Preliminary Commissioning Plan and General Acceptance Criteria

This section provides a qualitative description of the types of criteria that commissioned systems are expected to meet to "pass" the commissioning protocols. The quantitative acceptance criteria for the process equipment and systems are defined in the specific protocol for that system. Since the facility design is not complete at the time of the development of the Preliminary Commissioning Plan, the development of acceptance criteria and protocols will be a dynamic, on-going process until the design is complete and the equipment manuals are received.

General Acceptance Criteria

General Installation Qualification Acceptance Criteria

(1) The system is installed in accordance with contract drawings and documents. These may include P&ID's, plans, specifications, vendor prints, installation instructions, and other documents as appropriate.

(2) The required documentation is obtained for each item. Relevant documentation i.e. operating manuals, maintenance procedures, operating SOP's as furnished by the University, and record drawings are referenced here. The documents included are those that are required to operate and maintain the system in its commissioned state. The departments responsible for maintaining the documents are also identified.

(3) Instruments and equipment shall be properly identified. This may include tag number, manufacturer and model number, serial number, motor HP and RPM for each device per contract documents.

(4) Critical materials of construction match the contract documents.

(5) Contractor to verify all equipment, piping, valves, and joints are installed such that no forces or strain are exerted to surrounding equipment or systems. Proper flexible connections have been installed per contract documents.

(6) Initial cleaning, pressure testing, and other specified pre-operational tests have been completed and documented according to contract documents prior to request for final commissioning.

(7) Utility tie-ins are verified.

(8) Critical instruments have been calibrated in accordance with contract documents. Calibration records are attached.

(9) All electrical and control wiring labeling have been verified.

(10) Control system I/O and electrical point-to-point have been verified and documented.

(11) Leak testing of ductwork has been conducted in accordance with the contract documents.

(12) The HVAC controls field installation has been checked out and documented by the Design/Build Team, including loop checks and calibration of all critical loops, and failure mode testing.

(13) Room Pressure Decay for the following spaces:
Aero-Biology Animal Holding room
Aero-Biology Support/Necropsy

(14) The containment air handling system maintains space pressurization and physical barriers. The redundant exhaust fans operate at 50% capacity and maintain control of space pressurization as programmed.

(15) The building automation system is a direct digital control system and contains all points and loops referenced in the contract documents as appropriate to monitor and control the facility.
(16) The compressed air system has all dryers and conditioning equipment installed as indicated by drawings, P&ID's, installation instructions, vendor prints, and plans.
(17) The waste water treatment plant has been assembled and wiring terminated as indicated by the contract documents.
(18) Verify that all waste piping from containment discharges to the waste treatment plant per the contract documents.
(19) Perform leak testing on all high containment drain pipe discharging from containment per an approved procedure.
(20) HEPA filter testing to include DOP challenges and air flow requirements.
(21) Verify installation of all instrumentation, monitoring devices, and adherence to installation instructions, plans, and vendor prints for the facility security system.

General Operational Qualification Acceptance Criteria

(1) Control systems and devices operate in accordance with design, including control loops, interlocks, alarms, and failure modes.
(2) Control system security features are verified, such as passwords.
(3) Data archiving system are tested and verified as operating as specified in the design documents.
(4) Indicating and recording instruments used to collect test data have been calibrated according to an approved procedure and are traceable to NIST standards.
(5) Fire and life safety systems are operational and certificates as required by the contract documents and authorities having jurisdiction.
(6) Bio-safety cabinet passes NSF 49 2004.
(7) Waste treatment plant is challenged with endotoxins and successfully treats the effluent.
(8) Air Handling System operation is documented in a detailed test and balance report and values are maintained within 5% of the design. Values to be verified in the test and balance report will include: supply and exhaust/return air flows at each room; flow patterns, temperature, pressure, and dew point in main supply duct; temperature and relative humidity in each room; water flows at cooling and hot water heating coils; steam pressure at steam heating coils and steam humidifiers; overall airflow and supply duct pressure with simulated dirty filter loading.
(9) Containment exhaust ductwork airflows are as designed to maintain building pressurization.
(10) Noise levels are as specified in the design documents.
(11) The emergency power system allows uninterrupted operation of the containment exhaust fans, air compressors, security system, and building automation system.

