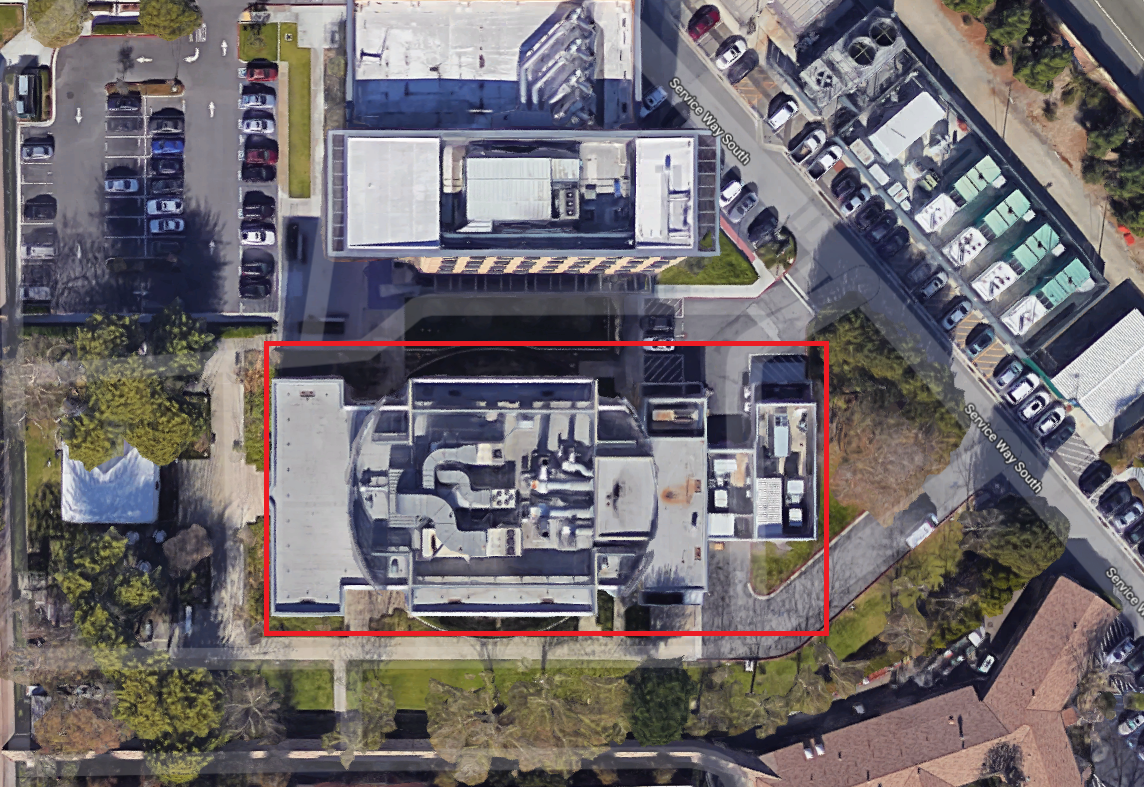
Detailed Project Program

CRII4 – Building 55

Major Building Maintenance

Project No. 5112289 / Contract No. 9007190



Design & Construction Services

101 Academy, Suite 200

Irvine, CA 92697-2450

Conformed March 1, 2019

DETAILED PROJECT PROGRAM (DPP)

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1. **INTRODUCTION**
   * + 1. University of California, Irvine will be renovating Shanbrom Hall ("Building 55"), a 60,274 gross square foot, four-story, occupancy Type-B laboratory and office building constructed in 1997. The building is located at the UCI Medical Center Campus in Orange, California. The HVAC system including air handlers, lab air control valves, and associated controls have failed and must be replaced. The roof is 21 years old and shall be replaced as part of the project.
       2. Existing Mechanical Systems:
          1. As designed, there are three (3) air handling units on the roof. Two (2) units are 100% outside air:

AHU-1 serves the office areas and has a 20 HP supply fan and 10 HP return air fan.

EC-2 serves basement vivarium spaces and provides 100% outside air with two 20 HP fans.

EC-3 serves Floor 1, 2, and 3 laboratory spaces and provides 100% outside air with two 50 HP fans.

* + - * 1. As designed, there are 5 exhaust fans on the roof:

Exhaust fans EF-1 and EF-2 are 40 HP each and serve laboratories on Floors 1, 2, and 3.

Exhaust fans EF-3 and EF-4 are 20 HP each and serve basement vivarium spaces.

Exhaust fan EF-5 is 3/4 HP and serves toilet spaces.

* + - * 1. Laboratory zone air control is effectively non-functional at this time. The valves are first-generation pneumatic-actuated Phoenix Controls airflow valves installed when the building was constructed. Many valves have been damaged beyond repair. No existing valves shall be retained in service at the conclusion of this project.
        2. Office air control is by pneumatic VAV terminal units.
        3. Reheat valves are pneumatically controlled by local thermostats.
        4. A Monitoring-Based Commissioning (MBCx) study was conducted in 2016. An ASHRAE Level 2 audit was conducted in 2018. These reports are provided as University Furnished Information.
        5. The University retained the services of Equal Air Balance to take readings of existing airflows at existing rooftop equipment as they currently operate. Refer to University Furnished Information. The report establishes the existing conditions and is not intended to indicate sizes or airflow requirements. The Design Builder shall determine those requirements based on University design criteria.
        6. Included in University Furnished Information is the University’s work order history for Building 55 for the past three years showing the types of complaints and service requests Facilities Management has received. The Design Builder is to review and determine if a pattern has developed that should be addressed in the design of this project and any accepted alternates that add value to Design Builder’s RFP submission.
        7. This project will not alter the existing emergency generator. The Design Builder shall connect replacement equipment to the same power source as the original equipment. If the old equipment was supplied with standby power, then the replacement equipment will be connected to the existing emergency power system. No load will be added to the emergency power system.
      1. Existing Floor Plans
         1. Included in University Furnished Information are the floor plans for Building 55 in PDF. The plans include the room numbers and square footages. The areas shall be confirmed by Design Builder after award of contract. The location of doors and walls may not be shown exactly and/or correctly on these plans.
      2. Laydown Areas
         1. An outdoor area for laydown and a construction trailer site have been identified. Refer to Figure below.



* + - 1. Known Conditions
         1. Recirculating (unducted) biosafety cabinets are in the following rooms: 138 (2x), 140, 172, 174, 182, 272 (2x), 338 (2x), and 372 (2x). These biosafety cabinets shall remain as currently configured.
         2. Ducted Type B-2 biosafety cabinets are currently in the following rooms: B38, B66, B70, B76. Refer to Base Bid Scope of Work (Part 3) for details on modifications to these cabinets.
         3. Ducted Type III A/B biosafety cabinets are currently in the following rooms: 140, 166 (2x), 170, 368, and 370. Refer to Base Bid Scope of Work (Part 3) for details on modifications to these cabinets.
         4. Existing EC-2 and EC-3 supply fans are on emergency power circuits. Existing EF-1, -2, -3, and -4 are on emergency power circuits.

1. SCOPE OF WORK OVERVIEW
   * + 1. Base Bid
          1. The Building 55 Major Building Maintenance Base Bid Scope of Work includes replacing the complete roof system and rooftop mechanical equipment. The base bid includes and is not limited to:

New single-ply roof and insulation.

Replacement of drain and overflow drain sump bodies and covers.

New building cooling systems, reconfigured with new air handling units, ductwork, and chilled water piping.

Modification to or replacement of exhaust fans and systems including stacks, stack bases, fans, motors, and controls.

New laboratory and vivarium supply and exhaust air terminal units and reheat valve actuators.

New office air control damper actuators and reheat valve actuators, retaining the existing VAV terminal units.

New building automation system for new and retrofit equipment.

Hazardous material abatement including asbestos and lead containing materials related to the roof and mechanical equipment. A hazardous material report has been provided with the RFP.

* + - 1. Bid Alternates
         1. Alternates are as follows:

Alternate No.1 – Cold Room Upgrades

Alternate No.2 – Mechanical Room Equipment Replacement

Alternate No.3 – Miscellaneous Repairs

Alternate No.4 – Building Security Upgrades

Alternate No.5 – Basement Flooring Replacement

Alternate No. 6 – Centralized Demand Control Ventilation

Alternate No. 6 is the University’s highest priority, followed by alternates 1 through 5 in numerical order.

* + - * 1. Design and construction for the base bid and alternates shall comply with UCI Facilities Management Campus Standards and specifications as provided with the RFP. Although not every Campus Standard or specification requirement is listed in this DPP with each description, many are included to highlight major design and construction requirements that must be maintained. The University sustainability requirements require this project to recycle at least 85% of construction waste by weight. Hazardous materials abated are not counted as part of recycling, though they shall be logged.
        2. For base bid and alternates, prepare documentation for participation in the Savings By Design program as outlined:

Provide calculations to show energy savings using software approved for submission to Southern California Edison (SCE) and Southern California Gas Company (SCG) as approved by the California Public Utilities Commission (CPUC), such as Trane Trace. Provide complete printouts of each input used for base and proposed cases.

Natural gas savings shall be calculated using 70% heating efficiency and shown in therms.

Payback calculations shall use utility costs of $0.125/kWh and $0.60/therm.

Provide a narrative describing the benefits of utility incentives and participation in Savings by Design as part of TAB 3 of the technical proposal.

1. BASE BID
   * + 1. Roof Replacement
          1. The new roof assembly shall be watertight and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
          2. Remove complete existing built-up roof including associated wall and roof curb flashings and roof deck insulation down to the existing concrete deck. All roofs on the building shall be replaced.
          3. The new roof membrane system shall consist of CA Title 24, Part 6 compliant; Cool Roof Rating Council (CRRC) approved gray or white fiberglass mat reinforced 80 mil feltback PVC single-ply roof membrane fully adhered to prepared deck substrate. Membrane that is 80 mil "nominal" (i.e. actually less than 80 mil) is not acceptable. Prepare deck substrate for application of new single-ply roof membrane per manufacturer’s requirements. Membrane layout and insulation installations are to meet or exceed the manufacturer’s FM 1-90 (minimum) wind uplift criteria.

Installation shall include new associated flashing and counterflashing at all membrane termination elevations:

* + - * 1. Roof membrane termination shall be a minimum of 10-inches in vertical height above the elevation of the finished installed roof system including roof insulation, substrate board, crickets, saddles, etc. Apply the membrane manufacturer’s polyester fleece reinforced two‐component polymethyl methacrylate (PMMA) liquid-applied penetration flashing system at locations where a 10-inch vertical height is not achievable. PMMA must be included in membrane manufacturer’s 20-year no dollar limit (NDL) warranty and five-year labor warranty.
        2. Install membrane manufacturer’s asphalt-resistant PVC membrane for installations on asphalt contaminated parapet wall surfaces, roof curb surfaces and other asphalt contaminated roofing surfaces.
        3. Install new pre-manufactured PVC membrane at inside and outside corners.
        4. Penetrations:

Penetration flashing shall be pre-fabricated PVC membrane pipe penetration flashing boots at round roof penetration locations.

