APPENDIX C BUILDING SYSTEM CRITERIA

C.1 Applicable Codes and Guidelines

The code review presented below is intended only to highlight currently applicable code issues and should not be construed as a complete review of all the codes. The Architect is responsible for verifying code issues to ensure compliance with all relevant aspects of the code, since regulations are subject to change.

1. 1998 California Building Code, or most recent edition
2. 1998 Title 24 California State Energy Code, or most recent edition
3. 1998 California State Mechanical Code, or most recent edition
4. 1998 California State Fire Code, or most recent edition
5. 1996 National Electrical Code
6. NFPA 45, 90, 90A and 91, or most recent edition
7. 1996 UCR Campus Design Guidelines - Volume I & 2
8. 1999 UCR Environmental Health and Safety Design Guide
9. ANSI Standards
10. ASME Guidelines and Standards
11. ASHRAE Design Guidelines
12. SMACNA Design Guidelines
13. AIHA Guidelines and Standards
14. CAL/OSHA, current regulations
15. Requirements for State Fire Marshal
16. Uniform Plumbing Code, [UPC] current edition
17. Uniform Mechanical Code, [UMC] current edition
18. Americans with Disabilities Act

All other local and state codes and the University of California, Riverside standards will be adhered to where applicable and available.

C.2 Occupancy Designation

The building is proposed as a business occupancy "B" for use as a teaching and research laboratory facility. The program for the building includes offices, research laboratories (dry), teaching laboratories and university classrooms. The general assignment instructional spaces and the large Seminar Room will fall within the assembly occupancy classification Group A-3 which is defined as; "Any building or portion of a building having an assembly room with an occupant load of less than 300 without a legitimate stage, including such buildings used for educational purposes and not classified as a group E or Group B Occupancy". Each of these designations should follow standards

for construction materials, allowable floor area, building height, fire-rating for occupancy separations, the protection of penetrations between spaces and exiting requirements.

Occupancy	Separations
B to A3	None

C.3 Construction Type

The following table presents the maximum allowable height and floor area for EBU2, per the California Building Code construction types & occupancies. Table 6-A of the California Building Code provides additional information regarding the specific fire resistive requirements of building components for each construction type. The maximum allowable area for this site assumes increases in basic allowable area for multi-story buildings, 100% increase for a fully sprinkled building, and a 100% increase for

Based on California Building Code Chapter 5 and Table 5-B

B-Occupancy

Construction Type	Allowable Height	Basic Allowable Area	Maximum Allowable Area
I	Unlimited	Unlimited	Unlimited
II FR	160 ft, 12 stories	39,900	159,600 (1)
II One Hour	65 ft, 4 stories (2)	18,000	144,000 (1) (3)

(1) Includes allowable increase for multiple floor (x2), sprinkled (x2)
(2) Design exceeds allowable height
(3) Includes allowable increase for 40 ft. sideyards (x2)

A-2 Occupancy

Construction Type	Allowable Height	Basic Allowable Area
I	Unlimited	Unlimited
II FR	160 ft, 4 stories	299,000
II One Hour	65 ft, 2 stories	13,500

due to side yard separations.

Allowable Area Tables
The assumption for the purposes of this DPP is that EBU2 is of Type II-FR construction.

When a building houses more than one occupancy, the area of the building shall be such that the sum of the ratios of the actual area for each separate occupancy divided by the total allowable area for each separate occupancy shall not exceed one.

C.4 High Rise Requirements

Group B occupancies having floors used for human occupancy more than 75 feet above the lowest level of the fire department vehicle access are classified as high-rise buildings. High-rise buildings are required to be Type I or Type II-FR construction, to have automatic sprinkler protection and required to meet all the requirements of California Building Code Section 403. These requirements include smoke detection, smoke control, pressurized exit stairs with vestibules, fire alarm and communication system, a central control station for fire department operations, elevator lobbies, and stand-by-power, light and emergency systems.

For the purpose of this DPP it is assumed that EBU2 is not of high rise construction.

C.5 Architectural Criteria

The following list contributed to the evaluation of the architectural criteria:

1. Applicable building codes
2. UCR planning standards
3. Campus group issues
4. Specific site planning criteria
5. Specific building concept criteria

For the purpose of this DPP it is assumed that there a lobby design will not require the criteria for an Atrium as described in CBC Section 402 for Atria.

ACCESSIBILITY

All occupancies shall be fully accessible as required by the California Building Code [CBC], Chapter 11. All building designs will conform to the Uniform Federal Accessibility Standards, #795, April 1, 1998.

Accessible sanitation facilities in all occupancies shall be provided as required in Chapter 11 of the CBC and the Division of the State Architect/Access Compliance requirements of the California Plumbing Code.

Entrances, ramps, stairs, corridors, sidewalks and walks shall provide accessibility as specified in Chapter 11 of the CBC.

Employee and faculty work areas shall be accessible by means of a 36” minimum aisle width and a 32” minimum clear opening door width, as specified in Chapter 11 of the CBC.

C.6 Systems Descriptions

The purpose of this section is to provide an outline of the intended scope for each of the primary building systems under the general categories of Structural Engineering, Mechanical Engineering (including building plumbing), and Electrical Engineering. Each discipline is described in the following narratives:

C.6.1 Structural Criteria

The structural system shall be designed based on the following criteria:

1. Governing Building Code: 1998 California Building Code , or the latest State of California Title 24 Building Code in use at the time of design. Consideration should be given to incorporating the seismic provisions of the 2000 International Building Code.

2. Design Live Loading:

Dry Laboratories	100 psf, fully reducible
Offices	100 psf, fully reducible
General Storage	125 psf, non-reducible
Circulation Areas	100 psf, non-reducible
Assembly Areas	100 psf, non-reducible

3. Vertical Vibration Criteria: For the purpose of this DPP, the suggestion for the vibration velocity not to exceed 5,000 micro inches per second is maintained. This criteria should be confirmed with the College during the design phase when the usage and equipment is finalized.

4. Seismic Design: Per the latest governing code, **I=1.15**, in occupancies in excess of 500 students. **Seismic Zone 4**.

C.6.2 Structural Systems Descriptions Concepts

The structural design for the EBU2 should provide a building system that will integrate the program and functional requirements for the space layout. The design should also provide for an integration of building services, and allow for the desired architecture while meeting current building code requirements.

The building is currently planned as a Type II FR structure, and as such, consideration should be given to either a structural steel or reinforced concrete structural system. Both systems could be configured to meet the functional and vibration requirements for the program. Final selection of the system may be driven by current market conditions, architectural considerations, or cost evaluation. For purposes of this DPP and costs, a structural steel system has been assumed.

The preliminary geotechnical report indicates a presence of fill soils within the area of the site that the building is planned. As such, a deep foundation system consisting of drilled, cast in place concrete piles supporting a series of interconnected pile caps is recommended. A mat foundation is also mentioned for consideration; however, the possibility for mat rotation must be considered (see geotechnical report for details). The

slab on grade requires that three feet of soil beneath the slab be removed and recompacted prior to slab placement. Please note that the geotechnical report utilized as the basis for the DPP will require an update to confirm the prior recommendations due to the age of the preliminary report.

Reinforced concrete systems and structural steel systems could be configured which would satisfy the project program goals. The following should be considered when assessing the viability of each system:

REINFORCED CONCRETE SYSTEMS

Advantages:
- Additional mass assists in vibration control
- System is sufficiently stiff to mitigate vibrations
- Minimal lead time for obtaining materials
- Possibility of reducing the floor-to-floor heights required

Disadvantages:
- Added mass adds load to lateral force resisting system
- Speed of construction
- Potentially less flexibility in renovations/future penetrations/future concentrated loading

STRUCTURAL STEEL SYSTEMS

Advantages:
- Speed of erection
- Flexibility for future renovations/penetrations/concentrated loading

Disadvantages:
- More difficult to configure a system with a mass and stiffness which will meet vibration requirements
- Mill ordering structural steel is potentially a long-lead item
- Possible increase in required floor-to-floor heights

The lateral force resisting system should balance the need for maximizing seismic safety, and layout integrates functional and architectural considerations, and economy. Lateral force resisting systems that should be considered include reinforced shear walls, ductile concrete frames, steel concentric and eccentric braced frames, and steel moment-resisting frames. Some advantages and disadvantages to these systems are summarized in the following table:

Lateral Force Resisting System	Program Flexibility	Architectural Flexibility	Relative Cost	Structural Performance
Reinforced Concrete Shear Walls	Low	Low	Low	Adequate
Ductile Concrete Frames	High	High	High	Adequate
Concentric Steel Braced Frames	Medium	Medium	Low	Adequate
Eccentric Steel Braced Frames	Medium-High	Medium-High	Medium	Adequate
Steel Moment Resisting Frames	High	High	Medium	Adequate

Architectural and program flexibility, which is desirable for this building, can be achieved in all of the systems by configuring the lateral force resisting systems around the perimeter of the building.

