December 29, 2008

Dr. George Gray
Assistant Administrator
Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

Dear Dr. Gray:

The Board of Scientific Counselors (BOSC) has completed a review of the Office of Research and Development's (ORD) Homeland Security Research Program (HSRP). This is the first BOSC review of this new research program (implemented following the events of September 11, 2001) and the National Homeland Security Research Center (NHSRC), which was chartered in 2004.

A nine-member BOSC Subcommittee was charged to conduct the review. The BOSC review was accomplished through a series of three teleconferences preceding a 2-day face-to-face meeting of the Subcommittee with the researchers and management of the NHSRC in Cincinnati, Ohio, on May 26-28, 2008. The Subcommittee review report was delivered for BOSC Executive Committee review and approval in October 2008. This report was vetted by the BOSC and appropriately clarified, revised, and approved for transmittal to ORD.

The HSRP is both expansive and complex as is the Agency's responsibility for responding to future terror events. Prior and recent reviews of the NHSRC (National Academy of Sciences and Science Advisory Board) have recognized this and have helped shape the scope of the current research program. The NHSRC has done a commendable job in analyzing and delineating the scope of its research program relative to available resources. The Subcommittee found enthusiastic researchers and high quality managers engaged in the HSRP. The quality of the research was judged to be good to very good. In general, the science and scientific questions being addressed are appropriate and the products are providing utility to NHSRC clients and downstream end users. The program is meeting our expectations.

This BOSC report is anticipated to further assist ORD in longer term program enhancement, comparative analysis with other programs, and intermediate research investment decision making. We expect the report will assist ORD in continuing to improve its science, and assist and inform clients within and outside the EPA of the significance of its research and its utilization. On behalf of the BOSC Executive Committee and the HSRP Subcommittee, it is my pleasure to transmit this program review report to you.

Sincerely,

Gary S. Sayler, Ph.D.
Chair, BOSC

B·O·S·C

BOARD OF SCIENTIFIC COUNSELORS

REVIEW OF THE OFFICE OF RESEARCH AND DEVELOPMENT'S HOMELAND SECURITY RESEARCH PROGRAM AT THE U.S. ENVIRONMENTAL PROTECTION AGENCY

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December 2008

This report was written by the Homeland Security Research Subcommittee of the Board of Scientific Counselors, a public advisory committee chartered under the Federal Advisory Committee Act (FACA) that provides external advice, information, and recommendations to the Office of Research and Development (ORD). This report has not been reviewed for approval by the U.S. Environmental Protection Agency (EPA), and therefore, the report's contents and recommendations do not necessarily represent the views and policies of the EPA, or other agencies of the federal government. Further, the content of this report does not represent information approved or disseminated by EPA, and, consequently, it is not subject to EPA's Data Quality Guidelines. Mention of trade names or commercial products do not constitute a recommendation for use. Reports of the Board of Scientific Counselors are posted on the Internet at http://www.epa.gov/osp/bosc.

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I. SUMMARY

I.1 Overview

A nine-member expert Subcommittee of the Board of Scientific Counselors (BOSC) was formed to provide a retrospective and prospective review of the Homeland Security Research Program (HSRP) of the U.S. Environmental Protection Agency (EPA) Office of Research and Development's (ORD) National Homeland Security Research Center (NHSRC). The NHSRC was established following the terrorist events of September 11, 2001, and the later anthrax mailings of that year. The NHSRC was made permanent in 2004.

The HSRP was developed in response to the requirements and statutory authority provided by the Public Health Security and Bioterrorism Preparedness Act of 2002, with resulting amendments to the Safe Drinking Water Act. The role and responsibilities of the Agency and the NHSRC were further defined and expanded by a series of Homeland Security Presidential Directives. The Subcommittee's review was framed by its charge to evaluate the HSRP and to provide a qualitative ranking of the performance of the NHSRC research program relative to each of the two long-term goals (LTG) guiding it. These LTGs are defined as follows:

- ✧ LTG 1: The Office of Water (OW), water utilities, and other clients use homeland security research products and expertise to improve protection from and the capability to respond to terrorist attacks on the nation's water and wastewater infrastructure.

