FACILITY DESIGN PLAN
FOR
ANIMAL DISEASE RESEARCH AND DIAGNOSTIC LABORATORY ADDITIONS AND RENOVATIONS
SOUTH DAKOTA STATE UNIVERSITY
September 4, 2016

SDSU seeks approval of this Facility Design Plan to construct an addition to the South Dakota Animal Disease Research and Diagnostic Laboratory and to renovate the existing facility. The Animal Disease Research and Diagnostic Laboratory (ADRDL) is the State of South Dakota's Veterinary Diagnostic Laboratory whose fundamental mission is to provide research and diagnostic services to serve the livestock industry, other animal owners, and public health interests of the state. The ADRDL facilities are located on the campus of South Dakota State University.

The Board of Regents approved the Preliminary Facility Statement at their October 2014 meeting and approved the Facility Program Plan at the December 2014 meeting to authorize architectural programming and examination of alternative schematic designs for the future project. A building committee was formed and selection of the design team was completed. The Clark Enersen Partners and West Plains Engineering were selected to provide design services. The programming and schematic design work was completed in 2015. SDSU requested the BOR seek approval from the 2016 State Legislature to authorize continued planning and design of the project. The BOR acted at the December 2015 meeting to support legislation that would allow detailed project planning to proceed. HB 1080, approved by the 2016 South Dakota Legislature, authorized funding for a design study for potential expansion and renovation of the State Animal Disease Research and Diagnostic Laboratory. The building committee selected McCown Gordon Construction as the Construction Manager @ Risk for the project in May 2016. Design and planning is proceeding into the design development stage of the project.

In addition to approval of this Facility Design Plan, SDSU requests support for legislation that would allow the project to be authorized for full design and construction by the 2017 South Dakota Legislature. The scope would include an addition to the existing ADRDL, renovation of the existing ADRDL, relocation of a livestock holding facility, and demolition of some small storage buildings.

a. Architectural, Mechanical, and Electrical Schematic Designs

The space needs remain consistent to the programmatic needs addressed in the Facility Program Plan which include:

1. Establishment and growth of antemortem testing (molecular diagnostics);
2. Growth of infectious disease research;
3. Establishment and growth of additional diagnostic sections for food safety testing and continued space needs for high throughput testing for livestock diseases;
4. Growth in testing to match growth in swine, dairy, and livestock production in the state and region;
5. Existing facility maintenance, upgrades, and retro-commissioning;

6. Need for flexible diagnostic and research space that can function as a Biohazard Safety Level 3 diagnostic laboratory;

The schematic design has been refined and the project has entered the design development phase. Alternatives for remodeling, renovation, and new construction were examined through the schematic design. Attached are contemporary architectural, mechanical, and electrical drawings of the project. Drawings illustrating building sections and elevations are also included. A description of the project scope is shown below.

The project scope will be an addition north of the existing Animal Disease Research & Diagnostic Laboratory (ADRDL). The existing building will be renovated and remodeled to address programmatic needs for efficient research space and address long term maintenance needs to upgrade the facility to modern standards. An essential design requirement is to maintain the full daily operations of the diagnostic and research lab throughout the construction activities necessary for the project.

The best option to ensure continuous operation of the ADRDL will be to construct an addition that will contain all diagnostic laboratory functions including the BSL-3 laboratory. The diagnostic and research functions can temporarily take place within the new addition while the existing laboratory is upgraded and remodeled into research space. When the renovations are complete, the remodeled ADRDL can be backfilled with the researchers and support staff. This phasing is seen as the most efficient (cost and time) for the project by the design consultants. This opinion has been affirmed by the construction manager at risk.

Categories for various laboratory and diagnostic sections are shown below to illustrate the distribution of the space needs. An attachment to this report is a detailed breakdown of space needs for these categories of spaces. The line titles are indicative of the dominant function of that particular laboratory section.

