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INTRODUCTION

Good Morning Chairman Boehlert and Members of the Committee. I am Paul Gilman, Assistant Administrator for Research and Development and Science Advisor to the Administrator, United States Environmental Protection Agency (EPA). I welcome this opportunity to appear before you today to discuss how homeland security-related research and development (R&D) is prioritized, coordinated, and executed at EPA. Before I begin addressing the specifics of our R&D homeland security efforts, I would like to briefly discuss the genesis of EPA's role in homeland security and provide a brief history of the Agency's efforts in this important arena, as these factors have played an important role in directing EPA's R&D homeland security efforts.

For over 30 years, EPA and our federal, state, local and tribal partners have made great progress toward a cleaner, healthier environment for the American public. Under the Federal Water Pollution Control Act, the Comprehensive Environmental Response, Compensation, and Liability Act (also known as CERCLA or "Superfund), the Superfund Amendments and Reauthorization Act (SARA) of 1986 (which includes the Emergency Planning and Community Right-to-Know Act (EPCRA), the Clean Water Act, as amended by the Oil Pollution Act of 1990 (OPA), the Safe Drinking Water Act, and other authorities, EPA is responsible for

preparing for and responding to emergencies involving the release of oil, hazardous substances, and certain radiological materials into the environment - any of which could be a component of a weapon of mass destruction. EPA has more than 200 On-Scene Coordinators (OSCs) at over 25 locations throughout the country, who are ready to quickly respond to release notifications. OSCs are the Federal officials responsible for evaluating, monitoring or directing responses to oil spills and hazardous substance releases reported to the Federal government. OSCs coordinate all Federal efforts with, and provide support and information to, local, state, tribal, and regional response communities. EPA also has specialized Environmental Response Teams and a Radiological Emergency Response Team available at all times. Working with other specialized Federal resources, these teams and experts are available and trained to respond to incidents involving hazardous substances. EPA can also provide direction, coordination, and support on hazardous release situations as needed. EPA is also the lead agency for Hazardous Materials Response under Emergency Support Function (ESF) #10 of the Federal Response Plan, under which we assist the Federal Emergency Management Agency in managing the consequences of major emergencies and disasters by providing environmental monitoring, decontamination, and long-term site cleanup.

In 1995, EPA was identified as one of six key federal agencies with roles in counterterrorism. Since then, EPA's homeland security emergency response and infrastructure protection roles have been reaffirmed and expanded in PDDs 62, 63 and the more recent Homeland Security Presidential Directives (HSPD)-5 *Management of Domestic Incidents*, -8 *National Preparedness*,-9 *Defense of United States Agriculture and Food, and -10 National Biodefense Strategy*. We played a vital role in the federal response to the World Trade Center, anthrax and ricin incidents and continue to work hard to enhance our capabilities to respond to multiple nationally significant incidents if necessary. Under PDD 63 and the more recent HSPD-

7 *Critical Infrastructure Identification, Prioritization, and Protection*, EPA has also been designated the lead agency for enhancing the protection of the Water Supply Sector of the Nation's infrastructure. Under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, EPA is assisting community water systems to conduct vulnerability assessments and develop emergency response plans. Other homeland security activities towards which EPA expertise has been applied include sample collection for the multiagency program, BioWatch, an early warning system for the release of biological agents to outdoor air; the collection of environmental counter-terrorism evidence; and the decontamination of indoor building environments. HSPD -9 *(Defense of United States Agriculture and Food*) tasks EPA with additional homeland security responsibilities for the water sector. The recently issued HSPD-10 *National Biodefense Strategy*, assigns EPA to lead the interagency effort for the development of strategies, guidelines, and plans for decontamination following a biological weapons attack.

With the post-September 11, 2001 increase in the pace and scope of EPA's activities, EPA faced a significant internal, as well as external, coordination challenge. In the weeks following the attacks, EPA's Administrator established a Homeland Security Working Group that included senior representatives from each of EPA's program offices involved in homeland security efforts. The group, led by the previous Deputy Administrator of EPA, developed a strategy for fulfilling our homeland security responsibilities while still fulfilling our traditional mission.