Apply the membrane manufacturer’s polyester fleece reinforced PMMA liquid-applied penetration flashing system at locations of irregularly shaped roof penetrations (angle-iron, square steel tube, etc.).

Provide PVC membrane fabricated storm collars above the top of the completed penetration flashings. The storm collar shall be independent from the penetration flashing boot. Secure the storm collar to the penetration with a stainless steel cinch-band. The top of the storm collar (above the cinch-band) shall be sealed with a liberal application of the specified polyurethane sealant. Refer to Campus Standard details.

Multiple penetrations within a single roof penetration flashing boot are forbidden.

The use of existing or installation of new pitch pans is prohibited.

* + - * 1. Install roofing manufacturer’s welded walkways from the roof access to the four sides of electrical and mechanical equipment, to each roof drain, and to each other piece of serviceable equipment. Provide an abundance of new walkways to protect the roof and provide maintenance staff with a non-slippery walkway.
        2. Inspect and pressure test existing roof drains, overflow drain assemblies, and receptors. Design-Builder shall check the horizontal runs of roof drain piping to the first vertical pipe for corrosion and other damage. Provide a report of findings to the University.
        3. University will hire an independent roofing consultant to develop and perform roof leak tests. Attend roof leak tests coordinated by University's Representative. Repair leaks identified during University's tests.
        4. Roof insulation shall have a minimum thickness to comply with 2016 Title 24 code.
        5. Provide a minimum 20-year No Dollar Limit warranty on roof material and 5-year labor warranty.
      1. Air Handling Unit Replacement
         1. Demolish existing air handling units, roof curbs, exterior ductwork, sound attenuators, and supports. Design-builder may elect to reuse existing roof curbs if they meet the structural requirements of the new equipment. Demolish existing water treatment lines back to metal point of connection and cap. Demolish existing make-up water feed back to ground-level point of connection and cap. In cooperation with the University, select the new air handlers meeting Campus Standards and requirements for a complete and fully functioning system. Examine existing capacity compared to current usage and provide new units that meet the Campus Standard design criteria for new equipment while maximizing ability to turn equipment down to minimum air changes. Avoid installing ductwork higher than top of air handling units unless no other option is available.

Capacity sizing: Provide the number of air handling units that provides the University with the greatest energy efficiency. Provide a minimum of two air handlers for labs and vivarium; AHUs shall be in parallel and service both the vivarium and labs wings together, not separately as is presently the case. Size total air handler capacity for laboratory air change rates calculated per DPP section 9.7.C.7 and split evenly between not less than two air handlers. Office air handler shall be a separate air handler. Comply with NIH requirements for vivarium ventilation rates and controls.

Air handler units shall be weather-resistant aluminum, stainless steel, or fiberglass construction, copper tubes and copper fins chilled water coils, direct-drive fan(s) with IEEE 841 motor(s) controlled by Variable Frequency Drive (VFD) with shaft grounding kit(s) and mounted on new curbs. Curbs shall be concrete or manufactured hot-dipped galvanized steel; wood is prohibited. Equipment shall comply with Campus Standards and specifications. Direct-drive fan wall technologies, EC motors, and centrifugal direct-drive fans are acceptable; belt driven equipment is prohibited. IEEE-841 is not required if EC motors are provided, as EC motors are not available in IEEE-841. Refer to Campus Standards and specifications for coil sizing requirements and other details of construction and material requirements. For maximum system efficiency, air handler fan and coil selections should consider the impact of selected alternates that change air flow or pressure requirements for the system.

Chilled water source: Concurrent to this project's design development, the UCI Medical Center will install a 16" direct-buried chilled water pipe along the south side of Building 55. Near the southeast corner of Building 55, the UCI Medical Center will place a vault with two 8" stub-outs and valves for connection to Building 55, at an approximate depth of seven (7) feet.

Contractor shall connect to 8" chilled water stub-outs in vault, trench to building perimeter, and run fully-welded piping up the side of the building for distribution to air handlers.

Piping exposed to view shall be concealed behind a corrosion-resistant, stainless steel or aluminum, chase attached to the building exterior. Chase shall be discreet and blend in with existing building exterior metal to minimize visual impact.

Boil-out is required for new steel pipe, and the Design Builder is responsible for providing all pumps, chemicals, and electrical required to accomplish the boil-out. Refer to Steel Pipe Treatment and Cleaning addendum.

Chilled water booster pumps are not required due to the distribution pressures provided by the Central Plant.

Furnish and install a BTU meter complying with the specifications in an easily accessible location. Electrical and electronic components shall use conduit and enclosures suitable for the location complying with Division 26. Connect ultrasonic meter ethernet output to network switch in nearest IDF.

Controls: Remove all existing building automation control systems and replace with new BACnet over ethernet/IP controllers complying with specifications. Provide new sensors for air handler control, including all air handler temperature sensors, supply static pressure sensor(s), fire smoke detectors, etc.

Provide new industrial computer running local Niagara 4 supervisor station, LogicSupply ML100G-10, Dell Edge Gateway 5000 or equal, physically located in IDF room 348. Design-builder is not required to provide accessories such as a keyboard or monitor. The local Niagara computer shall be access remotely via laptop. The local Niagara computer shall contain all graphics and reset programming required to operate the building in a stand-alone manner. In addition, the local Niagara 4 station shall be connected via internet hyperlink located on the existing main campus Niagara 4 graphics server for central monitoring, graphic viewing, and setpoint adjustment.

Provide one roof-mounted convenience hose bibb with vacuum breaker on each roof to service mechanical equipment. Reusing existing hose bibb is acceptable. Remove existing condensate hub drains and provide new sinks to suit new air handling units. Locate sinks next to AHU condensate drain outlets and avoid running piping across the roof. Coordinate AHU drain outlets to be located away from main service access side of the unit. Relocate existing vents through roof to maintain separation from AHU’s outside air intakes. Vents shall be at least 15 feet away from intakes or extend vertically to 2 feet above top of intake.

* + - 1. Exhaust System Replacement
         1. Demolish existing exhaust fans, ductwork, and sound attenuators on the roof. In cooperation with the University, select, furnish, install, and commission the new exhaust fans meeting University Standards and requirements for a complete and fully functioning system. Provide new stainless steel freestanding laboratory exhaust stacks.

Exhaust fans: Exhaust fans shall be AMCA Single-Width, Single-Inlet, Arrangement 8, direct-drive fans with IEEE 841 motors on VFD complying with campus standards and master specifications and mounted on concrete curbs. Exhaust system shall be N+1 design with fans serving a common rooftop plenum for the lab and vivarium exhaust, each sized such that normal operation will result in the fan running in the most efficient portion of the fan curve. Belt driven equipment is prohibited. Exhaust fan plenum shall include an outside-air bypass damper if required by wind study. Bypass damper shall operate only at minimum flow conditions or other conditions as determined by the wind study and shall not operate continuously.

Wind Study: Design Builder shall hire a consultant to perform a wind study with a physical model to determine safe exhaust stack heights, exit velocities, and outside air intake locations, based on wind speed and direction. Exhaust fans shall be programmed to modulate fan speed and outside-air bypass damper and anemometer (if a bypass damper is needed) to implement a control system to reset exit velocity if determined to be technically feasible. The appropriate system design will depend on the results of physical wind tunnel modeling. The goal is to minimize energy consumption by reducing exit velocities of the stacks when winds are relatively calm.

Exhaust Stacks: The building is a research laboratory and form follows function; visible exhaust stacks are acceptable. Exhaust stacks shall be installed with outlets even with each other. Ensure that not less than 3 stack diameters are provided downstream of any points of connection to the stacks, unless the Design Builder demonstrates to the University's satisfaction that fully developed flow can be provided with a shorter stack. Stacks shall be free-standing without any guy wires or diagonal braces except short stiffeners at the bases of the stacks, where needed.

Controls: Remove all existing exhaust fan control systems and replace with new BACnet over ethernet/IP controllers complying with specifications. Provide new sensors for exhaust fan control, including all static pressure sensors, VFD controls, flowstations, etc.

Replace existing toilet exhaust fan with new fan with ECM motor complying with specifications and Campus Standards.

Retain capped radioisotope ducts for future use and provide sheet metal caps.

* + - 1. Roof Electrical System Replacement
         1. Demolish and dispose of existing motor control center EMCCR on the roof. Furnish and install modern distribution panel for rooftop electrical loads previously fed by EMCCR and any new loads added by this project. The University prefers this modern distribution panel to be located in an easily accessible location inside the building.
      2. Zone Airflow Systems
         1. General

Controls: Remove all existing building automation control systems and replace with new BACnet over ethernet/IP controllers complying with specifications. No existing interior HVAC controllers shall remain after this project. All new zone controllers shall be connected to the new building automation control system. Zones may either have individual ethernet/IP controllers or consist of a string of MSTP protocol devices connected to one or multiple central controllers supporting ethernet/IP.

* + - * 1. Laboratory and Office Ductwork

Remove existing and provide new diffusers, registers and grilles.

Design-build teams shall select new laboratory diffusers, registers, grilles, and their locations to maximize ventilation effectiveness with respect to contaminant sweep.

Design-build teams shall select new office diffusers, registers, grilles, and their locations to maximize ventilation effectiveness with respect to thermal comfort.

New diffusers, registers, and grilles are not required in the vivarium.

Clean and seal remaining existing supply air ductwork. Remove filters and filter holders from ceiling diffusers with mounted filters after the duct has been cleaned.

Design-builder shall survey existing fusible-link dampers prior to demolition and notify University's representative of any deficiencies.

* + - * 1. Laboratory and Vivarium Air Control Valves

Replace laboratory and vivarium terminal units with new laboratory terminal units. Furnish and install new digitally controlled laboratory variable air volume control valves on supply, general exhaust, and fume hood and any other hood or exhaust inlet for laboratory and vivarium zones. Basis of design shall be Accutrol Accuvalve, Phoenix venturi, or Siemens venturi; other manufacturers require approval prior to bid. Laboratory air control valves shall be designed to operate at differential pressures of 0.35" or less across the valve. Convert existing constant volume spaces to VAV.