Addition:		
Molecular Diagnostics	-	3,248 nasf
Virology	-	2,220 nasf
Food Safety Microbiology	-	1,972 nasf
Bacteriology	-	2,252 nasf
Serology	-	2,493 nasf
Histopathology/Clinical Pathology	-	3,209 nasf
Necropsy	-	4,654 nasf
Sequencing & Informatics	-	910 nasf
BSL-3 Laboratory & BSL-2 Enhanced Necropsy	-	3,404 nasf
Receiving & Accessioning	-	2,790 nasf
Shared Laboratory and Laboratory Support Spaces	-	5,125 nasf
Office and Office Support Spaces	-	5,387 nasf
Total Net Assignable Square Footage	-	37,664 nasf
Unassigned space	-	43,099 sf
Total Gross Square Footage of Addition	-	80,763 gsf

The net assignable area of the building is supplemented by unassigned space (e.g. corridors, vestibules, walls, stairs, elevators, mechanical rooms, electrical rooms, plumbing, technology, and custodial). The total of unassigned space and the net assignable floor area results in the

gross building area. Laboratory buildings typically have a large percentage of the building that is unassigned floor space due to extensive space requirements for mechanical, electrical, and laboratory support systems. Attached is a detailed listing of spaces for the proposed addition.

Existing Building Renovation:		
Research Laboratories	-	8,480 nasf
Research Laboratory Support Spaces	-	3,598 nasf
Necropsy Research Suite	-	4,015 nasf
Graduate Student & Research Technician Offices	-	1,472 nasf
Offices and Storage	-	7,245 nasf
Total Net Assignable Square Footage	-	24,810 nasf
Unassigned space	-	38,650 sf
Total Gross Square Footage of Addition	-	63,460 gsf

The existing building has a full interstitial space above the research & diagnostic laboratory areas to facilitate maintenance, ensure biocontainment, and contain all mechanical equipment. This accounts for the high proportion of unassigned space to net assignable space in the existing building. Attached is a detailed listing of spaces within the renovated existing building.

The floor plans have been established utilizing modular planning. This is an organizational tool to allocate space within a laboratory section, utilize standard casework & equipment components, and standardize laboratory services. The module size for the building is 11 feet by 33 feet. This will accommodate standard peninsula benches, wall benches, fume hoods, biological safety cabinets, and benchtop equipment identified for use within the laboratories. It also provides aisles that are 5 feet wide which allows safe personnel passage within each laboratory and complies with accessibility guidelines. This module is adaptable as technology, equipment, and testing procedures change.

A fundamental principle for organizing the floor plan of the diagnostic laboratory is called the “Onion Skin”. Also, the principle of “clean” and “dirty” spaces also affect the organization of the spaces and bio-containment of the samples as they arrive and are analyzed.

These principles are applied to place the necropsy floor centrally. Essential technical sections that require direct access to the necropsy floor, surround the necropsy floor, essentially plugging into this space. Receiving/Accessioning, BSL-3 laboratory, BSL-2 enhanced necropsy, Virology, Bacteriology, and Histopathology/Clinical Pathology have been placed immediately adjacent to the high bay necropsy space. Samples delivered to accessioning or directly to the necropsy space can be directed to the proper lab via pass through windows. Molecular Diagnostics, Food Safety/Microbiology, and Serology typically receive samples through client drop offs or mail (rather than through the necropsy area), so these labs can be nearby without a direct connection to necropsy.

Research and diagnostic laboratory spaces (new construction, renovated space, and retro-commissioned space) will be constructed and equipped as Biohazard Level 2 (BSL-2) wet laboratory spaces, which is consistent with the existing ADRDL. Standard features of this type of laboratory are laboratory bench space with phenolic resin countertops, softened, treated and deionized water, laboratory gases, fume hoods, biosafety cabinets, and robust mechanical systems.

The laboratories will be planned as suites of space that include the wet lab space, adjacent instrument support space, and adjacent offices. Instrument support space will include necessary specialized equipment (i.e. walk-in coolers, thermocyclers, refrigerators, freezers, ultra-cold freezers, centrifuges, electrophoresis equipment, etc.). Private offices for principal investigators, managing lab technicians, and faculty members will be in close proximity to the laboratories. Shared offices are provided for lab technicians and graduate students.
The BSL-3 laboratory needs a direct connection to the BSL-2 enhanced necropsy space so that tissues and samples from suspect cases can be transferred directly to the BSL-3 lab for analysis. The BSL-3 space requires special accommodations. This lab will have its own locker and shower entry, pass through sterilizers, and equipment decontamination room. The BSL-3 suite is required to be a sealed, self-contained environment. Pathogens are to be contained, diagnosed, and rendered inactive entirely within this lab. Emergency power shall be available to all equipment and heating and ventilating systems. All air entering or leaving the lab shall be filtered with HEPA filters. Effluent shall be sterilized. All samples shall be rendered sterile and disposed of with a waste incinerator.