- ✧ LTG 2: The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research and program products and expertise to improve capability to respond to terrorist attacks affecting buildings and the outdoor environment.

I.2 Basic Findings

The HSRP is both expansive and complex and its overall responsibility exceeds the available financial resources. Consequently, prior and recent review of the NHSRC and its research program elements by the National Academy of Sciences (NAS) and the EPA Science Advisory Board (SAB) have helped shape the current research program. The NHSRC has done a commendable job in analyzing and delineating the scope of its research program, particularly with respect to LTG 1. This LTG currently is focused on drinking water systems, including treatment, storage, and distribution, with no resources allocated to the topic of wastewater infrastructure.

This is entirely consistent with the Public Health and Bioterrorism Preparedness Act, which mandates EPA support to water systems that are required to perform vulnerability assessments if they are serving more than 3,300 people. LTG 2 is clearly focused on building infrastructure and

outdoor environments, with a growing emphasis on outdoor environments. Both LTG research programs are structured around the thematic areas of protection, detection, containment, and remediation. In terms of Chemical, Biological, and Radiological (CBR) agent contaminants, LTG 1 has a greater focus on chemical and biological and LTG 2 is focused more on CBR.

It is clear that the HSRP is providing products to its principal clients OW and OSWER as well as to EPA regional offices. The products ultimately are intended for end users such as municipalities, utility districts, and first responders, and they will be manifest as outcomes in protecting public health in the event of an attack or natural disaster. The products of the research, as expected, are broad and include models and tools to assist in assessing threats and risks; development of standardized analytical methods and procedures (for safely sampling, shipping, and measuring contaminants); decontamination and flushing protocols and residual waste disposal; setting provisional advisory levels (PALs) for CBR contaminants; and establishment of an Environmental Response Laboratory Network (ERLN). In addition to the purely technical aspects of the HSRP, the program has begun to engage behavior sciences in attempting to define the most effective ways to communicate its products to the public and help them understand the risks associated with an event.

The Subcommittee found enthusiastic and high quality researchers and managers engaged in the HSRP, and the quality of the research was judged to be good to very good. In general, the science and scientific questions being addressed are appropriate and the products are providing utility to NHSRC clients and downstream end users. As may be expected for a program of such breadth, not all aspects of the program are equally strong, and the review found that some of the models and tools may not be fully calibrated or verified for the most significant threat scenario. In addition, the pace at which some of the tools and assessments are becoming available to the clients is slower than desired. This may be a function of striving for 100 percent accuracy or safety assurance when a tool accomplishing 50 percent accuracy may provide broader, more immediate utility for the end users. Given the significant focus on communicating to ultimate end users, the pace of that effort from a behavioral science perspective appears somewhat slow with too little feedback from those end users on the goals and agenda of the program.

Generally, the NHSRC research program has been responsive to reviews, observations, and recommendations by outside groups, although there are noteworthy exceptions such as an apparent absence of research on the protection of cyber infrastructure as commented on by the NAS. The NAS also noted that the NHSRC would benefit from a longer-term perspective for the research program. This recommendation has yet to be fully implemented. The program now has a new multi-year plan (MYP) to guide research for its LTGs, but it is a relatively young program focusing on the immediate needs of the post-9/11 events. The program remains somewhat near-term focused without the benefit of an established extramural research element, such as the Science To Achieve Results (STAR) Program, which could serve to expand the vision and input from the broader research community. The relative youth of the program also is reflected in the fact that it has not contributed greatly to the scientific literature. All of these issues may result from a combination of contributing factors, such as secrecy classification, resource availability, mission orientation, or workforce expertise.

