Fact Sheet on United States Government Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences

The United States Government conducts and funds life sciences research which is crucial to the long term health security and wellness of the public, animals, plants, the environment, and our economy. Federal departments and agencies are committed to fostering progress in the life sciences to include responsible research involving biological agents and toxins, conducted in a safe and secure manner. Basic and applied life science research are instrumental in developing national capabilities to mitigate the risks of infectious diseases and environmental risks, whether naturally occurring, deliberate, or accidental.

Reinforcing norms of safe and responsible conduct is one of the objectives of the *National Strategy for Countering Biological Threats* which highlights actions that should be taken to reinforce a culture of responsibility, awareness, and vigilance among all who utilize and benefit from the life sciences. Reinforcing these norms is critical to counteracting diversion of the life sciences for harmful purposes.

The Federal Experts Security Advisory Panel (FESAP) was established by Executive Order 13546 on July 2, 2010 to provide recommendations regarding the security of biological select agents and toxins (BSAT) to the Secretaries of Health and Human Services and Agriculture and the Attorney General. The White House National Security Council staff tasked the FESAP, in September 2014, to undertake a comprehensive review and identify specific recommendations to strengthen the Government's biosafety and biosecurity practices and oversight of federally-funded activities involving (but not limited to) BSAT, consistent with the need to realize such activities' public health and security benefits. While directed at the federal research system, FESAP recommendations have broad applications and may also inform biological risk management practices in non-federal life sciences research.

FESAP recommended several actions to strengthen and sustain the culture of biosafety, biosecurity, and the responsible conduct of science at the federal level such as promoting bioethics training that addresses the fundamental safety and security responsibilities expected of all life scientists; development and incorporation of bioethics modules into laboratory biosafety and laboratory biosecurity training and/or research design; and the development of semi-quantitative methods to evaluate the efficacy of training, education, codes of conduct, and similar interventions to reduce risk and improve safety in domestic research laboratories housing infectious agents and toxins. FESAP also emphasized that training should include discussions of ethical and legal considerations, as well as the social relevance of life science research, and the range of dual-use conundrums and dilemmas that may arise. FESAP's recommended discussions would emphasize the impact of science and technology on society, health, and national security, and highlight efforts that should be undertaken to encourage institutional leadership to support and implement bioethics components within their institution's training programs. FESAP also generated several interagency working groups to address these recommendations.

In order to advance the implementation of FESAP's recommendation on the culture of biosafety, biosecurity, and responsible conduct of life sciences, the United States Government established an interagency working group with representation from 15 offices and organizations across five federal departments and agencies. This interagency working group is co-chaired by the US Department of Health and Human Services / Office of the Assistant Secretary for Preparedness and Response and US Department of Agriculture / Animal and Plant Health Inspection Service. As part of its tasking, this working group refined training goals and objectives; identified the role of "culture" as it relates to biorisk management, emphasizing *principles for guiding decisions and behaviors* as they related to biorisk management (i.e. motivation, leadership, commitment and responsibility, professionalism and competence, learning and improvement, maintaining public trust); conducted an inventory of existing federal and non-federal training and education programs addressing the culture of biosafety, biosecurity and responsible conduct of life sciences; and consulted with experts from academia and professional organizations on best practices and lessons learned. This working group conceptualized training and educational materials to be used by federal departments and agencies in their internal outreach or in conjunction with non-governmental organizations; refined these materials to create, strengthen, and sustain a culture of biosafety, laboratory biosecurity, and responsible conduct in the life sciences research; compiled resources to enhance individual and collective responsibility; and identified resources to reinforce the biological risk management framework of laws, regulations, and policies.

In Hindsight:
Scenarios that Illustrate the Importance of a Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences Research

The purpose of these case studies is to raise awareness and promote understanding of the importance of a culture of biosafety, biosecurity, and responsible conduct in life sciences research, to build on individual and collective responsibility, and to reinforce the biological risk management framework of laws, regulations, and policies. These case studies have been prepared by a United States Government interagency working group co-chaired by the US Department of Health and Human Services / Office of the Assistant Secretary for Preparedness and Response and the US Department of Agriculture / Animal and Plant Health Inspection Service.

These case studies should be used and adapted by Federal Department and Agencies for their individual biorisk management or bioethics training needs. They cases studies will be publicly available for use by non-governmental organizations in their training programs, as appropriate.

Case Study #1 (reference: CDC Report on the Potential Exposure to Anthrax, 2014)

A laboratory scientist in a US Government laboratory is preparing extracts from a panel of multiple bacterial select agents, including *Bacillus anthracis* (*B. anthracis*), under biosafety level (BSL) 3 containment conditions. These samples were being prepared for analysis using matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry, a technology that can be used for rapid bacterial species identification. This technology is faster and less expensive than conventional species-identification methods, which require culture of organisms on selective bacterial media or extraction and characterization of bacterial nucleic acids. After chemical treatment for 10 minutes and extraction, the samples were checked for sterility by plating portions of them on bacterial growth media. When no growth was observed on sterility plates after 24 hours, the remaining samples, which had been held in the chemical solution for 24 hours, were moved to an adjoining BSL-2 laboratory. A week later, a fellow scientist observed unexpected growth on the anthrax sterility plate in the BSL-3 laboratory, raising concerns that the *B. anthracis* sample extract may not have been sterile when transferred to BSL-2 and potential anthrax exposure may have occurred.

Questions for discussion:

Q1. *What does it mean to have a strong culture of biosafety, biosecurity, and responsible conduct in life sciences research? Does this incident illustrate a strong culture of responsible conduct?*

A1. No. "Culture" as it relates to biorisk management is broadly defined as an assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents.

Q2. *Considering an organizational culture model*[1] *including the following main elements:*

- *Management systems which prioritize biosafety, biosecurity, and responsible conduct;*
- *Behavior of leadership and personnel to foster more effective biosafety and biosecurity;*
- *Principles for guiding decisions and behavior as they relate to biorisk management; &*
- *Beliefs and attitudes on biosafety and biosecurity,*

how could we have prevented this incident?

[1] Adapted from IAEA Nuclear Security Culture Model, 2008

A2. Each element of the organizational culture model could have been assessed periodically and strengthened as needed:

- Management systems (i.e. processes, procedures and programs in the organization which prioritize biorisk management and have an important impact on the biosafety/biosecurity functions) should have included, at a minimum, approved/validated research protocols, including validated sterility testing procedures; quality assurance; clear roles and responsibilities; contingency plans and drills; continual determination of trustworthiness; and training and qualification;
- Leadership behavior (i.e. specific patterns of behavior and actions which are designed to foster more effective biorisk management) should have emphasized inter alia expectations, decision making, management/supervisory oversight, effective communication, and motivation. Personnel behavior (the desired outcomes of the leadership efforts and the operation of the management systems) should have emphasized inter alia professional conduct, adherence to approved/validated procedures and research protocols, team work and cooperation, and vigilance;
- Emphasis should have been placed on *principles for guiding decisions and behaviors* as they related to biorisk management (i.e. motivation, leadership, commitment and responsibility, professionalism and competence, learning and improvement, and maintaining public trust);
- Beliefs and attitudes on biosafety and biosecurity should have been assessed periodically and reinforced through training and education aiming to: raise awareness on the risks associated with working in a laboratory with biological materials (e.g., accidental exposure, infection or release; intentional theft and/or misuse; others such as radiological/chemical/physical safety), the potential ramifications if such risk events were to occur (e.g., injury, death, epidemics, pandemics, economic consequences, etc.), and risk mitigation strategies; raise awareness and increase understanding of the ethical, legal, and societal issues and consequences concerning life sciences research, development, and associated technologies; raise awareness and place emphasis on the importance of quality systems and practices in laboratory biosafety and biosecurity training and research design; review codes of ethics and social responsibility guidelines in life sciences research; and review biosafety, biosecurity, and dual use research of concern (DURC) regulations, guidelines, policies and procedures, and any other specified training requirements.

