BIOLOGICAL RESEARCH LABORATORY

Michael Carbonara

Construction Management

Construction

Construction in the aspect of the budget was extremely important for the construction of the new BRL facility. The National Institute of Health (NIH) funded a large portion of this project, approximately 15 million, so many guidelines needed to be followed in order to capitalize on grant money. Many of these guidelines are found under the NIH Design Requirements Manual (DRM) which accounted for higher costs because of redundancies in building systems and other special requirements.

The actually construction of the Laboratory is difficult in the amount of mechanical and equipment that is to be placed within the structure. The Bio Research Lab consists of a single phase 20,000 sf. Laboratory that has intense amount of MEP systems. The basement along with the mechanical penthouse will consist of AHU's and Boilers providing the correct number of air changes per hour in each lab room to steam for sterilizing tools. The equipment lead time for specialized equipment could prove to be a big problem later on in construction as well. Items such as biological safety cabinets, one small and large sterilizer, liquid effluent decontamination system, specialized hoods, incubators all need to purchased and ordered at a reasonable time as to not delay the closeout of the facility.

Structure

The building footprint sits on a series of reinforced spread footings for the steel columns where the spread footing reinforcement extends into the column footing. The other form of structural support for the building is continuous footings which support the concrete wall, CMU and split-faced block walls. According to the geotechnical survey of the site, the wall footings and column footings must be 18 and 24 inches respectively to avoid punching shear failures. Below the column and wall footers was a soil of

3000 lbs/sq ft. or if soils were not approved in the location of the foundation, an eight-inch compacted sand buffer placed over rock must be utilized. A minimum of a six inch slab was used for the basement floor which sat on 4 inches of compacted stone. The first floor was comprised of a 2 inch metal composite deck with 2.5 inches of lightweight concrete. The steel throughout the structure will be comprised of both HSS4x4x4x3/8 as well as a series of wide flanged columns, W8x31 being the most commonly used. The beams in the structure are also supported by a series of hollow core structural steel as well as different types of wide flanged beams. The roof is comprised of a 1 1/2 inch metal decking that is supported by joists and the joists transfer the load to the beams and ultimately the columns.

One of the special structural features to the Laboratory is the wall and ceiling details of the containment labs. The basic wall will be composed of cold formed steel studs with impact-resistant gypsum wall board. On top of the GWB will be an epoxy base for more stability which is then topped with a four layer coated tough substrate. The ceiling is composed the same way with the high performance coating but the metal ceiling is stud framed to endure either a positive or negative pressure of 35 psi. These rooms are unique in that each room needs to be pin-hole free with a gas tight finish and able to withstand high pressure wash-downs.

Mechanical Systems

The Biological Research Lab is based upon NIH and AAALAC standards for interior cooling loads because of storage of animals inside the facility. ASHRAE was used for all of the remaining design conditions that were not addressed with NIH or AAALAC standards. The building utilizes two air cooled chillers supplying 44 degree water to the 5 main AHU units throughout the building. The chilled water pumps also have variable frequency drives for maximum flexibility with the pump/chiller operations. These 5 main AHU have heat recovery coils for 100% outside air units which supply fresh air to the containment labs. Along with the AHU's there are a series of fan coil boxes with no humidifiers to circulate air throughout the facility for ex. the mechanical rooms, stairwells and corridors.

The hydronic systems research laboratory consists of two boilers rated to be 100% of the winter capacity. The boiler pressure is 100psig and will be delivered at that pressure to the decontamination system. Using pressure reducing valves steam will be lowered from 100psig to 80 psig to supply and used as process steam throughout the building. The preheat, heat exchangers, humidifiers and heat exchangers utilize pressure reducing valves to reduce the 80psig steam down to 15 psig to serve the equipment.

Electric System

The electrical service into the building will be a 480Y/277 service that feeds a 1600 Amp double-ended switchgear. The power flows downstream to a pair of 1200 Amp switchboards which are fed from separate sides of the 1600 Amp double-ended switchgear. These two switch boards will supply the power to the mechanical, lighting and receptacle panel boards. The panels boards for the ABSL3 and BSL3 will be supplied from different panel located outside the containment barrier. The service for the

facility will be calculated as sized not only for the anticipated load but will include an additional 25% capacity for growth. A generator will also be placed on site for standby/Emergency and all life safety loads will be redundantly wired alongside with normal power in case an emergency.

The interior lighting will consist of high efficiency Light Emitting Diode fixtures and T8 fluorescent lamps placed in corridors and common areas. Lighting in all animal rooms will be individual controlled and have scheduled cycling which are all independent of each other. Throughout the facility emergency lighting will be placed, connected and powered by the life safety system. All of the luminance levels follow the IESNA and NIH requirements.

Fire Protection

In the Biological Research Laboratory will consist of two types of sprinkler systems in the facility. The first type of system is a wet system in the non-containment areas such as offices, stairwells and corridors. This area will have fusible links on the sprinkler heads and sprinklers that are located near equipment that produce an above normal amount of heat will specified to have high temperature fusible links. The second fire suppression system will be a dry in the containment zone eliminating the environmental impact on contaminated wastewater.

Fire Alarm System

The fire alarm system for the BRL Lab will be directly linked to Penn State Police Services for fast and timely response. Automated smoke and heat detectors will be placed throughout the rooms, spaces and labs to provide adequate protection as well as to comply with applicable codes. Detectors will also be placed inside metal ductwork and in contained hallways to alarm the AHUs there is a possible fire. Every area in the lab will have audible/visible alarms except for restrooms, conference rooms and changing rooms.

Information was provided by Payette Associates, the architect, Torcon Inc., the construction manager, and Penn State's Office of Physical Plant.