I.3 Qualitative Rankings

Both research programs for LTG 1 and LTG 2 were qualitatively ranked as meeting expectations. The quality of the science is high and the questions being addressed are highly appropriate and of value to the nation. The multifaceted research goals are largely being met with varying degrees of timeliness for the clients and end users. It is noted that the NHSRC is performing very well in collaborating with other agencies and is taking clear leadership responsibility, particularly where it has a mandate. Greater clarification and analysis contributing to these evaluations are provided in substantial detail in the narrative section of this report for LTG 1 and LTG 2, individually.

I.4 Recommendations

Recommendations originating from the review of the HSRP are provided in summary below. These recommendations are reiterated in the body of the report (in bold text), which provides the full context for each of the recommendations.

GENERAL RECOMMENDATIONS

1. The NHSRC should consider opportunities for a more expansive extramural contribution to its research program with a significant STAR component, perhaps supported jointly by the Department of Homeland Security (DHS) and EPA, if not in direct collaboration with the National Center for Environmental Research (NCER). Additional collaboration with other government agencies and with programs of other countries also is encouraged.

2. The NHSRC should explore the use of an acquisition life cycle model for individual research program elements, perhaps aligned along the Department of Defense (DOD) (Category 3), National Institute of Standards and Technology (NIST), or National Aeronautics and Space Administration (NASA) approaches, to provide a significant enhancement to the overall program.

3. The NHSRC should clarify the role and responsibility of the National Program Director (NPD) for the Center and more broadly across ORD.

4. Although the NAS recommendation for additional research in behavioral science seems to have been addressed initially at a preliminary level, more work in this area should be considered.

5. It is recommended that the NHSRC more formally establish a program to develop and periodically evaluate the priorities for evaluating research goals and for determining product delivery within research programs. Implementation of a mechanism to gauge the degree to which these priorities are heard and addressed in research activities is encouraged as part of this recommendation.

6. It is recommended that the NHSRC develop a specific goal to include development of well-defined digital "clearinghouses" of technical information that are easy to search and cover each of the major topics (prevention, detection, mitigation, etc.).

7. It is recommended that the NHSRC take a more integrative, systems-oriented approach when evaluating key research objectives to ensure that the correct question(s) are being addressed in the context of real risk assessment and management.

8. It is recommended that greater explanation be provided in the MYP for the current priority of NHSRC research efforts and how these priorities may change over the duration of the plan and realized budget.

LTG 1 DIRECTED RECOMMENDATIONS

1. Prior to implementation of the Real-time Monitoring System (RTMS) and Threat Ensemble Vulnerability Assessment (TEVA) to any more systems, a detailed sensitivity analysis of these technologies to determine the variance of the resulting decisions should be performed.

2. A review of the Blast Vulnerability Assessment (BVA) Tool's value should be undertaken, and the process used to conduct this review and analytically quantify the merits of further investment should be made transparent as a model for project lifecycle determinations.

3. A clearer presentation of milestones for the PALs development subgoal for water systems is desirable, and the NHSRC should undertake an analysis of what needs to be accomplished for a more timely release of useful information derived from this research (also relevant to LTG 2).

4. It is recommended that the Center examine the CARVER (an acronym for Criticality, Accessibility, Recoverability, Vulnerability, Effect, and Recognizability) methodology as a means of generating Probability of Attack (***Pa***) to improve Risk Assessment Methodology for Water Utilities (RAM-W).

5. A comprehensive model verification process should be established to evaluate the predictive capabilities of the advanced TEVA model and other models, such as Multi-Species EPANET (MS-EPANET), need to be quantified and documented, and the sensitivity of TEVA to predict the potential occurrence of an attack on the system needs to be evaluated in terms of the exact time and duration of a potential contaminant insertion.

6. A rapid assessment process needs to be put in place as the timeline from detection to public notification is slower than the contamination event progress; thus, effort should be placed on assessment methodologies following detection.