Based on our understanding of the program and functional requirements for the building, any of the systems appear to be viable options. If the reinforced concrete shear wall or steel braced systems are pursued, care should be taken to locate these elements outside the laboratory zones to maintain program flexibility. These options should be studied in detail in schematic design.

Alternate vertical and lateral force-resisting systems that are responsive to architectural and functional needs should be studied and estimated in the schematic design phase.

C.6.3 Mechanical Criteria

APPLICABLE CODES, GUIDELINES AND STANDARDS

The latest edition of approved year of the following codes and combination codes and guidelines will govern the Mechanical Systems (wet and dry) and associated support system design. The systems will be designed to meet or exceed these standards.

AGA	American Gas Association Standards
AIHA	American Industrial Hygiene Association Guidelines and Standards (Latest Edition)
AMCA	Air Movement and Control Association, Inc. Publications 200, 201, 202 and 203 (Latest Edition)
ANSI	American National Standards Institute, Inc.
ANSI/ASME	B31.1 Code for Power Piping B31.2 Code for Pressure Piping B31.3 Code for Process Piping B31.9 Code for Building Services Piping
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers Handbooks (Latest Editions)
ASHRAE	Standard 62-1989 Ventilation for Acceptable Indoor Air Quality
ASME	American Society of Mechanical Engineers Guidelines and Standards
AWS	American Welding Society
CAGI	Compressed Air and Gas Institute
CAL/OSHA	California Occupational Safety Hazard Authority
CBC	California State Building Code (Uniform Code with CA Modification)
CCR	Title 24 California Code of Regulations
CFC	California Fire Code
CGA	Compressed Gas Association
CMC	California Mechanical Code
CTI	Cooling Tower Institute
DHHS	Guide for the Care and Use of Laboratory Animals (U.S. Department of Health and Human Services.)
FCI	Fluid Controls Institute

IAPMO	International Association of Plumbing & Mechanical Officials
IES	Institute of Environmental Sciences (RP-CC Series of Reports) as applicable (Latest Edition)
NAFA	National Air Filter Association Guide to Air Filtration (Latest Edition)
NEBB	National Environmental Balancing Bureau Standards
NFPA	National Fire Protection Association Guidelines and Standards - as applicable to project
SFM	California State and Local Fire Marshall
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. Guidelines and Standards (Latest Edition)
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc. or equivalent testing lab approved by UC Riverside

All other local and state codes and UC Riverside standards will be adhered to where applicable.

OUTDOOR DESIGN CONDITIONS

Summer, Riverside per UCR Design Requirements, design will be based on:

Dry Bulb Temperature	=	110°F
Wet Bulb Temperature	=	64°F

Winter, Riverside per UCR Design Requirements, design will be based on:

Dry Bulb Temperature	=	34°F

INDOOR TEMPERATURE AND HUMIDITY DESIGN CONDITIONS

The design conditions will be per UCR Facilities Design Guidelines. Final design criteria will be developed during detail design.

Office, Conference, and Administrative Support Areas

Dry Bulb Temp.	Summer:	75°F ± 2°F
	Winter:	71°F ± 3°F
Relative Humidity		No requirement

Lobby, Waiting and Reception Areas

Dry Bulb Temp.	Summer:	75°F ± 2°F
	Winter:	71°F ± 3°F
Relative Humidity:		No requirement

Server/Network Rooms

Dry Bulb Temp.	Summer:	71°F ± 2°F
	Winter:	71°F ± 2°F
Relative Humidity:		40% to 60%

Computer Centers (CCSE, CRIS, CCN)

Dry Bulb Temp.	Summer:	71°F ± 2°F
	Winter:	71°F ± 2°F
Relative Humidity:		40% to 60%

Instructional Labs, Research Labs and Lab Support

Dry Bulb Temp.	Summer:	75°F ± 2°F
	Winter:	71°F ± 3°F
Relative Humidity:		No requirement

Electrical, VDER, and Fire/Security Rooms

Dry Bulb Temp.	Year Round:	85°F
Relative Humidity:		No requirement

Unoccupied Spaces

Dry Bulb Temp.	Year Round:	65 - 95°F
Relative Humidity:		No control

Student Lounge, Interaction Areas

Dry Bulb Temp.	Summer:	75°F ± 2°F
	Winter:	71°F ± 3°F
Relative Humidity:		No requirement

Active humidity control will be provided for the server/computer rooms. The controlled minimum relative humidity listed above will be maintained within the server/computer rooms by infrared steam humidifiers. The maximum relative humidity within these rooms should not be exceeded due to moisture removal at the cooling coils.

HEATING AND COOLING LOADS

Internal

The loads for the mechanical system will be based on the following combined electrical and process loading for the various spaces:

Office, Conference, and Administrative Support Areas

Lighting	=	1.5 watts per square foot
Equipment	=	3 watts per square foot

Lobby, Waiting and Reception Areas

Lighting	=	1.0 watts per square foot
Equipment	=	0 watts per square foot

Server/Network Rooms

Lighting	=	1.5 watts per square foot
Equipment	=	*30/8 watts per square foot

*Assumes 50 kVA connected load in Server rooms with 25% of load realized as room heat gain. Assumes 12.5 kVA connected load in the Network rooms with 25% of load realized as room heat gain. Final equipment loading to be defined during design phase. Room area approximately 400 square feet.

Computer Centers (CCSE, CRIS, CCN)

Lighting	=	1.5 watts per square foot
Equipment	=	*10 W/sq.ft. in CRIS
		*20 W/sq.ft. in CCSE & CCN

*Assumes 100kVA connected load in Computer Centers with 25% of load realized as room heat gain. Final equipment loading to be defined during design phase. Room areas approximately 2,400 sq.ft. for CRIS, and 1,200 sq.ft. for both CCSE and CCN.

Instructional/Research Labs

Lighting	=	2.0 watts per square foot
Equipment	=	7.0 watts per square foot

Labs Support

Lighting	=	1.5 watts per square foot
Equipment	=	15.0 watts per square foot

Electrical, VDER, and Fire/Safety Rooms

Lighting	=	0.5 watts per square foot
Equipment	=	per equipment loads

Unoccupied Spaces

Lighting	=	0.5 watts per square foot
Equipment	=	0 watts per square foot

Student Lounge/Interaction Areas

Lighting	=	1.5 watts per square foot
Equipment	=	0 watts per square foot

Some of the spaces will have internal loads that exceed the values previously noted. The internal loading for these spaces will be determined based on the electrical and process requirements of the equipment to be located in these spaces.

Occupancy

The occupancy heat rejection will be as follows:

Sensible	=	255 Btuh/person
Latent	=	255 Btuh/person

The number of occupants in each space will be based on the actual occupant density listed in the facility program.

Infiltration

The building heat loss calculations will include an infiltration load based on 1.5 CFM of infiltration air per linear foot of exterior wall with windows and 1.0 CFM of infiltration air per linear foot of exterior wall without windows.

VENTILATION LOADS

The minimum ventilation rates and space classifications for each occupancy type will be as follows:

All Areas:

20 CFM outside air per person.

Office, Conference, Administrative and Lobby Areas

Occupied: Minimum air changes per hour as required by ASHRAE Standard 62-1999 for indoor air quality.

Instructional Labs/Research Labs

Occupied: Minimum air changes per hour as required by ASHRAE Standard 62-1999 for indoor air quality.

Toilets

Occupied: Minimum 10 air changes per hour.

The above values represent minimum values of space airflow for a particular occupancy type. Typical design airflow rates calculated to provide comfort heating/cooling for these areas exceed these minimums. Final airflow values and room air change rates to be determined during the design phase.

NOISE CRITERIA

The design will target the following average noise levels. These noise levels do not include noise from equipment or personnel located within these spaces. Actual noise levels may exceed the design noise levels due to the actual type of equipment purchased, installation compromises, workmanship, etc.

Conference Rooms:	NC = 25 - 35
Private Offices:	NC = 30 - 40
Open Offices:	NC = 40 - 45
Circulation Space, Lobby:	NC = 40
Server/Network Rooms:	NC = 50 - 55
Computer Centers:	NC = 50 - 55
Instructional Labs/Research Labs:	NC = 35 - 45

PRESSURE RELATIONSHIPS

Building:	Positive to ambient
Offices:	Neutral or positive to adjacent spaces
Toilet Rooms:	Negative to adjacent spaces
Corridors:	Neutral to adjacent spaces
Instructional Labs/Research Labs:	Positive to adjacent spaces

Pressure relationships will be maintained by offsets between supply and return/exhaust airflow rates.

