January 3, 2020

# Final Report for

## Kansas Department of Health and the Environment Laboratory

# I. Introduction

The Kansas Department of Health and Environment Laboratory (KDHEL) is housed in a 1950s era building that originally served as a hospital. The state acquired the building in the mid-1960s and moved the KDHEL there at that time.

The director of the KDHEL, with the support of the leadership of the Department of Health and the Environment, approached the Association of Public Health Laboratories (APHL) with a request for an assessment of this facility and its ability to support the work of a modern public health laboratory organization.

APHL conducted a site visit of the KDHEL on December 17, 2019. The APHL project team consisted of Eric C. Blank, Dr. P.H., Chief Program Officer, APHL and Michael Mottet, Principle Laboratory Planner, HDR. Dr. Blank, former director of the Missouri State Public Health Laboratory, has extensive experience in laboratory facility and organizational management. Mr. Mottet has extensive experience planning and designing laboratory facilities with HDR, a world-wide architecture and engineering firm that specializes in laboratory design.

# II. Background

As with any public health laboratory, the KDHEL plays a vital role in detecting and identifying threats to the health and safety of the citizens of Kansas. These threats may be biological, chemical or radiological. The KDHEL monitors the Wolf creek nuclear power plant for detection of excessive or unexpected radiological contamination. It monitors municipal water supplies as part of the state's safe drinking water program. It has the capability to detect and identify current and emerging disease threats such as Zika, Mers-CoV, influenza, and enteric disease agents. It performs newborn screening to identify children born with inborn errors of metabolism, and working with the department's follow up program assures that those infants that are identified receive proper medical care and treatment to prevent developmental disabilities and even premature death. The public rightly expects the KDHEL to consistently fulfill these functions during emergencies and in normal times.

Critical to meeting the public expectations and the role the laboratory plays in protecting the public's health is a reliable and functional facility that can support the operations of the public health laboratory. The facility has to be built in such a manner to meet three over-arching requirements. First, the facility must be designed to protect its workers. As described above, the nature of the public health laboratory is to routinely work with high consequence biological agents, and hazardous chemical and radiological compounds. So it must have features that minimize the possible exposure of workers to these agents. Second, the building must be built in a manner that prevents any exposure to these agents within the community in which the laboratory resides. This means it has safe and secure ways of handling hazardous and infectious waste, and safety cabinets and fume hoods that prevent infectious agents and noxious fumes from leaving the laboratory and exposing the surrounding community. Finally, those same systems for employee and public safety must also have features that protect the integrity of the testing. As the reference laboratory for Kansas it must reliably and consistently provide testing of the highest quality. And, given the importance of its work, testing

quality is crucial for the public health programs the laboratory is supporting so that they can initiate appropriate prevention measures in a timely manner based on sound laboratory data.

Consequently, the physical and mechanical state of the laboratory building is of considerable interest and concern to those who work in it and are responsible for its operation. The KDHEL is in a facility that is nearly 60 years old. It was never meant to be a laboratory facility. Its mechanical plant was designed for the power, air handling, communication and data requirements of a hospital in the 1960s not a laboratory in the 21st century. This is what led the leadership of the KDHEL to ask for this facility assessment.

# III. Observations

At the outset, we must note that the KDHEL scientific staff and maintenance staff have done an outstanding job of adapting the present facility to support the changing needs of the laboratory operation over time. We have been to laboratory facilities with serious problems with the connections of safety cabinets and fume hoods to the exhaust system which we did not observe at the KDHEL. However, making adaptations so that the facility meets the operational needs also means that compromises are being made some of which have significant implications for staff safety and testing integrity as well as overall efficiency.

For example, in the BSL-3 suites, due to the extreme heat of those rooms especially in the summer months, additional industrial in-room floor mounted air conditioners have been installed. These units blow cool air through flumes into the open BSL 3 space. While it is perfectly understandable that additional air conditioning was needed since staff were experiencing heat exhaustion, their health and safety is compromised with the addition of the air condition units. BSL 3 suites should be designed to have air flow essentially moving through the space in a single pass method and safety cabinets are located such that room airflow turbulence is mitigated entirely. If a safety cabinet should malfunction, the air being blown out by the air conditioning units will disperse whatever agents were being worked on throughout the suite increasing the exposure of the staff working in that space. That in turn will complicate mitigation efforts in the immediate aftermath of the event but will also require the eventual decontamination of the entire suite, a very expensive process.

We also noted in the BSL-3 suite supporting select agent and bioterrorism threats testing that the placement of the air conditioning unit and its flumes were in close proximity to instrumentation used for molecular identification of the agents. Having air blowing into the open area in proximity to that instrument could lead to contamination of whatever is being tested. Avoiding contamination is a greater concern with molecular testing because the analysis is at the molecular level not at the organism level. In BSL-3 lab design, there is a balance of supply and exhaust air that effectively maintains directional airflow into the higher hazard space. With supplemental air conditioning units, the room balance may be at risk of being compromised.

