



November 26, 2013

## DESIGN ANALYSIS REPORT

### Project:

Replace Air Conditioning and Environmental Controls (FCAD)  
Mechanical Improvements - Phase 3  
VA # 573-10-600  
MES # 2012 – 578

### ARCHITECTURAL

#### **Supply Processing and Distribution (SPD) Area**

Under this project a dedicated HVAC unit is provided to serve this area. Work associated with this change will be divided into four (4) phases. Work during each phase will include the following: partial to full demolition, replacement with new ceilings, re-installation and repair of existing ceilings inside spaces to receive work. The existing ceilings consist of 2X2, 2X4 ACT and grid and gypsum board. Most work will require the removal of only the amount of ceiling needed to complete the installation of new mechanical systems. However, in some areas overall removal and replacement of the ceilings will be required. In most spaces, the work will occur inside confined areas. These existing walls will serve as boundaries for the project phasing. However, the work occurring in public spaces will take place during “off-hours” as defined by the VA. The construction of temporary partitions to define the limits of construction will be required in some areas. Determination in the field of the amount of ceiling required for removal to complete the installation of new mechanical systems will be required. The touch-up and minor repair of all surfaces including walls and ceilings will be an integral part of this project. All finishes will match the existing conditions as approved by the VA. Negative air and filtration will need to be provided during construction. Installation of new ceilings and finishes will be compliant with VA Design Guide: Supply Processing and Distribution.

#### **Laboratory (Lab) Room E126-1**

Work associated with this space will be limited to removing ceilings and finishes as identified to complete the installation of new structural support for the new AHU associated with SPD. Work during each phase will include demolition and replacement of the ceilings inside spaces to receive work. The existing ceilings consist of 2X2 ACT grid and tile. The majority of work will require the overall removal of most of the ceiling to complete the installation of the new mechanical systems. However, in some areas only removal of a limited amount of ceiling will be required. The construction of temporary partitions to define the limits of construction will be required to separate phases A and B. Again, any work occurring in public spaces will need to take place during “off-hours” as defined by the VA. Determination in the field of the amount of ceiling required for removal to complete the installation of new mechanical systems in The Blood Drawing Room E126H-1 and Transfer Room E126E-1 will be required. All existing furniture systems will remain protected in place. The VA will move any sensitive laboratory equipment that is identified for temporary re-location prior to beginning construction. The touch-up and minor repair of all surfaces including walls, ceilings and possibly

floors will be an integral part of this project. All finishes will match the existing conditions as approved by the VA. Installation of new ceilings and finishes will be compliant with VA Design Guide: Research Laboratory Design Guidelines. Negative air and filtration will need to be provided during construction. All work associated with Laboratory Room E126-1 will be part of Deduct Alternate Three.

### **MAS Scheduling Room E158B-1 and Roof**

Work associated with this space will be limited to removing ceilings, finishes, roof system, roof deck and structural elements as identified to complete the installation of new structural support for the new AHU associated with SPD area. All work associated with these spaces will need to occur during “off-hours” as defined by the VA and coordinated with the VA prior to beginning work. The existing ceilings consist of 2X2 ACT grid and tile and will be replaced with new ceiling matching the existing condition. Work will require the overall removal of the ceiling in MAS Scheduling, Room E158B-1 and Office, Room A103A-1 in order to complete the installation of new mechanical systems and four platform supports. However, in all public areas associated with the Corridor and Switchboard Desk removal of only a limited amount of ceiling will be required. Determination in the field of the amount of ceiling required for removal to complete the installation of new platform supports will be required. All finishes will be repaired or replaced to match the existing condition after approval of the VA and prior to beginning construction. Limited removal of the roof system and roof deck will facilitate the installation of the new supports. Temporary protection of the openings from the elements will be required until the openings are closed. New roof system installation will match the existing Modified Bituminous Membrane Roofing system. The existing expansion joint cover and system will be protected during construction.

## **STRUCTURAL**

### **Supply Processing And Distribution (SPD) Area**

1. A new single Air Handling Unit (AHU-SPD) system will be installed on the existing first floor roof (2<sup>nd</sup> floor) to replace existing units that serve this area. The new air handler will have new ducts that will penetrate the first floor roof (2<sup>nd</sup> floor) and first floor.
2. MCE will design and provide structural drawings for the steel framing support of new AHU-SPD unit. Also, MCE will analyze the existing first floor roof and first floor slabs at locations where the new duct (for AHU-SPD unit) openings are required.
3. A new Air Cooled Chiller (CH-SPD) will be installed on existing first floor roof and will be supported by an existing steel framings. MCE will analyze and reinforce the existing steel framings and provide structural drawings where the new CH-SPD will be installed.