INDOOR AIR QUALITY CONTROL METHODS

Indoor air quality will be addressed by three principal means:

- Filtration - 30-40% filters at all supply air handling units with space allocated for future charcoal filters.

- Minimum ventilation rates throughout the building as prescribed by ASHRAE Standard 62-1999.

- No fibrous media exposed to the airstream will be allowed in the ductwork downstream of any air handling unit's final filter bank. Sound attenuating flexible ducts at the diffusers will have woven nylon fabric type lining.

OUTDOOR AIR QUALITY CONTROL METHODS

Outdoor air intakes will be located to minimize cross-contamination between supply and exhaust air streams.

AIR HANDLING UNIT COMPONENT SIZING

Maximum allowable nominal face velocities for all air handling unit components are as follows:

Air Intake Louvers (thru free area):	800 FPM
Hot Water Coils:	600 FPM
Cooling Coils:	500 FPM
Filters:	500 FPM
Sound Attenuators:	700 FPM

DUCT SYSTEM DISTRIBUTION CRITERIA

Air velocity at occupied levels will be limited to:

General: 50 FPM

Supply Ductwork Sizing (based on diversified CFM)

From Air Handling Unit through Chase to Supply Main at each Floor:	0.1"/100' when <10,000 CFM; 2,000 FPM when >10,000 CFM
Supply Main to Air Terminal (AT) Device: (Duct size to AT device = AT inlet size within 15' of AT)	0.1"/100' when <10,000 CFM; 2,000 FPM when >10,000 CFM
Air Terminal Device to Supply Diffuser:	0.1"/100' when <8,000 CFM

Miscellaneous Ventilation Systems

All Ductwork:	0.1"/100' when <8,000 CFM; 1,600 FPM when >8,000 CFM

Miscellaneous Exhaust Systems

General Exhaust Ventilation:	0.1"/100' when <8,000 CFM; 1,600 FPM when >8,000 CFM

Sizing Deviations

Deviations from these criteria will be exercised as deemed necessary for proper air balancing, acoustic control, and duct routing space limitations.

ROOM AIR DISTRIBUTION

All Areas

Supply Diffusers:	Adjustable louvered face with OBD
Return Grilles:	Perforated face return grilles

Other Room Types

Linear bar grilles or ceiling diffusers as dictated by architectural design and desired performance.

PIPE SIZING CRITERIA

Preheat Hot Water, Heating Hot Water and Chilled Water

Minimum Velocity:	2.5 fps
Maximum Velocity:	10 fps
Maximum Pressure Drop (piping 1" and larger):	4 ft. per 100 ft.

SEISMIC CRITERIA

Seismic design will be based on NUSIG standards.

AIR HANDLING UNIT SIZING DIVERSITY

General

Airside diversity will be taken into account for variable air volume systems. Airside diversity will be applied to sizing the air handling units and other associated major equipment, but not applied to sizing any of the ductwork and diffusers. Care must be taken when selecting a diversity factor because if too much diversity is taken, the system will not operate properly and will not allow for future capacity requirements. If too little diversity is taken, first costs increase and system efficiency decreases. Therefore, diversity factors will be discussed with the Owner. Diversity can be broken down into component parts as shown below:

Solar Heat Gain Diversity

Solar heat gain diversity is normally considered on a variable air volume system, and will be included on this project during the DD and CD phases when a computer heat gain program is run to determine loads. This diversity considers that not all rooms will have peak airflows simultaneously due to changes in the position of the sun. East facing rooms will peak in the morning in August, west facing rooms will peak in the afternoon in August, and south facing rooms will peak in the afternoon in October. The building overall peak is normally in the afternoon in August, but this can vary depending upon building window quantity and orientation.

Equipment Heat Gain Diversity

Additional diversity will be taken for variable air volume heat gain driven rooms such as the computer based Instructional Labs and the Research Labs. Since not all labs will reach their design equipment heat gains simultaneously. A building overall equipment heat gain diversity multiplier of 75% will be applied during the DD and CD phase computer runs for all heat gain driven rooms.

C.6.4 Mechanical Systems Description

BUILDING CENTRAL AIR HANDLING SYSTEM

System Description

Engineering Building Unit 2 (EBU2) will be served by two or three equally sized variable air volume (VAV) custom factory-fabricated air handling units with 2" thick double walls. The actual number will be determined during the Schematic Design phase. The units will be manifolded together and will share a common discharge plenum. The supply air to all areas except the toilet rooms, janitor rooms and other such spaces will be returned to the units.

The air handling units will be designed as heating-cooling, single duct, reheat type to provide minimum outside air with a 100% outside air economizer on a variable air volume basis. Supply fans will be airfoil centrifugal plug type and return fans will be double inlet centrifugal cabinet or plug type. Variable frequency drives will provide supply and return fan volume control in response to a signal from a duct mounted static pressure sensors. Air handling unit and return fan speeds will be modulated simultaneously as required by building load.

The units will operate 18 hours per day, 5 to 6 days per week. For areas of the building with different schedules, damper(s) will be installed in the ductwork leading to those spaces. The building control system can then be programmed to close these dampers to isolate that space when unoccupied.

The supply distribution system will consist of medium-pressure externally insulated galvanized steel ductwork with pressure independent electrically actuated supply VAV or CV air terminal devices, reheat coils, low pressure externally insulated ductwork downstream of air terminals, and diffusers. Sound attenuators at the air terminal devices will not be provided. Instead, sound attenuating flexible ductwork with woven nylon fabric type lining will be provided at the supply diffusers to control noise.

Ductwork will be constructed in accordance with SMACNA standards and duct leakage shall not exceed 1% of the design volumetric flow rate for medium pressure ductwork and 2% for low-pressure ductwork. The use of sound attenuating flexible duct at diffusers and grilles will be limited to six feet in total length to minimize duct static pressure losses.

Equipment and Materials

The air handling units will be of powder coated galvanized steel construction. The units will consist of the following components:

- Space for future carbon filter.
- 40% efficient filter bank.
- Supply fan.
- Chilled water cooling coil.
- Discharge air sound attenuator.
- Isolation/smoke damper.
- Variable frequency drives to modulate fan airflows.
- Return fan.

Reserve Capacity and Redundancy

The building air handling system consists of multiple equally sized air handling units with multiple supply fans and multiple associated return fans. If one of the supply or return fans fails, the remaining fans will be able to provide at least 66% of the systems' design capacity.

SERVER/NETWORK ROOM AIR HANDLING SYSTEM

System Description

Independent Liebert type air handling units will serve the Server/Network rooms. These units will be located within the room with front return air and top discharge supply air ducted into the ceiling interstitial space for distribution.

If floor space within the room is not available for these units an option to mount an above ceiling fan-coil type unit could be considered. An appropriate floor to floor height should be reviewed for this option to insure proper space for installation and maintenance.

The Server/Network room air handing units will be designed as constant air volume, chilled water-cooled, electric reheat and infrared steam humidification type. City water will be provided to the infrared humidifiers. The units will operate 24 hours per day. The unit manufacturer provides unit controls.

The Server/Network rooms are expected to require cooling 24-hours per day. Ventilation air will be provided to these areas during normally occupied hours (18-hrs/day) as defined by the building HVAC schedule.

Equipment and Materials

The air handling units will consist of the following components:

- 30% prefilter.
- Chilled water coil.
- Electric reheat.
- Supply fan.
- Infrared electric humidifier.

Reserve Capacity and Redundancy

The Server/Network room air handling systems shall be designed with 10% reserve capacity. Each Server/Network room shall be served by two equally sized Liebert type units, sized for 60% of the load each. If one unit fails, the remaining unit will provide cooling to the space at a temperature above the standard setpoint. This will allow the users to maintain critical operations until repairs are made. One of the units will be served by emergency power.

COMPUTER CENTER (CRIS, CCSE, CCN) AIR HANDLING SYSTEM

System Description

Independent Liebert type air handling units will serve the Computer Centers. These units will be located within the room with front return air and top discharge supply air ducted into the ceiling interstitial space for distribution.

The Computer Center air handing units will be designed as constant air volume, chilled water-cooled, electric reheat and infrared steam humidification type. City water will be provided to the infrared humidifiers. The units will operate 24 hours per day. The unit manufacturer provides unit controls.

The Computer Centers are expected to require cooling 24-hours per day. Ventilation air will be provided to these areas during normally occupied hours (18-hrs/day) as defined by the building HVAC schedule.

Equipment and Materials

The air handling units will consist of the following components:

- 30% prefilter.
- Chilled water coil.
- Electric reheat.
- Supply fan.
- Infrared electric humidifier.