Q3. *Review the CDC Report on the Potential Exposure to Anthrax and identify actions which addressed post-incident specific elements of the organizational culture in order to reduce the risk of a similar event happening in the future.*

A3. The following elements of the organizational culture were addressed via specific actions:

- Management systems: ceased laboratory operations pending investigation, decontaminated potentially affected laboratory spaces, undertook research to refine understanding of potential exposures and optimize preventive treatment, and

conducted a review of the event to identify key recommendations. Planned actions include an assessment and appropriate follow-up actions for all laboratory staff to determine level of skills, training, supervision, knowledge, and expertise at all levels of the organization; also planned is an external advisory committee to provide ongoing advice and direction for laboratory quality and safety;

- Leadership behavior: A single point of accountability for laboratory safety was established for the organization. The report notes that, "The creation of a single point of accountability does not reduce the responsibility of people at every level of the organization, including center, division, and branch directors, chiefs, supervisors, and all laboratory scientists to strengthen the culture of safety";
- Personnel behavior: appropriate personnel actions have been taken with regard to individuals who contributed to or were in a position to prevent this incident;
- Principles for guiding decisions and behaviors*:* emphasis was placed on using approved techniques and standard operating procedures, and requiring a written study plan reviewed by senior staff or scientific leadership to ensure that the research design was appropriate and met all laboratory requirements. As part of these guidance efforts, the FSAP released its policy statement on inactivated *B. anthracis* in November 2015. Early in 2016, the FSAP also offered the regulatory community an opportunity to provide written comments regarding the "Inactivated *Bacillus anthracis*" policy. The FSAP requested these comments in order to improve its policy's clarity and to minimize unintended consequences that would result from its implementation;
- Beliefs and attitudes on biosafety and biosecurity: inadequacies in this area included the instructions provided by a supervisor to the scientists to use virulent instead of avirulent strains (even though the instrument manufacturer states that the system identifies bacteria to only the species level and would not distinguish strains of the same species) and the lack of due diligence in reviewing available literature which would have provided knowledge on minimizing risk using appropriate filtration methods to inactivate *B. anthracis*. A culture of responsible conduct of science should minimize the risk whenever possible. A lapse in biosafety and biosecurity culture is also illustrated by the practice described in the report as "piggy backing" (obtaining entrance to a secured area by following a colleague rather than by having all individuals swipe their own card key as should be done) which posed challenges to identifying potentially exposed personnel. Beliefs and attitudes may be reinforced through training and education including the review and monitoring of training policies and procedures for new and existing staff by the newly created lead laboratory science position as a single point of accountability for safety; establishing and enforcing agency-wide policies that require formal review and approval of new select agent research or program protocols and provide oversight for ongoing research and program projects (e.g., yearly reviews); ensuring adherence to laboratory quality and safety protocols; and creating effective and redundant systems and controls for protocols and procedures including, but not limited to, inactivation and access to laboratories (e.g., "piggybacking" and visitor access). Arguably, the most notable follow up action which has the potential to influence attitudes and beliefs in biosafety and biosecurity is to identify the points in any

project where potential mistakes would have the most serious consequences and provide specific actions to avoid these mistakes. Examples of these critical points and associated preventive actions include requiring protocols to be reviewed by supervisors before they are implemented, having standard and clear procedures to inactivate infectious agents and specify how they will be transferred to other labs, having formal incident response plans in place, controlling laboratory access, and instituting regular review of laboratory processes to ensure proper safety, quality management, and compliance with the Select Agent Regulations.

Case Study #2 (reference: Framework for Conducting Risk and Benefit Assessments of Gain-of-Function Research Recommendations of the National Science Advisory Board for Biosecurity)

In recent years, the federal government re-assessed the risk/benefit calculus underpinning funding decisions for a certain subset of gain-of-function research involving agents that pose a significant risk to public health. Gain-of-function research refers to any modification of a biological agent — like viruses or bacteria — that gives it new or enhanced activity, such as the ability to infect a different host. While research on factors that could increase transmission or infection can be important for informing prevention strategies, some information from these studies might also be misused for harmful purposes. Gain-of-function research came to public attention in 2010, in the context of studies on the transmission dynamics of highly pathogenic avian influenza (HPAI) H5N1 conducted by the University of Wisconsin in the US and Erasmus Medical Center in the Netherlands. These studies involved the mutation of two H5N1 strains through multiple passaging and identification of specific amino acid changes that enhanced airborne transmissibility of the virus between ferrets—a standard animal influenza model that exhibits a natural history and pathology similar to what is observed in humans. The potential translation from ferrets to humans raised concerns among funders (i.e. the US National Institutes of Health (NIH)) and the broader biosecurity policy community that the research could be used for intentionally harmful purposes or result in an accidental release from the laboratory into the general population[2,3.] Gain-of-function research may fall into the category of DURC which is defined as "life sciences research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security" and is subject to several US Government policies intended to

[2] IDSA and Gain-of-Function Experiments with Pathogens having Pandemic Potential, Frank et al, 2015.

[3] Gain-of-Function Research and the Relevance to Clinical Practice, Kilianski et al, 2015.

raise awareness and to limit the potential for misuse of scientific information derived from life sciences research[4].

Questions for discussion:

Q1. *How are gain-of-function research or more broadly, the dual use research of concern (DURC) policies, relevant to the goal of strengthening the culture of biosafety, biosecurity, and responsible conduct in life sciences research?*

A1. The aim of the US Government policies related to DURC and gain-of-function research are similar to efforts designed to strengthen the culture of biosafety, biosecurity, and responsible conduct in life sciences research, namely to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents.

Q2. *How are the risk mitigation strategies and analysis associated with gain-of-function research relevant to the goal of strengthening the culture of biosafety, biosecurity, and responsible conduct in life sciences research?*

A2. The National Science Advisory Board for Biosecurity (NSABB) recommended considering alternative experimental approaches to gain-of-function experiments that may provide the same or similar outcomes or additional/different benefits, without the same risks. These alternative approaches should be identified and their relative risks, benefits, and limitations thoroughly and impartially analyzed. NSABB also recommended that the effects of adequate or inadequate occupational medicine/medical surveillance programs, training, standard operating procedures, and administrative controls be examined and incorporated into the analysis. In addition, the impact of risk mitigation strategies and practices, the effect of public health interventions, and whether or not countermeasures are effective against novel strains, as well as how these strategies are actually employed (which may involve human error, crisis conditions, or other factors that decrease their effectiveness) should also be examined. In this context, strengthening the culture of biosafety, biosecurity, and responsible conduct in life sciences research through training, education, and awareness raising may be considered one of the risk mitigation strategies for gain-of-function research. The evaluation of such culture at the organizational level may enhance the risk/benefit analysis associated with gain-of-function research.

