Germs, Viruses, and Secrets: The Silent Proliferation of Bio-Laboratories in the United States

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Mr. Chairman, Distinguished Members of the Committee:

Thank you for the opportunity to speak to you today. My name is Gigi Kwik Gronvall. I am a Senior Associate at the Center for Biosecurity of the University of Pittsburgh Medical Center (UPMC) and an Assistant Professor at the University of Pittsburgh School of Medicine. The Center for Biosecurity is a nonprofit, multidisciplinary organization located in Baltimore that includes physicians, public health professionals, and biological and social scientists. I am a biological scientist, trained in laboratories at Johns Hopkins University and the United States Army Medical Research Institute for Infectious Diseases (USAMRIID). My colleagues and I at the Center for Biosecurity are committed to the development of policies and practices that help prevent bioterrorist attacks or destabilizing natural epidemics and, should prevention fail, that mitigate the destructive consequences of such events.

It is a privilege to come before you today to discuss the expansion of high-containment BSL-3 and -4 laboratories. Protecting the nation against destabilizing large-scale epidemics, whether natural or man-made, is an urgent priority. The anthrax attacks in 2001, the SARS epidemic in 2003, and the current threat of avian influenza all are important reasons why we must conduct research to determine how microbes work and how to defeat them with medicines and vaccines. These new high-containment biological laboratories are needed to provide the safe, protective environment necessary to do this research. In high-containment laboratories, potential bioterrorism agents such as Ebola or Marburg, as well as emerging diseases such as SARS and avian influenza, can be safely studied and understood. The labs can also be used to develop animal models essential to developing and testing vaccines, drugs, and other needed medical countermeasures.

The high-containment laboratories are necessary if we are to produce the scientific advances needed to develop medical countermeasures against bioweapons and emerging diseases. However, recent highly publicized laboratory errors and siting controversies have raised questions about whether the governing framework and standards for biosafety and biosecurity measures are adequate. Since 2005, my colleagues and I at the Center for Biosecurity have been concerned that the expanding number of high-containment laboratories may strain current systems for personnel training in biosafety and biosecurity. We held a meeting at the Center on July 11, 2006, to discuss these issues, the report from which we would like to submit into the record. At this meeting, we heard from distinguished scientists and experts in biosafety, biosecurity, and public health—both proponents of the laboratories, as well as those who oppose the recent expansion. Based on those conversations, we believe that there are several things that can be done to ensure that these new high-containment laboratories are productive and safe and operate with due consideration for their neighboring communities. These actions include expanding biosafety training for researchers and workers coming into high-containment research from less dangerous areas of research; monitoring the safety performance and operational experience of the high-containment facilities; increasing communication between the

high-containment laboratories to share operational experiences; and initiating a public engagement effort at the federal level that clarifies the need for high-containment laboratories.

Currently, operational BSL-4 facilities can be found in Frederick, Maryland; Richmond, Virginia; Atlanta, Georgia; Galveston, Texas; and San Antonio, Texas. There are additional BSL-4 facilities under construction in Hamilton, Montana; Boston, Massachusetts; Frederick, Maryland; and Galveston, Texas. The exact number of BSL-3 laboratories in the United States is not known, however an NIH-sponsored survey estimates that there are 277 distinct facilities with BSL-3, with about 600 individual laboratories, and a 2007 report from DHS and HHS states that 633 high-containment laboratories are registered in the Select Agent Program. In addition, 13 BSL-3 laboratories are being built specifically for biodefense research, principally funded by the National Institute of Allergy and Infectious Diseases (NIAID).

It should be noted, however, that high-containment laboratories are being built all over the world at a rapid pace. For example, there were 16 BSL-3 laboratories brought on-line in India in 2006 alone. This expansion is due in part to concerns about SARS and avian influenza, but also because of a recognition that bioscience is a key economic driver for the 21st century: in the US, the biopharma industry produced $188 billion in revenue and 400,000 jobs in 2004 alone. The model that the U.S. sets in operating these high-containment laboratories productively yet safely should provide leadership to other countries heavily investing in biotechnology and pathogen research.

Promoting safety, security, and scientific innovation in the biological sciences has been a challenge undertaken by the government and the bioscience community since 2001. It has led editors of scientific journals to come together in 2003, with the goal of reducing the likelihood that legitimate bioscientific research could be used for malevolent ends. It has led to the forming of the National Science Advisory Board for Biosecurity, chartered in 2004 within NIH. Government and university researchers have also participated in fora intended to diminish the risks and maximize the benefits of new areas of bioscience, such as synthetic genomics. While bioscience promises great strides in enhancing quality of life through the development of medicines and vaccines, it is a powerful technology that must be used safely if we are to enjoy its benefits.

