Existing Mechanical System

Air System

The ventilation system for P1 - vivarium comprised of six (6) 100,000 CFM custom air handling units (AHU) equipped with variable speed drives (VSD). All six (6) AHUs are demand based, and supply airflow can be reduced to 50% of the design airflow. Each AHU draws outdoor air (OA) from the OA intake plenum. OA then pass through 30% and 95% efficient pre-filter, heat recovery coil, direct injection steam humidifier, chilled water coil bank, a set of sound attenuators before and after the supply fans, and final filter of 99.9% efficient.

Two (2) AHUs are grouped together to deliver 100% outdoor air to each level by the means of variable air volume (VAV) system. Ductworks reach individual zone by ganged/manifold distribution concept through a mechanical distribution corridor on each floor.

Three (3) 120,000 CFM exhaust air handlers (EAHU) with sensible heat recovery remove majority of the indoor air, and preheat OA that become the supply air (SA). Other exhaust systems compensate for the remaining indoor air removal. The Vivarium Air Flow Diagram showed relation of AHUs, EAHUs, and exhaust fans to each space.

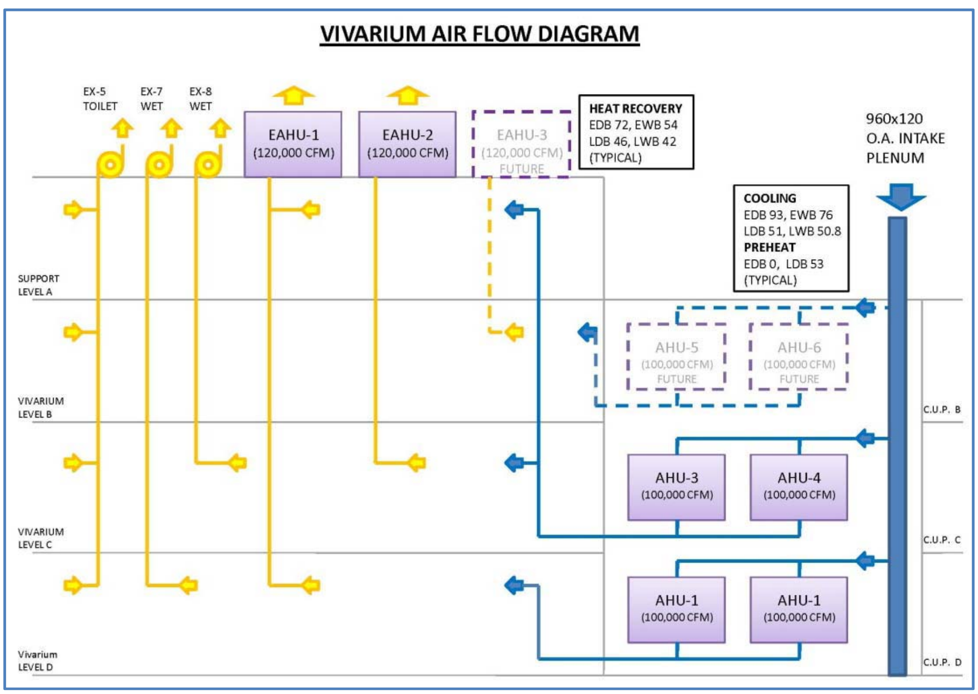

Figure 2: P1 Air Flow Diagram

The ventilation system for P2, eight (8) 50,000 CFM and one (1) 100,000 CMF custom AHU similar to AHU specified for P1, are located on seventh (7th) floor. On the nine (9) AHU, four (4) 50,000 CMF and one (1) 100,000 CFM AHU supply 100% OA to laboratory spaces on floor third (3rd) to sixth (6th). Two (2) 50,000 CFM AHU with minimum 25,000 CFM of OA serve offices on floor second (2nd) to sixth (6th). The remaining two (2) 50,000 CFM AHU with minimum 25,000 CFM of OA serve office and conference rooms on level A and first (1st) floor.

Three (3) 100,000 CFM EAHU with sensible heat recovery similar to EAHU specified for P1 are located on the eighth (8th) floor, currently the roof. These EAHU remove indoor air from laboratory spaces on floor third (3rd) through sixth (6th) to maintain 100% OA.

Heat Recovery & Pre-heat System

The exhaust air heat recovery system employed a runaround glycol loop, which has an effectiveness of 74%, to recover heat from exhaust air. The heat recovery loop is interconnected with the low pressure steam system through steam-water heat exchangers to pre-heat OA air to 53°F in winter months.