In response to EPA's increasing responsibilities in homeland security, the Agency determined that it was necessary to modify EPA's internal structure in specific areas. An Office of Homeland Security was established in the Administrator's Office to advise the Administrator

and continue to coordinate a consistent national approach to homeland security policy development across the Agency. The Office of Solid Waste and Emergency Response consolidated its emergency response and preparedness functions to create the Office of Emergency Prevention, Preparedness and Response (OEPPR), in order to focus many of the Agency's oil and hazardous substances emergency prevention, preparedness, and response duties. The Office of Water created a new division for Water Security, which created a permanent home for the activities that were being accomplished by the ad hoc Water Protection Task Force EPA created after September 11, 2001, to oversee protection of America's drinking water and wastewater systems. Finally, the Agency has established the National Homeland Security Research Center, which reports to me, to conduct and oversee research directly related to homeland security.

EPA has also made important additions to our response capabilities to address the threats presented by terrorism. EPA is establishing a National Decontamination Team of highly specialized personnel who will provide decontamination expertise and assistance for buildings and other infrastructure following a weapons of mass destruction event. Further, EPA has recently made significant improvements to the Agency's Emergency Operations Center to assist in overall coordination of EPA's activities during nationally significant incidents. We also augmented our existing two Environmental Response Teams by establishing a third Team location in Las Vegas, co-located with the western component of our Radiological Emergency Response Team, to improve our ability to respond to emergencies in the western United States.

EPA HOMELAND SECURITY RESEARCH ACTIVITIES

EPA research and development in support of the national homeland security effort is primarily conducted by the National Homeland Security Research Center (NHSRC) in the EPA

Office of Research and Development (ORD). ORD is also collaborating with the EPA Office of Water, Office of Solid Waste and Emergency Response and Office of Pollution Prevention and Toxic Substances in a variety of science and technology efforts related to homeland security.

The NHSRC was formed in October, 2002 in response to September 11th and the anthrax letter attacks to address critical science and technology knowledge gaps that became apparent in the emergency response and cleanup actions for those events. The goal of the research program is to rapidly provide appropriate and effective technologies, methods and technical guidance to understand the potential risks posed by potential chemical and biological terror attacks on buildings and water infrastructure and to improve our ability to detect and contain contaminants and decontaminate these facilities as necessary in the event of such attacks. Because of the urgency of generating this information, the Center was formed by reassigning some of the most experienced scientists and engineers from across ORD, including staff knowledgeable in environmental sampling and analysis, microbiology, chemistry, risk assessment, indoor air pollution, water supply and environmental cleanup. Staff were not asked to relocate. Instead they operate as a "virtual" organization across seven cities, with the greatest concentration in EPA's two major research facilities in Cincinnati, Ohio and Research Triangle Park, North Carolina This approach was important because it enabled the organization to be operational almost immediately, enabling some important research results to be produced and delivered within two months of the reorganization. To further emphasize the critical nature of this work, EPA established a goal for the research effort to produce important results for key stakeholders in the emergency response, building owner and water utility communities within the first three years. The need for research beyond that time was to be evaluated at mid-point in light of accomplishments, the magnitude and remaining research and technology gaps, and needs

identified by DHS and other internal and external clients.

The EPA homeland security research program is focused on chemical and biological contaminants that could be used by terrorists including: weaponized and non-weaponized pathogenic bacteria and viruses, biochemical toxins, chemical warfare agents and certain widely-available toxic industrial chemicals that could potentially be used in attacks. In addition, radiological contamination of water infrastructure is also being addressed. There are three primary components of the research effort:

(1) The Safe Buildings Program addresses technology and methods to enable cost-effective cleanup for reoccupation following contamination events;

(2) The Water Security Program, in close collaboration with EPA's Office of Water, develops methods and technologies to warn/detect an attack on water and wastewater systems and to facilitate system decontamination; and

(3) The Rapid Risk Assessment Program develops data, methods and models to rapidly characterize public health risks posed by contamination events and inform decision-making on necessary decontamination and cleanup goals.

