estimated on-site per meal

19.3.2 Patient foodservice must provide 3 meals and 2 snacks for all beds.

The full production kitchen will incorporate patient meal preparation, food court preparation and all clean-up. Many foods will be completed on site from frozen, fresh, dry and canned ingredients. Equipment will be specified to provide blast chilling and flash freezing capabilities for safe food handling.

Tray make-up and food distribution will be cold. Centralized rethermalization will only handle trayed meals for hospital medical beds & CLC trays will be shipped cold (6 carts). All tray carts will be 24 tray capacity per meal. Additional retherm carts will be provided for meals prepared ahead: 2 meals x 11 = 22 carts, plus bulk food carts.

All patient tray distribution and soiled ware return to the kitchen within the hospital will be with the automated transport system, except for cafeteria and late trays.

19.3.3 Medical/Surgical/Psychiatric

Kitchen equipment and space will provide the capacity to service to all beds in the hospital with trayed meals. Medical requires 2-24 tray cart; Surgical requires 1- 24 tray cart; Combined ICU requires 1- 24 tray cart; Psychiatric unit requires 2- carts 22 tray capacity. A standard cart size of 24 tray carts will be specified.

19.3.4 Community Living Center (CLC)

Foodservice will have the capacity to provide 3 meals per day plus 2-3 snacks for the full population. Actual provision volume and type will be determined by on-site operations. All receiving, storage, preparation, cooking and management will be through the central foodservice.

The CLC will have some direct, local support storage; and holding for heated and refrigerated foods. A serving line is provided for communal dining, all served, with limited choice menu consisting of: hot food wells with infrared warmers overhead, refrigerated cold wells, an ambient service unit, and beverage service. Support services within the CLC Central pantry will include: retherm units, ice machine, microwave oven, some storage and warewashing for the dishes and flatware kept here,

Trays (where needed) are assembled, held, and distributed before each meal from the central kitchen. They will be rethermed in the main pantry in the CLC. Re-thermed trayed meals will then be distributed to residents in rooms or in the central dining room.: 5 carts are projected with hospital 24 tray capacity for each meal. Trays and associated ware will be returned to central warewash in tray carts.

Supplies are stored here for personal preference changes from trayed meal: beverage alternates, condiments, additional cups, flatware, and dishes. Space is also needed for nourishment storage for snacks, supplemental beverages, and meal replacement liquids.

The main dining area will also be used in conjunction with recreation and other between meal activities.

For those CLC residents who are able, dining in the living units will be family-style (bowls of food served to the table and diners serve themselves). Bulk foods of the same menu will be transported cold from the main kitchen, rethermalized in the CLC center area, and distributed to the living units to be served by the unit staff or residents, as possible. Soiled pans will be returned to the hospital warewash. Tableware will be washed in theunits.

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19.3.5 Domiciliary

Foodservice will provide 3 meals per day plus 2 snacks, with full support and control by central foodservice. All serving, support, and kitchen will be lockable. Limited cooking equipment will be provided for professional use only: range, griddle, and oven. An exhaust hood, refrigeration, and prep space will be included. Any resident cooking will be in the kitchenette from foods procured through the main kitchen, or brought by family members for personal consumption.

The Dom will be equipped for receiving prepared bulk foods from the central kitchen, plus rethermalizing and holding foods at service temperature. An ice machine & microwave oven will be included. Meals will be served by staff at a serving line with limited choice menu. Equipment will include hot wells, cold wells, and ambient space; selection of several beverages will be self-service. Foodservice support will include self-contained dishwashing. Trays will be returned to the tray drop by patrons, broken-down, and washed.

Dining area is adjacent the multipurpose room separated with a movable partition to afford flexibility.

19.3.6 Staff foodservice

Foodservice, at some level, must be available 24 hours per day/ 7 days a week. Options will include The Food Court, Coffee Shop, and Vending. The Food Court, a multi-station servery with centralized cashiering, will be the primary venue. Dining is exposed in the building atrium and will have both fixed and movable seating, shared with waiting space, and incorporating day light and access to outdoor dining. All of the support space for the Food Court, staging, & storage is integrated with the main kitchen.

Vending machines will be accessible at all times in a variety of locations: Adjacent the dining area on the first floor; adjacent emergency on the first floor; on the third floor at surgery waiting; and on the forth floor at Hoptel.