Reserve Capacity and Redundancy

The Computer Center air handling systems shall be designed with 10% reserve capacity. Each Computer Center shall be served by two equally sized Liebert type units, sized for 60% of the load each. If one unit fails, the remaining unit will provide cooling to the space at a temperature above the standard setpoint. This will allow the users to maintain critical operations until repairs are made. One of the units will be served by emergency power.

GENERAL EXHAUST SYSTEM

System Description

EBU2 will be served by one constant volume exhaust system for each stacked toilet service core. Each exhaust fan will be roof mounted centrifugal type in a weatherproof enclosure. The exhaust system will operate 18 hours per day, 365 days per year, interlocked to run at the same time as the main air handling units.

The low-pressure system will utilize galvanized steel exhaust ductwork throughout the building. Sound attenuators at the exhaust fan will not be provided. Instead, sound attenuating flexible ductwork will be provided at general exhaust grilles to control noise.

Equipment and Materials

The centrifugal exhaust fans will be of standard construction with bearings and motors in the airstream. Fans wheels will be belt-driven, and housed in spun aluminum housings with bug screens on the discharge. All exhaust ductwork will be of galvanized steel construction. Each exhaust system will consist of the following components:

- Backdraft damper at each fan inlet.
- Constant volume centrifugal exhaust fans.

Reserve Capacity and Redundancy

There will be minimal reserve capacity and no redundancy in the exhaust system.

(PLANT) CHILLED WATER (42°F) SYSTEM

System Description

It is assumed that water from the central plant will be available at this building, at adequate flow rate and temperature to handle the building's cooling load. This is to be verified during the schematic design phase. Chilled water temperature available from the central plant is 38°F to 40°F, but 46°F will be used for design. The return water delta T is 20°F (from 1999 UCR Guidelines).

Chilled water will be utilized in EBU2 for HVAC cooling, and as cooling water for condensers of server/computer room Liebert style units.

The chilled water system serving EBU2 loads will connect to the secondary distribution loop with a thermal bridge, with a two way valve on the chilled water supply line from the secondary loop controlled by a temperature sensor in the chiller water return line to the secondary loop. A cross connection between the building return and supply with a check valve allowing flow from the return to the supply will assure high temperatures (above 60°F) being returned to the secondary system from the building. The building pumping system will consist of two tertiary chilled water pumps. A two-way control valve will be provided at each point of chilled water use. Variable Frequency drives will vary the speed of tertiary chilled water pumps to maintain a preset minimum pressure differential in most remote loop of the system.

Equipment and Materials

The building chilled water piping system will utilize copper or threaded carbon steel for pipe up to 2" and welded carbon steel piping for sizes above 2". Pipe insulation will be rigid glass fiber. The system will include the following equipment:

- Base mounted, end suction, centrifugal tertiary pumps.
- Pump variable frequency drive for the tertiary chilled water pumps.
- Appropriate valving and piping specialties.
- Air removal device, expansion tank.

Reserve Capacity and Redundancy

EBU2 chilled water tertiary pumps will each be sized to provide 60% of the design HVAC chilled water flow. During normal operation both pumps shall run. Failure of any one pump will result in partial capacity to the building system from the remaining pump.

REHEAT SYSTEM

System Description

Heating hot water (HHW) convertors will utilize steam from the central utility plant to generate HHW to be used for reheating. The HHW system will be designed to generate water at 140°F for reheat coils and heating terminal devices with 90-110°F water being returned to the HHW heat exchangers.

The preheat/reheat water piping system will consist of a variable flow water loop. Two base mounted, variable volume pumps will be utilized for the water circulation. Each pump will be capable of providing 60% of the reheat system design flow. Variable frequency drives will be provided at the pumps to minimize system pressure fluctuations at varying flow conditions. Piping systems will be designed to maintain flow velocities between 1 and 8 feet per second.

Subcircuits will be selected for linear control characteristics of the terminal device and control valve combination. All major control and balance valves will be sized by engineering calculations for linear control.

A 10% sidestream water filter will be provided to remove debris from the piping system.

Equipment and Materials

HHW system will utilize copper or threaded carbon steel piping for pipe sizes up to 2" and welded carbon steel piping for sizes above 2". Pipe insulation type will be rigid glass fiber. The system will include the following equipment:

- Shell and tube steam to water convertors.
- Base mounted, end suction centrifugal pumps.
- Pump variable frequency drives.
- 10% sidestream water filter.
- Open tank expansion tank with airtrol fitting.

- Chemical pot feeder.
- Make-up water assembly.
- Appropriate valving and piping specialties.

Reserve Capacity and Redundancy

EBU2 HHW pumps will each be sized to provide 60% of the design HVAC reheat water flow. During normal operation both pumps shall run. Failure of any one pump will result in partial capacity to the building system from the remaining pump.

BUILDING AUTOMATION AND CONTROL SYSTEMS

System Description

The control of the HVAC systems will be performed by local Direct Digital Controllers (DDC) that will be integrated with a building automation and control system network. The campus standard for building automation and control systems is Johnson Controls, Metasys system, and this system is to be extended to EBU2.

Local DDC panels will be connected to sensors and control devices locally for the air handling supply and return units, the chilled water tertiary and computer room chilled water systems, and the heating hot water systems. It is expected that these local DDC panels will be connected to the network for reporting to a central monitoring point located outside the scope of this project. The local VAV boxes will be DDC controlled however it is not expected these will be connected to the network.

C.6.5 Piping Systems Criteria

APPLICABLE CODES, GUIDELINES AND STANDARDS

The latest edition or approved year of the following codes or combination codes and guidelines will govern plumbing systems, fire protection, and other piping systems design. The systems will be designed to meet or exceed these standards.

AGA	American Gas Association
ANSI	American National Standards Institute
ANSI/ASME	B31.1 Code for Power Piping
	B31.2 Code for Pressure Piping
	B31.3 Code for Process Piping
	B31.9 Code for Building Services Piping
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers Handbooks (Latest Editions)
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers Databook Guidelines
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CPC	California Plumbing Code
CFC	California Fire Code
FM(x)	Factory Mutual or Other Insurance Company as used by Client
IAPMO	International Association of Plumbing & Mechanical Officials
NFPA	National Fire Protection Association
UL	Underwriters Laboratories Inc. or equivalent testing lab approved by UCSD

NOISE CRITERIA

The design will target UCR standards or if none exists will use Chapter 37 of the ASPE Databook.

SEISMIC CRITERIA

Seismic design will be based on the National Uniform Seismic Installation Guidelines (NUSIG).

- The fire protection piping requiring seismic shall be installed following the non-insulated single hanger or trapeze supported piping methods listed in the NUSIG Guidelines.

- Equipment, mounted on isolators will be seismically braced using loose cables, telescoping pipes or box sections, angles or flat plates used as limit stops or snubbers, either integral to or separate from the isolators. Non-rotating, fixed equipment will be bolted directly to the floor or structure.

- The following piping will be braced unless hanger length is 6” or less:

- Gas piping 1" and larger
- All piping in mechanical rooms 1-1/4" and larger
- All piping 2-1/2" and larger

All pipe racks and vertical risers will be braced.

A seismic brace will be provided at a minimum of every second hanger where the hanger length exceeds 6".

Insulated and/or non-insulated system as applicable.

All other local and State codes and UCR standards will be adhered to where applicable and available.

C.6.6 Piping System Description

POTABLE HOT AND COLD WATER

System Descriptions

Potable hot and cold water will be provided for all toilet rooms, showers, and all other fixtures and devices that require a potable water supply. All building source water will extend from the existing campus distribution system located approximately 100' to the north of the northern end of Engineering Building Unit 2 (EBU2).

The building water distribution system will be isolated from the campus water supply by providing a duplexed reduced pressure principal backflow preventer (RPBP) at the water service entrance. Meter and service to within 5 feet of building will be provided.

Equipment and Materials

Duplex water to water semi-instantaneous double walled U-tube bundles heaters, each sized for 100% of total hot water demand for EBU2 will be provided to produce hot water at 140°F. A central mixing valve will be provided, adjacent to the water heaters, to reduce the 140°F potable hot water to 120°F. The 120°F system will serve showers, lavatories, kitchen sinks, etc.

The domestic hot and cold water distribution piping will be Type L copper with lead free soldered joints and wrought copper fittings. Piping will be sized for a maximum velocity of 8 feet per second. Hot water lines will be circulated via a circulation pump to maintain water temperature. Water conservation faucets and fixtures will be utilized to meet and/or exceed all required code minimums.

Cold water piping in mechanical rooms and other unconditioned spaces of facility will be insulated.

All domestic hot water piping will be insulated.

Reserve Capacity and Redundant Systems

The incoming duplex RPBP's will each be sized on 100% of the estimated peak demand flow.