Q3. *Did NSABB ever make recommendations to the US Government on strengthening the culture of responsibility?*

[4] S3:Science Safety Security website.

A3. Yes, in the 2011 *NSABBGuidance for Enhancing Personnel Reliability and Strengthening the Culture of Responsibility*[5]. NSABB notes that, "above all, good management practices are the foundation that underpins the development of a culture of responsibility, integrity, trust, and effective biosecurity. In addition, strong institutional and laboratory leadership, clear articulation of priorities and expectations, and an institutional framework that provides relevant education, training, performance review, and employee support will facilitate responsible practices, personnel reliability, safety, and security, while allowing research on biological select agents and toxins (BSAT) to flourish". In this Guidance, NSABB provided recommendations for encouraging biosecurity awareness and promoting responsible conduct as well as a recommendation for assessing the effectiveness of practices aimed at enhancing personnel reliability and the culture of responsibility. NSABB also notes that, "all scientists—especially those working in the life sciences—are called to cultivate among themselves a culture of responsibility with regard to the conduct and the achievements of their research". NSABB emphasized with regard to all scientists—especially those working in the life sciences—that, "their goal remains that of the generation and advancement of knowledge, but, in some cases, such knowledge may be applied for both beneficial and harmful purposes; their beliefs, attitudes, and values must reflect a heightened consciousness of the implications of their research, especially of any potential for the deliberate misuse of the information, products, and technologies generated from their research; they must consciously live and demonstrate these beliefs, attitudes, and values through day-to-day practices of mindful research. With transparency, they must examine their own research with consideration of its potential for misuse, and they must conduct and communicate their research in ways that mitigate any risks of misuse. Finally, in cultivating and sustaining a culture of responsibility, scientists who conduct research must recognize that they engage in a continuous, reciprocal process of promoting and bearing mutual responsibility for their work: They must hold themselves and their peers accountable—collegially and with a shared commitment to advancing science and maintaining public trust."

Case Study #3 (reference: The Cooperative Biological Engagement Program Research Strategic Plan: Addressing Biological Threat Reduction Through Research)

Questions for discussion:

The US Government is funding programs supporting collaborative research projects abroad aimed at reducing risks associated with infectious diseases. An example of such a program is the Defense Threat Reduction Agency's (DTRA) Cooperative Biological Engagement Program (CBEP). The scope of CBEP's engagement activities increasingly intersects with major US Government and international program areas, including national security, force health

[5] Guidance for Enhancing Personnel Reliability and Strengthening the Culture of Responsibility, NSABB, 2011.

protection, global health security, science, and development and engagement. CBEP consciously engages and partners with other Department of Defense (DoD) and US Government entities (e.g., Army, Navy, Armed Forces Health Surveillance Center [AFHSC], Chemical and Biological Defense Program [CBDP], Department of Homeland Security [DHS], Department of Health and Human Services [HHS], Department of Agriculture [USDA], Federal Bureau of Investigation [FBI], United States Agency for International Development [USAID]); non-governmental organizations (e.g., World Bank, Foundation Merieux); and international programs (e.g., Food and Agricultural Organization of the United Nations [FAO], World Health Organization [WHO], World Organisation for Animal Health [OIE], and International Criminal Police (INTERPOL). For instance, CBEP projects at the Richard G. Lugar Center for Public Health Research in Tbilisi, Georgia, include research on emerging antibiotic resistance, epidemiology of human and environmental pathogens associated with vector borne diseases, and the impact of zoonotic pathogens on human health and veterinary practice, among other topics.

Q1. *Whose responsibility is it to create, strengthen, and sustain a culture of biosafety, biosecurity, and responsible conduct of science at an international location where US Government-funded projects are being implemented? Consider as an example CBEP projects at the Richard G. Lugar Center for Public Health Research in Tbilisi, Georgia.*

A1. Biosafety, biosecurity, and responsible conduct constitute a shared responsibility of the respective host organization, individual researchers, and the funding department or agency. They should work cooperatively to foster an assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents.

Q2. *Should the US Government research programs abroad [involving (but not limited to) BSAT] include (explicitly or implicitly) as an objective strengthening the culture of biosafety, biosecurity, and responsible conduct in life sciences?*

A2. Yes. The CBEP Research Strategy mentions fostering a culture of responsible scientific practice and specifies as one of its objectives the institutionalization of a culture of responsible and ethical conduct in biological research through thoughtful experimental design, competitive laboratory capabilities, and implementation of biorisk management practices that result in high-quality data, and active participation in professional societies and the peer-review process. Not all federal programs mention specifically such a culture.

Q3. *Are the Federal Experts Security Advisory Panel (FESAP) recommendations (including the recommendation to create, strengthen, and sustain a culture of biosafety, biosecurity, and responsible conduct in life sciences research) applicable to federally-funded research abroad?*

A3. Yes. The White House National Security Council (NSC) staff tasked the FESAP, in September 2014, to undertake a comprehensive federal review and identify specific recommendations to strengthen the US Government's biosafety and biosecurity practices and oversight system for

federally-funded activities involving (but not limited to) BSAT, consistent with the need to realize the public health and security benefits of such work. There is no waiver for federally-funded research abroad.

Q4. *Is "responsible conduct" a new concept for federally-funded activities?*

A4. No. The 2009 *National Strategy for Countering Biological Threats,* which articulates a vision of shared commitment wherein the US Government works with domestic and international partners to advance the health security of all people, includes as one of its objectives reinforcing of norms of safe and responsible conduct and highlights activities that should be taken to reinforce a culture of responsibility, awareness, and vigilance among all who utilize and benefit from the life sciences to ensure that biological materials and related knowledge, equipment, and technology are not diverted to harmful purposes. Such activities include: "encouraging the constituencies of the global life sciences community to engage in a robust and sustained dialogue as to the development of behavioral norms and options for their codification; encouraging professional societies in the life sciences to develop and communicate codes of ethics and consider how their membership policies can best reflect community norms; assisting professional societies and other representatives of the life sciences community in the development of relevant educational and training materials; ensuring the availability of tools and resources needed to document, communicate, and reinforce norms during the education and throughout the career of life scientists in academia, industry, or government; and supporting efforts by life scientists to explore community-based approaches for identifying and addressing irresponsible conduct". Federal departments and agencies report annually their Strategy implementation plans to the NSC.

