

Section D “Description of Planned Facility and Design Plan Justification”

General Facilities Description

This proposed, free-standing 56,520 gross square foot (GSF) facility will provide space for 100+ researchers, directors, administrators, managers, laboratory technicians and support staff, all dedicated to the University of Washington NIH WWAMI¹ Regional Center of Excellence (RCE) for Biodefense and Emerging Infectious Diseases and the Northwest Regional Biocontainment Laboratory (NWRBL), which will be the principle and permanent tenant. As described in the Project Strategic Plan, this facility will also serve as a regional resource and will have scientists who will collaborate with the RCE.

With rare exception, this allergy and infectious disease research facility will be self-contained. While under normal conditions, the facility will rely on major utilities delivered via the Campus utility tunnel system, it will have sufficient back-up resources to continue to operate, if those services are interrupted, including a fresh water supply.

The preliminary design responds to NIH/CDC BMBL, and other Federal and State guidelines for health, safety, security, and environmental protection required for conducting studies on NIAID Category A, B, and C priority pathogens. In addition to responding to the N+1 requirements, a full risk assessment has been conducted utilizing a Hazard Analysis and Critical Control Point (HACCP) assessment to insure the design and research protocols are in concert.

As required by the RFA, the research functions include BSL-3, BSL-2, molecular biology, cell culture laboratories, extensive ABSL-3 animal holding and procedure rooms, an aerobiology challenge suite, cage washing, waste treatment plant, alkaline digester, faculty, administrative and other support staff offices, as well as, conference rooms and supporting infrastructure. When non-human primate sterile surgery is required, it will take place in the Northwest Regional Primate Research Center (NRPRC), which is located less than a block away in the Health Sciences Campus. NRPRC also has an International Quarantine Facility, which will be used as required. Non-primate breeding will occur in the soon-to-be-completed Bioengineering and Genome Sciences complex, located across 15th Avenue North East.

One over-riding design principle that will be part of the Basis for Design is that the final layout of functional spaces, HVAC and other utility distribution systems will facilitate strategic renovations, i.e., pocket or small area renovations while maintaining full functionality in the remainder of the building. This concept is greatly enhanced by the use of interstitial space for utility distribution. All data, power, and piped utilities will be down-fed from the interstitial space. These utilities will have a single penetration and be distributed on standoffs within the BSL-3 and ABSL-3 spaces,

The cost plan includes allocations for durable finishes and materials not only for low maintenance but for a facility that will a useful life expectancy in excess of 20+ years.

The NWRBL will have a Facilities Manager/Engineer who is responsible for the Building Automated Systems (BAS) and all maintenance. The Commissioning Plan stipulates that members of the University Facilities Services will be trained in Building Systems operations and will be under the supervision of the NWRBL Facilities Manager/Engineer.

While most University building's BAS are controlled at a centralized Facilities Operation office, the RBL systems will only be controlled within the RBL. University Facilities Operations center will have read-only capabilities. The BAS will also monitor critical scientific equipment such as sub-zero freezers as well as the animal environmental conditions.

There is a complete description of the Building Systems and the N+1 redundancy in the previous Section.

Security and Containment

The security requirements for select agents, animals, personnel and research activities were one of the fundamental principles guiding the site selection, site access, interior circulation, layout of functional units, and building stacking. Given the density of this urban campus, the selected site meets the security requirements for NIAID Category A, B, and C priority pathogens.

The building has restricted and controlled access with multiple and progressive security zones. Additionally, these security restrictions and procedures insure the integrity of the research programs, research colonies, and select agents. All personnel enter the facility through a security checkpoint. Guests will be escorted and will only be allowed in primary secure areas of the facility.

Special attention has been given to providing a high security route for the movement of select agents within operating suites. This route includes secure corridors and an elevator with biometric access and controls. The operating units served by this route include a BSL-3 Laboratory suite, the Aerobiology ABSL-3 suite and the Vaccine lab, each of which also have biometric access controls.

Decontamination and Sterilization Procedures

In general, most solid waste, cages, racks and PPE will be sterilized using steam autoclaves. For materials such as HEPA filtered facemasks and small scientific instruments, which cannot be autoclaved, we have included a pass-through, VHP sterilization chamber in several locations. Tissue and other specimens leaving ABSL-3 and BSL-3 facilities will use chemical dunk tanks to sterilize the containers. Labs, animal holding and procedure rooms will be decontaminated via VHP, with paraformaldehyde as a back up. The Basis for Design will have a statement regarding the use of construction materials that are compatible with both of these methodologies as well as chemicals for routine sanitizing.

Waste Treatment & Environmental Protection

Given that this campus of the University of Washington is in an urban setting, it was decided early on to provide on-site waste treatment. All laboratory and animal waste will be treated and the outfall monitored prior to connecting to the sanitary sewer system.

Structural Plan

The structural design includes blast-resistant, concrete construction with an exterior that reflects traditional Campus architecture as much as possible to blend in with other

academic structures. The structural grid reflects bay spacing consistent with modern biomedical research facilities and a live load of 125-150 PSF.

Structurally the building will have two 20' high floors over a partial basement. The 20' high bays allow for 10' ceilings and a full interstitial space with walk decks for utility and HVAC distribution. Most of the building systems will be maintained in the interstitial spaces, some equipment like autoclaves, cage washers, will require the presence of service personnel in the occupied spaces. All personnel working in, or on the building require background checks and comply with the USA Patriot Act, but the use of interstitial for main utility services greatly reduces the number of research interruptions.

The basement will have a 14-foot clear understructure for large mechanical equipment and an access way with a lift-out and secure lid to replace chillers, boilers, and emergency generators.

The only major equipment not contained within the perimeter of the building are the air handlers and these are in a screened enclosure on the roof. The fresh air intake will be strategically located and designed to prevent entrainment of biological organisms and toxins².

There are two options for supporting the walk decks; they can be hung from the overhead structure or supported on the columns directly over the corridors below. In order to provide more open space for large equipment in the basement, the two interior columns system may be switched to one column using a transfer beam.

Exterior Circulation and Security

Core faculty and staff will enter the NWRBL via the southeast entrance. Service vehicles will arrive from Boat Street, completely enter the site in the service yard off Brooklyn, and then back into one of three secure dock spaces. All dock spaces are normally in a secure position behind a locked rolling steel door. The site has one parking place, which is dedicated to UW Facility Services vehicles.

One dock, isolated from the others, is dedicated to animals, animal food, and bedding. Delivery vehicles must back completely inside the facility and wait until the door is secured before unloading. Animals are off loaded directly into Receiving and Quarantine. Bedding and food will be off loaded and moved to storage after the vehicle has left the facility. A second dock contains a small trash compactor located completely inside the facility. The third slip is a common dock where the door will remain open during regular deliveries under the supervision of the Dock Manager.

The Dock Manager will control all dock doors and must authorize all deliveries. Select agent delivery protocols and procedures require authorization by the Responsible Official and the Dock Manager and the before acceptance. Deliveries will not be accepted at the personnel entrance.

Skamania Lane is a major pedestrian walkway connecting this site to the Health Sciences complex and borders the NWRBL building on the north side. The site will undergo extensive planning to prevent vehicles and unauthorized personnel from the exterior of the building. One of the major advantages of this site is the unobstructed visibility.

Interior Circulation and Security

Personnel background checks and identification are required for all personnel to work in the NWRBL. The University of Washington Health Sciences photo ID and proximity card system will be used in addition to biometrics for access control. These will continue to be issued by the Office of Health Sciences Academic Services and Facilities (HSAS&F) with the authorization of the Responsible Official (EH&S) and the UW Police Department. To insure maximum security, biometric data will be recorded by HSAS&F on a CD, which will be hand, delivered to the security server in the NWRBL.

The selection of a biometric system will depend upon the level of security and the specific protocols. However, login and logout is mandatory for all personnel working in or entering the facility. Since lab personnel are often in PPE, retinal and/or facial recognition may be used in the most secure environments.

The complete Security Plan is included in this application, however it is worth noting that the UW Police Department is located less than one block west of this site on Boat Street. The University of Washington Police Department is a Washington State Patrol and FBI accredited law enforcement agency, in which all uniformed officers are academy trained and certified.

There are two sets of stairs required by the International Building Code (IBC); one with an elevator is located in the south office area for vertical circulation. However, the strategic arrangement of bays for offices, research labs, and support functions minimizes the need for vertical circulation. This is a critical issue in a facility working with NIAID Category A, B, and C priority pathogens where movement of pathogens is restricted.

The south elevator and stair will serve multiple functions and will have stops at the basement, interstitial levels, first floor, second floor, and the roof. The security access system will insure that only those personnel with a "right-to-be" will have access to any or all of these areas. The University, through its long history of cooperation with the local Seattle Fire Department Battalion Chief, will develop emergency entry procedures for emergency personnel during the design and construction phase.

The north stair will be limited to emergency exit only. The north elevator will be operated using biometrics and coupled with secure corridors on the first and second floor, will be used to transport select agents between research labs, vaccine production and the aerobiology facilities. It will have stops only on floors 1 & 2.

Basement Plan

The basement houses the waste treatment plant, emergency generators, boilers, electrical switchgear, pumps, and chillers. Laboratory and animal waste is transported through exposed double-walled piping and is designed to be accessible for inspection. (See Appendix "B" and "C") The waste treatment plant room is designed to be containable.

The Campus utility tunnel will be extended to the NWRBL. Access to the NWRBL through this tunnel is addressed in Civil Section and well as the Security Plan.

Sound insulation will be added to the generator room to reduce noise in the animal facility.

Main (1st) Floor Plan

The first floor lobby and office zone houses the building main controlled access to include a sally port, Security Desk and Security Monitoring. It also houses a Video Conference room, open Interaction Space, Responsible Official office (UW EH&S), five (5) Research Faculty offices, Facilities Manager/Engineer office, Informatics Staff offices with a Secure Server (Data) Room, Secure Records Storage, core circulation including stair, passenger/freight elevator and “public” toilet facilities. (See Figure #17)

The research servers function on an internal, NWRBL LAN only for security purposes. However, users will be connected to the Campus computer network and voice system for regular business and non-research activity.

A portion of the laboratory zone is dedicated to a BSL-2 Suite with seven labs, a Molecular Biology Laboratory, a Mass Spec Laboratory, and a Core Instrumentation Laboratory that has additional live load capability and vibration isolation.

The Molecular Biology and BSL-2 labs serve the faculty located on the Main Floor and part-time faculty arriving from the Health Sciences complex a block to the east and from the other institutions represented in the RCE. It should be noted that the shower, toilets and locker rooms are larger than code requirements in order to provide space for these non-resident, researchers.

The remainder of the first floor is dedicated to animal housing, animal support functions, and building infrastructure.

ABSL-3 Facilities

We have elected to design a large, self-contained BSL-3 containment zone. This zone is served by male/female shower rooms and has five (5) ABSL-3 Animal Holding suites (holding with procedures rooms). Maximum containment is achieved by including Diagnostics, Necropsy (with a digester) and Vet Services within this containment zone (See Figures 9 & 10). Personnel working in this zone enter through a controlled access vestibule, which is stocked with additional PPE. Clean cages and racks also enter the zone through this vestibule. Personnel leaving this containment zone do so through the shower rooms.

Used cages (with waste and bedding) and racks from animal holding are sterilized through one of two autoclaves (w/Bioseals) located in the north wall of Cage Wash. Cage Wash also has a dunk tank for decontaminating specimens containers. Tissue leaving the facility will be “fixed” in Necropsy or Diagnostics.

The five animal suites are planned for holding mice and rabbits. Each suite has 3 ventilated racks, each with 160 cages holding 5 per cage, providing a total capacity for 12,000 mice. Rabbits will require different racks. The racks deliver HEPA-filtered fresh air to individual cages; the exhaust is hard-ducted to general room exhaust and exits through additional HEPA filters in the interstitial space. The Building Automated Control

System is designed to respond to changes in requirements for the number of animals and species.

Bottled water will be used for mice and rabbits. Each Holding room has a cage change station and the Procedure Room has a BSC for minor procedures. The SOP will address relocating racks during routine decontamination of the holding rooms.

Necropsy

This facility is dedicated to mice and rabbits, all non-human primate necropsies will be performed in the aerobiology suite. The room has a portable necropsy table lighting and a BSC A1 with CO² for euthanasia. Tissue specimen containers will be processed in a chemical dunk tank before transport to Tissue Processing. Carcasses and tissue may be stored in a secure freezer until sufficient quantities are reached to justify using the Tissue Digester.

Diagnostics and Veterinary Services

These spaces are dedicated to routine examination and treatment of normal animals. The Diagnostics laboratory has standard casework with a sink and countertop for equipment to including: plate readers, centrifuge, incubators, small autoclave, and PCR. Floor space is provided for a refrigerator and freezer. A BSC B2 will be used for routine tissue work and limited amounts of VOC. A section of the casework has a room-darkening drape for an FA dissecting microscope.

The Veterinary Services room will have an exam table with ceiling-mounted task lighting, a wall sink and safe for controlled substances.

The remaining space is an ABSL suite dedicated to Aerobiology with two (2) holding rooms and a large procedure room. The remainder of this floor is dedicated to Animal Receiving, Quarantine, Cage Wash, Food & Bedding, Tissue Processing, DNA Sequencing Lab, Docks, Dock Management Office, Showers, Toilets and Lockers, Veterinarian Office, Break Room, and Animal Care Supervisor's Office. There is also a Mass Spec lab on this floor.

The proximity of these various functions reflects the philosophy of minimizing the need to circulate between floors and limiting animal procedures to this floor. This strategy also augments security, as well as simplifies HVAC distribution.

Core Instrumentation

Procedures that take place in the Core Instrument facility require BSL-3 containment; therefore, there is an anteroom, shower, and PPE storage. Contaminated waste will be decontaminated chemically within the space. The scientific equipment includes a Florescence Activated Cell Sorter (FACS), Microscope Deltavision Confocal, Microscope deconvolution/FRET, Preparation ultracentrifuge, Small animal NMR, LC/GC Mass Spectrometer, and Robotic colony picker(s) plate handling.

Aerobiology

There is limited experience nationally in planning facilities for aerobiology challenges on non-human primates. As this Application is being prepared, members of the University RPRC and RCE are in contact with other research institutions that are exploring methods, protocols, and appropriate facilities. It is likely that prior to proceeding with the design of this RBL, those plans will have matured and we will modify our approach accordingly.

We have included a suite dedicated to aerobiology studies on non-human primates (See Figure #11). Given the impracticality of placing primates in individual isolation caging, this plan proposes to treat the holding rooms as primary containment, thus requiring special construction, protocols, and PPE for research staff.

The high containment nature of this suite requires construction that utilizes poured-in-place concrete walls and welded plate steel ceilings with a 90-mil "Carboline" a chemical-resistant, polyurea-elastomeric coating on walls and ceiling and using Air Pressure Rated (APR) doors. (A flat concrete slab is an alternative to the steel plate ceiling.) Pressure decay tests during construction and commissioning will be required to insure the integrity of the containment suite.

The design suggests using four Britz-Heidbrink^{RT} Animal Isolation Cubicles with automatic watering in each of two holding rooms. The cages would have a dry pan system. This arrangement would permit eight different trials to be conducted at the same time. The ventilated isolation chambers have glass doors and are orientated so animals will have visual contact with others.

The main access to this aerobiology laboratory is through a controlled access APR door for personnel, caging and foodstuff. In turn, each holding room has an APR door and will be designed to the same containment requirements as the procedure room.

The infection exposure phase (airborne challenge) of the studies will be carried out utilizing an "In-Tox^{RT}" device within a modified B3 cabinet with a hinged sash similar to ones used for centrifuges, which provides maximum protection for the researcher.

Blood draws would be performed in the Procedure room with the animal in a squeeze cage. Necropsies and tissue harvesting would be performed in a BSC. An alkaline digester is included for tissue disposal. Tissue and other specimen containers would be decontaminated in a chemical dunk tank prior to leaving the suite for processing.

A pass-through VHP sterile transfer chamber is planned for decontamination reusable PPE and a double-door, interlocked autoclave is provided for animal waste and decontaminating cages. All liquid waste lines are connected to the basement waste treatment plant via double-walled piping.

Personnel exit the aerobiology suite through an anteroom then the shower that is connected to the non-containment corridor through an APR door.

Molecular Biology Lab

This is a traditional wet laboratory for basic molecular and cellular research. There are two (2) BSC A1, casework, sink, and space for incubators. Given that much of the

research will be conducted on non-infectious specimens, these facilities, coupled with the BSL-2 labs will, form the majority of the research workspace.

Cage Wash and Cage Staging

The north wall of Cage Wash room forms a portion of the ABSL-3 containment Zone and devices protruding through this containment wall require bioseals. Cages with bedding arrive in red bags to the Cage Wash area and are sterilized in either the large rack size autoclave or the smaller one, which is reserved for routine maintenance of the larger rack unit.

- Sterilized bedding and waste are removed from the cages in the Dumping station
 - Bags of sterile bedding and waste are transported to the compacting dumpster
 - Cages are sent through the Tunnel Washer. There are two cage/bottle washers, which may be used as back up for the tunnel washer.
 - Cages are “staged” with new bedding and then stored in Cage Staging.
 - Racks from housing move directly to the large, rack-size autoclave and then to the Rack Washer. (The SOP requires that the corridor floor connecting Cage Wash with Holding be sanitized after racks are moved through the area.)
 - Clean/Sterile racks are stored until required in Cage Staging. There will be additional sterile, back-us racks when the rack autoclave is down from maintenance.
- Cage Staging area also contains: Bedding Filler Dispenser, Chlори-Flush Station, Chlorine Injection Station, and Bottle Filler.
- A clothes washer and dryer are provided for lab coats and other PPE, thus reducing the number of deliveries and vendor calls to the facility.
 - Access to maintain this equipment is in secure but non-containment space.

Food and Bedding

Animal food and bedding will arrive through the dock and be stored on pallets. There is a large secure refrigerator for storing food for primates. The space has direct access to Cage Staging.

Tissue Processing

The SOP will stipulate that only fixed tissue will be processed. However as an added safeguard, there is a BSC B2 available. The lab has the standard movable histopathology equipment, including, microscopes, tissue imbedding, and microtomes. The sink is intended for general lab purposes and also for tissue staining. There is limited storage capacity for chemicals.

DNA Sequencing Lab

This lab contains standard casework with a sink as fixed equipment and the following scientific equipment: Real-time PCR, Oligonucleotide synthesizer, Peptide synthesizer, Surge Freezer, Plate reader (UV/VIZ/Fluorescence)

Second Floor

The second floor office zone is dedicated to the facility Director’s suite, which contains, the Director’s office, offices for two (2) Assistant Directors (RCE and NWRBL), open staff cubicles and a large Conference Room. This suite is considered to be at security level 3

due to the nature of the research records. One of the Assistant Directors is also the Facility Administrator.

There are six (6) Senior Research Faculty offices, seven (7) Staff offices, Work Room, Lunch Room, Open Interaction space, and a Conference Room. It is significant that the Lunch/Break Room and the Interaction spaces are located with the nicer external views to encourage staff to remain in the complex.

BSL-3 Laboratories

Given the diversity of known infectious agents and emerging organisms, the facility has six (6) large BSL-3 procedure labs. These labs are divided into two suites of three labs each with supporting labs. Both suites have pass-through, interlocked autoclaves, personnel shower/lockers/toilet/lavatory and sterile transfer chambers. The main suite (See Figure #19) has a secure storage room, radioisotope lab, a warm and a cold room.

The second suite, which may be used for BSL-2 protocols until it is required for BSL-3 activity, has a large area for equipment and sub-zero freezers in lieu of the isotope lab; secure storage, warm and cold rooms.

As described previously, access control will be maintained with biometrics and while it is not required, we have added showers to these suites for added containment and toilets for added convenience. All centrifuges are in modified glove boxes.

BSL-2 and Support Laboratories

In addition to the BSL-3 suites there are 2 BSL-2 Suites on this floor. Each suite has 9 labs, 3 of which have CFHs and the remainder BSCs. (See Figure #23) There is an additional Molecular Biology Laboratory and six (6) Tissue Culture Labs. As previously stated, the majority of research will take place on low-level or non-infectious organisms, which accounts for the quantity of these types of laboratory spaces.

Shared Instrumentation

The Shared Instrument Laboratory will house scientific equipment such as a Phosphorimager, FPLC, GC, analytical balances, centrifuges, and HPLCs. It is anticipated that the facility will also be used in methods development and testing new equipment.

Vaccine Production Laboratory

Located between the two BSL-3 laboratory suites is a 1,568 square foot BSL-3, GLP vaccine production facility (See Figure #20) with lyophilizers, bioreactor, fermentors, cold room, pass-through-interlocked autoclave and a Class 100 sterile fill clean room.

The proximity of this facility to the BSL-3 labs minimizes and facilitates the movement of select agents within the facility. The North elevator will be accessed using biometrics and will transport vaccines and select agents to the aerobiology suite designated for clinical trials. The secure stair is an alternative to the elevator.

The suite has a controlled access entry using biometrics, in addition to a shower in the degowning area as an additional measure of containment.

Media Suite

This suite of rooms serves all the laboratories in the facility and contains a glass washer, dryer, steam sterilizer (using pure steam) and a commercial clothes washer & dryer, deli-case for storing plates and tubes, Horizontal Laminar Flow (HLF) cabinet for plate and tube pouring, a dry chemical storage cabinet and a balance table. The icemaker is available to the entire floor. Lab coats and scrubs to be laundered in this facility will be first autoclaved in Cage Wash.

1. The University of Washington School of Medicine is the lead institution for the regional medical education network representing the states of Washington, Wyoming, Alaska and Idaho. (WWAMI). The RCE also has an association with partners in eleven institutions in this region.

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While not yet operational for this application, a prominent UW group has developed biosensors that may be used to detect airborne biological organisms in the intake as well as exhaust and effluent.