Biosafety protection is designed to be flexible

In the U.S., biological laboratory research can be categorized by its safety level; Biosafety Levels (BSL) 1 through 4. In this testimony, we use the term high-containment to refer to work performed in the two highest levels, BSL-3 and BSL-4. BSL-3 laboratories are used to study biological agents that are potentially lethal and transmissible by the aerosol route and that require special safety design features, such as sealed windows and specialized ventilation systems. BSL-4 laboratories are typically used to study lethal agents for which no vaccine or therapy is available. They incorporate the BSL-3 laboratory safety features, plus additional safety features such as full-body suits ventilated by life-support systems.

In general, the biosafety requirements needed to protect researchers are dictated by the specifics of a biological experiment and are designed to be flexible. For example, an experiment that could normally be safely performed at a low biocontainment level may need additional biosafety protections if the researcher must handle a large volume of infectious material. This flexible system for applying biosafety protections requires researchers to weigh risks as they work. This is a necessity for bioscience research; hard-and-fast regulations for every situation are difficult to develop, as these researchers are not working on one repetitive process that can be fine-tuned but are constantly exploring new scientific ground. The researchers need to use informed judgment.

Biosafety guidelines, such as the Biosafety in Microbiological and Biomedical Laboratories Manual published by the CDC and NIH are thus intended to inform the judgment of researchers, biosafety officers, and others who advise on biosafety, so that biosafety protections can be applied where they are needed. However, some biological

organisms are more typically worked on in one safety level versus another: infectious Ebola and Marburg viruses are researched in the highest level of containment, BSL-4; SARS is typically worked on in BSL-3; and Bacillus anthracis, the causative agent of anthrax, is typically safely worked on in BSL-2.

Biosafety training program expansion for researchers entering high-containment

As the new high-containment laboratories become operational in the coming years, additional qualified staff will also be needed. As indicated in our report last year, we have concerns that the usual methods of biosafety training for high-containment research—that is, intensive one-on-one training within a mentor-apprentice relationship—will not be sufficient to handle the influx of researchers and technicians into the field. Developing core competencies and standards for new staff could be a useful and important way to train new staff on safety practices. It could also conserve the experienced mentors' valuable time and abilities and shorten the time it takes for the labs to become productive.

To develop the workforce, NIH could assess how many people will require training for their work in the high-containment laboratories, and develop and fund programs that can supplement on-the-job training. An assessment may be necessary, as not all of the new hires for a laboratory will work in high-containment conditions. For example, it is estimated that the Boston University National Biocontainment Laboratory will create 600 jobs, but not all of those new employees will work in high-containment conditions.

Biosafety officers, already required at every high-containment facility, will also be needed in greater numbers. Biosafety professionals can help researchers determine the best biosafety procedures and practices for laboratory-specific, experiment-specific containment decisions, so that the researchers can be productive and safe. Biosafety officers can also provide on-the-job biosafety training. NIH could work with the American Biological Safety Association, the biosafety professional organization, to determine credentialing standards required for work in high-containment laboratories. This may help to ensure that biosafety officers are knowledgeable resources for the researchers in these labs.

Monitoring safety performance of high-containment laboratories

With the laboratory expansion, a systematic analysis of safety issues and operational problems in high-containment laboratories can help to ensure that the laboratories are operating safely. Currently, reporting of laboratory-acquired infections is required for all select agents, those pathogens that require clearance to possess under the Select Agent Rule as defined by 45 CFR 72, whether they occur at BSL-2, -3, or -4 laboratories. NIH grants also stipulate that institutions report any serious accidents or research-acquired infections. However, many of the experts we consulted thought nonlethal infections were underreported, and operational problems or 'near misses' were generally not reported.

Without reporting, and without analysis of these incidents, lessons cannot be learned from the experience. Laboratory procedures cannot be analyzed in light of the accidents, so that future accidents can potentially be avoided. To correct this situation, disincentives to reporting should be removed, to encourage researchers and their institutions to report and take corrective action.

Generally, there is a disincentive to report acquired infections and other mishaps at research institutions. Infections lead to negative publicity and scrutiny from the granting agency, adversely affecting future research funding. In addition, after a scientist acquires an infection in the laboratory, neither the scientist nor the laboratory wishes to advertise the mistake. These barriers need to be cleared so biosafety can be enhanced through shared learning from operational experiences, and also so the public may be reassured that accidents are being thoroughly examined and contained.