Q5. *Outside the FESAP recommendations, are there any other international fora that address the culture of responsibility?*

A5. Yes. A culture of biosafety, biosecurity, and responsible conduct in life sciences research has been addressed in various multilateral fora. For example:

- WHO Guidance on *Responsible life sciences research for global health security*[6] promotes a culture of scientific integrity and excellence, distinguished by openness, honesty, accountability and responsibility and specifies that such a culture is the best protection against the possibility of accidents and deliberate misuse, and the best guarantee of scientific progress and development;
- At the 7th Review Conference of Biological Weapons Convention (BWC), States Parties noted that implementation of BWC includes measures to "… ensure the safety and security of microbial or other biological agents or toxins in laboratories, facilities, and during transportation, to prevent unauthorized access to and removal of such agents or

[6] Responsible life sciences research for global health security- A guidance document, WHO, 2010.

toxins…", "implement voluntary management standards on biosafety and biosecurity; …promote amongst those working in the biological sciences awareness of the obligations of States Parties under the Convention, as well as relevant national legislation & guidelines; promote the development of training and education programs for those granted access to biological agents … and encourage the promotion of a culture of responsibility amongst relevant national professionals and the voluntary development, adoption and promulgation of codes of conduct…";

- The Executive Summary from OIE's Global Conference on Biological Threat Reduction, 2015[7], notes inter alia that, "Veterinary education establishments have significant potential to positively influence the attitudes of future professionals in terms of ethics, responsible science, and in developing an international perspective" and that "The OIE should continue its efforts, in collaboration with veterinary education establishments, to refine the day one competencies, consider ethics as integral to education curricula, and develop on-line continuing education and learning tools, making them available to all Member Countries";
- The G7 Global Partnership against the Spread of Weapons and Materials of Mass Destruction is addressing the CBRN Security Culture in the context of its Centers of Excellence (CoE) and CBRN Security Sub-Working Group (SWG). Since its establishment in 2012, the CoE and CBRN Security SWG also looked at the vulnerability nexus of CBRN domains: the human factor in interrelated functional areas including security of relevant materials and associated facilities, strategic trade controls, and knowledge management. Under the Germany Chairmanship of the Global Partnership (GP), on 24 April 2015, the U.S. with support from the United Nations Office for Disarmament Affairs (UNODA), organized at the U.S. Consulate in Munich a side event on "Comprehensive CBRN Security Culture: Moving Forward to Address New Challenges" on the margins of the GP meeting. This side event sought broader stakeholders' input into how the CBRN Security Culture could contribute to the GP objectives of achieving international peace and security by preventing the proliferation of weapons of mass destruction and their means of delivery as well as effectively combating international terrorism. Participants agreed that the concept of CBRN Security Culture is inherently linked to promoting the responsible conduct of science in particular where issues of dual use research arise; as security is viewed differently across C, B, and R/N domains, a customizable approach should be developed to address domain-specific challenges; and a mechanism is needed to share lessons learned from outreach and education in support of strengthening the CBRN Security Culture as well as tools for assessing, evaluating, monitoring and improving the organizational culture in C,B, and R/N domains, with participation from a broad range of stakeholders[8].

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[7] Executive Summary from OIE's Global Conference on Biological Threat Reduction.

[8] CBRN Security Culture Discussion at the Global Partnership: Moving Forward, Ambassador Bonnie Jenkins,1540 Compass journal vol. 8, pp 12-17, 2015.

Strengthening an organizational culture that emphasizes biosafety, biosecurity, and responsible conduct in the life sciences

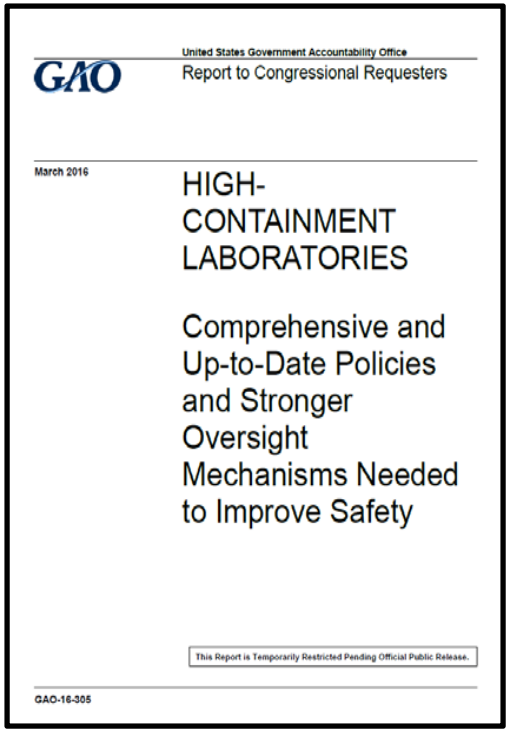
Template for Outreach to USG Internal and External Stakeholders

Objectives

- **Summarize policy context and strategic guidance underlying the process of strengthening the organizational culture that emphasizes biosafety, biosecurity, and responsible conduct in the life sciences**

- **Promote discussion and reflection on the elements of such an organizational culture and the path forward for assessment and sustainment**

Why do we need to optimize biosafety and biosecurity?


United States Government Accountability Office

GAO

Report to Congressional Requesters

March 2016

HIGH-CONTAINMENT LABORATORIES

Comprehensive and Up-to-Date Policies and Stronger Oversight Mechanisms Needed to Improve Safety

This Report is Temporarily Restricted Pending Official Public Release.

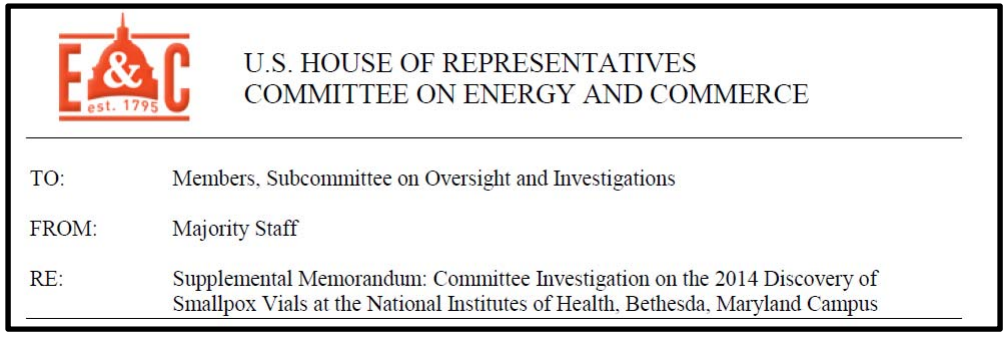
GAO-16-305

"In 2014 and 2015, two federal departments reported multiple lapses in laboratory safety that could have exposed personnel and other individuals to hazardous biological agents.

For example, within the Department of Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC) reported an incident in June 2014 that had the potential to expose laboratory personnel to live anthrax bacteria, and in July 2014, boxes containing decades-old vials of smallpox - some of which contained live virus - and other hazardous biological agents were found in a storage space of a Food and Drug Administration (FDA) laboratory on the National Institutes of Health (NIH) campus.

In May 2015, the Department of Defense (DOD) reported safety lapses at one of its high-containment laboratories stemming from inadequate procedures to fully inactivate anthrax that resulted in DOD shipping live anthrax to other laboratories."

Why the emphasis on the culture of safety?