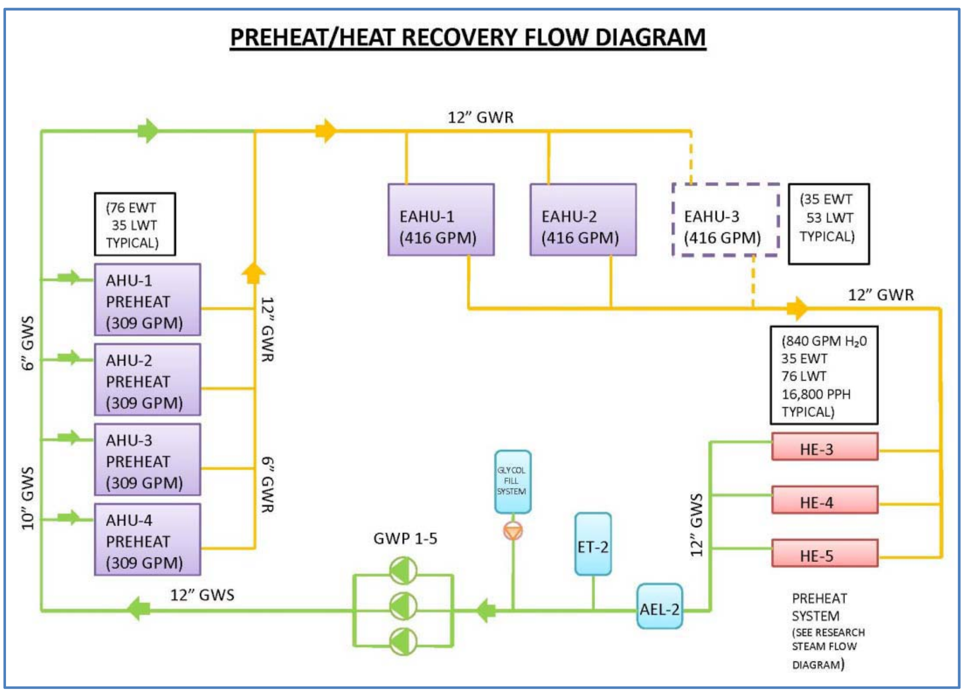

Figure 3: P1 Heat Recovery Diagram

Steam System

The boiler plant for Phase 1 and Phase 2 (P 1&2) are located on CUP level C. It included four (4) 800 boiler horse power (bhp) (27,600 lb/hr of steam each) dual fuel steam boilers with VSD blowers and stack economizer (BSE). Boiler stack economizer pre-heat boiler feed water by recovering heat. Each BSE has the capacity to increase boiler efficiency by 3.2%.

The boiler plant produce high pressure steam at 125 psig for high efficiency distribution, and drive steam turbine chiller(s) which operate at 120 psig. High pressure steam is reduced to 70 psig medium pressure steam for domestic hot water heating and laboratory process equipments. Steam pressure is further reduced to 2 psig low pressure steam for humidification and building hot water loop re-heat. Additional boilers will be added in future phases to increase steam capacity as construction continues.