Access and delivery of samples is a public function. The building design allows convenient public access where necessary, but is zoned to restrict access where bio-security and chain of custody is a concern. The floor plan is also organized to allow for a high level of interaction among the diagnostic sections.

The addition will be a 2 story building with a partial basement under the BSL-3 laboratory suite. The second story will be a combination of interstitial mechanical areas and laboratory sections. The building construction will be a structural steel frame. This frame will rest on concrete foundation or basement walls. Between structural framing elements exterior and interior walls will be either steel stud construction or concrete masonry. Concrete masonry will be utilized primarily in the necropsy suite and the BSL-3 lab. The exterior skin of the building will be brick masonry. Window systems will be aluminum curtain walls, aluminum storefront systems, or single aluminum windows.

Interior finishes will vary according to necessary clean-ability standards. For example, the animal delivery, necropsy suite, and BSL-3 labs will have epoxy finishes on floors and walls with epoxy paint on the ceilings. BSL-2 laboratories will have vinyl composition tile floors, cleanable paint for the walls, and acoustical tile ceilings. Offices will have standard carpet, vinyl tile, painted, and acoustical tile finishes.

The existing building and addition will be served with a fire sprinkler system. The BSL-3 lab suite will be an independent zone within this system. The sprinkler system in the existing building will be extended to serve non-sprinkled areas.

The plumbing system will have a few unique features. Laboratory faucets will include back-flow prevention devices. The building will have a softened RO/DI water system for laboratory grade water. Where high purity Millipore water is necessary for laboratory testing procedures, individual water polishers will be provided. Laboratory vacuum systems will be localized to individual labs where needed. Compressed air for laboratory use will be fed from a central medical grade air compressor. Foot operated plumbing fixtures will be required in necropsy and tissue preparation areas.

The BSL-3 laboratory will include an effluent sterilization system which essentially boils all liquid waste prior to disposal in the sanitary system. The liquid waste is collected from the BSL-2 enhanced necropsy space and BSL-3 lab suite in a tank. This liquid is drained from the

collection tank into a 'cook' tank, where effluent is sanitized. The waste is then cooled, tested, and allowed to drain into the sanitary sewer system. This system will only be used when the laboratory needs to operate as a BSL-3 laboratory. Otherwise, this system is bypassed.

Heating, ventilating and air-conditioning systems will be provided to meet diagnostic and research testing requirements and for occupant comfort. The number of air changes and amount of outside ventilation air will be adjusted as necessary for the function of the space, fume hood use, disease control, and odor control. Air to laboratory and necropsy sections will be humidity controlled.

All air will be filtered and air supplied to the BSL-3 lab suite and necropsy spaces will be HEPA filtered. The BSL-3 suite and BSL-2 enhanced necropsy will have HVAC equipment that solely serves this suite of spaces. The HVAC system in the BSL-3 and BSL-2 enhanced necropsy will have fully redundant features or equipment as is appropriate to ensure bio-containment. All HVAC equipment will be located in mechanical equipment rooms or an interstitial mechanical space to facilitate maintenance. Mechanical rooms are located so ductwork is minimized. Spaces throughout the building will have individual temperature control for occupant comfort and energy conservation.

Major renovations will be necessary in portions of the existing ADRDL where the new addition connects to the existing building, existing receiving and accessioning spaces are replaced by research laboratories, and support space is replaced by research laboratories. Some former diagnostic laboratories will be remodeled to create efficient modern research labs with proper research support space. Existing office and office support space will require only minor maintenance and remodeling. Maintenance and repairs will be completed in the necropsy laboratory and adjacent shower facilities, but remodeling will not be required. Mechanical systems will be replaced or upgraded, as existing equipment has reached the end of its nominal life.

The systems to receive major maintenance include the monorail and hoist system, walk-in coolers near the existing necropsy, partial fume hood replacement, partial biosafety cabinet replacement, partial autoclave replacement, necropsy surgical tables replacement, limited laboratory casework modifications, and water treatment/polishing equipment. Upgrades to air handling units, exhaust fans, and building support systems for heating, ventilating, air conditioning, plumbing, controls, and technology systems will be replaced or upgraded.

b. Changes From the Facility Program Plan

The design of the building is not changed from the Facility Program Plan. The current plan is a refinement of the concept design.

c. Impact to Existing Building or Campus-Wide Heating/Cooling/Electrical Systems

The ADRDL is located between the Animal Science Complex and the Foundation Seed Stock Division. North Campus Drive, a primary campus access road is south of the ADRDL. The Animal Resource Wing, the SDSU long term laboratory animal care facility, is linked to the ADRDL by adjoined mechanical rooms, and is located north of the existing building.

On the site of the ADRDL and the addition, some small facilities will be affected. The Veterinary Isolation Building (Bldg #2176) will be demolished. Demolition of this building was authorized during the 2016 legislative session. There are 4 other buildings that will be affected. One is a small livestock facility (Bldg #1910). The livestock facility will need to be removed and rebuilt as part of the project. The other three are small storage facilities. One of the facilities (Bldg

#1903) was salvageable, and has been relocated to a site further east. The other two facilities (Bldgs #1908 & #1907) will be demolished or relocated prior to construction.

A number of campus utilities will affect the project. The ADRDL is served by the campus steam distribution system. The steam service is composed of direct buried steam and condensate piping installed in 1993. These direct buried lines have reached the end of their expected life, and are inadequate to serve the existing building and addition. They will be replaced by a walking tunnel that will extend from the branching point on North Campus drive to both ADRDL and the Animal Science Complex. New steam supply and condensate return mains to serve the existing ADRDL and the addition will be installed in the tunnel. The tunnel and piping will be installed as part of the project. The new tunnel and piping are a long term solution for steam service, superior to the direct buried piping.

The new north chiller plant includes space for additional chillers. The new plant included distribution piping from the plant to a point east of the Facilities and Services office building. The primary distribution mains are buried under the parking area in between the existing ADRDL and the Animal Science Complex. They are routed east along the south edge of the existing ADRDL. The scope of the project will require an additional 750 ton chiller to be installed within the new chiller plant and will require service lines for the new addition.

The campus water distribution system is least affected by the project. A new service line will be installed from the mechanical room of the new addition to the existing water main. The storm water system is primarily a surface drainage system. The piping will be modified to capture storm water from North Campus Drive and direct it around or through the site, as well as capture storm water from roof drains. The municipal sanitary sewer service will not require modification. The waste stream from the BSL-3 laboratory will be treated prior to entry into the municipal system. All other waste will require a new service connection to the municipal system.

The campus electrical distribution system has adequate capacity to serve the building. A new distribution switch will be inserted into the 15KV high voltage distribution system to serve the new addition. A new pad mounted transformer will be provided to connect from the distribution switch and transform high voltage power to building power. The addition and renovated building will be served by a 600 KW emergency generator. All BSL-3 space and support spaces, the BSL-2 enhanced necropsy suite, and portions of the remainder of the building will be supported by emergency power in the event of a power outage.

One existing building system that will be replaced is the waste incinerator. Animal tissue disposal is currently accomplished by a 23 year old incinerator. BSL-2 and BSL-3 diagnostic laboratories will require equipment for animal tissue disposal. This can be accomplished by incineration. A new incinerator will be provided for the lab, as it represents an economical method of disposal, confirmed results, and the equipment is serviceable, and not prone to continuous maintenance.

Building systems supporting the BSL-3 laboratory will have a number of additional design and construction requirements. All air, water, and waste systems serving this part of the building will be controlled. Waste water from BSL-3 laboratory space, loading docks, coolers, and corridor spaces will be intercepted through a holding tank and treated (cooking or chemical treatment) prior to transfer to the municipal sewer piping. Backflow prevention is provided to all water supply systems. Exhaust air will be filtered through HEPA filters. HVAC systems will include features within air handling units to provide full redundancy with backup air handling coils, fans,

exhaust fans, and secondary control systems. These are all supported by emergency power. All openings through the walls separating BSL-3 space from other space will be sealed to prevent movement of air. Coolers for storage of tissue samples and carcasses are provided for dedicated use as BSL-3 support space. Airlock systems and entry spaces to this suite of spaces will include shower-in and shower-out space and protocols.