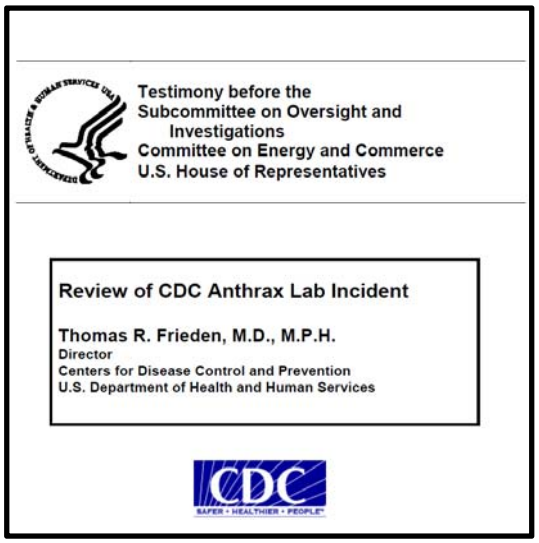
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON ENERGY AND COMMERCE

TO: Members, Subcommittee on Oversight and Investigations

FROM: Majority Staff

RE: Supplemental Memorandum: Committee Investigation on the 2014 Discovery of Smallpox Vials at the National Institutes of Health, Bethesda, Maryland Campus

"The hearings and reports show a pattern of recurring issues, of complacency, and a lax culture of safety. The lesson learned from past reviews is that Federal agencies must address cultural factors in addition to its policy and management efforts to ensure the effectiveness of its lab safety programs".



Testimony before the
Subcommittee on Oversight and Investigations
Committee on Energy and Commerce
U.S. House of Representatives

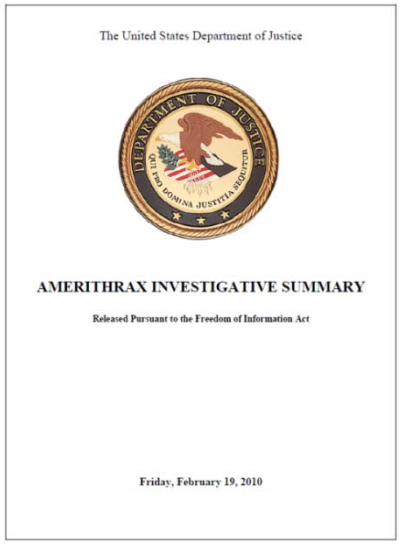
Review of CDC Anthrax Lab Incident

Thomas R. Frieden, M.D., M.P.H.
Director
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services

CDC
SAFER • HEALTHIER • PEOPLE™

"While specific corrective actions were taken in response to individual incidents in the past years, the broader pattern of inadequate laboratory safety was not addressed effectively. Addressing that broader pattern and our safety culture is what we are doing now."

What about the culture of security?

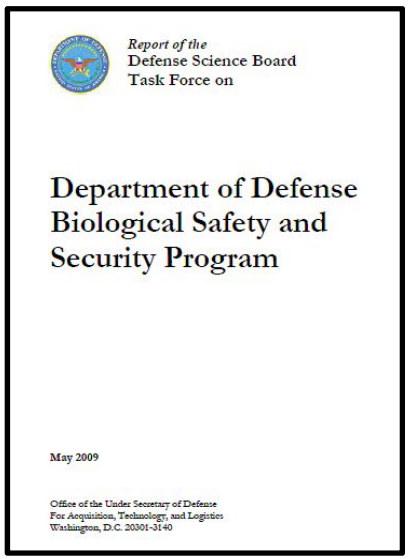

The United States Department of Justice

AMERITHRAX INVESTIGATIVE SUMMARY

Released Pursuant to the Freedom of Information Act

Friday, February 19, 2010

"Administrative and investigative steps taken in the past year toward closure of the investigation confirm the conclusion that Dr. Ivins perpetrated the anthrax letter attacks".


Report of the
Defense Science Board
Task Force on

Department of Defense Biological Safety and Security Program

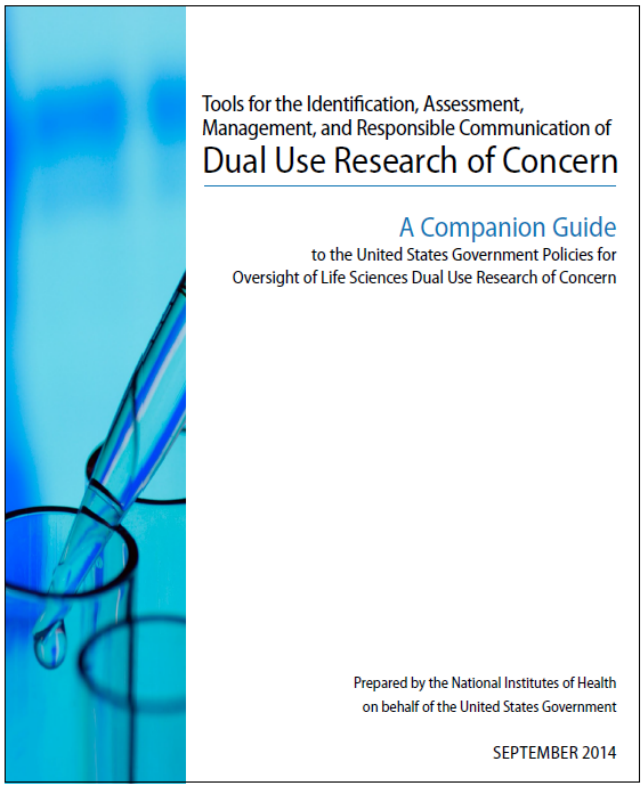
May 2009

Office of the Under Secretary of Defense
For Acquisition, Technology, and Logistics
Washington, D.C. 20301-3140

"The single overarching finding of this investigation is that a determined adversary cannot be prevented from obtaining very dangerous biological materials intended for nefarious purposes, if not from DoD laboratories, then from other sources".

Recommendations include making *"changes to monitoring activities to improve effectiveness without introducing overly intrusive measures. Hold periodic meetings with laboratory personnel to reinforce values, moral obligations, and observations that should be reported".*

Beyond the culture of safety and security
- example for consideration -



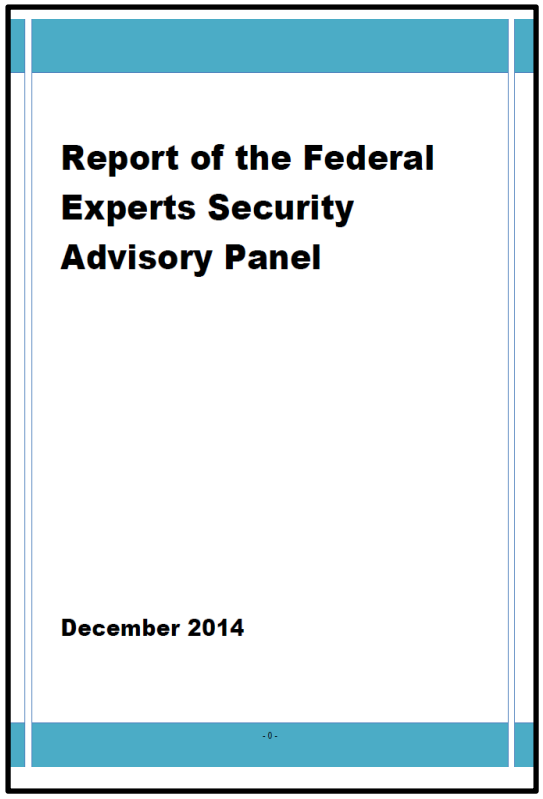
Is the individual and institutional oversight of DURC (which includes policies, practices, and procedures to ensure DURC is identified and risk mitigation measures are implemented, where applicable) an example of area where cultural factors are important?