A coffee shop venue will be located adjacent the in-patient entrance, opposite the Food Court. This will serve both staff and the public and will be on the primary circulation core of the hospital. Traditional 'Starbuck's' or 'Seattle's Best' service and offerings are anticipated.

Facilities for staff food brought from home: storage refrigeration and microwave ovens, outside of the dietetic department, may be incorporated with vending locations. If homemade foods are in any way handled by food staff or stored in foodservice equipment, the liability for that food implicates foodservice; thus the practice is discouraged.

19.3.7 Out-patient/visitor foodservice

Food and beverages for outpatients and visitors is combined with staff foodservice under combined management and with full support of the main kitchen. When open, the Food Court will be available to all persons.

A coffee shop with pastries, snacks and some food available is on the primary circulation path within the hospital. Vending areas with microwaves are placed on hospital floors, near waiting areas.

Toiletries, First Aid, and Groceries will be in the Canteen Retail store only (see Non-Food Retail section.)

19.3.8 Emergency Storage

Storage must include foods and supplies for a 7 day emergency period for hurricane and disaster preparedness. Supplies to be available include food, water, and single-service ware. Emergency supplies will be laid-in before hurricane season and cycled back into regular stock after the season. Operationally, enough supplies must be rotated as working stock to meet the 7 day requirement. The exception is refrigerated or limited-life products which, if cycled, would deteriorate. Proper inventory control and advance purchasing utilizing extensive storage can easily accommodate this.

Single service ware must always be available and accounted for in case of mechanical failure or quarantine.

19.3.9 Utilities for foodservice

Cooking Ventilation will utilize high velocity, low volume grease extractors with automatic water-wash cleaning; replacement air will come from fresh air requirements of adjacent spaces or through dedicated conditioning equipment. High efficiency air cleaning technologies will be evaluated for inclusion, based on environmental and budgetary requirements; i.e.: UV-C treatment or electrostatic precipitators. Heat reclamation may also be considered toward the LEED goals. Variable volume controls are also under consideration for the exhaust hoods, and would require integrated controls with the HVAC system.

Sanitary waste will utilize combination receptors for both indirect waste and floor drainage, as possible, to conserve cost and minimize floor drains. Greaseous sanitary waste will be routed through an exterior, in-ground interceptor, accessible to loading areas for pumping truck access.

Potable water will be softened for warewashing and hand washing. Un-softened water will be filtered/treated for ingredient and beverage use; piped separately throughout foodservice from a centralized, food-grade treatment system. Hot water will be generated as part of the central plant, delivered at a minimum of 140 degrees F for foodservice and tempered for public uses. A 180 degree F water loop will be provided for warewashing sanitization.

Water for scrapping soiled ware will incorporate a locally re-circulating system to minimize water usage from 7 GPM to 1-2 GPM. Warewashing equipment will be selected for low water consumption and energy efficiency.

An Electrolyzed water generator will be included for cleaning and sanitation without chemicals. This system produces alkaline water for grease and cellular breakdown and

acidic water for sanitization. The effectiveness of this system and the low cost per gallon of solution will be viable throughout the hospital.

Steam will be used for volume cooking via non-contact steam-steam coils in cooking equipment as well as for boosting water temps for ware-washing (in lieu of electric boosters).

Natural Gas will be the primary energy source for most cooking appliances.

Refrigeration systems for foodservice will utilize remote, water-cooled, parallel, multi-point rack mount systems. These will be multiple, sequential compressor systems which will cycle compressor use to load demand and run-time balance.

19.4 LEED Contributions

19.4.1 Efficient Utility Usage

As available, Energy Star listed equipment will be specified (to date fryers, reach-in refrigerators and freezers, warewashers, steamers, ice machines, and heated holding cabinets). As other equipment lines are listed, that criteria will be specified.

Timed operation of ice production equipment will be included to avoid peak use electrical increases.

Exhaust hoods will have efficient grease extraction and variable air volume hood controls.

19.4.2 Efficient Water Usage

Ice production equipment will be selected for maximizing pounds of ice production per gallon of water consumed. Also, minimized water usage will be selected for all warewashing machines and tray scrapping using re-circulated water and a pulper/extractor system will minimize water usage. In other waste generating areas, disposers will be equipped with demand water input and auto-off timer controls. IN addition, hand sink faucets will be low-flow.