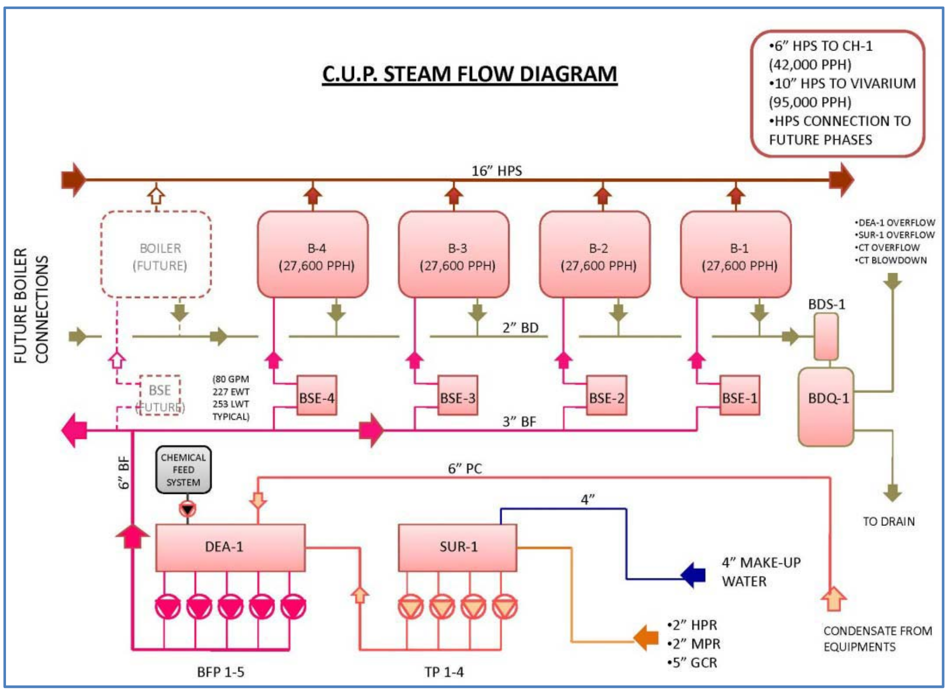

Figure 4: CUP Steam Flow Diagram

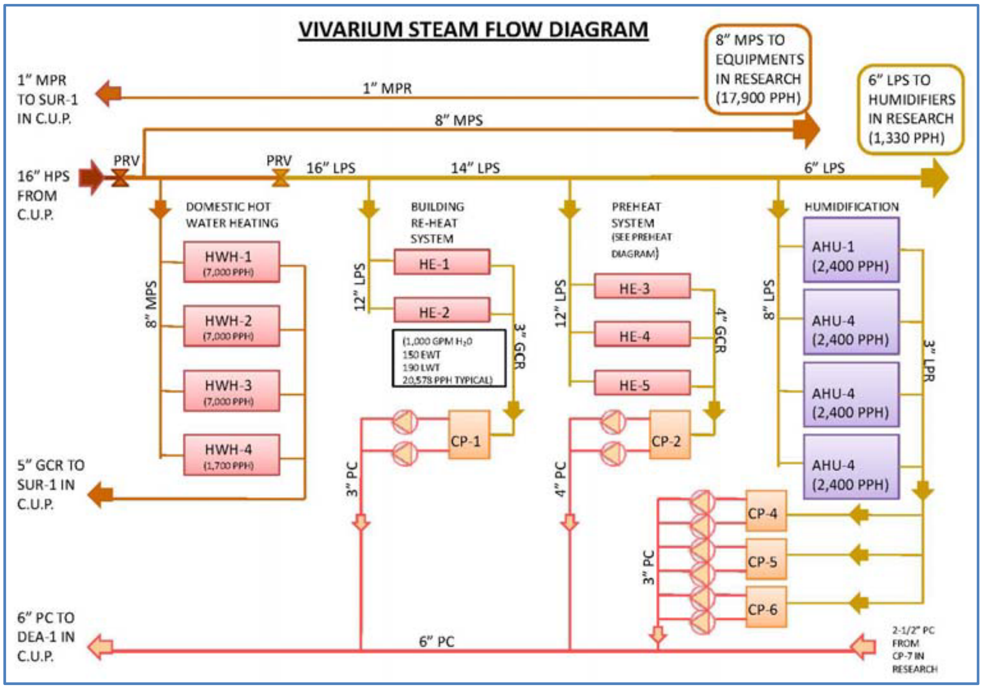

Figure 5: P1_Vivarium Steam Flow Diagram

Chilled Water System

The chiller plant for P1 and P2 consisted of one (1) 2,000 ton steam turbine chiller and one (1) 2,000 ton electric centrifugal chiller that produce 42°F chilled water. These chillers provide chilled water to the AHUs, as well as process chilled water (PCHW) loads. Chilled water is distributed to loads with two (2) variable speeds secondary chilled water pumps on a primary/secondary loop. Eight (8) or more 2,000 ton chillers will be added in future phases to meet capacity requirement.

Chillers reject heat via a condenser water system which included four (4) 1,000 ton cooling towers with VSD fans. These cooling towers serve both chillers and produce process chilled water in winter months. Additional cooling towers will be added in future phases to accommodate future chillers' heat rejection requirement.