FIRE PROTECTION

System Description

All areas of the building will be fully sprinklered by a total coverage hydraulically designed automatic sprinkler system. The building fire protection system will be supplied from the campus water system on site, approximately 100' to the north. The system will be designed in accordance with NFPA-13 and NFPA-14 guidelines.

Flow test information will be obtained during the Schematic Design Phase of this project.

Based on preliminary information, a fire water booster pump may be required to serve the building which is expected to rise to the 4th and 5th levels above ground.

The Machine/Computer Rooms will be served with a wet pipe sprinkler system as part of the building sprinkler system. No special systems or zoning is anticipated for these spaces.

Equipment and Materials

Piping for the sprinkler and standpipe systems will be Schedule 40 black steel with malleable iron threaded fittings. Other pipe materials and joints (i.e. Victaulic) can be used as allowed by NFPA-13 guidelines.

SANITARY WASTE

System Description

A sanitary waste and vent system will be provided for potable waste producing fixtures and equipment, with all fixtures trapped and vented to atmosphere.

The building sanitary waste system is anticipated to flow by gravity to the building exterior then flow to the existing campus site sanitary sewer point of connection, approximately 100' to the north of EBU2.

Equipment and Materials

Sanitary waste and vent piping above ground will be service weight hubless cast iron pipe. Below ground sanitary waste and vent piping shall be bell and spigot with push-on neoprene joints.

STORM WATER

System Descriptions

A storm water drainage system will be provided to convey rainwater from roof drains.

Building site storm water will be shown on Civil Drawings.

The building systems are anticipated to flow by to the existing campus storm sewer system point of connection, approximately 100' to the north of EBU2.

Equipment and Materials

Storm water piping materials will be similar to the sanitary waste system.

Reserve Capacity and Redundant Systems

Only the use of overflow roof drains will be considered a redundancy in the Storm Water Drainage System. Reserve capacity will not be provided for the storm and overflow drainage systems.

C.6.7 Electrical Criteria

Applicable Codes, Guidelines and Standards

The latest edition of approved year of the following codes or combination codes and guidelines will govern the Electrical Systems and associated support system design. The systems will be designed to meet or exceed these standards.

ADA	Americans with Disabilities Act Accessibility Guidelines
ANSI	American National Standards Institute, Inc
CAL/OSHA	California Occupational Safety and Health Administration
CCR	Title 24 California Code of Regulations Energy Commission
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
CEC	California State Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
SFM	California State and Local Fire Marshal
CBC	California State Building Code
UL	Underwriters' Laboratories, Inc. or equivalent testing lab approved by UCR

Compliance with other state, municipal codes and local jurisdictions will be applicable.

Conformance with Campus Design Standards will be applicable.

Conformance with equipment manufacturer's installation guidelines will be applicable.

LOAD CALCULATION CRITERIA

Design Voltages

Primary Voltage	-	12KV, 3 phase, 3 wire
Secondary Voltage		
Normal	-	480Y/277V, 3 phase, 4 wire
	-	208Y/120V, 3 phase, 4 wire
Emergency/Standby	-	480Y/277V, 3 phase, 4 wire
	-	208Y/120V, 3 phase, 4 wire

Design Loads

Overall Connected Volt-Amperes (VA) per Square Foot:

Admin. Support:		
Lighting	-	1.3
Receptacle	-	8.0
Atrium:		
Lighting	-	2.2
Receptacle	-	2.0
Center-CCSE:		
Lighting	-	1.8
Receptacle	-	100.0
Center-CCN:		
Lighting	-	1.3
Receptacle	-	10.0
Center-CRIS:		
Lighting	-	1.3
Receptacle	-	10.0
Classroom for 30:		
Lighting	-	1.6
Receptacle	-	25.0
Classroom for 60:		
Lighting	-	1.6
Receptacle	-	25.0
Conference/Seminar Room:		
Lighting	-	2.5
Receptacle	-	30.0

Conference Room-small:		
Lighting	-	1.3
Receptacle	-	5.0
Conference Room-large:		
Lighting	-	1.3
Receptacle	-	8.0
Copy/Supply/Mail		
Lighting	-	0.6
Receptacle	-	15.0
Corridors		
Lighting	-	0.6
Receptacle	-	0.5
Design Rooms		
Lighting	-	1.6
Receptacle	-	8.0
Electrical Rooms		
Lighting	-	0.7
Receptacle	-	0.5
Laboratory-Teaching		
Lighting	-	1.6
Receptacle	-	20.0
Laboratories-Research		
Lighting	-	1.6
Receptacle	-	20.0
Lecture Hall		
Lighting	-	2.5
Receptacle	-	30.0
Mechanical Rooms		
Lighting	-	0.7
Receptacle	-	0.5
Network Rooms		
Lighting	-	0.6
Receptacle	-	188.0
Office-Clubs		
Lighting	-	1.3
Receptacle	-	5.0
Offices-Dept Chair		
Lighting	-	1.3
Receptacle	-	5.0

Offices-Faculty		
Lighting	-	1.3
Receptacle	-	5.0
Offices-Honors		
Lighting	-	1.3
Receptacle	-	5.0
Offices-Post Doc		
Lighting	-	1.3
Receptacle	-	8.0
Offices-Research		
Lighting	-	1.3
Receptacle	-	8.0
Offices-TA		
Lighting	-	1.3
Receptacle	-	5.0
Resource/Reading Rooms		
Lighting	-	1.3
Receptacle	-	10.0
Restrooms		
Lighting	-	0.6
Receptacle	-	0.5
Server Rooms		
Lighting	-	0.6
Receptacle	-	125.0
Stairs		
Lighting	-	0.6
Receptacle	-	0.5
Storage Rooms		
Lighting	-	0.6
Receptacle	-	0.5
Systems Admin		
Lighting	-	1.3
Receptacle	-	8.0
Telecommunications Room		
Lighting	-	0.6
Receptacle	-	30.0
Workroom/Interaction		
Lighting	-	1.3
Receptacle	-	25.0

Equipment Sizing Criteria

Branch Circuit Load Calculations

Lighting	-	Actual connected load
Receptacles	-	180 VA per outlet
Surface Mounted Raceway	-	180 VA per outlet
Special Outlets	-	Actual connected load
Fixed Equipment	-	Actual connected load
Motors	-	125% of full load amps

Demand Factors

Lighting (continuous load)	-	125% of connected load
Receptacles	-	100% of first 10 KVA plus 50% of remainder
Fixed Equipment	-	100% of connected load
Specialty Outlets	-	100% of connected load
Motors	-	125% of largest motor plus 100% of all other loads

Minimum Bus Sizes

480Y/277V Lighting Panelboards	-	100A
480Y/277V Equipment Panelboards	-	225A
208Y/120V Receptacle Panelboards	-	225A
480V Motor Control Centers	-	600A

Distribution panels supplied from K-rated type transformers will have neutral bus sized at 200%.

Distribution panels and branch panelboards will be sized for a minimum of 20% future capacity and space availability.

Feeder Sizes

Feeders supplying to distribution panels will be sized the same as the distribution panel bus size.

Feeders supplying branch panelboards will be sized the same as the branch panelboard bus size.

Feeders supplied from K-rated type transformers will have neutral conductors sized at 200%.

Design Lighting Levels

Average Maintained Footcandles:

Admin Support	-	50
Atrium	-	50
Centers	-	50
Classrooms	-	50
Conference/Seminar Room	-	60
Conference Rooms	-	50
Copy/Supply/Mail Rooms	-	35
Corridors	-	20
Design Rooms	-	50
Electrical Rooms	-	35
Labs-teaching	-	60
Labs-research	-	60
Lecture Hall	-	60
Mechanical Rooms	-	35
Network Rooms	-	35
Offices	-	50
Resource/Reading Rooms	-	50
Restrooms	-	20
Server Rooms	-	35
Stairs	-	20
Storage Rooms	-	20
Systems Administration	-	50
Telecommunications Rooms	-	35
Workroom/Interaction	-	35

Preliminary Space Requirements

Description	Conceptual Size	Location	Remarks
Main Electrical Room	28' x 40'	First floor Northeast location	Minimum of two entrances. Double doors and or removable louvers are advisable for equipment removal.
Electrical Distribution Rooms	12' x 16'	One per floor Centrally located Vertically stacked	Alternately, two 10' x 10' rooms can be provided per floor.
Emergency/ Standby Distribution Room	100 sf	First floor Northeast location	For Automatic Transfer Switches.
Fire Control Room	90 sf	Fire Department Building Access	Location to be approved by Campus Fire Marshall.
Main Telecom Room (MDF)	12' x 20'	First floor Northeast location	
Telecom Distribution Room (IDF)	10' x 12'	One per floor Centrally located Vertically stacked	Alternately, two 10' x 10' rooms can be provided per floor.
Network Rooms	80 sf	One per floor Centrally located vertically stacked	
Server Rooms	400 sf	Two rooms required Centrally located Vertically stacked	

C.6.8 Electrical Description

ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM - NORMAL

System Description

Engineering Building Unit 2 will be supplied from the existing campus underground 12KV primary distribution system. Two new 15KV feeders will be routed from an existing manhole #V-24 to the first floor main electrical room of EBU2. Existing manhole #V-24 is located northeast of the project site on the north side of North Campus Drive.

The 15KV feeders will be installed in a 5" PVC concrete encased ductbank with a minimum of 24" earth cover. Additional access manholes will be provided at approximately 400 feet and coordinated with site conditions.

The new 15KV underground feeders will supply a new double-ended secondary unit substation located within the first floor main electrical room of EBU2.

Electrical distribution equipment will be designed to utilize the following voltages:

480V, 3 phase, 3 wire	-	Motors 1/2 HP and larger
480Y/277V, 3 phase, 4 wire	-	Fluorescent lighting, large equipment
208Y/120V, 3 phase, 4 wire	-	Receptacles, specialized lighting, motors under 1/2 HP and smaller equipment

The secondary unit substation will be double ended and will consist of duplex 2-position load interrupter type switches, cast coil type transformers and low voltage distribution sections equipped with draw-out type circuit breakers. The distribution sections will be connected by a tie circuit breaker installed in the unit substation.

Each distribution section will supply 480Y/277V distribution panels, 480V motor control centers and 480V-208Y/120V dry type transformers. These transformers will feed 208Y/120V distribution panels and 208Y/120V branch panelboard located on each floor in electrical distribution rooms.

208Y/120V branch panelboards will be located in order to minimize installed branch circuit length. Branch panelboards supplying centers, teaching and research labs and conference/seminar rooms will be located within the space served. Additional branch panelboards will be located within floor electrical rooms generally on the same floor as the area served.

Motor control centers serving mechanical equipment will be organized and located within proximity to the equipment being served.

Transient voltage surge suppression will be provided in the unit substation and at all 208Y/120V distribution panels.

Equipment and Materials

Secondary Unit Substation

The secondary unit substation will be provided as a complete prefabricated assembly and will consist of 15KV duplex 2-position load interrupter switches equipped with distribution class surge arresters, cast coil type transformers and low voltage distribution sections equipped with draw-out type power circuit breakers. All unit substation bussing will be manufactured of copper.

Low voltage distribution sections will be equipped with 100% duty rated draw-out type power circuit breakers with time current shaping features and ground fault protection. Distribution sections will be provided with electronic metering and transient voltage surge suppression.

Distribution Panels

Distribution panels will be of dead front construction, totally enclosed in NEMA 1 enclosure and equipped with copper bussing. All distribution panels will be provided with molded case type main circuit breakers with solid state, true RMS reading trip unit. Feeder circuit breakers will be group mounted, molded case type with adjustable magnetic trip settings.

Branch Panelboards

All branch panelboards will be arranged for 42 poles and be equipped with copper bussing. Minimum panelboard interrupting capacities will be 10,000 AIC for 208Y/120V panelboards and 14,000 AIC for 480Y/277V panelboards. All branch panelboards will be equipped with main circuit breakers. All circuit breakers will be bolt-on, molded case type.

Dry Type Transformers

Dry type transformers will be air cooled, 3-coil, 2 winding type, with a minimum of (2) 2-1/2 percent taps above and (4) 2-1/2 percent taps below rated voltage. Transformers from 25KVA to 112.5KVA will be rated 115°C temperature rise above 40°C ambient and will be capable of carrying a 15 percent continuous overload without exceeding a 150°C rise in the same ambient.

Transformers above 112.5KVA will be rated 80°C temperature rise above 40°C ambient and will be capable of a 30 percent continuous overload without exceeding a 150°C rise in the same ambient. The top of the enclosure shall not exceed maximum temperature of 35°C above a 40°C ambient. Transformer windings shall be manufactured of copper.

Transformers supplying non-linear type loads will be of the K-rated type and equipped with electrostatic shielding and double sized neutral terminals.

Sound levels will not exceed:

-45 dB for 25-50KVA transformers

-50 dB for 51-150KVA transformers
-55 dB for 151-300KVA transformers
-60 dB for 301-500KVA transformers
-65 dB for 501-750KVA transformers

Motor Control Centers

Motor control centers will be factory assembled and will consist of motor control equipment and accessories such as individual motor starters, disconnect switches, molded case circuit breakers, motor circuit protectors, thermal overload devices, control power transformers, selector switches, pilot lights, control wiring terminal strips, etc. Motor control centers will be equipped with copper bussing braced for minimum of 65,000 amps RMS symmetrical.

Each individual motor controller will be equipped with a disconnect, control power transformer, primary and secondary control fuses, thermal overload devices with manual reset, auxiliary contacts, H-O-A selector switch, pilot lights, terminal strips, etc.

Each individual motor controller will be capable of being padlocked in the "off" position for safety purposes.

Reserve Capacity and Redundancy

All service and distribution equipment will be appropriately sized to supply the estimated demand load plus 20% spare capacity for future growth.

ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM - EMERGENCY/STANDBY

System Description

The building's emergency/standby distribution system will be supplied from a single diesel driven engine/generator set. Based on preliminary load information, the estimated size of the engine/ generator set is 600KW/750KVA.

For the purposes of this report, it is assumed that the diesel driven engine/generator set will be installed at an exterior location adjacent the building. It should be noted however that possibilities for an indoor location also exist. Further evaluation will be necessary during the project's subsequent design phases.

The University has expressed interest in the possibility of re-utilizing an existing engine/ generator set currently serving Bourns Hall. The existing engine/generator set is rated for 600KW/750KVA and will need to be relocated to accommodate construction of the new Engineering Building Unit 2. This concept introduces several important issues, which will require additional evaluation during subsequent design phases.

(1) Based on preliminary load calculations, it is unlikely that the existing engine/generator set will have adequate capacity to serve the new Engineering Building Unit 2 and existing Bourns Hall simultaneously. Based on the calculation 4va/sf x 1.2 future capacity, it is apparent that 100% of the proposed engine/generator set's capacity will be required to supply the new building.

(2) It is assumed that the existing engine/generator set is currently equipped with a single main line circuit breaker, which supplies the Bourns Hall emergency distribution system via a single underground feeder. In order to effectively serve both buildings, the existing engine/generator may have to be retrofitted to accommodate an additional line circuit breaker and underground feeder. If technically possible, this work will likely represent significant down time and will impact continuity of emergency electrical service at Bourns Hall. Modifications to engine controls and support equipment will also be necessary.

(3) Additional modifications to the existing Bourns Hall emergency distribution system must also be taken into consideration. Currently adopted codes have become more stringent regarding emergency/standby distribution system requirements. Compliance with current code requirements at Bourns Hall may require significant rework to the existing electrical distribution systems. This work will likely represent significant down time and will impact continuity of emergency electrical service at Bourns Hall.

Emergency Power (legally required)

480Y/277V, 3 phase, 4 wire	-	Egress and exit lighting Fire Pumps, Elevators
208Y/120V, 3 phase, 4 wire	-	Fire detection and alarm systems, Communication systems

Standby Power (not legally required)

480V, 3 phase, 3 wire	-	Motors 1/2 HP and larger
480Y/277V, 3 phase, 4 wire	-	Fluorescent lighting, large equipment
208Y/120V, 3 phase, 4 wire	-	Receptacles, motors under 1/2 HP, small equipment and select control equipment

The emergency/standby distribution system will be organized and divided into several distribution systems as categorized above. Each consisting of an automatic transfer switch, feeders dry type transformers, distribution equipment and branch circuit wiring.

Generally, emergency/standby system transformers will be located on each floor to transform voltage from 480V to 208Y/120V in close proximity to the loads served.

Generally, emergency/standby system panelboards will be located on each floor in close proximity to the loads served.

For code compliance, emergency system feeders and branch circuit wiring will be arranged entirely independent of other systems and installed in a separate and dedicated raceway system.

For code compliance, when supplying smoke control systems, automatic transfer switches must be physically separated from the normal electrical service equipment and located outside of the main electrical room.

Equipment and Materials

Engine/Generator Set

Based on preliminary load information, the estimated rating of the engine/generator set is 600KW/750KVA at 277/480V-3phase, 4 wire.

The engine/generator set will be equipped with a UL listed, double wall, sub-base fuel tank with the capacity to provide a minimum of 24 hours of operation at 100% rated load.

The engine/generator set will be equipped with fuel level controls, electronic governor, critical grade muffler and exhaust system, radiator and cooling system, batteries and starting system, digital control panel, line circuit breaker with auxiliary contacts, jacket water heaters, flexible connections, remote status panel and other accessories and support equipment necessary for a complete installation.
The engine/generator set will be installed with appropriate vibration isolators on a curbed concrete pad specifically designed for fuel containment.

Automatic Transfer Switches

The automatic transfer switches used to switch from normal power to emergency/standby power will be of the 4-pole type. Automatic transfer switches are designed to transfer the load when any phase of the normal voltage drops below 90%, and shall automatically restore the load to normal when all phases of the normal source are 95% of nominal line voltage rating. Re-transfer from emergency/standby to normal source will be by either open or closed transition.

Reserve Capacity and Redundancy

The engine/generator set and the emergency/standby distribution system will be sized for the anticipated demand load, plus 20% spare capacity for future growth.

BRANCH CIRCUIT DISTRIBUTION SYSTEM

System Description

A complete branch circuit distribution system will be provided to supply all loads, including outlets, lighting, receptacles, surface mounted raceways, appliances and equipment.

In general, branch circuits supplying computer equipment will have no more than three receptacles per circuit.

In general, branch circuits serving computer equipment, electronic ballasts and other nonlinear type loads will be provided with 200% rated neutral conductors.

In general, branch circuits serving loads with special power quality requirements will be of the isolated ground type.

Equipment and Materials

Receptacle Design Criteria

Admin. Support Space
Approximately (3) to (6) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for copiers and equipment.

Atrium
At least (1) duplex receptacle will be provided per wall at 12'-0" on center minimum.

Center-CCSE
Approximately (24) duplex receptacles are anticipated. Equipment areas with raised flooring will be provided with access floor modules and or under floor mounted duplex receptacles. Dedicated outlets and branch circuits will be provided as necessary for equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Center-CCN
Approximately (24) duplex receptacles are anticipated. Hard wired connections to systems furniture will be provided as necessary. Equipment areas with raised flooring will be provided with access floor modules and or under floor mounted duplex receptacles. Dedicated outlets and branch circuits will be provided as necessary for copiers and equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Center-CRIS
Approximately (24) duplex receptacles are anticipated. Hard wired connections to systems furniture will be provided as necessary. Equipment areas with raised flooring will be provided with access floor modules and or under floor mounted duplex receptacles. Dedicated outlets and branch circuits will be provided as necessary for copiers and equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Classroom for 30
Approximately (12) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment.

Classroom for 60
Approximately (64) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment. An in floor trench duct system should be considered for organized and flexible branch circuit distribution.

Conference/Seminar Room
Approximately (64) duplex receptacles are anticipated. Dedicated outlets and branch

circuits will be provided as necessary for equipment. An in floor trench duct system should be considered for organized and flexible branch circuit distribution.

Conference Room-small
Approximately (6) duplex receptacles are anticipated.

Conference Room-large
Approximately (6) duplex receptacles are anticipated.

Copy/Supply/Mail
Approximately (6) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for copiers and equipment.

Corridors
At least (1) duplex receptacle will be provided every 40'-0" on center minimum.

Design Rooms
Approximately (6) duplex receptacles are anticipated.

Electrical Rooms
Approximately (1) to (3) duplex receptacles are anticipated.

Labs-Research
Approximately (36) duplex receptacles are anticipated. Hardwired connections to systems furniture will be provided as necessary. Dedicated outlets and branch circuits will be provided as necessary for equipment.

Labs-Teaching
Approximately (36) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment. An in floor trench duct system should be considered for organized and flexible branch circuit distribution.

Lecture Hall
Approximately (128) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment. An in floor trench duct system should be considered for organized and flexible branch circuit distribution.

Mechanical Rooms
Approximately (1) to (3) duplex receptacles are anticipated.

Offices
Approximately (3) to (6) duplex receptacles are anticipated for enclosed offices. Open offices will be provided with hardwired connections to systems furniture as necessary.

Network Rooms
Approximately (24) duplex receptacles are anticipated. Branch circuit distribution will be provided by access floor modules and or under floor mounted duplex receptacles. Dedicated outlets and branch circuits will be provided as necessary for equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Resource/Reading Rooms

Approximately (6) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment.

Restrooms

At least (1) duplex receptacle will be provided adjacent sink location. Receptacles will be of the GFCI type.

Server Rooms

Approximately (24) duplex receptacles are anticipated. Branch circuit distribution will be provided by access floor modules and or under floor mounted duplex receptacles. Dedicated outlets and branch circuits will be provided as necessary for equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Stairs

At least (1) duplex receptacle will be provided in each stairwell for cleaning and routine maintenance.

Storage Rooms

Approximately (1) to (3) duplex receptacles are anticipated.

Systems Admin

Approximately (12) duplex receptacles are anticipated. Hardwired connections to systems furniture will be provided as necessary. Dedicated outlets and branch circuits will be provided as necessary for copiers and equipment.

Telecommunications Rooms

Approximately (4) to (8) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment. Owner furnished UPS equipment will be supplied from the building's standby distribution system. Isolated ground type outlets and branch circuits will be provided as necessary for equipment.

Workroom/Interaction

Approximately (6) duplex receptacles are anticipated. Dedicated outlets and branch circuits will be provided as necessary for equipment. Receptacles at sink locations will be GFCI type.

Reserve Capacity and Redundancy

Branch panelboards serving branch circuit distribution systems will be provided with 20% spare capacity for future growth.

GROUNDING SYSTEM

System Description

Grounding system will be designed in accordance with CEC Article 250 and will be based on equipotential grounding with the telecommunications system bonded to the building grounding system.

System resistance to ground will be 5.0 ohms or less. System ground resistance will be tested at the main service entrance to ground by means of a three point "fall-of-potential" testing method.

All conduit terminations at panelboards, enclosures, cabinets and gutters will have grounding bushings with bonding jumpers interconnecting all conduits and panelboards, gutters, etc.

The grounding system will extend from the building service transformers to the branch circuit outlet or device. The grounding electrode system will include underground water lines, structural steel and Ufer ground.

Bonding jumpers will be provided as required across pipe connections to water meters, dielectric couplings in metallic cold water system, and across expansion/deflection couplings in conduit and piping system.

A signal reference grid and equipment bonding will be provided below raised floor installations.

The complete electrical distribution system will be provided with an equipment grounding conductor sized per CEC.

Equipment and Materials

The reference ground for the equipment grounding system will be established from a structural ground grid as follows:

A UFER ground will be provided in the footing of the building consisting of 50' of 500kcmil wire located 3" from the bottom of the footing.

Wall mounted copper ground bar will be located in the main electrical room and floor electrical rooms. Main electrical room ground bar will be connected to UFER ground.

A separate insulated ground wire in conduit will be provided from main electrical room ground bar to each electrical distribution room ground bar.

The system grounded conductor (neutral) will be bonded to the equipment ground bus within the substation by removable bus bar link.

A code sized unbroken bond leader will connect electrical room ground bar to XO terminal of the local transformers.

A No. 4/0 AWG bare copper grounding electrode conductor will be extended to all

telecommunications rooms, so that those systems can be properly bonded to the building ground system.

All connections to grounding electrode system will be made utilizing exothermic welding method.

A separate, green, insulated equipment grounding conductor will be provided in all conduits, in accordance with CEC Article 250.

LIGHTING SYSTEMS

System Description

A complete lighting system for all indoor and site illumination will be provided. The indoor lighting system will consist primarily of energy-efficient fluorescent fixtures. Incandescent lighting will be used only as requested by the Owner or where aesthetics or performance is of prime importance. The outdoor lighting system will consist of high intensity discharge (HID) fixtures.

All lighting fixtures will be installed and controlled in accordance with the requirements of California Title 24 Energy Code.

A new microprocessor based lighting control system will be provided for automated lighting control. The system will consist of individual lighting relay cabinets installed on each floor. Local controls and manual override functions will be provided by sentry switches, line voltage switches or low voltage switches.

Emergency/night lighting will be supplied from un-switched branch circuits. These un-switched branch circuits will be supplied from the building's emergency distribution system.

Equipment and Materials

Preliminary Lighting Fixture Application

Admin. Support
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Atrium
Recessed or surface mounted HID and or wall mounted compact fluorescent sconces.

Center-CCSE
Recessed 2' x 4' fluorescent troffers with deep cell parabolic louvers.

Center-CCN
Recessed 2' x 4' fluorescent troffers with deep cell parabolic louvers.

Center-CRIS
Recessed 2' x 4' fluorescent troffers with deep cell parabolic louvers.

Classrooms
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Conference/Seminar Room
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Conference Rooms
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Copy/Supply/Mail
Recessed compact fluorescent down lights.

Corridors
Recessed fluorescent fixtures or wall mounted compact fluorescent sconces.

Design Rooms
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Electrical Rooms
Surface or pendant-mounted industrial fluorescent fixture with lens or wire guard.

Labs-Research
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Labs-Teaching
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Lecture Hall
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Mechanical Rooms
Surface or pendant-mounted industrial fluorescent fixture with acrylic lens or wire guard.

Offices
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Network Rooms
Recessed 2' x 4' fluorescent troffers with deep cell parabolic louvers.

Resource/Reading
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Restrooms
Recessed fluorescent perimeter system with recessed compact fluorescent down lights.

Server Rooms
Recessed 2' x 4' fluorescent troffers with deep cell parabolic louvers.

Stairs
Recessed or surface mounted architectural fluorescent fixtures.

Storage Rooms
Recessed 2' x 4' fluorescent troffers with prismatic acrylic lens.

System Admin
Suspended direct/indirect fluorescent fixtures and recessed compact fluorescent down lights.

Telecom Rooms
Surface or pendant-mounted industrial fluorescent fixture with acrylic lens or wire guard.

Workrooms/Interaction
Recessed compact fluorescent down lights.

Illuminated exit signs will be State Fire Marshal approved LED type, located in all paths of egress in accordance with requirements of California Title 24.

Lighting fixtures installed in wet or damp locations will be appropriately UL listed for the specific application.

Site lighting will generally consist of HID type pole lighting, bollards, steplights and landscape lighting. All site lighting will be of weatherproof construction and should match existing campus design standards where possible.

Lamps and Ballasts

Fluorescent lamps will be energy efficient, T8, 3500 degrees Kelvin color temperature, with a color rendering index (CRI) of 75 or greater.

Metal halide lamps will be clear with a color rendering index (CRI) of 60 or greater. High pressure sodium lamps will be clear.

Fluorescent ballasts will be high frequency electronic type with less than 10% total harmonic distortion. High intensity discharge ballasts will be high power factor, constant wattage type.

TELECOMMUNICATIONS INFRASTRUCTURE

System Description

Telecommunication infrastructure will comprise of backboxes, conduits, cable tray and backboards for equipment mounting.

Telecommunications service to EBU 2 will require the installation of 4 - 4" underground conduits from the existing Main Distribution Frame (MDF) at Bourns Hall to the new Main Distribution Frame (MDF) located on the first floor of EBU2. The Main Distribution Frame (MDF) should be centrally located and sized approximately at 12' x 20'.

All floors of Engineering Building Unit 2 will be served via at least one Intermediate Distribution Frames (IDF) located on each floor. IDF should be centrally located, vertically stacked and sized approximately at 12' x 10'. Conduit sleeves will be provided between IDFs and MDF. The fifth floor IDF Room will also be equipped with a conduit sleeve to the roof level. 1-1/2" conduit will be routed from the roof to the nearest electrical room.

The telephone/data system will consist of wall outlets in all occupied spaces, such as offices, labs, conference rooms, etc. These outlets will be connected to the MDF and the IDFs via conduit and cable tray system. A single conduit with pull cord will be run from each wall outlet box to cable tray or accessible ceiling space.

Television outlets will be located in each conference room. Elevator car telephone control boxes, fire alarm control panel and building management system will be provided with conduit to the nearest cable tray. Wall telephones will be provided at exits of mechanical and electrical rooms and mounted 48" above finished floor. Outlets for public telephones, house and emergency communications will be provided in lobbies, entrances, corridors, etc.

Equipment and Materials

(1) The walls of the MDF and IDFs will be lined with 3/4" x 8' high plywood, painted with a fire retardant paint. Boards will be anchored securely to wall.

(2) Cable trays will be aluminum ladder type.

(3) Minimum raceway size to be 1" conduit, with end bushings and metallic grounding clamps to terminate conduit to cable tray in the ceiling space. 1-1/4" conduit will be provided for video distribution.

(4) A recessed two-gang box with plaster ring will be provided at each voice/data outlet.

(5) In laboratories where double channel raceways is provided, voice/data outlets will be located in top channel of the surface mounted raceway.

(6) Raceway, components, sleeves, cabinets, etc., will be installed in accordance with requirements of equipment supplied.

(7) Systems and power separation will be maintained.

Reserve Capacity and Redundant Systems

The area of the central equipment room and voice/data rooms will be sufficient to accommodate the installation of 25% future voice/data outlets.

TELECOMMUNICATIONS CABLING

System Description

A complete voice/data/video cabling system will be provided for this facility. A Main Distribution frame (MDF) and Intermediate distribution Frame (IDF) will house terminal equipment and active electronics for voice, data, and video information services. Others will provide active electronics, while the infrastructure and cable plant (wire and outlets) will be provided in this project.

Telecommunication system cable plant will consist of feeder cable, riser cable, station cable, riser termination blocks, station termination blocks, and telecommunication jacks.

Equipment and Materials

Data network service will be delivered to the building MDF via one seven-cell air blown fiber tube with fiber cable from the campus vault # 5. Voice system will be connected via 400 copper pairs from the new Engineering Building 2.

Data network service will be delivered within the building from the MDF to each IDF via a minimum 6-strands of multi-mode fiber in a minimum of 2-cell air blown fiber tube. Voice system will be connected via copper riser cabling with the pair counts determined during detailed design.

Station cable from outlets to the IDF's, for both voice and data will be 4 pair, UTR, Category 6. Specification for Category 6 cable will be determined during schematic design. Cables that originate on the floor shall be terminated on the same floor.

Broad band video will be distributed vertically and horizontally through the building with RG11 and RG6 coaxial cable. Design will include splitters, couplers, amplifiers, and terminators arranged in a homerun configuration to each IDF as required to deliver a 6+ dBMV (+3/-4 dBMV) to each port.

Standard voice/data outlet will contain a minimum of two data ports and one voice port.

Reserve Capacity and Redundant Systems

The voice/data plant spare capacity will be determined during detailed design.

FIRE ALARM SYSTEM

System Description

The fire alarm system shall be an electronically multiplexed addressable type detection, alarm and voice communication system as manufactured by Siemens/Pyrotronics Honeywell/Notifier or Simplex. Remote transponder panels shall be used to provide supervised amplifiers and signal circuits for audio/visual devices and magnetic door holders. The system shall utilize photoelectric type smoke detectors, rate compensated/fixed temperature heat detectors, manual pull stations, and addressable monitor and control modules. The system shall monitor all sprinkler supervisory and water flow switches and shall interface with elevators, HVAC smoke control and fire/smoke dampers.

Equipment and Materials

The main Fire Alarm Control Panel (FACP) will be located in the fire command center room.

The fire alarm annunciator panel will be located at the main building entrance.

Audio/Visual devices shall be installed in all areas of the building in accordance with the NFPA and the ADA guidelines.

Smoke detectors shall be installed as required by the NFPA, CBC and CFC. Smoke detectors shall be installed in, but not limited to, the following locations: equipment rooms, elevator lobbies, machine rooms, hoistways and air handling units.

Manual pull stations shall be installed adjacent to all exit doors with maximum 200' of travel distance from the nearest manual pull station.

A reverse-polarity module will be provided for transfer of system alarm and trouble signals to the UCR Central Fire Alarm Console via campus fire alarm proprietary cable plant, with connection point at the fire alarm control panel.

All wiring shall be installed in conduit. Minimum size is 3/4".

Reserve Capacity and Redundancy

Fire alarm system reserve capacity will be identified during subsequent design phases.

SECURITY SYSTEMS INFRASTRUCTURE

System Description

The security systems will consist of an intrusion detection system, a door access and control system and a closed circuit video surveillance system.

All equipment and wiring will be provided by Owner under separate contact. The electrical contractor will provide backboards for equipment, conduit, cable tray and back boxes only.

Equipment and Materials

The security system infrastructure will be comprised of the following:

Conduit	-	1/2" EMT minimum
Back Boxes	-	4-11/16" x 2-1/8"

Reserve Capacity and Redundancy

Security system reserve capacity will be identified during detailed design.

PUBLIC ADDRESS SYSTEM

System Description

The public address system will consist of loudspeakers, grilles, horns, amplifiers, volume controls, microphones, wiring, tape players, and all associated equipment and hardware to provide a complete working system. All components will be U.L. listed for their function and installation

Equipment and Materials

The public address system infrastructure will be comprised of the following:

Conduit	-	1/2" EMT minimum
Back Boxes	-	4-11/16" x 2-1/8"

Reserve Capacity and Redundancy

Public address system reserve capacity will be identified during detailed design.