There are two important ways EPA homeland security research priorities have been established: (1) stakeholder/user needs input and (2) a comprehensive threat scenario analysis. Early on, staff interacted extensively with stakeholders and experts in the emergency response community, water industry, key federal agencies with expertise in chemical and biological weapons and with organizations representing building owners and managers. These discussions, along with an evaluation of lessons learned from the World Trade Center and anthrax letter events as well as an evaluation of known attempts to intentionally contaminate water systems, revealed a number of key research and information gaps that needed to be addressed as quickly

as possible. Most of the early research resources available to EPA were directed to these consensus needs, which included work such as development and evaluation of anthrax sampling, analysis and decontamination methods; assessments of the treatability of contaminants in water treatment and distribution systems; establishment of a program to verify the performance of commercially available homeland security technologies, and other near-term critical needs.

The second and more comprehensive manner in which priorities have been established is through the identification and analysis of threat scenarios. There are literally thousands of possible combinations of facility types, attack agents and attack methods that are possible for buildings and water infrastructure. Each combination (threat scenario) represents a range of possible consequences in terms of human health and economic (i.e., from clean up, disruption) impact. The research program is designed to focus its attention only on the most probable, highest consequence events.

In recognition of the importance of peer review, EPA submitted its Safe Buildings Research Plan and its Water Security Research and Technical Support Action Plan to the National Academies of Science. Two independent panels were formed and provided extensive input to enhance the research plans. The water panel stressed the need to quantify the multiple benefits and costs attributable to the proposed research. The buildings panel recommended that the primary focus of EPA's research be decontamination and disposal and that detection and containment efforts should be primarily targeted towards this end. Each panel also provided a considerable listing of specific recommendations to EPA. EPA has conducted an extensive analysis of these recommendations and has incorporated nearly all of them into our research implementation plans.

Leveraging with other agencies and organizations is also critical to our success. This

helps us avoid duplication, accelerate the pace of research outcomes and build on complementary work. Important collaborations have already been put in place with 17 federal research organizations in the Department of Defense (DOD) and Department of Energy (DOE), as well as with the Centers for Disease Control and Prevention (CDC), National Institute for Standards and Technology (NIST), the U.S. Geological Survey (USGS) and the Food and Drug Administration (FDA). In fact, nearly 35% of EPA's homeland security extramural research budget is being utilized to support over 36 interagency projects to enhance and expand our research effort. Much research is also being conducted in collaboration with water industry associations including the Water Environment Research Foundation and the American Water Works Association Research Foundation.

As stated previously, the Department of Homeland Security (DHS) is a critical partner for EPA's homeland security research program. Our primary interaction on homeland security research is with the Science and Technology Directorate. EPA has shared its research plans with DHS, and the organizations hold regular joint-briefings on the status of research and future plans. The most recent briefing was held last month in Washington. Shorter, individual project briefings are held with key DHS staff as important results come in. EPA and DHS have established and also co-chair the Intergovernmental Building Protection and Decontamination Workgroup that meets monthly to share information and help prioritize building protection and decontamination research across the nine participating agencies. These include DOD, DHS, EPA, Department of State (DOS), General Services Administration (GSA), CDC, U.S. Postal Service (USPS), NIST and Federal Emergency Management Agency (FEMA). DHS is also a member of the Distribution System Research Consortium established by EPA to coordinate government and non-government research on water distribution system contamination

prevention.

DHS has also sought EPA review and advice on DHS funding priorities. EPA has contributed to topical areas incorporated into DHS research solicitations and has participated in proposal review panels for the DHS National Laboratory Program, the University Grants Program and the Homeland Security Advanced Research Projects Agency (HSARPA). At the request of DHS, EPA has submitted a number of FY 2004 research proposals to supplement EPA efforts in building decontamination, water security and risk assessment. Decisions on these proposals are currently under review at DHS. EPA and DHS also recently agreed to jointly fund a Request for Applications (RFA) for research in the area of biological risk assessment.

SPECIFIC EPA RESEARCH COLLABORATIONS AND ACCOMPLISHMENTS

EPA is supporting collaborative research across the federal government in all of the components of its homeland security research program. These components are: detection containment, decontamination/disposal, risk assessment, commercial technology verification and science support to emergency response. Several examples are provided below for illustration.

Detection Research

One critical need that arose from the anthrax cleanup activities in the postal facilities and the Capitol Hill complex is the need for improved, validated surface sampling and analysis protocols to inform decontamination decisions. EPA and CDC have collaborated to develop these protocols and are working in concert with the U.S. Army at Dugway Proving Ground to validate and modify the protocol as necessary. Drafts of the protocol have been provided to the response community as interim guidance.