Select the air control valves so that the minimum air flow range of the system is not more than two (2) air changes per hour. In any laboratory zone where the minimum ACH is greater than two (2) air changes per hour with fume hood sashes fully closed, the laboratory air supply air control valve minimum flow may be sized to the minimum fume hood flow. Ensure that each system can produce not less than six (6) air changes per hour. Purge air flow shall not be less than (6) air changes per hour. The maximum purge shall be the full flow of the supply air valves plus or minus the required pressurization offset. Vivarium rooms and room B20 shall be sized for a maximum of fifteen (15) ACH except where existing ductwork constrains the airflow to less than fifteen (15) ACH; Design Builder is not required to increase ductwork size in the vivarium.

Provide dedicated constant flow exhaust valves for cage racks in rooms B40 and B72. No other rooms shall be provided with constant volume valves for future ventilated cage racks.

Furnish and install new thermostats for all new terminal units. Vivarium thermostats shall report humidity in addition to temperature.

Demolish the entire control compressed air system, including but not limited to: control air pipe, control air compressor, motor power wiring and conduit, filter dryer, and connection at motor control center.

Biosafety Cabinets

Demolish and dispose of type B-2 ducted biosafety cabinets in the following rooms: B38, B66, B70, B76.

Furnish and install recirculating 4' A-2 biosafety cabinets in Room B38, B66, and B76.

Furnish and install new 4' fume hood and associated laboratory airflow controls in B70.

Convert ducted Type III A/B biosafety cabinets to recirculating configuration in the following rooms: 140, 170, and 370.

Design-builder shall determine whether additional general exhaust is required as a result of biosafety cabinet reconfiguration and/or replacement. Where additional general exhaust is required, provide new terminal unit, controls, grilles, and other components complying with laboratory airflow valve requirements, specifications, and Campus Standards. Where additional general exhaust is not required, demolish exhaust ductwork back to point of connection and cap with welded steel.

* + - * 1. Office Terminal VAV Units

Demolish existing pneumatic VAV components in zone office air control system. Furnish and install new direct-digital controllers, actuators, and thermostats for office zones. Set minimum office airflow CFM at, or less than 20% of maximum but no less than minimum code-required ventilation. Ensure conventional terminal units are only used to serve non-laboratory spaces (offices, lobbies, storage, etc.) and that spaces that are used as laboratories receive laboratory airflow controls.

* + - * 1. Zone Reheat Coils

Retain existing laboratory and office zone reheat coils. Clean reheat coil fins and flush reheat coils. Report failed reheat coils to the University's Representative.

Replace existing combination valves with new shut-off valves. Replacing combination valves for each floor's reheat coils will require a whole-floor heating hot water shutdown. Record drawings indicate floor-level heating hot water isolation valves exist, Design-Builder to verify. Coordinate whole-floor heating hot water shutdown with University's representative to minimize number of whole-floor shutdowns required and coincide with phased interior work.

Furnish and install new reheat coil controls and appurtenance package (e.g. control valve, strainers, testing plugs, hoses, etc.) to and from shut-off valves, complying with specifications and Campus Standards. Repair duct and pipe insulation damaged during ductwork modification and reheat valve installation.

* + - 1. Abatement
         1. Abate any hazardous materials (e.g. asbestos and lead) from any activities impacted by base scope of work or selected alternates. This includes, and is not limited to, roof insulation, roof flashing, roof mastics, ductwork mastics, ductwork insulation, and piping insulation. Refer to University Furnished Information for hazardous materials testing report for information on where hazardous materials are located.
      2. Building Scheduling Requirements
         1. Contractor shall phase work so that new roof is installed and water-tight before October 1, 2019.
         2. Whole-building air shutdowns for main rooftop equipment construction and installation shall be completed with one (1) scheduled interruption of building air (supply and exhaust) no more than ten (10) business days in length. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of air handling and exhaust equipment down-time. The Design Build team shall become thoroughly familiar with the project scope of work and identify any additional outages that will be required for any reason.

Whole-building shutdowns may only occur outside of dates indicated in red on the Calendar of Basement Teaching Lab Courses provided as University Furnished Information.

Crane work shall occur on weekends to the maximum extent possible. Crane work with any impact to traffic between Building 55 and OSHPD Central Plant may occur Monday through Friday but only before 6:30 AM. The area behind Building 55 is high-traffic and cannot be blocked or congested after 6:30 AM on weekdays. All crane lifts require prior approval from the University and two weeks advance notice.

* + - * 1. Construction, testing, and start-up activities for interior activities in laboratories and the vivarium shall be completed within scheduled interruptions of no more than 15 consecutive business days per phase. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of down-time. Provide professional cleaning service to fully clean laboratory and vivarium suites prior to turn-over. Refer to Division 01.

Vivarium interior construction shall be scheduled adjacent to or coinciding with the whole-building shutdown to the maximum extent possible.

Surgical teaching laboratories in basement rooms B06, B12, and B20 are used regularly. Interior construction work affecting these rooms shall be scheduled and completed outside of dates indicated in red on the 2019 Class Schedule provided as University Furnished Information.

* + - * 1. Formal commissioning may be completed at project end, but all systems must be functional when spaces affected by this scope of work are turned back over to the University.
        2. The University will work with the design-build team to define the specific area impacted by the work and any equipment to move or hazards to remove. UCI will clear any chemical or radiological hazards from the space impacted prior to work. UCI will clear benchtop glassware. Design-builder shall protect remaining equipment in place to the maximum extent possible. Design-builder shall protect in place glassware on shelves, or package and relocate glassware that remains. UCI will work with the Design Builder to minimize relocation of equipment and therefore recalibration. UCI will recalibrate equipment where necessary. Removal of hazards will be prior to the beginning of the Design Builder's shutdown time. The University will make vivarium spaces unoccupied during construction of vivarium interior spaces and whole-building shutdowns.
        3. Any activities impacting the building interior that are required to fully complete the work beyond the allocated downtime (e.g. drilling, coring, fan testing, etc.) shall be completed between the hours of 9:00pm and 9:00 am or on weekends. Work isolated to the roof with no impact (no noise, no vibration, etc.) to the building interior such as insulation and roofing installation may be completed during normal working hours.
      1. Design Requirements
         1. See Part 20 of the RFP, Scope of Work, for design deliverables and the Campus Standards.

1. ALTERNATE NO. 1
   * + 1. Upgrade and repair existing Cold Rooms as follows:
          1. Cold room scope of work shall be completed for B52, 178, 278, and 378. These rooms shall be 4°C cold rooms.
          2. Calculate cooling requirements for each room. While existing capacity may be compared to the calculated requirements, it shall not be the basis of sizing.
          3. Demolish existing condensing unit, evaporator, line sets, and electrical. Remove all building rooftop items related to refrigeration system. Design-builder is responsible for evacuating remaining existing refrigerant in compliance with regulatory requirements. Furnish and install new air-cooled condensing unit, evaporator, and all piping, insulation, and electrical required for a fully functioning system. Condensing unit shall be located on top of cold room with suitable vibration isolation and adequate support, within the occupied corridor space and not on building roof. Provide condensing units meeting NC50 noise criteria as measured in the space immediately outside the cold room. Refrigerant shall be R-448A unless otherwise approved by University's representative. Controls shall be start/stop (pump down) operation.

Ventilation for the rooms currently housing condensing units shall be redesigned and rescheduled as storage rooms.

B52 cold room condensing unit is currently in room 144A.

178, 278, and 378 cold room condensing units are currently in room 192A.

* + - * 1. Evaporator

Low profile fan front design, 120 VAC, with Electrically Commutated Motors with carbon bladed fans.

All refrigerant piping shall be copper suitable for bending and flaring and specifically cleaned for use in refrigeration systems and shall be insulated.

Condensate piping and traps may stay within the cold room and spill into the existing sinks to match existing.

Select system for low energy use and minimum head pressure requirements.

Evaporator Unit attached to ceiling of each environmental room of box with suitable, sturdy, corrosion resistant fasteners (e.g. ¾-inch all-thread with lock washers) per structural engineer design requirements.

Provide electric defrost heaters for all units. If energy analysis shows a savings, fan-powered defrost may be used on the 4°C environmental rooms in addition to electric defrost.

* + - * 1. Replace cold room door, gaskets, heater, and closer. Cold room door shall be Commercial Cooling, Inc., or equal. Replace existing lighting with LED on occupancy sensor with manual override for if sensor fails. Sensor shall be rated for low temperature. Check and seal existing and new box penetrations and horizontal and vertical joints to reduce air infiltration.
        2. Provide control panels for installation complying with University detail in University Furnished Information. Control panels shall be configured for BACnet connectivity over ethernet/IP to the building management control system. Provide ethernet cable from cold room control panel to data closet and verify control panel can communicate with building automation server. Control panel capabilities shall include:

Unit using output based on set point for liquid line pump down.

Unit with input sensing temp for control, and alarms.

Unit able to interface with personal emergency alarm, and shut down the entire refrigeration system.

Unit able to control defrost for freezer, if applicable.

Unit able to sound local and remote alarms, and alert assigned people and groups.

Unit enclosed in metal box with door,

Door with temp display, alarm status, Alarm mute, and lock.

* + - * 1. Reuse existing personal emergency alarm, ensure local buzzer and lights. Shut down refrigeration system upon activation.
        2. Clean cold room prior to turnover to the University.
        3. Design Builder may elect to replace the cold room boxes in their entirety, so long as the replacement cold rooms provide the items in Section 6.1 and comply the Campus Standards and specifications. If cold room boxes are replaced in their entirety, install stainless steel shelving with seismic lip and provide same utilities in new cold room as existing.
      1. Access Requirements During Construction
         1. Construction, testing, and commissioning activities for activities in this Alternate shall be completed within scheduled interruptions of no more than 15 consecutive business days per room. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of cold room down-time.
         2. Any activities required to fully complete the work outside of the allocated downtime (e.g. programming, punch list, insulation, etc.) shall be completed between the hours of 9:00 pm and 9:00 am or on weekends.
      2. Hazardous Material Abatement
         1. Abate hazardous materials from materials that are removed or otherwise affected by this Alternate's activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
      3. Design Requirements
         1. See Part 10 of the DPP, Scope of Work, for design deliverables and the Campus Standards.

1. ALTERNATE NO. 2
   * + 1. Mechanical Room Equipment Replacement
          1. Replace and upgrade existing equipment in the mechanical room 149 as follows:

Heating Hot Water Converters: Replace steam to heating hot water converter with two new converters providing N+1 100% configuration. Converters shall be sized for building loads with new airflows resulting from base bid scope of work, and produce low-temperature condensate to maximize heat transfer from steam system. Original converter was 155 GPM and 3.1 MMBTU/hour converter, controls, appurtenances, insulation, and connect to steam and heating hot water systems. Replace existing steam to heating hot water control valve with a digital control valve. Replace existing isolation butterfly valves with gate valves complying with specifications at the converters and pumps.

Heating Hot Water Pumps: Furnish and install new heating hot water pumps complying with Campus Standards and sized for the new equipment using heating hot water. Replace hot water pump variable frequency drives. Connect controls and commission new drives and pumps. Furnish and install differential pressure sensors at the roof and floors necessary for control; implement hot water differential pressure reset based on zone demand. Replace air separator with new separator complying with specifications and Campus Standards

Domestic Water Generators: Demolish and dispose of existing domestic water natural gas boilers and tank. Install new domestic hot water tank with double-wall tube bundle for converting steam to domestic hot water, instead of using natural gas to make domestic hot water as currently configured. Controls may be direct-digital complying with specifications or Accritem using laboratory air. Connect tube bundle to steam system and provide controls, mixing valve, and appurtenances required for a fully functional system, including condensate return system. Tube bundle thermal capacity shall meet or exceed current gas-fired domestic hot water system capacity.

Pressurized condensate return: Demolish and replace the existing steam-powered condensate draining system and replace with low-NPSH 210°F code condensate station located in ground or on slab surface. Heat exchangers and domestic water tank shall use the new condensate station and be co-located to the maximum extent possible. Demolish 100psi piping from existing system back to main riser point of connection and cap.

Chemical pot feeder: Replace chemical pot feeder. Replace chemical pot feeder piping with new piping and configuration complying with campus standard details.

Vacuum pumps: Replace vacuum pumps with new dry screw or dry claw vacuum pumps of equivalent size. Existing tank to remain.

Laboratory air compressors: Replace air dryer with new heated desiccant dryer. Dryer shall be sized only for the existing laboratory air compressor capacity and not oversized.

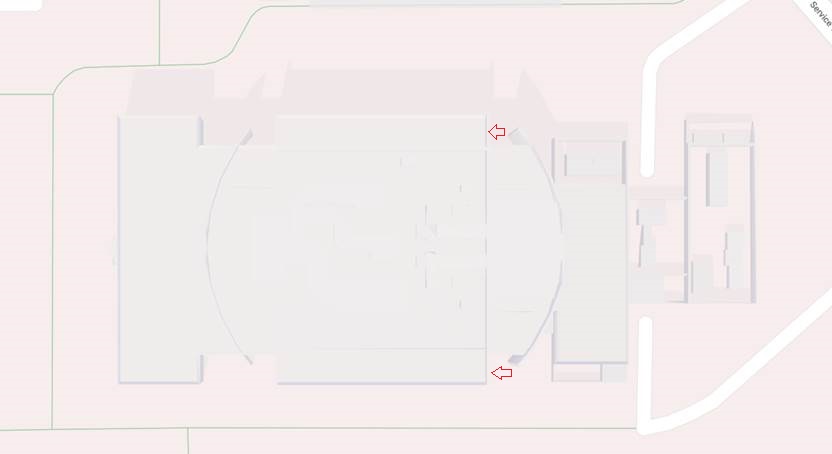
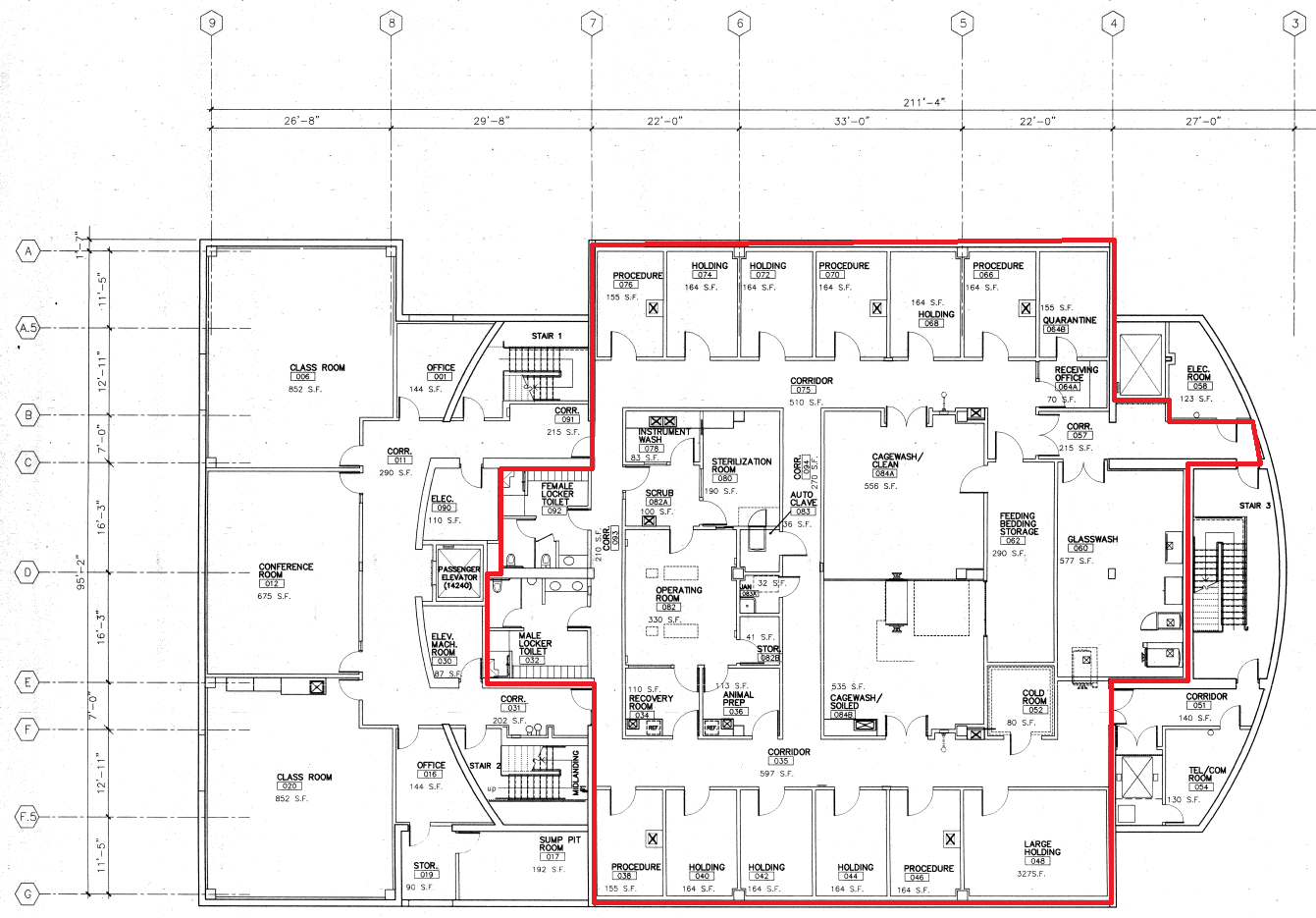
Steam metering: Furnish and install new steam flow meter to meter incoming steam from the UCI Medical Center boiler plant. Steam meter shall be pressure compensated, capable of 20:1 turndown, and be physically located within mechanical room 149. Provide reduced-bore metering section or steam meter with integrated flow conditioning to achieve required velocity and flow profile. Steam meter shall have a local instantaneous and totalizing display and be connected to the building automation system for remote monitoring.

Controls: Remove existing mechanical equipment building automation control systems and replace with new BACnet over ethernet/IP controllers complying with specifications. New controllers shall control heating hot water heat exchangers, heating hot water pumps, and domestic hot water tank and circulating pump, and receive inputs from the sensors required to adequately control and monitor this equipment. Furnish and install new digital sensors for air compressor discharge pressure and status, vacuum pump system pressure and status, and regenerating dryer status.

Insulation: Reinsulate existing steam heat exchanger and appurtenances. Remove existing insulation at steam regulating station and reinsulate. New insulation shall comply with Title 24 except where removable blankets are installed. Provide removable insulating blankets meeting campus requirements for valves and strainers. Do not insulate steam traps.

Include replacement of existing control valves, shut-off valves and appurtenances in the mechanical room for the new equipment.

* + - * 1. Sizing of the equipment shall use current Campus Standards sizing criteria for design temperatures, fouling factor, pressure drop, etc.
      1. Access Requirements During Construction
         1. Construction, testing, and commissioning activities for activities in this Alternate shall be completed in such a manner that minimizes down-time. Scheduled interruptions shall be no more than five consecutive business days per piece of equipment and scheduled with two weeks advance notice to University's Representative. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of equipment down-time.
      2. Hazardous Material Abatement
         1. Abate hazardous materials from materials that are removed or otherwise affected by this Alternate's activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
      3. Design Requirements
         1. See Part 10 of the DPP, Scope of Work for design deliverables, and the Campus Standards.

1. ALTERNATE NO. 3
   * + 1. Interior Lighting
          1. Upgrade Floor 1, 2, 3, and basement lobby interior lights to improve light distribution and overall appearance. Existing lobbies are underlit, resulting in a dark and gloomy environment. Refer to University Furnished Information for lighting audit sheets with existing fixture count and fixture type and conditions.
       2. Exterior Lighting
          1. Provide two new exterior lights near building exist doors as indicated on the plan below. New fixtures shall be Hubbell Series 55 wallpacks to match other existing fixtures at Building 55. Provide fixtures with motion sensors and photocell controllers complying with specifications. Motion sensors and photocells shall be factory-mounted and integrated into the fixture frame.
          2. 
       3. Conference Room 212
          1. Existing roller shades on the west windows of Conference Room 212 no longer function. Repair or replace roller shade system and replace shade controller located on the south wall with a shade controller that controls each shade individually.
          2. Existing accordion doors for Conference Room 212 are damaged. Repair or replace accordion doors and provide a fully functional folding door system.
       4. Access Requirements During Construction
          1. Construction, testing, and commissioning activities under this Alternate must be completed within the 15 days allocated per phase in the base bid. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of laboratory down-time.
       5. Hazardous Material Abatement
          1. Abate hazardous materials from materials that are removed or otherwise affected by Alternate No.3 activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
       6. Design Requirements
          1. See Part 10 of the DPP, Scope of Work, for design deliverables and the Campus Standards.
2. ALTERNATE NO. 4
   * + 1. Building Security Upgrades
          1. Upgrade existing Istar Pro security panels to Istar Ultra. Existing security panels are located in room B54 (4 ports available), 146 (1 port available), and 248 (7 ports available).
          2. Furnish and install new multiclass card readers at the entrance from each stairwell into the building except the rear stairwell on Floor 1. Furnish and install new multiclass card readers at the corridor entrance to each elevator (passenger, freight) on Floor 1.
          3. Upgrade existing card readers to multiclass readers.
          4. Upgrade existing camera system to NVR, including new cameras and a new video recorder system installed in Building 55. Current building-wide system is HDVR. Integrate NVR camera system with C-Cure 9000 security system.
       2. Access Requirements During Construction
          1. Construction, testing, and commissioning activities for activities in this Alternate shall be completed in such a manner that minimizes down-time. This work may be completed on straight time provided it does not interfere with access to the building. Work inside the elevator shall be completed within three business days for each elevator, with at least two weeks advance notice to the University prior to beginning the outage. Only one elevator may be under construction at any time. Develop and submit a construction phasing sequence plan to allow coordination of equipment down-time.
       3. Hazardous Material Abatement
          1. Abate hazardous materials from materials that are removed or otherwise affected by this Alternate's activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
       4. Design Requirements
          1. See Part 10 of the DPP, Scope of Work for design deliverables, and the Campus Standards.
3. ALTERNATE NO. 5
   * + 1. Basement Flooring Replacement
          1. Replace flooring in all vivarium spaces. New flooring shall be a resinous MMA-based flooring system suitable for a vivarium with 8" cove base height.
          2. Rooms affected by this scope of work are basement rooms: B32, B34, corridor B35, B36, B38, B40, B42, B44, B46, B48, B57 (partial), B60, B62, B64A, B64B, B66, B68, B70, B72, B74, corridor B75, B76, B78, B80, B82, B82A, B82B, B83, B83A, B84A, B84B, B92, and corridor B94. See Figure below:
          3. 
       2. Access Requirements During Construction
          1. Construction, testing, and commissioning activities under this Alternate will be granted an additional 10 days per phase beyond the base bid. Flooring installation under this Alternate shall be scheduled adjacent to or coinciding with interior vivarium construction and the whole-building shutdown to the maximum extent possible. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of vivarium down-time.
          2. Large fixed equipment such as cages and holding pens will be removed by UCI in advance of flooring work.
          3. Large cage washing equipment cannot be feasibly moved; provide flooring up to edge of equipment. Provide flashing, caulking, or other method to prevent water from getting under equipment and new flooring.
       3. Hazardous Material Abatement
          1. Abate hazardous materials from materials that are removed or otherwise affected by this Alternate's activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
       4. Design Requirements
          1. See Part 10 of the DPP, Scope of Work for design deliverables, and the Campus Standards.

**PART 8A –** ALTERNATE NO. 6

8A.1 Centralized Demand Control Ventilation

Furnish and install centralized demand control ventilation to reduce minimum existing six (6) air changes per hour (ACH) to 4 ACH when occupied and 2 ACH when laboratory is unoccupied. Provide dual (PIR/microphonic) technology motion sensors to reduce laboratory airflow control valves when unoccupied. Ultrasonic motion sensors are prohibited. Provide a Facilities Monitoring System (FMS) to sample air quality at a maximum of every fifteen minutes and, if total VOCs are exceeded, signal HVAC controls to increase airflow to maximum CFM setpoint until VOC’s are displaced and indoor air quality limits are maintained. Demand control ventilation system shall sample temperature, relative humidity, total VOCs, and particulates. The University has identified rooms that are eligible for reduced air changes; these rooms are indicated on a floor plan and a room list is provided as University Furnished Information.

Provide emergency exhaust override that increases ventilation to maximum when activated. Provide local display units that display information about the space to users such as airflows, occupancy status, and temperature. Provide room pressurization monitoring. In lieu of a separate emergency exhaust overrides, pressure monitors, and local display units, Design Builder may provide those features on a single device.

8A.2 Access Requirements During Construction

* + - * 1. Construction, testing, and commissioning activities under this Alternate must be completed within the 15 days allocated per phase in the base bid. Develop and submit a construction phasing sequence plan and prepare written switching procedures to allow coordination of laboratory down-time.
      1. Hazardous Material Abatement
         1. Abate hazardous materials from materials that are removed or otherwise affected by Alternate No.6 activities. Refer to University Furnished Information for a hazardous materials testing report on where hazardous materials are located.
      2. Design Requirements

See Part 10 of the DPP, Scope of Work, for design deliverables and the Campus Standards.

* + - 1. Priority of Bid Alternates
         1. Alternate No. 6 is the University’s highest priority alternate, followed by alternates 1 through 5 in numerical order.

1. DESIGN CRITERIA
   * + 1. SITE CONSTRUCTION
          1. Site Description: The University of California, Irvine Medical Center is located in the City of Orange, California. The campus is bound by Chapman Avenue on the north, Interstate 5 on the east, Service Way and Dawn Way on the south, and The City Drive South on the west.
          2. Any electricity or water required shall be acquired from the existing campus utilities. Design Builder shall provide electric sub-meter for trailers and water meter to measure the electricity and water used during construction activities. University will bill for electric and water usage monthly. Utilities used inside the building will not be charged.
          3. Upon completion of project laydown area and hardscape and landscape areas damaged by construction of this project shall be returned to better than original materials and plantings. New plants shall be drought tolerant in accordance with Green and Gold Plan and approved prior to purchasing.
       2. EXTERIOR MATERIALS AND SYSTEMS
          1. Roof Systems:

The roofing system shall be a single-ply membrane system and shall extend over all mechanical equipment pads prior to the placement of the stainless steel cap and flashing assembly. The system shall be installed over tapered insulation of thickness complying with code. The existing roof plan shows basic components which will require further verification and coordination as to the quantity, size and configuration of elements on and items penetrating the roof system.

Building components penetrating the roof system, such as roof drains, electrical conduit, and mechanical ductwork and piping, shall have lead flashing and lead counter flashing with a stainless steel clamp band and sealant. Specific flashing details shall be developed based on the current Sheet Metal and Air Conditioning Contractors’ National Association’s (SMACNA) Architectural Sheet Metal Manual. This flashing is deliberately an addition to the standard detail for the typical single-ply roofing based on the University’s experience with single-ply roofing and is a requirement.

Provide stainless steel caps over concrete curbs and underneath air handling units and exhaust fans. Metal clad self-sealing roofing products (i.e. Sarnaclad, or equal) are also acceptable.

The roofing system shall terminate at the parapet with a prefabricated surface-mounted reglet and spring lock counter flashing. The reglet is to be installed at a constant elevation above the roof surface. The elevation shall be based on the highest point of the roof at the parapet, plus a minimum of 8”. The continuous elevation shall be determined and clearly shown on the drawings.

The roof systems shall take into consideration the removal and replacement of same without destroying or bending the metal counter flashing system.

Roof system valleys shall be a minimum of 18” away from roof penetrations or directional changes.

Specific Roof System Design Criteria:

Parapet sheet metal assemblies shall be of a spring lock counter flashing with a surface mount receiver and sealant. Inside and outside corners shall be pre-manufactured and one piece.

Roof penetrations shall be circular and follow the recommendations of SMACNA. (See Figure 4-14C) for all penetrations 2” or larger. The base flashing shall be 4 pound lead with a 4” flange minimum. The multiple pipe penetration (see 4-14A) shall be of lead base flashing, structural support as required, and a 4-pound cap.

Pitch pockets are prohibited for any use.

Structural concrete columns shall be flashed similar to a pipe penetration, and shall have an 8” flange minimum.

Equipment pads shall be a minimum of 8” above the roof. The roofing shall overlap the pad and run flat over the pad with a minimum of three plys, prior to the placement of the stainless steel metal cap. The minimum 22-gage 316 stainless steel cap shall cap over the edge and turn down not less than 4 inches. Water shall drain away from the top of all equipment pads and equipment. Ensure that the cap does not deflect and create a puddle when equipment is placed on it. This may require slightly crowning the pad. This requirement is difficult and shall be met and demonstrated.

Flashing expansion and contraction joints shall be at 10’-0” on center maximum and 2’-0” each side of the pre-manufactured corners. Joints shall have covers and back-up plates type J5, per SMACNA. Type J1 through J4, shall not be used.

f. Provide walking pads around all sides of existing remaining and new mechanical and electrical equipment and roof drains. Provide walking pads from roof access to every piece of equipment that must be maintained.

* + - 1. INTERIOR MATERIALS AND SYSTEMS
         1. Ceilings

No hard ceiling access panels shall be allowed. Access shall be through accessible ceilings. Written approval by the University’s Representative is required only if that is impossible and an access panel must be installed.

Any existing ceiling damaged by the work of the project shall be repaired with materials to match existing.

* + - * 1. Walls

Existing walls if removed to allow construction to proceed or damaged during construction shall be repaired to match existing materials and as follows.

Fixed elements shall be structurally supported. Coordinate and provide structural bracing to meet equipment or casework needs.

Dry walls shall be terminated with ‘J’ molding at all dissimilar materials or wall terminations. Corners shall have corner beads.

* + - * 1. Specific Interior Systems

The laboratory areas shall be designed with spill control as defined in the California Building Code. The intent is to not allow a spill to traverse from one level to another. Steel sleeves extending 4” above the floor level are required for floor penetrations. A 4” high concrete curb is required at shafts, and existing piping floor penetrations and new penetrations not receiving steel pipe sleeves.

* + - 1. STRUCTURAL DESIGN AND SYSTEMS
         1. General

The Design Builder shall design, engineer, and construct a complete structural system if required for the new mechanical equipment being placed on the roof. As a minimum, a California registered structural engineer shall review the existing construction and provide calculations documenting that the existing structure can support the system.

Close coordination of the mechanical and electrical systems and the structure is required and support or pads shall be constructed to reduce vibration into the building or structure.

Concrete pads on the roof shall be doweled into the existing concrete. Refer to Campus Standards and Master Specifications.

* + - * 1. Live loads (for loads not listed, see the California Building Code [CBC])

Roof loads: 20 psf (reducible per CBC)

At roof top mechanical: Perform structural analysis on existing roof structure to determine roof structure can safely hold the new mechanical equipment, new roof insulation, and new roofing material. This shall include the code minimum live load. If additional supports are required, they shall be provided as part of the contract. Note that original roof and floor live loads are listed in the 1999 Original Documentation drawing S0.01 provided as University-furnished information.

* + - * 1. The seismic design for mechanical equipment support and mechanical and electrical materials shall be based on both the dynamic and static lateral force procedures prescribed in the current CBC.
        2. Equipment anchorage shall comply with ASCE 7-10 Chapter 13. Detailed dynamic analysis is not required if ap and Rp values are used per Table 13.6-1.
        3. Provide seismic and wind anchorage with an importance factor of 1.0, as this is a Risk Category II building per 2016 CBC section 1604.5.
        4. Miscellaneous Structural Components

Provide calculations for anchorage of mechanical, electrical and plumbing distribution systems and fixed items, in accordance with the CBC. Show details on the appropriate discipline or on the structural drawings.