7. During a mass contamination event, prioritization of the cleanup process likely will be required and a cost-benefit analysis methodology, along with a database as a decision-making support tool, should be developed to assist water systems in this prioritization.

LTG 2 DIRECTED RECOMMENDATIONS

1. It is recommended that the NHSRC better understand and evaluate time limitations in research requests of EPA program offices and regional homeland security research needs, and address these limitations with the appropriate level of implementation, recognizing that in some instances an implemented 50 percent solution is better than no implementation of a 100 percent solution.

2. It is recommended that customer support surveys be broadened to include On-scene Coordinators (OSCs), the national decontamination team, and other state and local responders, and expanded to include follow-up assessment, recommendation disposition, and end-user response.

3. The NHSRC should take a more active role in identifying field-ready technology, and initiate an evaluative board or review processes to allow for and facilitate civilian/public testing. Included in this recommendation is the need for draft information materials and preliminary tools to be developed early on so that procedures and directions for actions relating to CBR events are available more quickly to clients and the response community (also relevant to LTG 1).

4. Threat assessment evaluation similar to that employed in LTG 1 should be used to ensure that realistic source terms for key threat agents are identified and used to effectively set research objectives and priorities.

5. It is recommended that the NHSRC should focus its efforts on evaluating existing commercially available real-time or near real-time detection systems and/or making some modifications to enhance specific needs, rather than on the development of new sensors and analytical equipment, which is best left to the commercial sector (also relevant to LTG 1).

6. Development of PALs for additional media beyond water and air are recommended to assist consequence management. It also is recommended to pursue advances in microbial risk assessment in partnership with the Centers for Disease Control and Prevention (CDC).

7. Additional research in technical mitigation and remediation measures appears to be lacking and it is recommended that some consideration be given to possible new efforts that can be pursued in this area, particularly as it relates to environmental setting and media.

8. An examination and report on the environmental settings and media that are likely to be impacted by various threat scenarios and the basic research needed to address fate,

residence, persistence, and alternative disinfection and decontamination practices are recommended.

Other aspects of these recommendations are provided in greater detail in the body of the report as there are more specific detailed research needs that the NHSRC is strongly encouraged to consider in further developments of the program. This is particularly true for LTG 2 and that section of the report documents these needs well.

II. INTRODUCTION

II.1 Background

ORD's HSRP is a relatively new program, established after the terrorist attack of September 11, 2001, and the anthrax spore mailings and building contamination later that year. The HSRP is administered by ORD through the NHSRC. The Center was formed by EPA in September 2002, in response to the Public Health Security and Bioterrorism Preparedness Act of 2002 and resulting amendments to the Safe Drinking Water Act. Initially, the NHSRC was a virtual center chartered for a 3-year period but, given the complexity and magnitude of its mission and further expansion by a number of presidential directives, it became permanently established in November 2004.

NHSRC's original research program was one of immediacy and was guided by the EPA Water Security Research and Technical Support Action Plan, Parts I and II, and the Safe Building Program Research and Implementation Plan. These research plans were independently and extensively reviewed by the NAS National Research Council (NRC), which recognized the complexity of problems being addressed and the short-term nature of the research objectives of the program. Both reviews recommended the development of strategic research plans and a long-term research program. The EPA Homeland Security and Strategy document has since been developed and published (October 2004) and the NRC has re-examined the NHSRC Water Security research effort. Recently, the EPA SAB also offered comments on the Center's "Emergency Consequence Assessment Tool" (ECAT) and on the "Incident-Based Microbial Risk Assessment" white paper.

II.2 Charge and Review Process

The BOSC Homeland Security Research Subcommittee (see Appendix A for Subcommittee membership) was charged to conduct a prospective and retrospective review of ORD's HSRP, evaluating the program's relevance, quality, progress, scientific leadership, communication, coordination, and impact. The Subcommittee was charged to: (1) provide a program assessment evaluating the entire research portfolio; and (2) provide a summary qualitative rating assessment of HSRP performance for each LTG. The Subcommittee's program review charge and specific review charge questions are documented in Appendix B.