Similarly, water utilities have expressed concern for a lack of validated water sampling and analysis methods for chemical and biological terror agents. These methods are needed to

detect or confirm attacks and inform cleanup and response decisions. The EPA NHSRC and the Office of Water have combined forces with the CDC and the U.S. Army's Edgewood Chemical and Biological Center (ECBC) to develop and field-validate methods for both chemical and biological agents. The Office of Water is also collaborating with the DOD Technical Support Working Group (TSWG) to evaluate concentration/extraction methods for chemical contaminants in water. Furthermore, a cross-government workgroup, led by ORD, has just completed the development of a Compendium of Standardized Analytical Methods for Use During Homeland Security Events. The Compendium identifies standard and best available methods for analysis of chemical and biological agents in water, dusts, and aerosols. It is an important step in establishing a national environmental sampling and analysis capacity for responding to terror events.

Finally, EPA and the U.S. Army Research Laboratory are jointly conducting research to adapt laser-based detection methods for rapid and specific identification of biological agents on surfaces. This research, which is being conducted at EPA's research facility in North Carolina, is showing great promise for improving the speed and cost of cleanup.

Containment Research

In the event of biological or chemical attacks on buildings or water, it is important to understand how to contain the release and minimize the potential human exposure and the amount of infrastructure that will potentially need to be decontaminated. In the case of water systems, our attention is focused on understanding the effectiveness of existing water treatment systems to deactivate or remove contaminants introduced into water systems. EPA and CDC are collaborating to jointly determine the effectiveness of various disinfection methods for deactivating biological warfare agents including anthrax. Much of the work is nearing

completion, and key findings relating to particular water system vulnerabilities have been provided to the EPA Office of Water and DHS. The Office of Water is also collaborating with the DOD Office of Naval Research to develop mobile treatment units for providing alternative water supplies in the aftermath of contamination events.

Once contaminants enter water systems, containment strategies rely on the ability to predict where and how fast contamination will propagate. EPA is conducting extensive in-house research to adapt EPA-developed water distribution models to better understand fate and transport of contamination in complex water distribution systems. The DOE Argonne National Laboratory and the Sandia National Laboratory are also collaborating with EPA to enhance the capabilities of the model and to develop approaches to optimize the cost and deployment of early warning sensors in distribution systems. The U.S. Geological Survey and EPA have agreed to team in the field deployment and testing of these technologies.

In the case of building contamination, EPA and the DOD-sponsored Technical Support Working Group are collaborating to evaluate the effectiveness of filtration systems for removal of chemical and biological agents from air entering building air supplies. These systems will provide an important first line of defense against large scale external releases of many chemical and biological agents. EPA has also interacted extensively with the DOD Immune Buildings Program to extend military facility protection technology to domestic building contaminants.

We have also been able to take advantage of complementary work being conduced under ORD clean air research to enhance our homeland security research efforts. EPA building air flow and ventilation models developed as part of our indoor air pollution research program have been adapted to both create building air contamination simulation models for threat scenario analysis and evaluate the fate and transport of contaminants in buildings for a number of key

contaminants and attack methods. This work will be synthesized into an interim Building Protection Design and Operational Guidance Manual that will be provided to building owners in 2005. Similarly, an urban canyon modeling field study underway in mid-town Manhattan at the time of the World Trade Center collapse enabled ORD to rapidly deploy on-the-ground air sampling in lower Manhattan and incorporate these and other air quality data into a detailed plume model. This model has since been enhanced to provide an important tool for simulating and predicting the fate and transport of hazardous air pollutants in urban terrain following large scale outdoor releases.