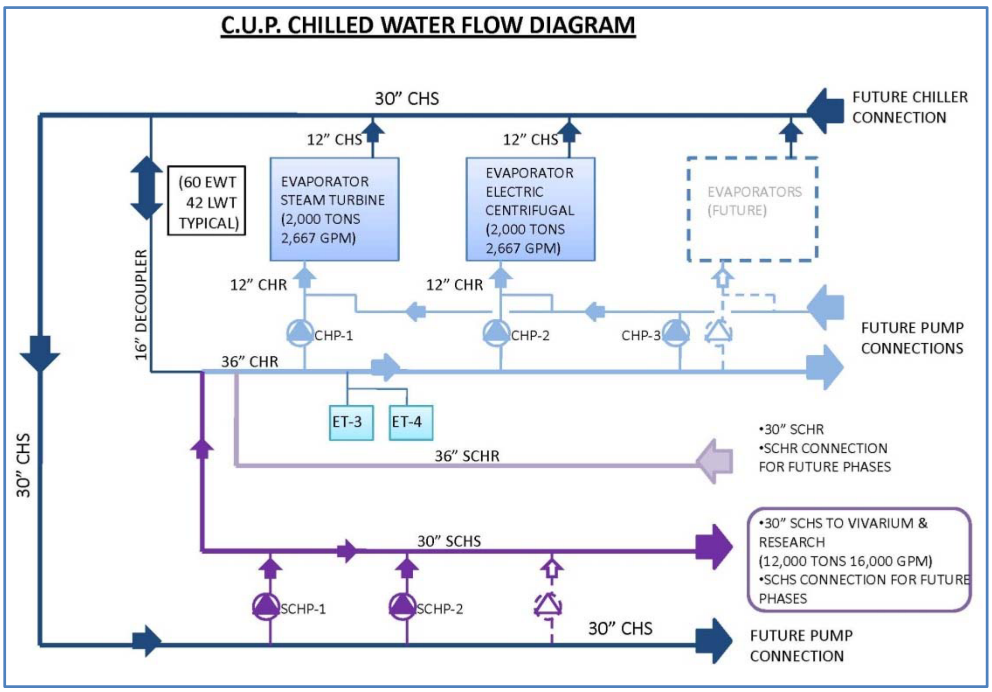

Figure 6: CUP Chilled Water Flow Diagram

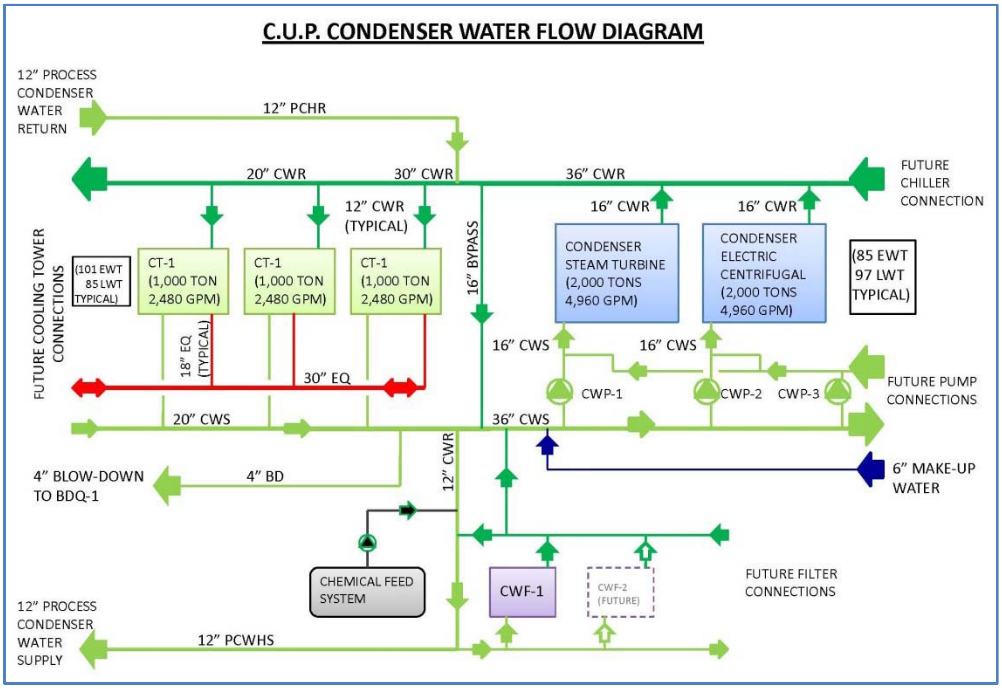

Figure 7: Condenser Water Flow Diagram

Existing Electrical System

Electrical power is supplied by an electric company in Pennsylvania on two 13.2KV service feeders via underground duct bank. The 15 KV duel line switchgear with bus tie breaker, rated at 2,000 A delivers electricity to three substations by means of secondary selective for improved reliability. Two 2,500 KVA double ended substations with tie breaker, step 13.2 KV to 480/277 V, 3ϕ, 4 wires, and distribute services to P 1&2, and future phases. A 5,000 KVA substation steps 13.2 KV to 4160 V, 3ϕ, 4 wires for a 2,000 ton electric centrifugal chiller. Emergency/life safety demand is supported by two 2 MW diesel powered generators. Additional switchgear and substation will be added to the CUP as part of future phases.

Existing Structural System

The structural system for Phase I consisted of steel frame with concrete shear walls on shallow foundation system with spread footings. Foundation walls are integrated with structural frame via steel shear plates. Each 24 inches thick shear wall has two curtains, vertical and horizontal reinforcement varies with height, and steel columns implanted for extra stiffness. The shear wall system, running from Level D to Level A, is sized to resist lateral forces transferred from future phases above. The composite floor system consisted of 4,000psi concrete on composite steel deck with shear studs. Steel beams ranged from W12 – W24 for the research facility, W8 – W30 for CUP, and bay width varies from 24' to 33'.