### **Laboratory (Lab) Room E126-1**

1. A new Air Handling Unit (AHU-LAB) system will be installed on existing second floor (same place where existing units are located) of Mechanical room area to replace existing units. The new air handler will have new duct larger in size that will penetrate the second floor.
2. MCE will analyze the existing structure where the new unit (AHU-LAB) will be installed and analyze the slab at this location where the new duct (for AHU-LAB) openings are required.

**Existing Bridge Across Existing and New Mechanical Pipes Located at Existing 1<sup>st</sup> Floor Roof (2<sup>nd</sup> Floor) to be Extended**

1. Existing bridge across existing and new mechanical pipes located at existing first floor roof (2<sup>nd</sup> floor) shall be extended.
2. MCE will design and provide structural framing plan for the extension of existing bridge across new and existing mechanical pipes.

**Wind Design Pressures:**

1. MCE will provide wind load design pressures to be used by any exterior elements supplier.

**FIRE PROTECTION**

**Supply Processing And Distribution (SPD) Area**

1. This area is presently only protected by sprinklers in the D100M-1 Clean Receiving. The existing heads are to be replaced with new sprinkler heads.
2. A new wet pipe sprinkler zone will be added to provide complete coverage for the SPD area. Contractor shall field verify location of new connection tie-in to the existing system.

**MECHANICAL**

**Supply Processing And Distribution (SPD) Area**

1. This area is presently served by AC-1 and AC-2. Each of these units has a cold and hot deck. The air supplied to the area is constant and through several dual ducts (hot and cold) mixing boxes. Our test of Nov 2012 indicated that the total air supplied to this area was 11 880 cfm.

A new single dedicated air handling unit (AHU) system of 13 600 CFM will be provided for this area. The new AHU shall be 100% outside air, equipped with a variable frequency drive (VFD), and a chilled water coil connected to both the existing main chiller system as primary cooling and to a new 150 Ton air cooled chiller as backup cooling. The VFD is to maintain constant airflow to overcome increased pressure drop in system (ie dirty filters). There will be a hot water coil in the unit to preheat the air during less than 32 deg F days.

2. Single duct air terminals with hot water coils will be provided to replace the dual ducts (hot and cold) mixing boxes. The coils are for heating or humidity controls.
3. Due to the continuity of the operation of the area, and minimum interruption is desired, the majority of the existing ductwork will be reused and new duct is only provided as required. Existing ducts to be cleaned and pressure tested.
4. The existing air devices will be replaced with new per the project Statement of Task.

3. A steam to hot water converter system will be provided to produce hot water to the new AHU and the air terminals. System to be located in the sub basement.
4. A new heat pipe system will be provided to recover the energy associated with the exhaust air. System to be located on the first floor roof.
5. New systems described above will be tied to the existing energy management system (EMS).
6. Construction work will be sequenced to take into account the continuous operation of the area.
7. Installation of the new back up chiller. Chiller CH-SPD shall provide back up cooling for AHU-LAB and AHU-SPD. Chiller was sized for the larger load of the two.
8. Proposed sequencing of work:

Phase 1:

Installation of new AHU-SPD on roof with ductwork down to the SPD area.

Installation of new hot water system in sub-basement. Run pipes up to SPD area.

Phase 2: Demolition and Installation of new air terminals, piping and ductwork in SPD area.

Phase 3: Demolition and Installation of new air terminals, piping and ductwork in SPD – Soiled area.

Phase 4: Demolition and Installation of new air terminals, piping and ductwork in SPD – Clean area.

### **Laboratory (lab) room E126-1**

1. The room is served by existing single zone unit AC-3E. It consist of a heat wheel section, filters, preheat coil, cooling coil, supply fan and an exhaust fan. Fans have VFDs.

Our test of Nov 2012 indicated that AC-3E was providing approximately 12,000 cfm and only 6,125 cfm was returning from the laboratory. This short of return air was due to the outdoor air was being forced through the gap from where the removed heat recovery wheel would reside. This condition prevents the required quantity of hot return air from effectively being pulled from the Lab and means that the Lab is operating at a positive condition rather than the negative condition it should be at.

Existing AC-9E is a 7.5 tons (3 550 cfm) unit and is serving an area in the 3<sup>rd</sup> floor.

This design consists of replacing both existing AC-3E and AC-9E with a single new AHU-LAB. The lab loads require a capacity of approximately 15,000 cfm (127 tons) which is 125% above the current peak airflow/tonnage. The new 18 550 CFM AHU shall be equipped with variable frequency drives, a chilled water and a hot water coil, a heat wheel section, filters, supply fan and an exhaust fan. The chilled water coil will be connected to both the existing main chiller system as primary cooling and to the same new 150 Ton air cooled chiller that backs up the AHU-SPD as emergency cooling.