Decontamination Research

Decontamination research is a major focus of EPA's homeland security research program. EPA has significant scientific and operational experience in cleanup methods for industrial chemicals in the environment, and the military has developed a substantial body of knowledge and technology for decontamination of personnel, equipment and facilities in warfare situations involving biological and chemical weapons agents. The challenge is to extend this common knowledge to the relatively untested domestic application of decontamination of public buildings and water systems. In the case of buildings, techniques for hard surface decontamination are available, but methods for porous surfaces, sensitive or high value property and large areas are relatively unproven and expensive. Questions remain over the effectiveness, design and operational requirements, cost, and potential secondary health effects of available techniques such as chlorine dioxide and vaporous hydrogen peroxide fumigation. To help address these needs, EPA is working with the U.S. Army Edgewood Chemical and Biological Center to conduct studies of the effectiveness of these techniques for important organisms, surface types and environmental conditions. This work, in combination with lessons learned in

the Capitol Hill and postal facility cleanups, will lead to interim design and operational guidance that will enable more optimized cost-effective decontaminations in the future. In addition, EPA's Office of Pesticide Programs is collaborating with ORD and the Food and Drug Administration to develop methods to more quickly, effectively and even prospectively develop the data necessary for EPA to make crisis exemption determinations for fumigants and antimicrobials as required under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA).

While shock disinfection and flushing are possible decontamination methods for water systems, little is known about the effectiveness of these methods and others that will need to be developed for decontaminating biological and chemical weapons agents or non-traditional persistent water contaminants in water systems. EPA has greatly expanded its unique in-house water system research facilities to initiate detailed studies of the effectiveness of available and emerging decontamination methods including chlorination, surfactant and enzyme treatment approaches. We are collaborating with the American Water Works Association Research Foundation to survey existing decontamination performance information and identify innovative approaches. EPA is also collaborating with the U.S. Army Edgewood Chemical and Biological Center, the Army Corps of Engineers and with the National Institute of Standards and Technology to evaluate decontamination methods for both chemical and biological agents in distribution systems and for internal building piping and appliances.

The goal of EPA's decontamination research is to produce interim design and operating guidance for decontaminating buildings and water systems by the end of 2005. Longer-term research will need to focus on broadening the suite of chemicals and biological agents for which data are available, evaluating evolving innovative technology, field validating the effectiveness and cost of decontamination methods and examining methods for decontamination of outdoor

areas.

In addition to these efforts, the EPA Office of Radiation and Indoor Air is working on improvements in radiological detection and decontamination methods. This work includes development of a portable radiological scanning technology for gamma radiation isotopic analysis, "rapid alpha" technology for quick plutonium detection, and development of a series of documents to update technical guidance on radiological cleanup and decontamination methods. Portions of this work are being conducted in collaboration with the DOE Savannah River Laboratory.

EPA is working with a number of other agencies, in addition to DHS, to develop improved methods to quantify the dose received by people exposed to harmful gases and particles in urban areas, both outside and inside buildings. For example, EPA and NOAA are collaborating on wind tunnel modeling in support of Homeland Security activities, focusing on Manhattan and parts of the National Capital Region (specifically, the Pentagon) to assist in dispersion forecasts.

Risk Assessment Research

EPA's risk assessment research program is focused on two key homeland security needs: methods to rapidly assess the potential human health risk associated with chemical and biological attacks, and identification of appropriate methods and data to support cleanup level determinations. EPA has considerable experience in health effects and environmental risk assessment. While much information exists regarding the toxicity and hazard associated with chemical and biological warfare agents, considerable effort is needed to adapt information collected for warfare situations and transform it in a scientifically transparent way for use in

domestic contamination situations. EPA has established collaborations with DOD and the DOE Argonne National Laboratory to help with this effort. Both the Edgewood Chemical and Biological Center and the Center for Health Promotion and Preventive Medicine (CHPPM) are working with EPA to develop rapid risk assessment methods for civilian inhalation exposures to microbial agents. Working with the Argonne National Laboratory, EPA is working to develop short-term (1-30 day) exposure level inhalation guidance for a list of key chemicals and chemical agents. Further, we are collaborating with the National Academies of Science and the EPA Office of Pollution Prevention and Toxic Substances to develop Acute Exposure Guideline Levels (AEGLs) for inhalation exposures to key chemical warfare agents. All of these data are critical inputs to a rapid risk assessment expert system that EPA is developing for use by the emergency response community. Similarly, this information supports a cross-EPA effort that the Deputy Administrator has asked me to direct to establish cleanup levels for chemical and biological agents that may be used in terror attacks. This initiative is also being coordinated with a cross-government effort under the leadership of the Office of Science and Technology Policy (OSTP) Subcommittee on Standards.