General Perturbation Testing Acceptance Criteria

(1) The emergency power system maintain the controls for containment exhaust system, building automation system, compressed air system, and security system. The output of the emergency power system should maintain all designated functions during facility power failure.
(2) Loop upset of room set points are corrected properly by the BAS.
(3) Loss of communication link of the DDC system does not result in failure of any systems.

General Performance Qualification Acceptance Criteria

(1) System maintains environment for 30 days.

(2) During four weeks of normal operating conditions, the conditions in the commissioned spaces are maintained as specified in the contract documents.

(3) The steam system supplies raw steam to air handling unit preheat coils, steam converters for water heating, domestic hot water tanks, waste water treatment plant, and wash down stations with adequate pressure, flow, and condensate removal during maximum and minimal demand.

(4) The control compressed air system delivers dry, oil-free air to the control instruments and lab dispensing locations for facility usage. The dew point of the control air should be maintained with a dew point below –40^{o}F.

(5) All security system interfaces should function as designed and control personnel access throughout the facility. Motion detection equipment, remote cameras, and readers should record movement and alarm the building automation system upon detection.

(6) The waste water treatment plant discharges sanitary waste meeting applicable requirements.

(7) An ongoing monitoring program will be established to verify that the processes commissioned do not exceed the specified limits.

(8) A change control procedure for the building automation system will be in place to prevent unauthorized modifications to the control system.

Support Programs

As part of the commissioning effort, the support programs will be implemented to maintain the quality and repeatability of the commissioned systems. These support programs include training, preventive maintenance, SOP's, calibration programs, and a change control procedure.

Training

The CxA will play a major part of the Owner's operating personnel training program. The CxA will review training material as submitted and presented by the Construction Team and specialty equipment vendors. The Construction Team and specialty equipment vendors will perform the training of Owners personnel responsible for the operation of critical facility and process systems in the proper use of the equipment or systems. All systems requiring training will be identified during the IQ and OQ phases of commissioning and appropriate training will be developed with the involvement of the Owner/User so that each area has a sufficient number of trained individuals. It is recommended that the appropriate Owners personnel be present during the performance-testing phase of critical systems as part of the training process. This training will be documented, with documentation included in the final commissioning report and included in the individual(s) training record. The CxA will also develop an estimated "Potential Maintenance Effort Hours" program to identify the ongoing needs of the facility and maintenance staffing required. This will be developed prior to the finalizing of the training program.

Calibration

The calibration program consists of periodic calibration of critical instruments according to an approved schedule and approved calibration procedures. Critical instruments are those required for proper operation or control of the system, whereas non-critical instruments are generally provided for convenience. The CXA will develop this documentation which will include an instrument master listing, the required calibration frequency for each critical instrument, and calibration procedures for each type of instrument requiring calibration. This documentation will be included in the final commissioning report.

Maintenance

A list of preventive maintenance tasks for each commissioned system, along with the required frequency of the task, will be developed by the University of Washington and incorporated into maintenance SOPs. Records will be kept on critical equipment maintenance. Maintenance procedures and spare parts lists will be confirmed by the CxA as part of the IQ on each system. An electronic Operations and Maintenance Manual will be developed by the CxA during IQ for each system. This documentation will be referenced or included in the final commissioning report.

Systems Commissioning Requirements Tables

Table Set 1: Installation Qualifications

- Level 0: Commissioning Authority personnel will not be involved with any testing, verification, or witnessing of Contractor testing
- Level 1: Commissioning Authority personnel will witness the Construction Team testing authority and will sign off at the conclusion of a successful verification
- Level 2: The Construction team will perform their verification on the system then the Commissioning Authority team will perform an independent verification of that system, using independent testing equipment, standards, and personnel. The Contractor will be requested to assist in this effort as necessary to operate systems.
- Level 3: The Commissioning Authority team will perform additional testing and verification not performed by the Construction team to insure performance of critical systems.

1.1 Emergency Power System

Subsystem	Factory Accept. Test	Util. Tie--In	Wiring
Diesel Generator Unit	0	1	1
Transfer Switch	0	1	1

1.2 Containment Exhaust System

Room Type	Subsystem	SMACNA Leak Check	Helium Leak Check	DOP	Gen. Install.
BSL2					
	VFD	-	-	-	1
	Exhaust fans	-	-	-	1
	Ductwork	1	-	-	1
BSL3					
	HEPA Exhaust Housing	1	-	-	1
	VFD	-	-	-	1
	Exhaust fans	-	-	-	1
	Ductwork	1	-	-	1

Room Type	Subsystem	SMACNA Leak Check	Helium Leak Check	DOP	Gen. Install.
	HEPA Filters	-	-	3	1
ABSL3					
	HEPA Exhaust Housing	1	3	-	1
	VFD	-	-	-	1
	Exhaust fans	-	-	-	1
	Ductwork	1	-	-	1
	HEPA Filters	-	-	3	1
	Gas Tight Dampers	-	-	-	1
Aero-biology					
	HEPA Exhaust Housing	1	3	-	1
	VFD	-	-	-	1
	Exhaust fans	-	-	-	1
	Ductwork	1	3	-	1
	HEPA Filters	-	-	3	1
	Gas Type Dampers	-	-	-	1

1.3 Containment Room System

Room Type	Subsystems	Gen.Install	FAT	Helium Leak Check	Leak Check
	APR Door System	1	1	-	-
	Coatings	1	0	-	-
	Gas Type Dampers	1	1	-	1
	FFE	?	-	-	-
	Gating	1	-	-	-

Room Type	Subsystems	Gen.Install	FAT	Helium Leak Check	Leak Check
	Wash Down System	1	-	-	1
	Penetrations	1	-	-	-
	Camera	1	0	-	3

1.4 Air Supply Systems

Subsystems	Amp	VFD	Vibration	Filter Chk	Cond.	Humidity	SMACNA Leak	Gen. Install	DOP	Util. Tie-in	He Leak Aero-Biology
Air Handling Unit	1	1	1	1	1	1	-	1	-	-	-
Ductwork	-	-	-	-	-	-	1	1	-	-	-
Diffusers/Returns	-	-	-	-	-	-	-	1	-	-	-
Hanger Rods/Tapes/Sealants	-	-	-	-	-	-	-	0	-	-	-
Insulation	-	-	-	-	-	-	-	1	-	-	-
HEPA Filters	-	-	-	1	-	-	1	1	3	-	-
Terminal Units	-	-	-	-	-	-	-	1	-	1	-
HEPA Housings	-	-	-	-	-	-	-	-	-	-	3

1.5 Building Automation System

Subsystems	Point/ Point	Verify Instr. Calibration	General Install.	Wiring	Password	Damper Limit Switch Verification	Leak Check
HVAC Inst. & Controls	1	1	1	1	1	1	-
Alarm Systems	1	-	1	1	1	-	-
Security Systems	1	-	1	1	1	-	-
Fire Safety	1	-	1	1	1	-	-
Communications	1	-	1	1	-	-	-
Data Archiving		-	1	1	1	-	-
Pneumatic Controls		-	1	1	-	-	1

1.6 PLC Controls System- Waste Treatment Plant

Subsystems	Point/Point	Verify Instr. Calibration	General Install.	Wiring	Password
Valve Limits	1	0	1	1	1
PLC & I/O	1	-	1	1	1
Data Archiving	1	-	1	1	-
Pneumatic Controls	-	1	1	1	-

1.7 Waste Water System

	Steam	Cond.	Cal./Instr	General Inst.	Wiring	Dom. Water	HEPA Filter Challenge	Pressure Testing	FAT	Head Press. Testing
Cook Tanks	1	1	1	1	1	1		-	1	1
Vent Tank	-	-	1	1	-	-	-	-	1	1
Exhaust Fans/HEPAs	-	-	-	-	1	1	3	-	-	-
Bio-Waste Piping	-	-	-	1	-	-	-	3	-	-
Plumbing HEPA Vents	-	-	-	1	-	-	3	-	-	-
Heat Exchanger	-	-	1	1	-	1	-	-	-	-
Lab Waste Drain Piping	-	-	-	1	-	-	-	-	-	1
Interconnect Piping	-	-	-	1	-	-	-	-	-	1

1.8 Security Systems

Subsystems	Wiring	Point to Point	Password
Alarms	1	1	1
Access Control Equipment	1	1	1
Closed Circuit TV Cameras	1	1	1
Intercoms	1	1	1

1.9 Compressed Air System

Subsystems	Utility Tie In	General Installation	Wiring	Leak Test
Compressor	1	1	1	1
Piping/Valves	1	1	1	1
Filtration	1	1	1	1
Dryer	1	1	1	1

1.10 Chilled Water System

Subsystems	Amp	Rotation	Utility Tie Ins	General Inst.	Wiring	Leak Test
Chillers	1	1	1	1	1	1
Pumps	1	1	1	1	1	1
Cooling Towers	1	1	1	1	1	-
Compression Tank	-	-	-	1	-	-
Starters	1	1			1	-
Piping						1

1.11 Heating Water System

Subsystems	Amp	Rotation	Utility Tie In	General Installation	Wiring	Leak Check
Heat Exchanger	-	-	1	1	-	1
Pumps	1	1	1	1	1	1
Air Separator	-	-	-	1	-	1
Expansion Tank	-	-	-	1	-	1
Chemical Shot Feeder	-	-	-	1	-	1
Unit Heater	-	-	-	1	1	1

1.12 Steam System

Subsystems	General Installation	Wiring	Amp	Rotation	Leak Test
Dom. Water Heaters	1	?	-	-	1
Flash Tank	1	-	-	-	1
Pumps	1	1	1	1	1
Condensate Piping	1	-	-	-	1
Vents	1	-	-	-	-
Supply Piping	1	-	-	-	1

1.13 Life Safety Systems

Subsystem	Point to Point	General Installation	Wiring
Fire/Sprinkler	1	1	-
Fire Alarm	1	1	1

1.14 Building Power Systems

Subsystems	General Installation	Wiring	Amps	Volts	Level	Labeling
Primary Main Switchboard	1	1	1	1		1
Distribution Panels	1	1	1	1		1
Lighting Panels	1	1	1	1		1
Switch Gear	1	1	1	1		1
Lighting	1	1	1	1	3	1
Outlets	3	3	3	3		1
MCC	1	1	1	1		1
Dry Type Transformers	1	1	1	1		1
Power Monitoring & Controls	1	1	1	1		1
Local UPS	1	1	1	1		1

1.15 Electrical Systems

Subsystems	General Installation	Wiring	Labeling
Grounding	1	1	1
Bonding	1	1	1
Lightening Protection	1	1	1
Cable Trays	1	-	1
Conduit	1	-	1
Cables/Rods	1	-	1

1.16 Data & Telecommunications Systems

Subsystems	General Installation	Point to Point	Transmission	Data Rate
Telephony	1	1	1	-
Dedicated Fiber Pair	1	1	1	1
LAN	1	1	1	1
Termination Ports	1	-	1	-

1.17 Lab Equipment

Equipment	Calibration Verification	Wiring	Gen. Install.	Util. Tie Ins	Leak Test	Pressure Decay	Cycle Programming	ASHRAE 110	DOP	NSF 49 Field Test
Bio Safety Cabinets	1	1	1	1	3	3	-	-	3	3
Autoclaves	2	1	1	1	1	-	1			
Fume Hoods	1	1	1	1				3		
Cage/Bottle Washer	0	1	1	1						
Dump Stations	1	1	1	1					3	
Ice Machine	0	1	1	1						
Glassware Washer	0	1	1	1			1			
Mobile VHP Unit	2	-	1	-		-				
Chemical Storage Cabinet	-	-	1	1						
Washer	-	1	1	1						
Dryer	-	1	1	1					1	
Necropsy Table	-	1	1	-						
Bottle Fill Station	-	-	1	1						
Walk-in Cold Storage	2	1	1	1						
Scale	0	1	-	-						
Freezers	2	1	1	1						
VHP Chambers	2	1	1	1	1		1			
Downdraft Table	-	1	1	1						

Table Set 2: Operational Qualifications

2.1 Emergency Power System

Verify Operation	Generator	Electrical Panel
Diesel Fuel	1	
Oil Pressure	1	
Voltage		1
KW Output		1
Transfer Switch		1
Water temperature	1	
Exhaust Temperature	1	
Exhaust Reintrainment	1	
Frequency Stability		1
Starter Counter	1	
Run Hour Meter		1

2.2 Containment Room System

Room Type	Verify Calibration of DP Transmitter	Room Air Change Rate Verification	Space DP Verification	Gross Leak	SNOOP	Pressure Decay	APR Doors Operation	Seq. of Operation
BSL2	1	1	1	-	-	-	-	-
BSL3	1	1	1	1	-	-	-	-
ABSL 3	1	1	1	-	-	-	1	1
Aerobiology	2	1	1	1	3	2	1	1

2.3 Security System

Verify Operation	Clarity & Accuracy	Reliability/Data Transfer
Intercoms	1	1
Cameras	1	1
Card readers	1	3
Biometric Readers	1	3
Emergency Alarms	1	1
Data Archiving	1	3

2.4 Compressed Air System

The following operational qualifications will be performed on the system:

a) Cycling (Operating time %) – (1)

b) Pressure – (1)

c) Air Quality (Instrument Air) – (3)

2.5 Chilled Water System (Existing System)

The following operational qualifications will be performed on the system:

a) Supply Temperature –(1)

b) Supply Pressure –(1)

c) Return temperature –(1)

d) Chemical Treatment Loads –(1)

e) PRV Cracking Pressure –(1)

2.6 Heating Water System

The following operational qualifications will be performed on the system:

a) Supply Temperature –(1)

b) Supply Pressure –(1)

c) Condensate Return temperature –(1)

d) Pressure Relief Operation/Lift Pressure –(1)

2.7 Steam System

The following operational qualifications will be performed on the system:

a) Supply Temperature –(1)

b) Supply Pressure –(1)

c) Condensate Return Temperature –(1)

d) Pressure Relief Operation/Lift Pressure –(1)

2.8 Life Safety Systems

The following operational qualifications will be performed on the system:

a) Pull Station Test –(1)

b) Smoke Detector Test –(1)

c) Sprinkler Testing –(1)

2.9 Building Automation System

Subsystems involved in OQ	Loop Calibration Verification	Sequence of Operation	Com. Rate Verification	Comm. Cable Capacitance Check	Data Collection	Data Synch.	Alarm Set Points	Data Logging
Air Handling System	3	1	-	-	-	-	-	1
Security Systems	-	1	-	-	-	-	-	1
Life Safety	-	1	3	3	-	-	1	1
Data & Telecom.	-	1	3	3	-	-	-	-
Data Archiving	-	-	-	3	3	3	-	1
Waste Water	-	-	-	3	3	3	-	1
Chilled Water	-	-	-	3	3	3	-	1
Heating Water	-	-	-	3	3	3	-	1
Steam	-	-	-	3	3	3	-	1
Compressed Air	-	-	-	3	3	3	-	1
Emergency Power	-	-	-	3	3	3	-	1
Containment Exhaust System	-	-	-	3	3	3	-	1
Electrical Systems	-	-	-	3	3	3	-	1
Building Power Systems	-	-	-	3	3	3	-	1

2.10 Waste Water System

Subsystems involved in OQ	Temperature	Pressure	Flow	Seq. of Operation	Alarm Verification
Cook Tanks	1	1	-	1	1
Vent Tank	-	-	1	1	1
Exhaust Fans/HEPAs	-	-	-	-	1
Heat Exchanger	1	1	1	1	1
Controls/Data	-	-	-	1	1

Subsystems involved in OQ	Temperature	Pressure	Flow	Seq. of Operation	Alarm Verification
Data Archiving	-	-	-	3	-

2.11 Lab Equipment

Equipment	Operational Test	Temp Profile
VHP Chambers	1	3
Mobile VHP Unit	1	3
Autoclaves	1	3
Walk-in Cold Storage	1	3
Freezer	1	3

Table Set 3: Perturbation Testing

Perturbation Testing will occur after completion of Operational Qualifications. This testing involves, in many cases, the interaction of multiple systems and subsystems and the evaluation of the overall performance when one or more of those components are placed into a non-standard operating condition - hence the term “Perturbation”.

Examples of the types of perturbation tests to be performed are given below. A protocol for each test will be written, including detailed log sheets to record each system’s condition before, during, and after the test. In each description, the following is given:

- The goals and objectives of the test
- What systems and subsystems are involved
- What staffing will be required for each test
- The passing criteria for the test

Autoclaves/Sterilizers

- Loss of steam
- Loss of power while in process
- Failure to seal doors

Goals and Objectives: To evaluate Autoclaves/Sterilizers used in containment areas for BSL3 and ABSL-3 during non-routine operation. This will insure materials being removed from containment, if present in an autoclave during a support system failure or an autoclave malfunction, will not be transferred into a clean space without treatment.

Systems Involved: Autoclaves/Sterilizers in the containment spaces for BSL-3 and ABSL-3.

Acceptable results:

- For power outage condition, equipment must shutdown into safe failed mode. Autoclave/Sterilizers must indicate the cycle has been interrupted. Equipment may automatically restart when power is restored but must resume at the beginning of the cycle.
- For loss of steam, autoclave should detect this failure and not operate. If steam is lost during a cycle, the equipment should stop, indicate failure, and require a restart at the beginning of the programmed cycle.
- For door seal failure, the autoclave should detect poor seal during the start of the program. It should stop, indicate a failure, and not allow restart until the door seal is repaired and a reset is indicated.
- For all failure modes, the system must maintain the interlock system to keep contained items from being removed from clean side of autoclave until a cycle has been completed. In the case of single door autoclaves/sterilizers, the unit must clearly indicate whether a cycle has been completed.

HVAC System

- Loss of Supply to BSL3/ABSL-3 – Power Failure
- Failure of auto-damper in exhaust duct
- Failure of auto-damper in supply duct
- Change of temperature greater than 5 degrees
- Failure of fan unit
- Reaction of VFD to changes in set point
- Loss of instrument air

Goals and Objectives: To evaluate the HVAC Systems during failures of support systems and particular critical subcomponent failure. This will involve evaluating the effect on containment rooms' temperature and pressure and air changes.

Systems Involved: All HVAC equipment serving BSL-3 and ABSL-3

Acceptable results:

- For power outage condition, equipment must shutdown into safe failed mode. Fans must ramp down and auto-seal dampers must close in high containment areas. Both exhaust duct and supply duct must not have excessive pressure/vacuum from the closing of the dampers. The containment rooms should maintain containment and not go positive with respect to the corridors or other outside areas. The equipment must restart when power is restored or the emergency generator is operating while maintaining an acceptable pressure differential in the containment rooms. If power is cycled off then on in short intervals, the system should react so that containment is maintained.
- For failure of an auto-damper in the exhaust or supply duct, the system must detect the failure of the damper. The reaction of the air handler to the condition should be such that the containment room does not become positive to the surrounding rooms.
- For large changes of temperature (greater than 5 degrees), the reaction of the HVAC control system will be evaluated. The system should not "ring" or have sustained oscillation. The change in temperature in a given zone for an air handler should occur within XX minutes.
- For the failure of a fan unit in an individual air handler, the redundant fan should be capable of supply sufficient air to maintain set point for the pressure differential in the containment rooms. An alarm should be sent to the BAS.
- For the loss of instrument air, the system should maintain the pressures on the containment rooms as specified. An alarm should be sent to the BAS.

Emergency Power Systems

- Loss of power feed to building while operating
    - Impact on HVAC supply and return ducts/reaction of auto-dampers
    - Time of ramp up of generator to full power
    - Emergency lighting adequacy
    - Maintenance of pressure control of containment areas
    - Elevators
    - Effect on waste treatment facilities
    - Alarms and notification system adequacy
    - Drives & Controls functionality
    - Environmental chamber temperature control
    - Functionality of all UPS systems
- Switch-over when main power feed is restored

Goals and Objectives: To evaluate the reaction of building systems and equipment during a failure of the Building Power. To evaluate the failure of particular critical subcomponent failure. The evaluation includes evaluating the effect on containment rooms.

Systems Involved: All power equipment

Acceptable results:

- For power outage condition, HVAC equipment must shutdown into safe failed mode. Fans must ramp down and auto-seal dampers must close. Controls must maintain through the outage and not be effected by the loss of data/control of subsystems.
- The generator should reach full power within XXX seconds.
- Emergency lighting should come on and stay on for XXX minutes for evacuation of personnel. Lighting must be adequate, as referenced in NFPA 101 as 1 foot candle per egress.
- The containment rooms should maintain containment and not go positive with respect to the corridors or other outside areas for a sustained time not to exceed XX seconds. Equipment serving the containment rooms and labs must restart when power is restored while maintaining an acceptable pressure differential. If power is cycled off then on in short intervals, the system should react so that containment is maintained.
- Power to elevators should be turned off. Personnel should be able to open doors manually.
- For variable frequency drives (VFD), programming for the unit must “ride through” the power outage and resume control on emergency power.
- For the alarm systems and BAS, the alarms must be able to be received and recorded throughout the power outage. The data archiving system must maintain operation and no data may be lost during the outage. This applies to the security system data as well as the BAS data.
- For environmental chambers, controls must maintain set points and the systems must be able to operate on emergency power.
- For the WWT system, the control system must maintain the set points. Insure that during the power outage, the system can continue to receive waste. Verify the WWT plant can process waste on the emergency power system at full capacity.
- For the UPS backup (specific systems are equipped with this feature), the UPS must maintain sufficient power to operate the specified equipment for XX minutes. The UPS must alarm when activated to the BAS.

Compressed Air System

- Loss of power – ability to keep pressure on APR doors
- Loss of compressor/valve
- Loss of pressure due to compressor equipment failure

Goals and Objectives: To evaluate the Compressed Air System during failures of support systems and particular critical subcomponent failure. This will involve evaluating the effect on containment rooms with APR doors, WWT system, and other systems serviced by the Compressed Air System.

Systems Involved: All APR, all AHU units, and WWT system's valves and controls.

Acceptable results:

- For power outage condition, equipment must maintain proper seal around door to keep air from escaping containment areas.
- For failure of the compressor, the system must alternate to the standby compressor automatically. It must send an alarm to the BAS.
- For failure of the system (rupture, second compressor does not start), the system must alarm to the BAS and immediately alert maintenance personnel.

Security System

- Loss of power – effect on building security
  - Control of doors
  - Ride through for data collection, main controls
- Security level and ability to enter without proper authorization

Goals and Objectives: To evaluate the Security System during failures of support systems and particular critical subcomponent failure. This will involve evaluating the effect on entering and exiting containment rooms during power outage.

Systems Involved: All Security equipment in the Building

Acceptable results:

- For power outage condition, Security system must maintain secure access to facility and have remote doors function from Security desk. Personnel must be able to exit the containment rooms with power out. Data archiving must continue with a power outage. Camera control must continue for power outage.
- For improper access, the system must recognize the combination of card access and biometric reader. The system must alarm to the Security Console in the event of repeated attempted access to areas with improper clearance.

Building Automation System

- Control of HVAC Systems during fire alarm condition
- Loss of power – effect on overall building control
  - Fire alarm systems
  - Communications (telephony/data/fiber)
  - Alarms and remote notification
  - Lighting levels and ability to use cameras
- Data archiving failure

Goals and Objectives: To evaluate the Building Automation System during failures of support systems and particular critical subcomponent failure. This will involve evaluating the effect on containment rooms.

Systems Involved: All Automation equipment in the Building

Acceptable results:

- For fire alarm conditions, the BAS must shut down designated systems as outlined in the Safety Matrix.

- For power outage condition, equipment must maintain fire alarms, communications, access alarms, lighting levels, and camera mobility. If power is cycled off then on in short intervals, the system should react so that monitoring conditions are maintained.
- For the failure of data archiving, a redundant system must operate and resume operation.

Waste Water Treatment

- Loss of power – system reaction and alarms
- Processing conditions out of specification – evaluation of system
    - Loss of domestic water for cooling
    - Loss of compressed air supply
    - Loss of steam
    - Failure of load cells

Goals and Objectives: To evaluate the Waste Water Treatment System during failures of support systems and particular critical subcomponent failure. To evaluate the Waste Water Treatment System during the loss of services such as water or compressed air.

Systems Involved: All Waste Water equipment.

Acceptable results:

- For power outage condition, equipment must maintain correct waste flow path and have no backflow. If power is cycled off then on in short intervals, the system should react so that waste containment conditions are maintained.
- For power outage conditions, the controls system must maintain set points and “ride through” until emergency power is on line. Load cells must be on UPS power to insure accurate measurement of tank levels in power outage.
- For loss of domestic water (used for cooling), the system must alarm to indicate an impending discharge problem. Discharge from the system above the allowable temperature must be returned to a treatment tank and not discharged into the sanitary system.
- For loss of compressed air, valves in the system must fail such that wastes can continue to discharge into the system and not back up into the rooms. An alarm must be sent to the BAS. Critical valves must have manual overrides.
- For loss of steam, the WWT controls must detect the loss and stop processing automatically. An alarm must be sent to the BAS. When steam is restored, the cycle must start at the beginning, not resume.
- For a failure of load cells on the tank, the WWT system must detect a potential load cell malfunction and alarm to the WWT controls. Waste must be diverted into another tank until the load cell is repaired/calibrated.

Bio-Safety Cabinets

- Effect of change in room pressure on containment
- Loss of power – effect on containment

Goals and Objectives: To evaluate Bio-safety Cabinets when support systems fail. To evaluate effectiveness of cabinet when the room pressure changes.

Systems Involved: Bio-safety Cabinets in BSL-3 – ABSL-3

Acceptable results:

- For power outage condition, equipment must shut down and restart when emergency power initiated.
- For Room change differential, the containment must be preserved through the range of possible room pressures (positive or negative).

Table Set 4: Performance Qualifications

Performance Qualification testing will occur as the final stage of the Commissioning Plan. During this extended period, systems will be challenged to evaluate their overall performance, reliability, and accuracy.

Biological Challenge Tests

A challenge using a biological agent will be conducted on the following equipment:

- Autoclaves in BSL3 – ABSL-3 areas
- Aero-Biology spaces
- Waste Water Treatment

The goal of this testing is to insure that systems designed for containment and destruction of bacteria operate correctly and provide an acceptable kill rate when operated as specified.

1. Autoclaves

Goals & Objectives: To evaluate the performance of autoclaves in the high containment area using known bacteria. Samples will be ampoules containing bacteria, Bacillus stearothemophilus, at a know concentration. These will be placed throughout the autoclave volume and the standard cycle will be run. Analysis of the ampoules will be performed to determine if the degree of kill is acceptable.

Systems Involved: Autoclaves in ABSL-3 and BSL3 areas

Acceptable results:

- 6 log reduction of bacteria in the ampoule

2. VHP Cleaning of a Containment Room

Goals & Objectives: To evaluate the decontamination of a BSL3 or ABSL-3 room using Vaporized Hydrogen Peroxide (VHP). Spore strips containing Bacillus Subtillis will be placed around the room on horizontal and vertical surfaces. A standard protocol of VHP decontamination will be performed then the strips will be removed and analyzed by a certified lab.

Systems Involved: BSL3, ABSL-3, Aero-Biology Suite, VHP mobile unit, Bacillus Subtillis

Acceptable results:

- XX% bacteria killed

3. Waste Water Treatment

Goals & Objectives: To validate the Waste Water system operation. The liquid waste decontamination system must be capable of automatic operation that renders the waste stream biologically inactive. This test will be performed using a bacteria, Bacillus stearothemophilus.

Systems Involved: Waste Water Treatment System and Support Equipment

Acceptable results:

- 6 log reduction of bacteria contained in ampoules treated in the system

Building Air Regulation

This test will confirm constant and stable pressure and temperature control for all zones of the RBL over an extended period.

Goals and Objectives: To evaluate the HVAC system in the building for 30 days to maintain constant air pressure and temperature. During this time, temperature and pressure set points will be modified and the system control monitored. Normal and non-routine activities (doors opening, dampers operating) will occur and the system reaction will be evaluated.

Systems Involved: HVAC, BAS/Controls

Acceptable results:

- Maintenance of set points and achievement of performance as established
    - XXX Air Flow
    - XXX Temperature Range

Data Control

To insure correct logs, charts, and graphs are being generated from the appropriate systems

Goals and Objectives: To evaluate the data control system for data measuring and recording after 30 days.

Systems Involved: Data Control System

Acceptable results:

- XXX
- XXX

Data Storage and Archiving

Insure all data being generated through the RBL is being properly backed up and archived from all systems

Goals and Objectives: To evaluate the data archiving system for backup and archive procedures at the end of 30 days. This test will include data retrieval and confirmation of information using a secondary data storage media. Data will then be transferred to the archiving media and successful transfer will be confirmed

Systems Involved: Data Archiving System, various systems transmitting data

Acceptable results:

- XXX
- XXX