Yes. DURC policies emphasize a culture of responsibility by reminding all involved parties of the shared duty to uphold the integrity of science and prevent its misuse

"All scientists—especially those working in the life sciences—are called to cultivate among themselves a culture of responsibility with regard to the conduct and the achievements of their research"

- 2011 NSABB *Guidance for Enhancing Personnel Reliability and Strengthening the Culture of Responsibility*

Culture in context



"Recent incidents involving BSAT have raised serious safety and security policy issues. The White House National Security Council (NSC) staff tasked the FESAP, in September 2014, to 1) identify needs and gaps and make recommendations to optimize biosafety, biosecurity, oversight, and inventory management and control for BSAT; 2) identify actions and any regulatory changes to improve biosafety and biosecurity; and 3) identify an approach to determine the appropriate number of high-containment U.S. laboratories required to possess, use, or transfer BSAT".

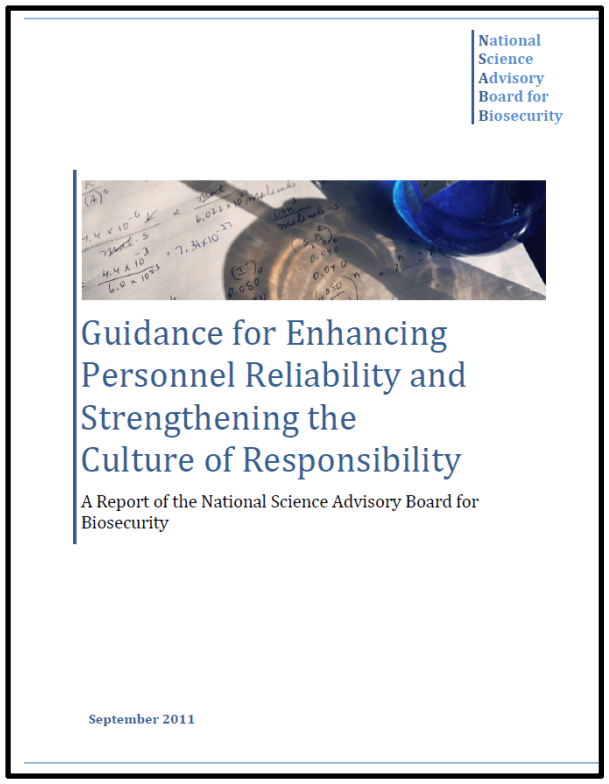
Recommendation 1.1: Create and strengthen a culture that emphasizes biosafety, laboratory biosecurity, and responsible conduct in the life sciences. This culture of responsibility should be characterized by individual and institutional compliance with biosafety and laboratory biosecurity regulations, guidelines, standards, policies and procedures, and enhanced by effective training in biorisk management".

Definition of culture as it relates to biorisk management

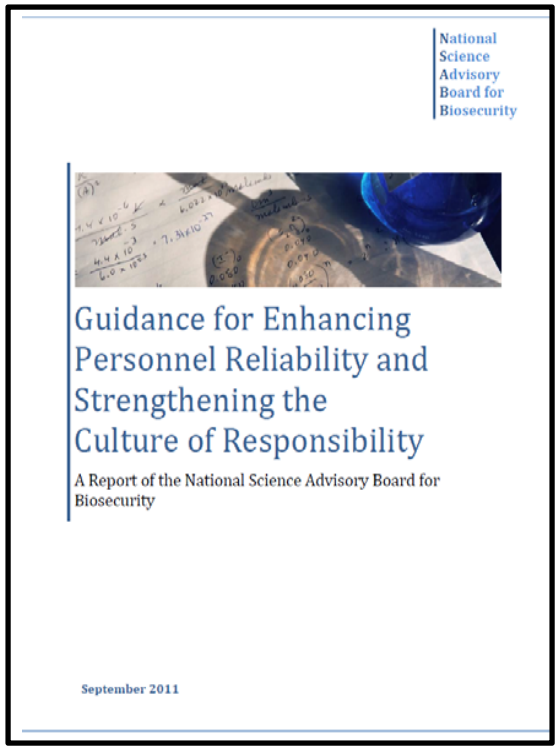
An assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents.

What elements should we consider for strengthening the organizational culture?

***Management systems* which prioritize biosafety, biosecurity, and responsible conduct**	Processes, procedures and programs in the organization which prioritize biorisk management and have an important impact on the biosafety/biosecurity functions
***Behavior of leadership and personnel* to foster more effective biosafety and biosecurity**	*Leadership behavior* (i.e. specific patterns of behavior and actions which are designed to foster more effective biorisk management) should emphasize inter alia expectations, decision making, management/ supervisory oversight, effective communication, and motivation. *Personnel behavior* (the desired outcomes of the leadership efforts and the operation of the management systems) should emphasize inter alia professional conduct, adherence to approved/validated procedures and research protocols, team work and cooperation, and vigilance.
***Principles for guiding decisions and behavior* as they relate to biorisk management**	Emphasis should be placed on p*rinciples for guiding decisions and behaviors* as they related to biorisk management (i.e. motivation, leadership, commitment and responsibility, professionalism and competence, learning and improvement, maintaining public trust)
Beliefs and attitudes on biosafety and biosecurity	Beliefs and attitudes on biosafety and biosecurity should be assessed periodically and reinforced through training and education aiming to: raise awareness on the risks associated with working in a laboratory with biological materials (e.g., accidental exposure, infection or release; intentional theft and/or misuse; others such as radiological/chemical/physical safety), the potential ramifications if such risk events were to occur and risk mitigation strategies; raise awareness and increase understanding of the ethical, legal, and societal issues and consequences concerning life sciences research, development, and associated technologies; raise awareness and place emphasis on the importance of quality systems and practices in lab biosafety and biosecurity training and research design; review codes of ethics and social responsibility guidelines in life sciences research; and review biosafety, biosecurity, and dual use research of concern regulations, guidelines, policies and procedures, and any other specified training requirements.



"Above all, good management practices are the foundation that underpins the development of a culture of responsibility, integrity, trust, and effective biosecurity. In addition, strong institutional and laboratory leadership, clear articulation of priorities and expectations, and an institutional framework that provides relevant education, training, performance review, and employee support will facilitate responsible practices, personnel reliability, safety, and security, while allowing research on biological select agents and toxins (BSAT) to flourish".



The scientists' "***goal remains that of the generation and advancement of knowledge, but, in some cases, such knowledge may be applied for both beneficial and harmful purposes; their beliefs, attitudes, and values must reflect a heightened consciousness of the implications of their research, especially of any potential for the deliberate misuse of the information, products, and technologies generated from their research; they must consciously live and demonstrate these beliefs, attitudes, and values through day-to-day practices of mindful research.***

With transparency, they must examine their own research with consideration of its potential for misuse, and they must conduct and communicate their research in ways that mitigate any risks of misuse.

Finally, in cultivating and sustaining a culture of responsibility, scientists who conduct research must recognize that they engage in a continuous, reciprocal process of promoting and bearing mutual responsibility for their work: They must hold themselves and their peers accountable—collegially and with a shared commitment to advancing science and maintaining public trust."