19.4.3 Solid Waste Reduction

Recycling cardboard from kitchen receiving, and bottles and cans from beverages at the tray waste side will be included. Recycling of paper from the offices and Canteen retail operations will also be enabled.

Pulping of solid waste from the food court and dietary trays will minimize solid waste volume, help control vermin, and introduce soluble and macerated food matter into the sanitary waste stream where it can be dealt with most efficiently. Composting of food waste is not currently being considered, but the design will accommodate future programs.

19.4.4 Ozone Depletion Factors

Refrigerant with an ozone depletion factor of .05 or less will be specified. No CFC's will be included in specified refrigerated equipment. In addition, using Electrolyzed water for

cleaning and sanitation generates a small fraction of the amount of chlorines, no chemical residue, and no propellants.

19.4.5 Materials and Resources

Regional manufacturers and materials will be specified, as possible. Also, rapidly renewable resourced materials will be specified in millwork, as possible.

Use of reflective, light color finishes are suggested to enhance lighting levels which must be a minimum of 50 foot-candles in food preparation and handling areas.

19.4.6 Indoor environmental Quality

Low VOC materials, adhesives, finishes, and sealants will be specified throughout the foodservice areas. As previously mentioned, the use of Electrolyzed water instead of cleaning chemicals will positively impact the indoor environment while maintaining a significantly higher level of sanitation.

19.5 Equipment cost

Set-in-place, anticipated bid price for the in-Patient, Domiciliary, and CLC food equipment is estimated to be an order of magnitude of $2,830,000 for equipment areas of 16,165 sq. ft. (not including staff/public servery, dining, retail, & other non equipped areas). Of those other areas, 5,020 NSF in the Food Court would be $880,000, including counters, and 6,173 NSF for dining would be $150,000.

This estimate does *not* include items in other budgets: Any mechanical or electrical work outside of the equipment including rough-ins and final connections, except refrigeration piping which is included; built-in insulated floors under walk-ins; any applied surface finishes of walls, floors, and ceilings except at prefabricated wall and ceiling panels of walk-ins; office furniture; data cabling; cash register system hardware and installation; smallwares: pots, pans, utensils, tableware, and serving ware; any structural work: recesses, pads, special suspensions or supports, wall backing, etc.; or bathroom fixtures.

19.6 Non-food Retail (Canteen Services)

Non-food planning will be by VCSCO (Veterans Canteen Services Company).

Retail space is allocated for clothing, appliances, sundries, and personal care items. Retail display and merchandizing fixtures are selected by VCSCO and are not under this specification. However, VCSCO will be encouraged to support the LEED guidelines.

Support for retail includes immediately available storage, offices including secure cash room, concession rooms for outside vendors, and dedicated, securable warehouse storage (see Warehouse). Utilities required for the canteen retail include electrical only for display units and specialized lighting. Retail space also needs standard lighting, egress lighting, and sprinklers per use code.

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19.7 Warehouse

The warehouse space will include most of Canteen Retail storage for bulk inventory and large items such as appliances.

All receiving is through the warehouse, as well as bulk trash and recycling staging. Clear paths of circulation will be maintained to allow food to be rapidly transferred to the kitchen temperature-controlled storage facilities. Many areas will be connected with the Automated Transport System.

19.8 Preliminary Equipment List

Quantity is 1 unless otherwise noted.

PROGRAM	ROOM	QTY		DESCRIPTION
224	026		***Receiving***	
				Floor scale
				Bench scale & stand
		4		Receiving truck
				Pallet jack, electric
				Jack charging station
				Receiving desk with drawer
				Desk stool
				Wall clock
				Hand sink unit
206	012		***Storage***	
224	020			Walk-in cooler, receiving
224	022			Walk-in cooler, storage
224	024			Walk-in freezer
				Meal carts refrigerator
				Day cooler
				Vending cooler
		9		Floor water receptor
				Refrigeration system, central to 8 points
		Lot		Mobile shelving unit