* + - 1. LABORATORY DESIGN CRITERIA
         1. Provide as needed a complete design, including installation and start-up of all laboratory furnishings including but not limited to fume hoods, fixtures and fittings, laboratory and controlled temperature rooms.
         2. Submit seismic calculations and details for environmental room installations.
         3. Light fixtures shall be oriented to be parallel to and above the front edge of the lab benches to prevent shadows from being cast on benchtops
         4. Fume hoods shall be of the variable air volume (VAV) type or converted to VAV by sealing existing bypass. Hoods shall exhaust with constant face velocity depending on the sash location. Provide occupant zone presence motion sensors on VAV fume hoods to detect occupant directly in front of hood. Motion sensors shall allow reduction of face velocity from 100 fpm to 60 fpm when hood is unoccupied.
         5. Minimum fume hood airflow shall be the greatest of the following three at each height from fully closed to fully open:

25 CFM per sq. ft. of work surface.

100 fpm face velocity occupied.

60 fpm face velocity unoccupied.

* + - * 1. Condensate lines from evaporators in the environmental rooms and walk-in freezers shall be run down inside the wall to the existing point of connection. The condensate lines shall not be exposed except where existing.
      1. NOISE CONTROL
         1. Noise control requires specific attention to design and construction details, especially in mechanical and electrical systems. New systems provided shall consider noise as discussed in this section; parts of the existing building would not comply with these requirements. The following features shall be addressed in the design of the mechanical and electrical systems:

Fan noise transmitted to spaces through the duct system or through the building structure. This noise is characterized by a low-frequency rumble and often includes pure tones.

Noise generated by air flowing past dampers, terminal device louvers, and comprising mid-to-high frequency energy.

Noise generated by the excitation of duct wall resonance produced by fan noise, by pressure fluctuations caused by fan instability, and by high turbulence caused by discontinuance in the duct system.

Water circulation system noise caused by high velocities or abrupt pressure changes, which is generally transmitted through structural connections.

Leakage at existing joints in existing supply and exhaust ducting.

Noise and vibration generated by the normal operation of fans, pumps, compressors, etc. Noise and vibration caused by out-of-balance forces need not be considered.

Air handling units shall have built in sound attenuators in lieu of duct silencers.

Provide sound testing and vibration recordings for HVAC equipment.

* + - * 1. Special design precautions are required in certain areas to maintain a high level of sound and vibration isolation. For example, conduits shall not directly link noise-sensitive spaces, nor shall they mechanically bridge vibration-isolated building elements using a rigid connection. Flexible conduit must be used for connections to isolated floor slabs, walls, and vibration-isolated mechanical/electrical devices. Duct silencers shall be considered when duct distance is not sufficient to provide adequate acoustical separation, or if low frequency noise is a concern and other options have been considered and found unacceptable.
        2. The background noise criterion (NC) is a measure of the noise that shall not be exceeded by building mechanical, electrical and plumbing systems to achieve acceptable ambient sound levels for various space uses. Noise Criterion (NC) curves are used to describe acceptable noise environments for a variety of functional areas. The standard family of NC curves has been in use for years, and may be found in the “Sound and Vibration Control” Chapter of the HVAC Applications Handbook published by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
        3. The following internal noise criteria from mechanical services shall be followed for new equipment.

Laboratories: NC50 (measured at a workbench within 12-feet of a fume hood with sash closed).

Laboratory Support Areas: NC50

Open offices and Office Support Areas: NC35

Offices: NC35

Conference Spaces: NC30

* + - * 1. Selection of Equipment to Meet the Noise Criteria

Mechanical and electrical equipment shall be selected to ensure noise output characteristics consistent with the noise criteria. For equipment located in mechanical or electrical rooms or on the roof, the distance between the source and receiver as well as the nature of the intervening structures shall be taken into account in evaluating the acceptability of the noise output of each piece of equipment. For ducted equipment such as fans, air handling units, fan-coil units, VAV boxes, etc., the inlet, outlet and casing- radiated sound power levels shall be considered. Noisier equipment selections will require increased structure around them as well as enhanced sound attenuation measures – sound attenuation, duct/plenum lining, etc. – to satisfy the noise criteria.

Special attention shall be paid to the selection of equipment to be located in the ceiling plenum, including, but not limited to VAV boxes, fan-coil units, fans, air-handling units and air recirculation devices. Radiated noise from such equipment is often the controlling factor in achieving the required noise levels in the occupied spaces below. Air handling and fan units shall not be located in ceiling spaces.

Air diffusers, grilles and registers shall be selected and sized to meet the required noise criteria. Low NC requirements for certain rooms may require special measures to limit self-noise at diffusers, grilles and registers.

Fan air volume control shall be achieved by means of variable frequency drives. Inlet air guide vanes and other methods which may increase noise while decreasing air volume are not permitted.

Sound traps shall be avoided wherever possible due to pressure drop inefficiencies from sound traps in the airstream.

Sound-attenuating devices, including sound traps, acoustical louvers, duct, plenum and equipment room liners, acoustical flexible ducting etc. shall be designed to meet the required noise criteria when used in conjunction with the other mechanical and electrical system components. Sound traps shall be selected and sized for adequate insertion loss and for appropriately low pressure drop, taking the manufacturer’s pressure drop multipliers for any non-ideal conditions (proximity to bends, fans, take-offs etc. and open inlet or discharge) into account. Duct sound traps are prohibited if provided at ductwork size. Sound trap shall be furnished inside air handling units or when used in ductwork shall be twice the normal duct size or larger to provide low pressure drop and shall be installed with more than minimum requirements by sound trap manufacturer.

Where existing slab-to-slab partitions occur for sound isolation, ducts shall penetrate only those partitions that have doors in them; penetration of “solid” partitions (no doors) shall be avoided. Where it is truly impossible to avoid penetrating a solid partition, sound attenuating material (such as acoustical lining) or a crosstalk control device (such as a sound trap) shall be introduced into the duct sufficient to ensure compliance with the sound isolation criteria prescribed elsewhere in this section.

A direct duct connection to the underside of rooftop air handling equipment is allowed when sound attenuators are installed within the air handling units. Rooftop air handlers without sound attenuators shall have side duct connections with a sufficient length of ducting at the roof to accommodate the necessary in-duct attenuation.

Piping shall be sized for flow velocities consistent with the noise criteria. In addition, significant active plumbing piping shall be sized for maximum flow velocities of not more than 8 feet per second.

* + - * 1. Vibration Isolation

HVAC, electrical and plumbing equipment, piping, and ducting shall be isolated as necessary to meet the noise and vibration criteria.

Vibration isolation systems shall be provided on rotating mechanical equipment greater than ½ hp located within the critical area, greater than 5 hp elsewhere in the building, and greater than 10 hp outside the building within 200 feet of the building.

Special design consideration shall be given to the duct layout reducing noise transfer between rooms, especially noise generated by loud equipment or discussions in adjacent rooms.

Ducts of equivalent diameter less than 24 inches do not require isolation provided flow velocities do not exceed 1,200 feet per minute.

Building code requirements shall be met for seismic restraint parameters. SMACNA guidelines shall be followed for seismic restraint. For suspended equipment and piping, use slack aircraft cables or angle-iron braces for seismic restraint. Seismic restraints shall be all-directional type and shall not short-circuit vibration isolation devices.

Provide the signature of a structural engineer who is licensed in the State of California for seismic restraint calculations.

Isolators shall operate in the linear portion of their load versus deflection curves. The load versus deflection curve for each isolator shall remain linear over a deflection range of 50% above the design deflection.

Provide vibration isolation mounting frames and/or brackets of sufficient strength and stiffness to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

Provide UL listed, fire-retardant and airtight flexible connectors for sheet metal ducts. Clear width shall be 6 inches not including clamping section.

Provide flexible pipe connectors with flanges.

Engage manufacturer to provide technical supervision and certification of installation of vibration control products.

* + - * 1. Installation Practice

Comply with manufacturer’s instructions for installation and load applications to vibration control materials and isolation supports. Adjust to ensure that vibration isolation supports have the correct static deflection, do not bottom-out or coil-bind under loading and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.

Use recommended methods as outlined in the current editions of the ASHRAE Handbooks.

As necessary, use special noise and vibration control methods as outlined in "A Practical Guide to Noise and Vibration Control for HVAC Systems", published by ASHRAE.

Install a 5-foot (maximum) length of flexible acoustical duct between diffusers and grilles in occupied spaces.

Gaps around duct penetrations in ceiling or floor slabs or walls shall not exceed 1 inch and shall, at a minimum, be filled with 1.5 lb/cf fiberglass insulation to full depth a sealed from both sides with acoustical sealant. Enhanced penetration sealing/closure methods may be required in areas where a high level of sound isolation (NIC value) is required.

Pipe penetrations of slabs and walls shall be sleeved with a 25 gauge (minimum) metal sleeve protruding at least 2 inches from the slab or wall on either side. The sleeve shall be tight fitting in the wall and sized to allow a gap all around the pipe of not less than 1 inch and not more than 2 inches. The gap between the pipe and the sleeve shall be in filled with 1.5 lb/cf fiberglass insulation to full depth and sealed from both sides with acoustical sealant. No rigid contact is permitted between the pipe and the slab or wall or sleeve. Additional sound control measures may be required in areas where a high level of sound isolation (NC value) is required.

Where pipes or ducts penetrate the exposed roof slab, waterproof flashing shall be provided.

In any case where ductwork forms a sound leakage path between private or sound-insulated space provide crosstalk attenuation in the form of a sound trap or additional acoustical lining to maintain the required sound isolation rating.

* + - 1. HEATING, VENTILATION AND COOLING (HVAC) SYSTEMS
         1. General Requirements

Provide design, engineering, installation, start-up testing, adjusting and balancing and commissioning of a complete operational HVAC system. HVAC criteria may appear in other Sections throughout this document. Review complete documents and comply with the requirements. Conflicts shall be reported to the University’s Representative for resolution.

RFP is intended to describe the basic methodology of the project. Any indicated sizes, quantities and capacities are minimum requirements are based on schematic design calculations. The Design Builder shall confirm final sizes, through detailed calculation which are submitted to University for review and approval. Specifications herein identify minimum levels of quality, materials and workmanship that are to be followed without exception.

* + - * 1. Design Criteria

Climatic design parameters shall be as follows:

|  |
| --- |
| **Climate Data – UCI Medical Center** |
| Location:           City of Orange, California |
| California Climate Zone:      8 |
| Latitude:                                   33.6 |
| Elevation:                                 194 ft. |
| *External Design Conditions* |
| Summer: |
| Dry Bulb:                             99°F db |
| Coin. Wet Bulb:                    70°F wb |
| Daily Range:                        27°F |
| Cooling Tower Design:          72°F wb |
| Winter: |
| Dry Bulb:                             33°F |
| Moisture level:                      10 Grains/lb of dry air |

Laboratory and auxiliary spaces shall be considered a “critical facility." Special humidity control is not necessary for this building.

Building envelope shall be determined based on record drawings and any modifications made by this project.

Building Hours of Operation shall be 24 hours for laboratories and lab auxiliary rooms. Offices and administration areas hours shall be 8 AM to 6 PM Monday through Friday.

Occupancy (Unless otherwise noted below in specific requirements)

|  |  |
| --- | --- |
| Space | Basis |
| Laboratories | 100 ft2/person |
| Lab Support rooms | 1 person per room for <100 SF & above 200 ft2/person >100 SF |
| Conference Rooms | Room C100J- 10 persons, C240B- 8 persons, any others 20 ft2/person |
| Offices | 100 ft2/person |
| Lobbies, Foyers | 250 ft2/person |
| Corridors, hallways & toilets | zero |

Internal Heat Gains

|  |  |  |
| --- | --- | --- |
| Space | Lighting load | % gain to return air |
| Laboratories | 1.2 Watts/ft2 | 0 |
| Meeting Rooms | 1.0 Watts/ft2 | 0 if ducted and 20% if RA plenum |
| Offices | 1.2 Watts/ft2 | 0 if ducted and 20% if RA plenum |
| Lobbies, foyers | 0.8 Watts/ft2 | 0 if ducted and 20% if RA plenum |

These are lighting budget numbers only, actual heat gain from lighting shall be determined from lighting audit or by the electrical engineer if new LED lighting is provided.

Miscellaneous Internal Heat Gains

| Space | Load | Notes |
| --- | --- | --- |
| Research Laboratory | 5 Watts/ft2 |  |
| Auxiliary lab rooms | 12 Watts/ft2 | Refer to University Furnished Information for rooms identified as Auxiliary. |

The equipment heat gain listed above shall be the basis of design. Calculations shall include air handling unit fan motor heat if motor is in air stream.

Research laboratories are defined as those laboratories with exterior exposures.

Auxiliary lab rooms are the interior building lab spaces located between the exterior zone research labs.

Spaces with additional internal heat gain equipment such as autoclaves shall use the internal heat gain stated by the equipment manufacturer.

Design-builders may propose reducing room internal heat gain if the Engineer of Record determines it is too large. UCI will work with the Design Builder if adjustments are necessary.

Ventilation Requirements:

Ventilation shall comply with California Building Code, ASHRAE Standard 62 latest editions and Campus Standards.

Laboratories & Laboratory Support Areas: Laboratory wing shall be exhausted 100%, returning no air to the air handlers. Exhaust shall be through fume hoods or the general laboratory exhaust.

Data/Telephone equipment rooms: Minimum three air changes exhaust per hour unless room has electronic equipment, in which case the minimum requirement is to maintain 90°F in room.

Fume exhaust systems (Note: branch duct and air valve shall be sized for sash at full height position, not 18 inches.) Main duct and exhaust fans shall be sized on based on the following:

Eight foot fume hood with sash at 18”= 1200 CFM

Six foot fume hood with sash at 18”= 900 CFM

Five foot fume hood with sash at 18” = 750 CFM

Four foot fume hood with sash at 18”= 600 CFM

Snorkel, constant volume = 100 & 200 CFM

Other fume hood sizes shall be calculated for a minimum required velocity of 100 fpm over the wide-open sash for any hood. Ensure sufficient exhaust capacity at each hood to provide this velocity.

The following tabulates the quantities of fume hoods and snorkels. Design-Build team shall confirm number and sizes during site investigation phase:

| **Room No.** | **Fume Hood size/quantity** | | | |
| --- | --- | --- | --- | --- |
| **3’** | **4’** | **5’** | **Notes:** |
| 136 |  | 1 |  | Variable air volume |
| 142 |  | 1 |  | Variable air volume |
| 162 |  | 1 |  | Variable air volume |
| 180 | N/A | | | Linear (Slot) Exhaust, Constant air volume |
| 236 |  | 1 |  | Variable air volume |
| 242 |  | 1 |  | Variable air volume |
| 262 |  | 1 |  | Variable air volume |
| 274 |  | 1 |  | Variable air volume |
| 336 |  | 1 |  | Variable air volume |
| 342 |  | 1 |  | Variable air volume |
| 362 |  | 1 |  | Variable air volume |
| 374 |  | 1 |  | Variable air volume |
| 380 | N/A | | | Linear (Slot) Exhaust, Constant air volume |

The following tabulates the quantities of ducted biosafety cabinets. These shall be converted to recirculating, non-ducted type. Design Build team shall confirm number and sizes during site investigation phase:

| **Room No.** | **Biosafety Cabinet quantity** | |
| --- | --- | --- |
| **Count** | **Notes:** |
| B38 | 1 | Constant air volume |
| B46 | 1 | Constant air volume |
| B66 | 1 | Constant air volume |
| B70 | 1 | Constant air volume |
| B76 | 1 | Constant air volume |
| 140 | 1 | Constant air volume |
| 166 | 2 | Constant air volume |
| 170 | 1 | Constant air volume |
| 368 | 1 | Constant air volume |
| 370 | 1 | Constant air volume |

* + - * 1. Future Capacity and Diversity

Design of the Laboratory air handling systems and exhaust fan systems shall include, and not limited to, fume hoods, and systems sufficient to comply with University campus requirements to meet peak airflow and cooling conditions. This shall include the supply, return, relief, and exhaust air for both the Laboratory and Office portions of the building. Diversity shall only reduce equipment sizing in accordance with Campus Standards. Ductwork and airflow (CFM) to each space shall be based on total load without diversity.

The basis of design shall include variable air volume valves and motion sensors on VAV fume hoods to reduce face velocity from 100 fpm to 60 fpm when hoods are unoccupied. This allows the Design Builder to use diversity in sizing the capacity of the Laboratory supply and exhaust fan systems. This diversity shall be a maximum of 10% (assume all fume hoods occupied).

Ductwork air leakage and heat loss factors shall be added to suit design conditions and actual installation. Provide for heat gain in supply air ductwork exposed on roof or installed in unconditioned spaces.

Allowance for morning warm-up shall be included for office systems.

Pressure relationships: The Laboratory area shall be negative to the Office areas and the outside environment. Offices shall be positive to the outside environment. Design-builder shall individually determine pressure relationships in the vivarium with regard to clean side, dirty side, holding rooms, etc.

Fire pressure requirements: In the event of a fire, shut down the associated air handler and leave the exhaust fans running, provided that less than 30 lbf is required to open any egress door. If field testing determines that greater than 30 lbf is required, air handlers shall run at a reduced speed such that less than 30 lbf is required.

Building Calculations: The following outlines the calculation steps for the Laboratory Building mechanical equipment. The equipment size shall be determined based on the highest CFM of the following three calculations:

Supply airflow required to offset each room’s load at the time of the building’s peak block load as determined by heat gain calculations.

Minimum air changes per hour required for the spaces.

Minimum exhaust airflow shall be per code at 1 CFM per square foot or the following, whichever is greater.

Exhaust airflow of fume hoods and ventilated cabinets, etc. Fume hood exhaust shall include the additional proposed future fume hoods at maximum CFM with sash at 18” open and without any diversity for variable airflow. Add 100% of exhaust CFM for the ventilation cabinets and any other exhausts to calculate the total exhaust air. Any locations, ductwork, sub-outs, etc. shown on the original drawings for future fume hoods shall be included as future fume hoods.

* + - * 1. Energy Conservation: The requirement is for the Design-Builder to pursue an energy conscious design. Design-builder shall aggressively pursue maximum energy savings within the constraints of the existing building.
        2. The University requires the inclusion of the following energy conservation measures in the design if applicable to the project:

Office AHU shall be designed to provide not less than 20 CFM of outside air per person at design occupancy. Control minimum outside air for office AHU with CO2 sensors to provide outside air by measuring the level of CO2 in the building.

Variable volume air systems shall be used.

Provide electronic speed control. Inlet guide vanes, inlet cones, discharge dampers, inlet dampers, etc. for control of fan volume are prohibited.

Fume hoods shall be VAV and use occupancy zone sensors to instantly provide 100-fpm face velocity upon an occupant walking up to fume hood. After a timed period without an occupant being within reach of the fume hood, the face velocity shall be reduced to 60-fpm.

Reduced coil and filter face velocity design for low air pressure drop to save fan horsepower year round.

Design ductwork for low velocity, with efficient fittings, transitions, and routes designed for low pressure drop.

Two-way valves for coils with variable pumping systems using a variable frequency drive.

Supply air temperature and static pressure resets for supply and exhaust systems based on zone voting.

Each zone valve shall either have differential pressure hardware sensing differential pressure across the valve to validate positional feedback, or a flow station that reports measured airflow. All values must be reported to the building automation system through the local controller.

* + - * 1. System Description

General

The Laboratories shall be served by dedicated air handling system.

The Offices and the Office support areas and conference rooms shall be served by a separate air handling system or may be combined with lab AHUs provided the return air is sent back to AHU and office areas can be isolated by control dampers to shutoff airflow at night and weekends.

Laboratory Air Handling Units

The Laboratory VAV air-handling unit(s) shall supply 100% outside air in a blow-through arrangement. System shall contain two separate units of the following minimum components; supply air fans, motorized fan isolation dampers, chilled water cooling coils, filter section, sound attenuators (if required) and vibration isolators. Units shall be installed with isolation dampers to allow maintenance on one fan with the other still in operation.

Each Laboratory shall have a supply air valve and reheat coil, supply air diffusers, registers, exhaust grilles, general exhaust air valve, and fume hood exhaust air valves. These shall provide individual temperature control based zoning and maintain pressurization appropriate for each space as determined by the engineer of record.

Supply air shall run continuously to provide makeup air to fume hoods except during loss of normal electrical power. On loss of normal power, the units shall restart on standby power.

Smoke and/or fire dampers shall be provided in the supply air ductwork as required by CBC or DCFM. Where supply air duct does not have fire dampers existing two-hour rated shaft, provide motorized fire-smoke dampers.

Laboratory Exhaust

Lab exhaust shall be designed to be adaptable to changes of research protocols and building operations as much as possible. The systems shall be designed to be easily modified so that ventilation can be provided to new sources of hazards as they might appear in the Laboratory.

A combination of fume hood/general exhaust system allows maximum flexibility as fume hoods can be interchanged with general exhausts. The combined general exhaust also increases dilution of the exhaust air within the duct system thus, adding to the safety of the system.

Fume Hoods shall be tested and certified in accordance ANSI Z9.5 for fume hood containment using test method in ASHRAE Standard 110 after the new exhaust fans are installed. The University's consultant will perform the ASHRAE 110 testing.

Office Air Handling Unit

The Office building VAV air handling unit shall contain the following minimum components in a blow-through arrangement: supply air fan, chilled water cooling coil, low pressure drop filter section, return air fan, sound attenuators, outside air economizer, outside air, return and relief dampers and vibration isolators.