The BOSC Subcommittee was informed in its review by a newly available ORD Homeland Security Research Multi-Year Plan (May 2008) that more completely defines the LTGs, Annual Performance Goals (APGs), and Annual Performance Measures (APMs) within the overall scope of the program. To accomplish this review, a nine-member expert Subcommittee was established with expertise to cover the range of research efforts currently underway as components of the

HSRP. All members had, at minimum, secret security clearance classification to enable review of classified information relevant to the HSRP.

The Subcommittee was provided extensive written, electronic, and published documentation on the background of the NHSRC. This included research outputs and a bibliometric analysis of the program researchers' publications, the organizational and management structure of ORD and the Center, and the Agency's Homeland Security Strategy. Oral and poster session overviews of the research program, as well as the goals, products, outcomes, and testimonials from clients were provided to the Subcommittee. The review was accomplished through a series of three teleconferences preceding a 2-day face-to-face meeting of the Subcommittee with the researchers and management of the NHSRC in Cincinnati, Ohio, on May 26-28, 2008. (A description of the background and information review materials provided to the Subcommittee is provided in Appendix C and the agenda of the May meeting is included in Appendix D.)

II.3 Research Program and Goals

The HSRP is tasked with providing ORD and the Agency with research and development on methods and means to prevent, detect, and respond to various CBR terrorist contamination threats. This program complies with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, which also amends the Safe Drinking Water Act and its 1996 amendments, and requires water systems serving greater than 3,300 persons to perform vulnerability assessments. A fundamental mission of EPA's HSRP is to provide support, information, guidance, and methodology for this requirement. The research program supports EPA's broad responsibilities as expanded by Homeland Security Presidential Directives (HSPD):

- HSPD-7 *Critical Infrastructure Identification, Prioritization, and Protection* (2003), which designates EPA as the sector-specific lead agency for critical water infrastructure safety and security and the development of risk management strategies to address terrorist events.

- HSPD-9 *Defense of U.S. Agriculture and Food (2004*), which directs EPA to develop a fully coordinated surveillance and monitoring program for early detection and a nationwide laboratory network to support monitoring and response requirements.

- HSPD-10 *Biodefense in the 21st Century* (Classified) (2004), which provides reaffirmation of EPA's lead roles and a directive for decontamination efforts.

- HSPD-22 *Domestic Chemical Defense* (Classified).

LTGS OF THE NHSRC

The LTGs of the HSRP follow:

- LTG 1: EPA's OW, water utilities, and other clients use homeland security research products and expertise to improve protection from and the capability to respond to

terrorist attacks on the nation's water and wastewater infrastructure.

- ✧ LTG 2: EPA's OSWER and other clients use homeland security research and program products and expertise to improve capability to respond to terrorist attacks affecting buildings and the outdoor environment.

It is clear that both the LTGs speak directly to the primary (OW and OSWER) and secondary clients' needs, and the need for the research products to be translated into effective outcomes for the clients/users. Operationally, these LTGs also have been defined as:

- ✧ LTG 1: **Water Security**. *Improving our nation's ability to protect against and respond to terrorist attacks on the nation's water and wastewater infrastructure.* Annual planning for this LTG is conducted through communication with OW and thematic research groups such as the Water Security Initiative and Decontamination.

- ✧ LTG 2: **Building and Outdoor Areas**. *Improving the nation's capability to respond to terrorist attacks affecting buildings and outdoor areas*. Annual planning is coordinated through the TRIO advisory group consisting of the Office of Emergency Management (OEM) and Office of Solid Waste (OSW) along with OSCs and special teams, such as the Radiological Emergency Response Team.