Due to the continuity of the operation of the area, and minimum interruption is desired, the majority of the existing ductwork will be reused and new duct is only provided as required. Existing ducts to be cleaned and pressure tested.

2. Some existing VAV boxes presently installed in ceiling directly above some specific equipment to be removed. The new replacement boxes will be located away from that equipment per user's request.
3. Replace the existing air terminals with heating/reheating hot water coils with new like kind air terminals, and existing air devices with new per the project Statement of Task.
4. New system described above will be tied to the existing energy management system (EMS).
5. Area's operation is continuous. Sequencing of work is critical. Schedule of work in the evenings and Friday night after midnight to Sunday night at midnight is recommended.
6. Proposed sequencing of work:
  - a. Existing DX roof top unit to provide temporary cooling to the affected area during replacement work. Connect temporary ducts to existing duct risers.
  - b. Remove existing AC-3E and AC-9E and related appurtenances.
  - c. Install new AHU-LAB and related ductwork and piping in the mechanical room.
  - d. Install new SA duct riser.
  - e. Schedule to remove all existing abandoned exhaust ducts during one night.
  - f. Remove and replace one air terminal unit at a time. Other areas of laboratory to remain functional.

## **ELECTRICAL**

The above referenced project consists of HVAC upgrades for the Supply, Processing & Distribution as well as the Laboratory on the first level. The project also consists of upgrades to the existing lighting. The design will be compliant with all Technical Information Library items including *The Electrical Design Manual December 2010*, *HVAC Design Manual for New, Replacement, Addition, and Renovation of Existing VA Facilities* and the *Design Guide for Supply Processing & Distribution February 2010* as well as all pertinent NFPA codes.

### **Normal Power for SPD upgrade**

The existing service for the Main Building consists of 2 medium voltage 800A switchboards at 12.47KV, 3 phase fed from Building 25. The Voltage is stepped down using 2500 KVA dry type transformers with a secondary voltage of 480/277V. Both transformer secondary feed 4000A 'A' and 4000A 'B' switchboards via bus respectively. These low voltage distribution switchboards are connected together by a tie breaker. The new normal service will be provided from a 600A feeder from a new 800AF/300AT circuit breaker in Switchboard 'MSGR-B'.

### **Normal Power for 1<sup>st</sup> Level Laboratory**

The existing service for the 'E' wing consists of medium voltage power fed from the existing Main Building 800 Amp switchboards. Each medium voltage feeder is 150 Amps. The voltage is stepped down to 480/277V for distribution via 1000 KVA transformers. The new normal source feeder will be fed from switchboard #5 from a new 600A circuit breaker.

### **Emergency Power for SPD upgrade**

The existing emergency power for the Main Building is from a 1250 KW generator at 480/277V. The new 300A, panel will be fed from emergency power in a future project.

### **Emergency Power for 1<sup>st</sup> Level Laboratory**

The existing emergency power for the 'E' wing is from 4 parallel generators and a large paralleling switchboard 'ACA'. A new 600A circuit breaker will be provided. A new 600A Automatic transfer switch will be provided for the new emergency feed. The location of the new automatic transfer switch must be coordinated with the new E-wing distribution work. Ideally, it would be placed in an Essential Electrical Room for the E-wing. The transfer switch will feed from switchboard EMDP-5 in the existing electrical room. Emergency power is required for air handling units / chillers serving laboratories in accordance with *HVAC Design Manual for New, Replacement, Addition, and Renovation of Existing VA Facilities*, Sheet 6-47.

### **Lighting and Lighting Controls**

The existing lighting utilizes T8 fluorescent lamps. The existing light fixtures in spaces that have not recently had a ceiling renovation shall be upgraded to new LED lighting by Cree. Lighting control will be provided by 0-10V control dimmers interfacing with the 0-10V LED drivers in the new Cree lighting fixtures. The facility is a 24 hour operation type, so automatic shutoff is not required by the energy code. All lighting controls will be manual.

### **Fire Alarm**

The fire alarm for the building is a addressable fire alarm and detection system. The existing main fire alarm control panel is located in the Fire Command Control Center located on the basement level. Where work is indicated on the plans, the fire alarm equipment shall be new with new conduit and wiring tied into the existing system.

END OF REPORT

Report done by:

Architectural: Ward Scanlin, AIA

Structural: Nelson Dacanay

Fire Protection: Frank Poruba

Mechanical: Mai Nguyen

Electrical: Erika Imhoff