VAV terminal air units shall provide zoning with hot water coils for space heating. Define zones by exposure and usage with a maximum of three exterior rooms and four interior rooms on each terminal unit. Usage must be similar to be combined. Retaining existing thermal zoning in office spaces is acceptable. Conference rooms, seminar rooms, training rooms, labs, etc. shall have individual zone controls. Terminal units shall be connected to lighting motion sensors so that if all spaces in the zone are unoccupied then the terminal unit shall close to minimum position after a 30 minute time delay. Wall temperature sensors shall override motion sensors should temperature in the space rise to 80°F. Heating CFM shall not be the minimum CFM and shall be based on heating CFM required for the space with a 20% pickup factor.

* + - * 1. Air Filtration: 12-inches thick low pressure drop filters in 24”x24” modules only, MERV 14. Pressure drop 0.28-inches W.C. at 2,000 cfm. Include 1.25-inches W.C. in fan static for dirty filter.
        2. General Exhaust

Replace existing toilet exhaust fan.

* + - * 1. Exhaust Fans

Exhaust fans shall be AMCA Single-Width, Single-Inlet, Arrangement 8, direct-drive fans with IEEE 841 motors on VFD complying with campus standards and master specifications and mounted on concrete curbs. Exhaust system shall be minimum N+1 design with fans serving a common rooftop plenum, each sized for one-half the exhaust air requirement or other amount determined by the Design Builder that provides the University with the most energy efficient system and one fan being standby. Belt driven equipment is prohibited. Use a combination of variable air volume for fan speed controls and bypass dampers to maintain a constant suction pressure and to maintain exhaust discharge velocity.

Exhaust fan plenum shall include an outside-air bypass damper if required by wind study performed. Bypass damper shall operate only at minimum flow conditions or other conditions as determined by the wind study and shall not operate continuously. For a tight control, size outside air bypass for maximum pressure drop in the exhaust system. Provide manual opposed blade dampers at bypass damper for adding pressure drop if needed. Oversizing this bypass will compromise control of the system.

* + - * 1. Insulation – New installations and existing systems affected by the work of this project such as supply and return ductwork exposed to unconditioned spaces, chilled water supply and return piping, steam piping, heating water supply and return piping, domestic and industrial hot water supply and recirculation piping, and steam piping and equipment shall be insulated.
        2. Ductwork System

Construction of ductwork shall be in accordance with SMACNA latest edition except as modified in Division 23 and for the appropriate duct pressure classification. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances. Base duct pressure classification on the maximum pressure the fan can produce at the maximum speed the fan can operate with the motor fitted.

Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. Longitudinal seams shall use Pittsburgh lock. Button punch snap lock is prohibited. Internal reinforcement of ducting is prohibited. Provide heavier gauge and sufficient external reinforcement to avoid any internal reinforcement. Run outs to grilles, registers or diffusers on exposed ductwork shall be the same size as the flange outer perimeter on the grille, register, or diffuser.

To achieve acceptable concentration levels and desired concentration rates, the exhaust system shall combine and mix exhaust volumes from multiple uses.

Return air system shall be ducted in shafts, above ceilings and non-conditioned spaces. Return air plenums are prohibited in laboratory areas.

Ductwork Accessories - Provide a manual volume damper in the ductwork upstream of a terminal unit or air valve to reduce entering air pressure and sound level for the unit. This is extremely important for terminal units and air valves closer to the AHU and sensing a higher duct system pressure.

Duct Liner: shall be used only on a limited basis where required by the acoustical consultant and after approved by the University’s Representative. Supply air duct mains shall be provided with exterior duct insulation even if installed with duct liner.

* + - * 1. Terminal Units - Terminal units with reheat coils shall be provided with an access door. Internal liner shall be covered with suitable material to avoid degradation of the liner.
        2. Lab Air Valves - Laboratory airflow control system components shall be the products of a single manufacturer for single point responsibility, Accutrol, Phoenix Controls Corporation, Siemens Industry, or equal.
        3. Grilles, Registers and Diffusers

Air distribution within the Laboratories is critical. Supply diffusers shall be positioned such that air discharge does not affect the operation of the fume hoods.

The terminal velocity shall not exceed 50 fpm at 2 feet from the face of any fume hood and 50 fpm at 6 feet above the floor.

Spaces without fume hoods shall use a 2’x2’ module aerodynamically formed face panel.

Diffuser shall not include volume dampers.

Return grilles shall be 2’x2’ to lay-in T-bar ceilings, with 45° angled blades.

Exhaust grilles shall be 45° angle blade types.

* + - * 1. Controls

A direct digital control (DDC) BACnet control system shall be engineered and provided for the mechanical systems. Stand-alone modules shall control air handlers, pumps, etc. A common data highway shall link the modular controllers. Large valve and damper actuators shall be high-torque 24-volt, 120-volt, or 3-phase industrial-grade electric actuators. Large dampers are considered economizer dampers larger than 5 sq. ft., supply air or exhaust air isolation dampers of any size, and valves with flow rates greater than 50 gpm. 24V actuators with torque ratings in excess of the damper requirements are acceptable; if selected and installed actuators are insufficient, the Design Builder will be responsible for increasing actuator torque at their own cost. Stacking actuators is prohibited. Splitting dampers into smaller sections does not mitigate these requirements and is unacceptable.

Laboratory Control Systems - The design of the lab control system shall maintain a safe working environment for the users. A closed-loop tracking system shall be provided. The control system shall include features to enable control of the following:

Supply and exhaust variable air volume.

Supply and exhaust offset based on lab use requirements.

Laboratory pressurization based on lab use requirements.

Pressure independent variable volume hood exhaust.

Room temperature control.

Laboratory Sequence of Operation:

As the static pressure in the exhaust and supply duct systems fluctuate, the laboratory air flow control valve shall modulate to maintain a fixed set-point air volume within one second.

As each fume hood’s sash opening increases or decreases, the sash sensor signal to the related fume hood monitor shall change proportionally. A sash sensor and monitor are mounted on each fume hood. Affected laboratory air flow control valves shall have one-second response time to new air volume setpoint.

With an operator at the VAV fume hood, the fume hood occupancy sensor shall detect the operator and shall send a signal to its associated fume hood monitor. This signal shall switch the monitor into its Standard Operation mode. Based on the combination of user status and sash position inputs, the fume hood monitor shall control its associated hood exhaust valve, thus maintaining a constant average face velocity at the fume hood opening (100 fpm).

When the operator walks away from the VAV fume hood and out of the fume hood occupancy sensor detection zone for a timed interval, a signal shall switch the monitor into its Standby Operation mode. Hood exhaust valve shall maintain a constant average face velocity of 60 fpm.

Each hood exhaust valve shall generate a feedback signal to the make-up air controller. The make-up air controller shall calculate the total hood exhaust volume from hood(s) exhaust valves and shall generate a total hood exhaust signal. The make-up air controller shall maintain a constant, adjustable net negative offset between the zone’s total exhaust and make-up air volumes. This offset shall not vary with changes in exhaust volume magnitude and represents the volume of air that enters the zone from the corridor or adjacent spaces. Labs shall remain negative to the corridor even in the event of a fire.

On a rise in lab temperature, the electronic thermostat or DDC controller shall send a thermal demand signal to the make-up air controller. This signal shall be proportionate to the supply air volume required to condition the lab. The make-up air command signal shall be generated by comparing the minimum ventilation setting, the make-up air for hood demand and the scaled thermal demand signals, and selecting the highest of these three.

The make-up air controller shall generate a signal to control the zone’s general exhaust valve. Signal shall equal the difference between make-up air and total hood exhaust; in addition, the room offset and constant supply and support supply volumes. Open the general exhaust valves when additional volume is required to maintain zone pressure. Should hood exhaust volume increase, the make-up air controller shall decrease the general exhaust valve.

The lab thermostat or DDC controller shall control the reheat coil.

When the differential static pressure across each hood exhaust valve drops below the valve’s minimum operating differential static pressure, the differential pressure switch shall open, causing the fume hood monitor to generate an audible and visual flow alarm. Upon a valve jam condition the monitor shall generate a flow alarm.

Fail-safe condition for exhaust valves shall be their maximum mechanical limits and the supply make-up air valves shall fail to their minimum mechanical limits.

* + - * 1. System Start-Up, Testing, Adjusting & Balancing - The work includes system start-up, test, adjust, and balance (TAB) of HVAC air and water distribution systems including equipment, ducts, piping and controls for the project. Include integration with the Campus centralized control system.
        2. Commissioning: Design Builder shall assist, work closely with, and cooperatively deliver a fully commissioned and functional system to the satisfaction of the University.
      1. PLUMBING SYSTEM
         1. Provide design, engineering, installation, and testing plumbing systems required for the project, including demolition.

Provide other plumbing modifications as necessary for the work as part of the project.

Existing roof drains demolished shall be installed concurrently to avoid the building not having a working roof drainage system at any time during construction.

* + - 1. FIRE SUPPRESSION SYSTEM
         1. This project does not involve installation of a fire suppression system. Where existing fire suppression systems are encountered, provide engineering, design, and construction of any modifications required by the work of this project. Design the system in conformance with the 2016 California Building Codes, NFPA-13, 14, and 24.
      2. ELECTRICAL SYSTEM
         1. Power system: Use existing circuits and/or conduits to the greatest extent possible to minimize disturbance to the occupants. Confirm existing wire sizes in the field prior to engineering new power circuits. Demolish existing and provide new power circuits for mechanical and electrical work provided by this project where required. No aluminum wiring shall be used or reused if found.
         2. Main electrical circuits and electrical panelboards shall only be shut down when adequate notice has been given to the University’s Representative as per contract requirements, and written acceptance has been issued by the University's Representative.
      3. FIRE ALARM SYSTEMS
         1. Fire Alarm System - existing addressable (multiplex) fire alarm system shall be protected and remain in operation during construction. If system needs to be turned off for any length of time a fire watch shall be provided.

Coordinate with University’s Representative if existing area smoke detection or heat detectors need to be turned off or covered to allow construction without having a false alarm.

Existing audio/visual alarm stations or pull stations shall remain and shall be relocated if blocked by work of this project.

* + - * 1. The fire alarm system shall shut down the office air handler in case of fire alarm signal. If the space that detected the fire is in a laboratory or laboratory air handler, the lab air handlers shall also be disabled. The fire alarm system shall also be connected to the sprinkler flow switches and valve supervisory switches. The fire alarm system is already connected to sprinkler flow switches and valve supervisory switches.
      1. PRODUCTS
         1. Products, equipment, materials, supplies, etc. are specified in Divisions 01 through 33.
      2. EXECUTION
         1. Design shall be in accordance with Scope of Work in the RFP and construction execution shall be in accordance with Division 01 through 33.