The fundamental core of the HSRP focuses on physical damage and disruption of infrastructure (i.e., explosion) and the use and release of CBR agents to achieve a terror outcome. It is clear, however, that program research products have significant, if not critical, dual use in normal utility operations and during natural disasters such as hurricanes, fire, or floods. The research program has developed an Event Chronology outlined below (Table II-1) that summarizes the comparative role and responsibility of both LTGs in responding to an event. In both cases, the LTGs' directed research has similar expected contributions with the exception of protection against attacks; for LTG 2, the event is presumed to have occurred already, hence no measures are planned to avert the event. For the purpose of this review, the Subcommittee condensed the work efforts related to the event chronology to: Protection and Prevention, Detection Including Characterization, Containment and Risk Mitigation, and Remediation (including Decontamination and Disposal).

Table II-1. Event Chronology Guiding LTG Research Efforts of the NHSRC

Event Chronology	**EPA responsibility for providing guidance methods and tools**
Protect Against Attack	LTG 1 NA
Monitor, Detect, and Confirm CBR	LTG 1 LTG 2*
Minimize Public Exposure	LTG 1 LTG 2

Event Chronology	**EPA responsibility for providing guidance methods and tools**
Characterize the Nature and Extent of Contamination	LTG 1 LTG 2
Assess Human Health Risk and Establish Cleanup Goals	LTG 1 LTG 2
Cleanup	LTG 1 LTG 2

*A responsibility shared with other agencies

During the establishment of the NHSRC research program, a front-end assessment was conducted to delineate the research program consistent with available resources. The outcome of that analysis was that LTG 1 has focused on drinking water systems instead of wastewater and is structured to provide OW with the research necessary to support assistance to the utilities. Likewise, for LTG 2, with its roots in the anthrax building contamination of 2001, the mission has gradually evolved to include a focus on outdoor areas and air with regard to decontamination for biological and radiological agents. Cross-cutting activities include research supporting the ERLN, development and validation of sample collection and analytical methods, and the development of risk-based advisory levels.

III. REVIEW FINDINGS

III.1 General Findings

The Subcommittee was universally impressed with the spirit and enthusiasm of the NHSRC staff and management concerning the establishment of the Center, the research program, and the interface with its clients. It is clear that the NHSRC sees end users (to the level of first responders, utility districts, waste management companies, and analytical laboratories) as ultimate customers for the research products it produces. In that regard, research related to LTG 1 is more mature than that for LTG 2, but that is consistent with historical research experience within ORD and the existence of large and strong professional organizations within the water and wastewater industry that can disseminate information to literally tens of thousands of members as it becomes available.

The general quality of the research being conducted is quite high and directed by a well organized MYP. Some aspects of the research have potential outputs, such as the Standardized Analytical Methods (SAM), which will have great utility when harmonized across the states and nation. Even though the HSRP is relatively young, it demonstrates both research and organizational leadership and very good cooperative interactions with other agencies. This likely is due to the clear statutory authority and presidential directives delineating the agencies and their roles and responsibilities and the fact that in its short existence the program has undergone significant review by both the NAS and SAB. The full scope of the research under the NHSRC mandate could be very large and perhaps unachievable, given that there are clear resource limitations, but the scope of the research program has been rightly focused to areas of highest mission need. The research program was born out of the expediency of the post-9/11 events and retains a character of shorter term research objectives without the benefit of significant STAR grant funding to help expand either the intellectual or time horizons for assured sustainability of the research program. This fact was previously noted in an NAS review, which commented on the lack of a long-term research program. **The NHSRC should consider opportunities for a more expansive extramural contribution to its research program with a significant STAR component, perhaps supported jointly by DHS and EPA, if not in direct collaboration with NCER.**

Even with deliberate constraints, the research program is complex. The NHSRC is engaged in the development of continuous and real-time methods development for CBR detection and characterization in a variety of matrices; standardization of sampling; shipment and analysis of contaminants; development of risk-based guidelines of exposure and exposure mitigation, including decontamination and reaerosolization avoidance; and disposal of contaminated debris. As research matures and end user needs are more completely satisfied, there seems to be a mechanistic gap, from both a programmatic and operational perspective, on how to achieve a research project life cycle assessment to close mature projects or release them to the commercial sector.