Foundational values of an organizational culture that emphasizes biosafety, biosecurity, and responsible conduct

- **Research excellence: foster quality in life sciences activities, which is the basis for developing new treatments and therapeutics, strengthening health research systems, and promoting public health surveillance and response activities. These elements are essential to protecting and improving the health and well-being of all people.**

- **Bioethics –promote responsible and good research practices, the provision of tools and practices to scientists and institutions that allow them to discuss, analyze and resolve in an open atmosphere the potential dilemmas they may face in their research, including those related to dual use research of concern, the possibility of accidents or misuse of the life sciences.**

- **Biosafety and biosecurity –implement and strengthen of measures and procedures to: minimize the risk of worker exposure to pathogens and infections; protect the environment and the community; and protect, control and account for biological materials within laboratories, in order to prevent their unauthorized access, loss, theft, misuse, diversion or intentional release. Such measures reinforce good research practices and are aimed at ensuring a safe and secure laboratory environment, thereby reducing any potential risks of accidents or deliberate misuse.**

Assessment of the organizational culture that emphasizes biosafety, biosecurity, and responsible conduct in the life sciences

- **Organizations / laboratories are encouraged to develop methods for outcome measurement (i.e. systematic determination and evaluation of their training and oversight systems aiming to strengthen the culture of biosafety, biosecurity, and responsible conduct, and comparison with the strategic goals and intended or projected results)**

- **Outcome measurement has become increasingly important given the complexity of biosafety/biosecurity oversight systems, the need for evidence-based decision-making (e.g. on staffing, areas for improvement, choice of training programs), and the ability to detect changes associated with a particular intervention**

- **Such a systematic assessment (conducted periodically) is critical to understanding the efficiency/effectiveness of the biorisk management framework, causality of system breakdowns or analysis of incidents, sources of human error or breaches of biosafety/biosecurity, efficiency/effectiveness of training, etc.**

Methods of assessment of the organizational culture that emphasizes biosafety, biosecurity, and responsible conduct in the life sciences

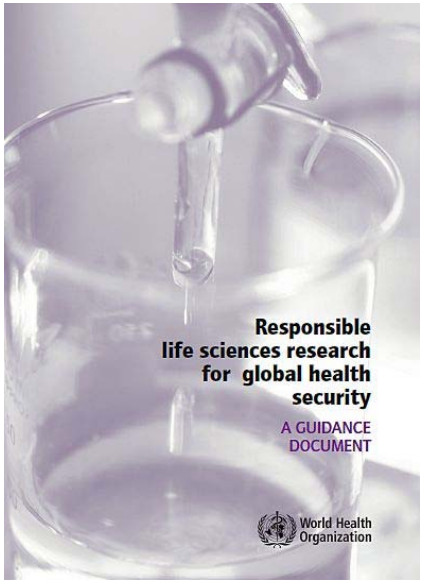
- **Basic** (based on statistical methods and information derived mostly from document review, observations, and other sources- i.e. percentage of employees who have received safety/security refresher training during the previous quarter or year; percentage of safety/security improvement proposals submitted, considered, or implemented during previous quarter or year; number of laboratory safety/security incidents or near-misses, etc);

- **Intermediate** (based on managers' own "yes" or "no" judgment regarding the evolving structure and functionality of the biosafety/biosecurity framework; areas assessed requiring a "yes" or "no" response may include: information on the availability of safety/security policies, regularly held management meetings covering significant safety and security issues, professional rewards or recognition are associated with the achievement of safety/security goals, etc.) or

- **Comprehensive** (multi-stage process comprising both non-interactive and interactive assessment tools focusing on management and behavior characteristics of the biorisk management culture). Methods to be included in the plan may include: 1) non-interactive methods (surveys, document review, and observations) and 2) interactive methods (individual interviews and focus-group discussions).

Aim to develop a continuous improvement system that provides feedback, reassessment, and on-going training and learning opportunities

International perspectives



WHO "promotes a culture of scientific integrity and excellence, distinguished by openness, honesty, accountability and responsibility. Such a culture is the best protection against the possibility of accidents and deliberate misuse, and the best guarantee of scientific progress and development".

States Parties noted that implementation of BWC includes inter alia measures to "*… ensure the safety and security of microbial or other biological agents or toxins in laboratories, facilities, and during transportation, to prevent unauthorized access to and removal of such agents or toxins*…", "*implement voluntary management standards on biosafety and biosecurity*; promote the *development of training and education programs* for those granted access to biological agents … encourage the promotion of a *culture of responsibility* amongst relevant national professionals and the voluntary development, adoption and promulgation of *codes of conduct*…"

2011 Biological Weapons Convention
7th Review Conference

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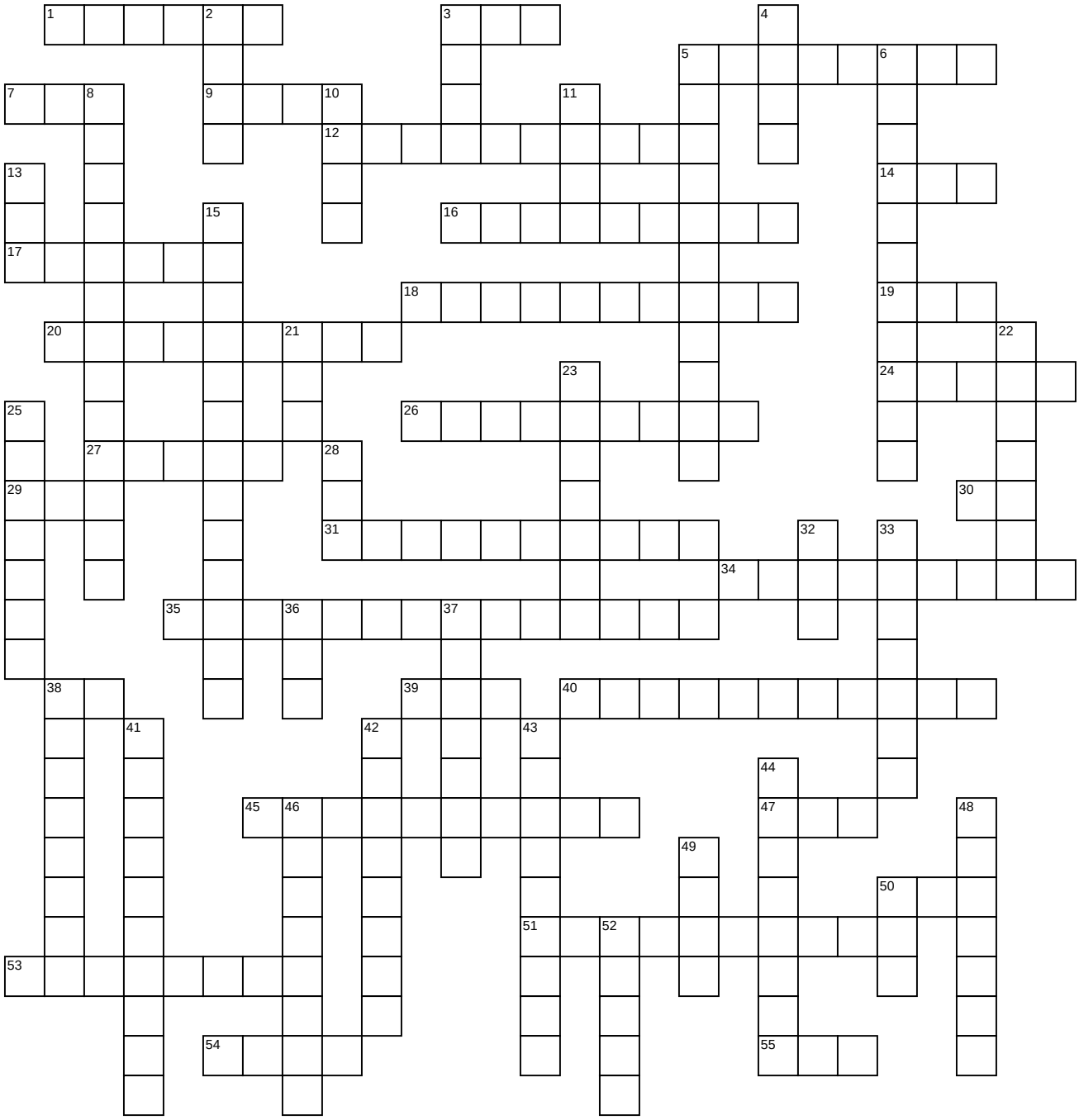
- ***A guide to implementing a SAFETY CULTURE in our universities***, **APLU, 2016, http://www.aplu.org/projects-and-initiatives/research-science-and-technology/task-force-laboratory-safety/**