Technical Support & Technology Verification

Finally, EPA is also providing direct scientific support to the emergency response and technology user community. EPA has augmented its existing Environmental Technology Verification (ETV) Program to rapidly provide objective performance evaluation information for commercially available detection, containment and decontamination technologies applicable to homeland security needs. By the end of this calendar year, over 40 technologies will have been evaluated, including six hand held detectors for cyanide in water, ten air filtration technologies and eight rapid toxicity monitors for water. Results of evaluations to date are posted on EPA's

ETV web site.

In addition, EPA's research and development program has established a capacity to provide real-time science and engineering support to EPA's emergency response and cleanup personnel in the Office of Solid Waste and Emergency Response and in our ten Regional Offices. A 24-hour seven day a week emergency call-in line has been established and three "Red Teams" composed of ORD technical staff have been formed and trained to be available to provide direct support in areas such as sampling and analysis, microbiology, engineering, decontamination, medicine, health effects and exposure modeling. ORD staff also participate with the EPA Emergency Response Teams in national training and exercises. ORD will also work closely with the new EPA National Decontamination Team to validate decontamination technology and design guidance being developed by the NHSRC.

The Office of Research and Development continues to provide advice to the anthrax cleanup efforts at USPS facilities and the Department of State (SA-32), as well as the recently initiated cleanup of the American Media International (AMI) Building in Florida. ORD staff also provided rapid support to the cleanup effort for the Ricin attack on the Senate Office Building in the form of preliminary risk assessment and sampling and analysis methods.

Future Homeland Security Research at EPA

There is a critical need for delivering technical information and guidance to users in the water industry and emergency response community as soon as possible. In recognition of this, EPA established a goal at the formation of its homeland security research program to deliver as much of the important guidance as possible within three years. We recognized that this was a difficult charge, but felt it was critical to setting the necessary pace and focus for this important research. We also recognized that it was likely that not all of the critical research could be completed in that time frame and committed to a mid-term evaluation of the need to continue

beyond the three years. This evaluation has been underway for several months.

The analysis has focused on two key elements. The first involves assessing stakeholder and user community views of the completeness and relevance of ORD outputs delivered or anticipated by the end of our third-year. ORD has consulted on this with individual EPA Program Offices and Regional Offices, as well as with DHS and a broad range of other Federal agencies and external users. This assessment also included a half-day meeting with over two dozen key clients and partners in April to gather additional input. The overall stakeholder conclusions that have resulted from these discussions have been that: (1) EPA efforts to establish a sound, focused and responsive homeland security research program in only 18 months are impressive; (2) the guidance and information developed and anticipated are relevant and important steps toward protecting facilities and responding to chemical and biological terror attacks; (3) the scope and magnitude of remaining and evolving science needs are significantly beyond what ORD can provide in three years; and (4) EPA should continue its research beyond three years to improve protection and decontamination guidance and begin to address the new and evolving needs identified by the participants.

The second element in the analysis involved an evaluation of strategic homeland security research priorities at the Federal level. This included an examination of DHS science and technology (S&T) priorities and expectations of EPA, as well as EPA taskings and related S&T needs associated with Homeland Security Presidential Directives, specifically HSPD-7, -9 and -10. From these examinations, it is clear that EPA will have continuing and, in fact, increasing responsibilities to support the national effort. These include lead responsibilities for coordinating water surveillance for infrastructure protection and decontamination following chemical and biological agent terror attacks. Each of these responsibilities carries with it the need for research to develop improved data, technology and protocols for characterizing the

environmental impact of an attack; assessing risk; and determining appropriate, cost-effective approaches for response and decontamination.

EPA is in the process of analyzing and considering all of these inputs and will work closely with the Homeland Security Council and the Department of Homeland Security to determine what future level of effort is needed.

SUMMARY

EPA's homeland security effort is strategically designed to address the most important scientific and technological gaps facing decision-makers charged with protecting buildings and water systems from possible chemical and biological terror attack. Program priorities are threat-based and closely coordinated with national priorities established by the Department of Homeland Security. EPA's research is based upon strong scientific peer review and is highly leveraged with the skills and resources of nearly two dozen key federal research organizations. We are rapidly developing relevant, user-oriented tools, data, and technology to help detect, contain, decontaminate and understand the potential health risks associated with chemical and biological terror attacks on buildings and public water supplies.

I thank you for this opportunity to describe our scientific and technological efforts in homeland security.