Thus, this adaptation, while necessary to allow for work to be conducted in the BSL 3 suites throughout the year could well compromise the health and safety of the staff in the event of a malfunction of the safety cabinets and could compromise testing done within

the suites due to in room air flow. This is an example of the aging buildings mechanical system not meeting modern laboratory criteria and is not and ideal nor safe approach.

The problems with heating and cooling are not limited to the BSL 3 suites. We were told that temperature control is problematic throughout the building. Temperature control does affect testing. Rooms with large numbers of analytical instruments require additional cooling, but as we noted during our walkthrough that wasn't the case. In a modern laboratory, even in winter, a room with a large concentration of analytical instruments will be noticeably cooler than other work areas simply because those instruments put off so much heat during operation. That was not what we observed in our walk through where room temperature fluctuations were outside the norm. Temperature for instruments used in environmental testing is essential to optimizing the performance of the instruments. When typical measurements for substances such as volatile organic compounds and pesticides are in the parts per billion ranges under regulatory requirements, heat in particular can prevent the instrument from properly functioning and may prevent it from being able to detect at the regulatory levels. Finally, for chemical analysis, the lack of temperature control could abort instrument runs or require repeated runs because the quality controls were out of range due to temperature fluctuations. This costs time and money.

Some biological tests also require tests to be run within a temperature range of a few degrees. Heat and humidity affect the dried blood spot specimen used in newborn screening. Those properties can cause deterioration of some of the markers that are indicative of certain inborn errors of metabolism which can result in a false negative or ambiguous result. That in turn would require a re-test and a loss of time. For conditions that manifest themselves within days of birth, the time needed for getting another specimen and completing testing puts the affected infant at risk.

Throughout our walk through we noted paint peeling from walls and ceilings, signs of humidity problems which are related to temperature control. There were signs of corrosion of metal fittings throughout the building. In the newborn screening unit, even in winter conditions, a punch machine had to be moved out of its room so that the appropriate sample could be reliably obtained due to the increased humidity in the room. We noted that the radiators in the rooms were functional however, many of them leaked. Window blinds were either open or closed for added room temperature control. It should be noted window blinds are not ideal in labs due to their inherent ability to collect dust, and are difficult to thoroughly clean. We also heard that there is a mold problem in several areas of the building during the warmer months.

Exacerbating these problems are the presence of leaks, some from the roof and laboratory spaces, some from equipment, such as autoclaves, refrigerators, freezers, etc., throughout the building. An extreme example was given by pictures of a light fixture that had fallen in a laboratory area on the third floor. A roof leak occurred after a heavy rain storm this past summer. The leak caused water to enter the light housing and the weight of the water in the housing caused the fixture to break from its ceiling mountings. Fortunately, no one was hurt. That noted, we saw evidence of roof leaks on the third floor and of leaks from higher floors to lower floors. There was leaking from the newborn screening laboratory on the third floor into the serology laboratory area on the second floor while we were there.

We noted and were told that the building cannot handle any further power load. Laboratory operations these days require large amounts of electrical power due to heavy reliance on instrumentation and computers. In the serology-virology unit, they have been experiencing power interruptions such that they are unplugging incubators when making molecular testing runs. We were told that this is not an unusual situation and that management has to consider the acquisition of new instruments and equipment in light of inadequate available power occasionally causing delays in obtaining updated instrumentation and equipment.

Related to this, we noted the presence of wall mounted power strips throughout the building that have been installed over time to keep up with the demand for outlets. Some of these power strips were showing signs of corrosion around the plugs and along the strips themselves. This could become a safety issue but it also is affecting staff confidence in their facility. We were told that staff worry whether they should be using outlets on those wall-mounted strips. But, also its apparent staff do not have confidence in the post war in-wall infrastructure such as power, that is reliability needed to support their equipment and procedures.

As noted earlier, the KDHEL is in a building originally designed as a hospital. In some respects, this has some advantages. The halls are wide. Even with surplus equipment stored along the walls, there was plenty of room for people to walk. There are also lots of rooms which has allowed the laboratory operation over time develop new capabilities to keep up with changing technology and new service demands. However, there is a downside to this compartmentalization. It severely impairs work flow especially in biological and molecular testing. Molecular testing does require specimen preparation, loading and amplification to be performed in separate areas moving from "dirty" space to "clean" space. Ideally, this is done within a suite of rooms adjacent to each other so the prepared specimen can be moved from place to place within a fairly confined area and not transported in open areas where the risk of contamination is greater. In the KDHEL facility, that cannot be done due to the overall design of the building. Even in the serology-virology unit, where the rooms for the various steps are adjacent to each other, the samples must be moved out of one room into an open hallway before going into the next room. An extreme example is that for molecular testing of an environmental organism prepared on the third floor, it has to be taken to the second floor to finish the analysis. Finally, the compartmentalization of the existing spaces diminishes the overall flexibility and adaptability for the organization to expand and contract as is typical in modern labs.

This lack of useful flexible laboratory space is manifested in other ways that compromise safety. We noted that in the instrument rooms on the third floor reagent solutions and discharge buckets were placed on the floor behind the instruments but right next to the power outlets and cords for those instruments. It was noted during one purge cycle that the tube into the waste bucket actually jumped up from the force of the purge. Had it got out it would have sprayed its contents around active outlets. At best, that could lead to a simple shorting of the outlet. At worst, it could create a situation where the instrument was damaged and a possible electrical fire could start.

We further noted that all compressed gasses are manually moved from the first floor supply area to the upper floors. Because of the space limitations, we noted several instances where compressed gasses were mounted on outside walls or next to desks and fume

hoods in laboratory areas. This placement of compressed gasses raises a safety and ergonomic issue for staff but also present a risk to the building itself.

We noted that emergency and unknown samples (i.e. "white powders") are delivered to a secure stairwell that goes from the first floor to the second floor adjacent to the BSL-3 suites. However there is no area on the first floor to do any preliminary examination of the sample/specimen to assure that it is safe to work with in the BSL-3 suite. Most public health laboratories use an "all hazards" approach to these samples doing some preliminary examinations of the samples/specimens for toxic chemicals or explosives before moving them to the BSL-3 suite. This is an added layer of safety for the employees but it also protects the BSL-3 suite from being contaminated by a toxic chemical, or even worse, moving an explosive device into the building. However, the current space configuration at the KDHEL does not allow for this preliminary screening to take place effectively away from the BSL-3 suites.

We also note that the building does not have a large enough "pipeline" for data transmission. In the age of whole genome sequencing (WGS) and analyses for a growing number of complex chemical compounds, any public health laboratory generates truly vast quantities of data every day of operation, not giga-bytes but terra-bytes of data. Not being able to move data quickly and efficiently to public health programs at the state level impedes local intervention efforts at the local and state level. At the national level the inability to move data quickly could slow the identification of a multi-state disease outbreak or the detection of the emergence of a national public health threat.

Finally, we were shown pictures of a corroded metal fitting that had fallen through the ceiling tiles into an open laboratory area. As with the light fixture issue reported earlier, fortunately no one was hurt. Nevertheless, it is another example that the building is deteriorating.

Beyond the physical condition of the building, we noted the following issues regarding the current location of the building. It is in a remote location, far removed from the parent agency, the Kansas Department of Health and Environment. Consequently there are few public amenities such as restaurants in the vicinity. For all the space there is limited parking. These characteristics must present a serious challenge to the KDHEL in recruiting and retaining staff. While we know and understand that the KDHEL facility has been in use for 50 years or more, the younger generations of workers expect a workplace that allows and encourages more social engagement during and after business hours.

# IV. Conclusion

As can be seen from reading our report, there is no single factor that makes the current KDHEL facility inadequate to support the functions of a modern public health laboratory. Many of these issues are the result of the age of the building and its mechanical and electrical systems which are just as old. Too many adaptations have, while making the building marginally functional for the laboratory operation, compromised the safety of the staff and the integrity of the testing. To minimize those effects, extra work and time is often needed to assure the quality of results. Those actions cost time and money and there is little mitigation, beyond awareness of the problems, of the safety implications. The building has simply outlived its usefulness as a public health laboratory facility.

We whole-heartedly endorse Kansas' decision to let a contract to Clark Enersen Partners for programming and planning of a new laboratory facility. This is entirely in keeping with our recommendation to begin the process of constructing a new facility for the KDHEL. We further note that the ultimate design of a new laboratory facility may likely be smaller, in terms of gross square feet than the current facility. In other words, we do not foresee that a new building will be a one-for-one replacement of the current structure. We are confident that the new design will allow for much more efficient use of space, more flexible space and, incorporate adjacencies to enhance work flow but in fewer square feet. In addition, the new design will account for improved temperature control, have greater power capacity, a bigger data capacity, and allow for a better all hazards approach to the reception of unknown emergency samples or specimens.

Finally, we learned that possible sites for the new laboratory would be closer to the capitol building and in downtown Topeka. We have no reservations concerning the siting of the new facility in these locations. As noted earlier in the report, a modern well-designed and constructed laboratory facility is built to minimize the chance of any release of either toxic chemicals or infectious agents. We know of numerous instances where laboratories, both public health and research laboratories, are operational in urban and residential areas. Two notable examples are the main CDC campus in Atlanta, GA adjacent to Emory University and the NIH laboratories in Bethesda, MD.

This concludes our report. We would like to acknowledge the engagement and assistance we received from Jennifer Evans, Michael Weinkauf, Keith Miles, Leila Maurmann and Dr. Phil Adam from the KDHEL in conducting our walk through. We also acknowledge the participation of the Assistant Secretary for Environment, Leo Henning, at our exit conference. We thank them all for their time, openness and accommodation.

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