The specimen processing, specimen receiving, receiving/loading dock, necropsy, and BSL-3 receiving areas are functionally related to each other. New and renovated space on the east side of the ADRDL will be required. Rigid protocols and work sequence flows for recording, documentation, and processing of specimens will be part of the functional design of the building and addition. Specimens arriving as dead carcasses or mailed tissue/fluid samples are treated individually according to the diagnostics required or their biological hazard. Receiving docks require overhead hoist and monorail systems connecting them to necropsy laboratories. Convenient access to tissue disposal equipment is required. Specimen receiving areas need to be able to process hundreds of small tissue and fluid samples that arrive daily.

d. Total Construction Cost Estimates

The total project cost is $68,153,637. Attached is a detailed project cost recapitulation. The project costs includes all professional design services, construction services, a CM@R construction contingency, an overall project contingency, furnishings, equipment, and project management services.

e. Changes From Cost Estimates for Operational or M&R Expenses

The estimated changes in utility consumption are shown below. These are based on historic records of utility consumption of the existing ADRDL and projections provided by the designers of the project.

New Addition	
Electricity -	$160,920/year
Steam -	$ 73,755/year
Water & Sewer -	$ 37,995/year
Natural Gas –	$ 14,000/year
Total utilities cost estimate –	$286,650/year

Utility notes:

Electricity – Electricity is used for all the lab equipment, building lighting, and building power. It is also the energy utility for air conditioning. Typically electricity consumption peaks in July (maximum air conditioning loads) and has a noticeable jump from May through September (air conditioning season). We anticipate reduced electrical energy consumption when the building is connected to the new central chilled water plant due to the more efficient operation of the central plant in comparison to stand alone chillers. Lighting will utilize LED fixtures. Variable frequency drives will be installed with all large horsepower motors.

Steam – This is the energy source for heating domestic water and for heating the building. Typically steam consumption peaks in January (maximum heating load) and has a noticeable upwards jump between October and April (the heating season). The building and the addition are connected to the central heating plant for the campus.

Water and Sewer – Water is used for personal use, laboratory use, cleaning, laboratory RO water, dish washing, and all normal operations. Demand varies between a narrow range, with no distinct peaks or valleys.

Natural Gas – Natural gas is solely used for lab procedures and for the incineration of waste tissue that needs proper disposal.

We anticipate need for two additional custodial staff people and one additional maintenance technician (specialized to ADRDL). Assuming a need for 3 FTE's at an average cost of $35,000/FTE, the additional annual staffing needs would be about $105,000/year.

There are other operational costs that will average about $2/sf ($149,000) per year. Examples of these costs will include maintenance work orders, custodial supplies, recertification of fume hoods and biosafety cabinets, maintenance contracts (e.g. fire sprinkler, elevator, monorail, incinerator, autoclave), recertification of bio-hazard level (BSL) 3 laboratory and enhanced BSL-2 necropsy areas, and HVAC control points.

The total of these categories should be representative of the costs to operate and maintain the addition on an ongoing annual basis.

The ADRDL is a facility of the State of South Dakota and is not included within the facilities inventory of the South Dakota Board of Regents. The proposed square footage will be recorded on SDSU's facilities inventory as a revenue category building. The SDSU HEFF M&R Allocation will not be affected. Based on regental standards and industry guidelines, the annual funding for maintenance and repair/capital renewal funding should be equal to 1.5% - 2% of the construction replacement value of the facility. Based on the construction estimate for the addition, the estimate for capital renewal funding is $660,000.

g. Proposed funding sources for costs of

a. Construction – Appropriations of the state of South Dakota will be used for project funding.
b. Ongoing operations – Routine operations and maintenance will be funded through ADRDL revenues and ADRDL appropriations. Utilities will be paid from the state utility pool.
c. Maintenance and repair – M&R will be funded through ADRDL revenues and ADRDL appropriations.
d. Project Planning – Project planning costs through the schematic design phase have been paid from ADRDL reserves and revenues. Project planning costs through the design development phase will be paid from ADRDL reserves and revenues and a 2016 legislative appropriation through the livestock emergency fund of $1,575,000. The total funding made available to date is $2,742,000. Funding sources for project planning into construction documents and construction are indicated within the construction category shown above.

List of Attachments:
Architectural, Mechanical & Electrical Drawings
Proposed Elevations of the Building
Addition and Renovation Detailed Project Room Lists
Total Project Cost Recapitulation
Anticipated Project Timeline

End of report 9/4/2016