Questions?

Culture of Biosafety, Biosecurity, and Responsible Conduct



ACROSS

1 A principle, plan, or course of action that the Executive branch of the Federal Government can establish it through the use of both regulations and guidance documents
3 Biosafety cabinet
5 Systematic investigation aimed at the discovery or interpretation of facts, revisions of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws, including the processes of experimentation, development, testing, and evaluation
7 Security Risk Assessment
9 Recombinant DNA
12 Such agents include any microorganism (including, but not limited to, bacteria, viruses, fungi, rickettsiae, or protozoa), or infectious substance, or any naturally occurring, bioengineered, or synthesized component of any such microorganism or infectious substance, capable of causing death, disease, or other biological malfunction in a human, an animal, a plant, or another living organism; deterioration of food, water, equipment, supplies, or material of any kind; or deleterious alteration of the environment
14 Presidential Policy Directive
16 "biological" and "hazard" combined
17 Public Health Emergency Medical Countermeasures Enterprise
18 A rule based on a statute
19 Select agent regulations
20 The ethics of medical and biological research
24 A type of research that is meant to increase our scientific knowledge base with regard to certain phenomena or behavior
26 The application of combinations of laboratory practices and procedures, laboratory facilities, safety equipment, and appropriate occupational health programs when working with potentially infectious microorganisms and other biohazards
27 The toxic material or product of plants, animals, microorganisms (including, but not limited to, bacteria, viruses, fungi, rickettsiae, or protozoa), or infectious substances, or a recombinant or synthesized molecule, whatever their origin and method of production, and includes any poisonous substance or biological product that may be engineered as a result of biotechnology, produced by a living organism; or any poisonous isomer or biological product, homolog, or derivative of such a substance
29 An infection resulting from exposure to an infectious agent in a laboratory
30 Responsible Official
31 When applied to risk, it is a process used to identify the hazardous characteristics of a known infectious agent or potentially infectious agent or material, the activities that can result in exposure to such an agent, the likelihood that such exposure will cause a laboratory-acquired infection (LAI), and the probable consequences of such an infection
34 The Biosafety Review …. or a group of individuals affiliated with a facility whose functions typically extend beyond those of the "institutional biosafety committee" (IBC) as described in the NIH Guidelines
35 For all high and maximum containment facilities, it refers to the physical containment barriers in a facility such as contained dressing and shower rooms, sealed service penetrations, specialized doors, entry and exit avenues to prevent cross-contamination, specialized air handling systems for contamination control, personal protective equipment, biosafety cabinets, etc.
38 The individual designated by a research entity to direct a project or program, and who is responsible to the entity for the scientific and technical direction of that project or program
39 Specialized clothing or equipment worn by an employee for protection against a hazard
40 The protection of hazardous biological agents, including toxins, from loss, theft, diversion, or intentional misuse
45 The effective … of risks posed by working with hazardous biological agents in laboratories; it includes a range of practices and procedures to ensure the biosecurity, biosafety, and biocontainment of high-consequence pathogens
47 A body of rules of conduct of binding legal force and effect, for instance the Public Health Security and Bioterrorism Preparedness and Response Act of 2002
50 Biosafety level
51 Likely to spread infection
53 A laboratory event that may include exposure of staff or the public to an infectious, potentially infectious, or zoonotic agent; environmental release of a biological hazard; escape of infected animals or vectors; spill of a biohazard outside of a primary containment device; loss or theft of biohazardous agents and other loss of containment; or equipment failure in conjunction with a biohazard (e.g., centrifuge accident) that may lead to a release of a hazardous agent within the laboratory environment or outside the laboratory environment
54 National Plant Diagnostic Network
55 Laboratory Response Network

DOWN

2 Chemical, biological, radiological, and nuclear
3 Biosafety in Microbiological and Biomedical Laboratories
4 Biological Select Agents and Toxins
5 An assurance that individuals with access to dangerous pathogens are trustworthy, reliable, and physically and mentally competent
6 This type of conduct in research is simply good citizenship applied to professional life
8 An objective assessment of an institution's biosafety/biocontainment or biorisk management program by an independent body
10 Designations of laboratories for work with biohazards used in a vivarium that include zoonotic or human pathogens
11 When referring to containment is BSL-3
13 Select Agents Program
15 Validating the expertise and credentials of an individual or an engineering control and in some cases a laboratory facility
21 Institutional Biosafety Committee
22 A microscopic organism, such as a bacterium, fungus, protozoan, or virus
23 When referring to containment is BSL-4
25 An assumed truth which is part of the organizational culture (plural)
28 Deoxyribonucleic acid
32 Subject Matter Expert
33 The combination of the probability of the occurrence of harm and the severity of that harm where the source of harm is a biological agent or toxin (adapted from ISO/IEC Guide 51:1999)
36 Code of Federal Regulations
37 … biosafety and biocontainment research - Research designed to generate science-based practices and procedures, engineering controls, personal protective equipment, and risk-assessment methodologies necessary to optimize the safety of research facilities; and to keep safety equipment, practices, and procedures up to date
38 A microorganism (including bacteria, viruses, rickettsiae, parasites, fungi) or other agent, such as a proteinaceous infectious particle (prion) that can cause disease in humans, animals, or plants
41 Standards or principles written by an organization to assist in the effectiveness of an operation, or to recommend a course of action
42 The action of teaching someone a particular skill or type of behavior
43 The process of a multi-tiered, often-overlapping system-from principal investigators at individual laboratories to agencies of the Federal Government-seeking to ensure the safety of biological laboratories and their activities through compliance with existing laws, regulations, policies, standards, and guidelines on biosafety and biocontainment
44 A type of laboratory where diagnostic or other screening procedures are performed on blood or other potentially infectious materials
46 A manner of thinking, feeling, or behaving that reflects a state of mind or disposition and is fundamental to the culture of biosafety, biosecurity, and responsible conduct
48 An assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, diversion, of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents.
49 National Registry of Certified Microbiologists
50 Biosafety officer or biological safety officer
52 Federal Experts Security Advisory Panel

Culture of Biosafety, Biosecurity, and Responsible Conduct

Solution: