- ANSWERS MARKED IN BLUE -

Project Delivery:

- Design-Build (D-B)
- Integrated Project Delivery (IPD)
- Construction Management @ Risk (CM) with Guaranteed Maximum Price (GMP)
- Design-Bid-Build (D-B-B)
- Performance Contract (PC)

Owner Team:

- Laboratory Complex Management
- Building Program Committee
- Owner Representative (consultant)
- Financial Manager
- Third-Party Commissioning Consultant (CxC)

Project Delivery Team:

- D-B Project Manager
- IPD Project Manager
- D-B-B Project Manager
- Research Grant Representative
- Architect, Acoustical, Plumbing, Electrical, Structural, Fire Protection, and Security Consultants

HVAC Project Team:

- HVAC D-B Engineer
- Automatic Temperature Control (ATC) D-B Technician
- Building Automation System (BAS) Technician (in-house staff)

- Building Automation System (BAS) Technician (In-House Staff)
- Testing, Adjusting, and Balancing (TAB) Technician
- Energy Engineering Consultant (EEC)

Application:

- Places of Assembly, Chapter 5
- Hotel, Motel, and Dormitories, Chapter 7
- Energy Use and Management, Chapter 37
- Owning and Operating Costs, Chapter 38
- Building Energy Monitoring, Chapter 42

Project Type:

- New Construction
- Addition
- Infrastructure Lab Room Retrofit
- Energy Audit and Retrofit

References:

- 2017 ASHRAE Handbook – Fundamentals
- 2018 ASHRAE Handbook – Refrigeration
- 2019 ASHRAE Handbook – HVAC Applications
- 2020 ASHRAE Handbook – HVAC Systems and Equipment

Other References:

- ASHRAE GreenGuide: Design, Construction, and Operation of Sustainable Buildings
- ASHRAE Procedures for Commercial Building Energy Audits
- ASHRAE Fundamentals of Design and Control of Central Chilled-Water Plants
- ASHRAE Standard for Commercial Building Energy Audits
- ASHRAE Standard 90.1 (Minimum Energy Standards)
- ASHRAE Standard 202 (Commissioning Process for Buildings and Systems)
- Design-Build Institute of America (DBIA)
- International District Energy Association (IDEA)

DESIGN INTENT DOCUMENT (DID)

- The HVAC System Selection and Design Intent Are Based on the Process Outlined in ASHRAE Handbook 2020, Chapter 1, HVAC System Analysis and Selection. It includes the Owner's Building Program Goals and Additional Goals, System Constraints and Constructability Constraints, and Reference is made to ASHRAE Handbook 2020, Chapter 3, Central Cooling and Heating Plants.
- Complete Energy Audit of Primary-Secondary-Tertiary Chilled Water System from Central Chiller Plant to Individual Buildings that Make Up the Laboratory 24-Room Complex.
- Automatic Controls shall Include New Chilled Water System Flow Monitoring and Btuh Energy Metering at the Central Plant and Individual Labs. Energy Data will Be Converted to Cost for Chilled Water as well as Other Energy Meters to Capture the Total Utility Cost to Operate These Individual Research Labs.
- Interface of New and Existing Temperature Transmitters, Pressure Differential Transmitters, GPM Flow Metering Transmitters, Pump Controls, and BACnet Interface and Internet Interface with New BAS.
- Program and Project Goals: Refer to Functional Goals: (Chapter 3, 2020 Handbook). Budget Goals Are Energy Consumption Reduction and Life Cycle Cost.
- Management Goals Include Property Management, Outsource Mechanical and Electrical Services, and Mechanical/Electrical Operation and Maintenance Management.
- Existing Conditions Include Four Water-Cooled, Variable-Speed Compressor Chillers; One Steam Absorption Chiller, Six Draw-Through Cooling Towers and Two Plate-and-Frame Waterside Economizer Heat Exchangers. Existing Pumps Are a Combination of Split-Case Horizontal and Vertical-Based Mounted and with Variable Frequency Drive (VFD).

DESIGN CRITERIA DOCUMENT

- The Design Criteria Shall Be Based on an Energy Audit of the Central Chilled Water System Distribution Followed By Financial Reimbursement Analysis and also an Energy Conservation Analysis of Existing Air Conditioning Conditions, Associated Operation, and Proactive Maintenance Management in Sync.
- Based on the Proposed Retrofit Project a Lab Continuous Monitoring Utility Cost Analysis Shall Inventory the Chilled Water Flow Meters and Btuh Energy Metering to Determine Potential Grant Funding Associated with Each Research Lab.
- The Addition of a New BAS Computer System with Remote Monitoring and Management Shall Control the Existing Cooling System to Reduce Operating Cost and Enhance Operation and Maintenance of this Primary-Secondary Tertiary System.
- The Existing Utilities Included Electrical Power and Central Chilled Water Distribution with Flow Meters and Btuh Energy Metering as the Cooling Media Leaves and Returns from the Multiple Laboratory Buildings. This Energy Retrofit Project Shall follow ASHRAE Guideline 62

Energy Retrofit Project Shall Follow ASHRAE Guideline 82.

- The D-B HVAC Design Engineer Shall Provide System Flow Diagrams with Associated Automatic Energy Management control and Sequence of Operation.
- The D-B Project Manager Shall Include Estimates for All Costs Associated with Design, Build, and Warranty the Project.