One possible model for high-containment laboratories to emulate is the reporting mechanism used for aviation incidents, wherein airlines can contribute operational experience without fear of regulatory action. Mistakes are analyzed and learned from, but they are not attributed to individuals (except when mistakes result from criminal actions, such as drunkenness). Institutional anonymity may also be required in order to get robust reporting from research institutions. Procedures would need to define thresholds and mechanisms for reporting if an accident poses a danger to the community surrounding the laboratory, however.

There are other potential models for the high-containment labs from the nuclear and chemical industries. The Institute of Nuclear Power Operations (INPO), formed after the Three Mile Island accident, emphasizes personnel training, safety management, and lessons learned; and Responsible Care, formed after the Bhopal tragedy, is a voluntary initiative of the chemical industry to share lessons learned. These models are from for-profit enterprises, underlining that any reporting system will be expensive. Another possibility could be a reporting clearinghouse, where operational experiences would be posted and available for outside analysis.

Ultimately, it is the laboratory director's responsibility to ensure that all laboratory personnel are properly trained to do research safely in high-containment. Yet, the institution where the research takes place may be responsible for ensuring that the head of the laboratory, the staff, and the lab environment conforms with biosafety requirements and accepted practices. The CDC or NIH could monitor proactively whether biosafety is being managed at those institutions where federal money pays for the research and infrastructure.

High-containment laboratories and sharing lessons learned

Mechanisms to enable and encourage inter-laboratory training and information exchange will be important for these laboratories. Currently, the Select Agent Rule and concerns about legal liability may have inadvertently become barriers to learning across high-containment research facilities. Under the Select Agent Rule, as defined by 45 CFR 72, HHS and USDA keep lists of pathogens that require select agent clearance. The rule regulates the possession, use, and transfer of those agents; imposes security requirements for the facility in which the work will be performed; requires inspections; and can impose criminal and civil penalties on those who do not adhere to the Rule. In addition, security risk assessments are administered to individuals who work with select agents by the Department of Justice, a process that is renewed every five years. Once cleared, an individual is allowed to work with a specific biological agent, but only within a specific laboratory. The specificity of this clearance procedure inhibits the practical exchange of safety-related information and techniques between high-containment laboratory researchers, by preventing, for example, a technician in one laboratory from demonstrating techniques in another laboratory without going through a separate lengthy clearance process.

In addition to clearance barriers, the perception that laboratories will be liable for accidents that occur to scientists visiting for training purposes may have prevented some training opportunities from taking place. This should be addressed so that experienced scientists and technicians can more easily demonstrate techniques and safety procedures developed in one laboratory to another. This could speed up the process for new laboratories to become productive; it could maximize the use of specialized facilities of some laboratories; and it could result in increased safety of the research.

Public engagement as a federal priority for high-containment labs

NIAID has a great deal of information about the new high-containment laboratories on its website, but direct engagement with the communities where the laboratories are being built is handled by the institution proposing the laboratory. Thus, the strategies and outcomes of public engagement, as well as the transparency of laboratory operations to the public, have varied considerably. This has undoubtedly exacerbated the controversy surrounding

the siting and operation of these laboratories, particularly in the face of highly publicized laboratory errors. While individual facilities bear final responsibility for their relationships with their neighbors, NIAID could have a clearer mechanism to engage with the public about the siting and operation of these laboratories, beyond the NEPA process. It may help if there is a more aggressive and proactive federal effort to standardize public engagement and transparency of operations for high-containment laboratories and to direct funds to this purpose.

A public engagement program could address the concerns that have surfaced in siting high-containment laboratories. Often, proponents of the labs interpret protests against the laboratories as a lack of understanding of science: however, the concerns about the labs are varied. For example, there have been concerns that the labs would become a terrorist target, or that the laboratory would not provide jobs to the community. The communites' concerns could be actively addressed both by HHS and NIAID and by the institution sponsoring the laboratory.

Conclusion

These high-containment laboratories should be a critical part of the research infrastructure for understanding the mechanisms of pathogenicity, as well as developing and testing medical countermeasures. However, as these labs come online, so should new systems for training of personnel, monitoring safety performance, and engaging the public. Experience has shown that proactive steps such as these can lead to more effective and cost-efficient safety management than burdensome requirements imposed following a serious accident. A new governance framework could enable the laboratories to operate more safely, with consideration for their communities, and it could help the laboratories fulfill their intended purpose of protecting the nation against natural and man-made biological threats.