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PROGRAM	ROOM	QTY		DESCRIPTION
		Lot		Mobile pan rack
		Lot		Dry storage shelving unit, mobile
		Lot		Dunnage rack
		45		Bulk food transport cart
224	018		***Ingredient Room***	
				Worktable
				Worktable w/ sink
		4		Mobile pan rack
		3		Mobile shelving unit
				Scale, electronic
				Scale, bench w/ stand
				Hand sink unit
224	017		***Cold Prep***	
206	010	2		Automatic slicer
				Vertical cutter/mixer
		2		Food processor, 6 qt
		3		Mobile equipment table
				20 qt mixer
				Mobile mixer table
				60 quart mixer
				Mixer accessories rack
		Lot		pan rack
		2		prep sink
		2		prep disposer
		4		Prep table, utensil rack, o/s, dwr
		4		Kitchen utility cart
		6		Mobile shelving unit
				Hand sink unit

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PROGRAM	ROOM	QTY		DESCRIPTION
224	017		***Food Production***	
206	010	2		Utility distribution system
		2		Exhaust hood, washdown, UV
				Fire suppression system
				Optical hood control system
				Hood control & detergent system
		2		Range w/ oven
				Steamer/kettle combination unit
				Steamer unit
		2		Combi oven
				Combi oven, roll-in
				Braising pan, 30 gal
				Braising pan, 40 gal
		3		Floor grate & pan
				Convection baking oven
		2		20 quart kettle
				40 quart kettle
				40 gallon kettle
		2		Kitchen utility cart
				20 qt mixer
				Mobile mixer table
		4		Prep table, utensil rack, o/s, drawer
		2		Pot/pan rack
				Hand sink unit
				Blast Chiller
224	017		***Tray Assembly***	
				Tray assembly conveyor
				Support table w/ sink

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PROGRAM	ROOM	QTY		DESCRIPTION
				Starter unit
		3		Tray dispenser
				Plate dolly
				Rack dolly
				Cover rack
		2		Kitchen utility cart
224	008	30		Tray Cart
		2		Mobile retherm/serving unit
				Hand sink unit
			Special Diets Prep	
				Prep counter w/ sink
				Wall cabinet
				Refrigerator
				Freezer
		2		Blender
				Scale, electronic
				Food processor, 2 qt
				Hand sink unit
			Catering Support	
				Catering counter w/ sink
		3		Wall shelf unit
				Coffee brewer & portable pots
		4		Utility cart
				Roll-in refrigerator
		2		Refrigerator rack
				Hand sink unit
224	025		***Rethermalization***	
		15		Retherm unit

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PROGRAM	ROOM	QTY		DESCRIPTION
		15		Tray cart
224	013		***Pot & Pan Wash***	
				Soiled ware table
				Recirculating sink
				Pulper, pot wash
				Pot wash machine
				Vent hood
				Clean ware table
				Hose station
		2		Pot/pan rack
				Detergent & rinse aid dispensing system
				Hand sink unit
224	010		***Warewash, main***	
224	011			Warewasher
224	012			Breakdown table, conveyor
				Pulper & control
		2		Floor grate & pan
		2		Exhaust duct
		2		Hose station
				Cleanware table
				Mobile sorting table
				Plate dolly
				Rack dolly
				Cover rack
				Detergent & rinse aid dispensing system
				Hand sink unit
			Warewash, Ancillary	

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PROGRAM	ROOM	QTY		DESCRIPTION
				Tray accumulator conveyor
				Breakdown table
				Pulper & control
		4		Tray cart
				Tray washer/dryer
				Detergent & rinse aid dispensing system
				Hose station
				Hand sink unit
			Ancillary Housekeeping area	
				Service faucet
				Mop receptor
				Mop/broom rack
				Detergent wall shelf
				Cleaning products dispenser
224	024		***Cart wash***	
				Hose station
				Power washer
				Floor grate & pan
		2		Floor water receptor
224	015		***Can wash/crush***	
				Trash can washer
				Can washer/crusher
				Floor grate & pan
				Floor water receptor
			Extractor room	
				Waterpress & control, to 3 points
				Hose Station
				Floor water receptor

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PROGRAM	ROOM	QTY		DESCRIPTION
		4		Waste container
			Ice production	
				Ice plant, cubed
				Ice bin
				Ice machine, flaked
				Ice bin, flaked
		2		Floor water receptor
				Mobile ice bin
				Ice shovel
				Ice paddle
		2		Wall hook
				Ingredient water filtration system
				Hand sink unit
			Offices	
224	001-6			Per Equipment Guide list, Chapter 224
224	019		***Housekeeping aids closet (2)***	
206	015	2		Service faucet
		2		Mop receptor
		2		Mop/broom rack
		2		Detergent wall shelf
		2		Cleaning products dispenser
		2		Electrolyzed water generator
224	016		***Cleaning equipment facilities***	
				Floor cleaning machine
				Charging station
		2		Storage shelving unit
224	023		***Sanitation supply area***	
		4		Storage shelving unit

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PROGRAM	ROOM	QTY		DESCRIPTION
				Warewash detergent system
				Hood detergent system
206	011		***Food Serving Area/Food Court***	
			See ancillary Food Court equipment list	
		2		Exhaust hood, Grill and Deli
				Exhaust hood, Hot Food
		2		Exhaust hood, Pizza and International
		2		Fire suppression system
				Optical hood control system
		4		Hand sink unit
206	007		***Dining Area***	
				Two-top table
				Four-top table
				Six-eight-top table
				Chair
				Condiment stand
312	032		***Domiciliary Kitchen & Serving***	
312	033			Air screen refrigerator
				Cold food serving unit
				Hot food serving unit
				Ambient serving unit
				Beverage serving unit
				Ice/soda dispenser
				Juice dispenser
				Cup dispenser
				Coffee brewer & carafes
				Tea brewer
				Bulk mobile retherm/heated

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PROGRAM	ROOM	QTY		DESCRIPTION
				cabinet
				Roll-in refrigerator
				Back counter w/ Sink
				Hand sink unit
				Refrigerated equipment stand
				Griddle
				2 burner hotplate
				Underfired broiler
				Fryer
				Worktop freezer
				Fry dump station
				Countertop high-speed oven
				Microwave oven
				Soiled ware table
				Disposer & control
				Warewasher
				Booster heater
				Vent hood
				Detergent & rinse aid dispensing system
				Clean ware table
				Hand sink unit
		2		Kitchen cart
				Pot/pan rack
				Three compartment sink
				Worktable
				Utility sink
		4		Storage shelving unit
				Storage refrigerator

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PROGRAM	ROOM	QTY		DESCRIPTION
				Ice machine & bin
				Ingredient water treatment system
312	034			Storage shelving unit
312	035		Housekeeping aids closet	
				Service faucet
				Mop receptor
				Mop/broom rack
				Detergent wall shelf
				Cleaning products dispenser
				Electrolyzed water generator
106A	035		***CLC Kitchen & serving***	
106A	037			Cold food serving unit
106A	038			Hot food serving unit
				Ambient serving unit
				Beverage serving unit
				Ice/soda dispenser
				Juice dispenser
				Cup dispenser
				Coffee brewer & carafes
				Tea brewer
				Bulk mobile retherm/heated cabinet
				Roll-in refrigerator
				Back counter w/ Sink
				Hand sink unit
				Microwave oven
		3		Soiled tray cart

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PROGRAM	ROOM	QTY		DESCRIPTION
		6		Retherm unit
				Soiled ware table
				Disposer & control
				Warewasher
				Booster heater
				Vent hood
				Detergent & rinse aid dispensing system
				Clean ware table
				Hand sink unit
				Kitchen cart
				Pot/pan rack
				Three compartment sink
				Worktable
				Utility sink
				Storage shelving unit
				Ice machine & bin
				Ingredient water treatment system
				Storage shelving unit
106A	039		Housekeeping aids closet	
				Service faucet
				Mop receptor
				Mop/broom rack
				Detergent wall shelf
				Electrolyzed water generator
				Cleaning products dispenser

19.9 Food Court Equipment

Assume quantity is 1 unless otherwise noted.

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PROGRAM	ROOM	QTY		DESCRIPTION
206	011		**Deli**	Serving Counter
				Food shield
				Refrigerated sandwich make-up table
				Toaster
				Panini Grill
				Reach-in refrigeration
				Microwave Oven
				Bread racks
				Slicer
				Plate dispenser
			Grill	Serving Counter
				Food shield
				Griddle
				Grill/broiler
				Fryer
				Sandwich make-up table
				Refrigerator
				Freezer
				Heated display shelf
				Heat lamp
				Bread storage
			Hot Food	Serving Counter
				Food shield
				Heat lamps
				Hot food wells unit
				Back-up heated holding cabinet
				Plate dispenser

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PROGRAM	ROOM	QTY		DESCRIPTION
				Range with oven
				Warming drawer unit
			Salad Bar	Serving Counter
				Food shield
				Refrigerated cold pans
				Ambient display, breads & rolls
				High heat soup well & cover
			International	Serving Counter
				Food shield & counter guard
				Burners unit, induction or gas
				Refrigerated ingredient pan
				Refrigerated toppings pan
				Heated display or wells
				Heat lamps
				Back-up refrigerated holding
				Warming drawer unit
			Pizza	Serving counter
				Food shield
				Pizza make-up table
				Conveyor oven, small
				Heated display
				Refrigerated holding
				Proofing cabinet
			Dessert/Bakery	Bakery display case, self serve, dual temp
				Service Counter
				Food shield
				Frozen novelty chest freezer

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PROGRAM	ROOM	QTY		DESCRIPTION
			Cold Beverage	Serving counter
				Bag-in-box system
				Ice & soda dispenser
				Ice machine, top mount
				Iced tea brewer & server
				Lemonade server
				Juice dispenser
				Cup dispenser
				Lid dispenser
				Straw dispenser
			Hot Beverage	Serving Counter
				Condiment counter
				Coffee brewer, thermal pots
				Thermal coffee server
				Espresso machine, simple
				Hot chocolate/mocha dispenser
				Cup dispenser
				Lid dispenser
			Snack	Serving counter
				Bagged snack display, tiered
				Fresh fruit display
			Tray pick-up	Multi-level counter
				Flatware cylinders
				Napkin dispensers
			Quick Pick	Refrigerated display case
			Cashier	Counters with cash drawer
				Registers

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PROGRAM	ROOM	QTY		DESCRIPTION
				Scales
				Card reader
				Stool
			Condiments	Serving counter
				Securable storage
				Flatware cylinders
				Napkin dispensers

19.10 Preliminary Room finishes

The following areas are to have ceramic tiled walls, tire-tread quarry tile floors and coved bases, and cleanable, moisture resistant ceilings with fluorescent lighting to provide minimum 50 ft. candles at a 36" AFF work surface. Walls and ceiling to be light in color to reflect room lighting. These include food handling areas of Domiciliary and CLC.

206	012		Dry Storage
224	026		Receiving
224	018		Ingredient Room
224	017		Cold Prep
206	010		
224	017		Food Production
206	010		
224	017		Tray Assembly
224	008		Tray Cart
224	025		Rethermalization
224	013		Pot & Pan Wash
224	010		Warewash, main
224	011		
224	012		
224	024		Cart wash
224	015		Can wash/crush

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			Extractor room
			Ice production
224	019		Housekeeping aids closet
206	015		
224	016		Cleaning equipment facilities
224	023		Sanitation supply area
106A	039		Housekeeping aids closet
312	032		Domiciliary Kitchen & Serving
312	033		
106A	035		CLC Kitchen & Serving
106A	037		
106A	038		

In the following spaces walls, ceiling, and lighting will be part of the walk-ins.

Tire-tread pattern quarry tile with coved base is to be installed over the recessed insulated floor.

224	024			Walk-in cooler, receiving
224	024			Walk-in cooler, vending
224	024			Walk-in cooler, storage
224	024			Walk-in freezer
224	024			Blast Chiller
224	024			Day Cooler

Food handling spaces behind serving lines in the servery must have similar finishes and lighting to the rest of the kitchen areas.

Patron part of Food Court to be tire-tread quarry tile or slip resistant ceramic. Walls to be enamel painted gyp board. Ceiling and lighting similar to dining area, below.

206	011		Food Serving Area/Food Court

Dining area to be tiled or carpet tiled, or a combination. Gyp walls with enamel paint. Ceiling and lighting per dining space requirements.

206	007		Dining Area

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All office areas will need gyp walls, painted, carpet tile floor, light colored ceiling with fluorescent lighting at work levels.

224	01-06		Offices

Canteen Retail uses gyp walls which will be fitted with slat wall for retail; Hard wearing floor tile; and standard retail-level lighting. Retail spot-lighting is by VCSCO.

206				Canteen Retail, non-food