Recommendation: An acquisition life cycle model, perhaps aligned along DOD (Category 3), NIST, or NASA approaches, may provide a significant enhancement to the EPA program.

Efforts to meet the needs of the end user community are excellent. As more end user input is received on the front end of research planning, it is anticipated that there will be steady improvements in generating useful products. The NHSRC is commended for engaging behavioral scientists in its research program to improve effective communication and products for end users and the public. This appears particularly relevant in LTG 2, and hopefully will be more fully implemented in LTG 1. The need for behavior science input into the research program was identified earlier in the NRC report of 2007, and the NHSRC has reacted positively in a preliminary manner to this recommendation.

To date, there appears little activity relative to protection of the cyber infrastructure, which is another area noted in the NRC report. The reasons for this are unclear, but may be multifold, including insufficient resources or expertise, coverage by other agencies, or security classification (although this later issue was not addressed). Science and engineering contributions to the literature as a research program output also are rather limited. This fact may be an attribute of a rather young R&D program, a focus on meeting perceived user needs, or security classification that was not recognized by the Subcommittee. The peer review process and the engagement of the broader research community in contributing to the direction and conduct of the research program also are more opaque than transparent and this too may reflect, to a degree, the perceived classified nature of some program objectives.

For other EPA research centers, the NPDs are very involved in the research conducted by the laboratories and centers as well as the subsequent evaluation of the work. This did not appear to be manifest in the NHSRC program structure. It was reported that the NPDs determine the work that should be performed by the laboratories and centers, but personnel and implementation decisions are the responsibilities of the Laboratory and Center Directors. The NPD and Laboratory and Center Directors communicate the results to customers once research products are available. This communication is important because diverse program and regional offices, states, and tribes must use the research products to achieve outcomes. With respect to the NPD's role in NHSRC, it was reported that it is structured so that activities reside within the NHSRC and not across ORD, and the NPD acts both as an NPD and part of the center leadership. This deviates from the prevailing program structure and may appear to present a programmatic conflict of interest. **The NHSRC should clarify the role and responsibility of the NPD for the Center and more broadly across ORD.**

Overall, the HSRP was qualitatively ranked as meeting expectations. This is the same ranking that was given to the research programs supporting both LTG 1 and LTG 2 independently. There are some elements of the research program, particularly for the more mature LTG 1, that exceed expectations in the areas of program relevance, structure and coordination, and communication. No area was considered unsatisfactory, although the issue of program efficiency was found nearly unaddressable given available information.

III.2 Descriptive Overview of LTG 1: Improving our Nation's Ability to Protect and Respond to Terrorist Attacks on the Nation's Water and Wastewater Infrastructure

This research program stems directly from the Water Security Research and Technical Support Action Plan of 2003 and has been updated in the MYP for the HSRP. A primary driver is support of utilities and community water systems, of which there are 52,838, by providing research and tools for conducting vulnerability assessment mandated by the Bioterrorism Act of 2002. In addition, there are significant dual-use opportunities to contribute to day-to-day operations as well as response to natural disasters. Because of resource limitations a decision was made to focus research investment primarily on drinking water systems (i.e., water treatment, storage, and distribution). The research program supports OW in tool development such as the BVA Tool and TEVA, which assesses the public health impact of contamination events. TEVA extends the program focus to four thematic research areas of protection, detection, containment, and mitigation. The detection thematic area covers both Contamination Warning Systems (CWS), which are sensor-based approaches for real-time excursion monitoring in distribution systems. Detection also includes extensive follow-up sampling, transport, and analysis requiring both protocol and analytical method development. Based on HSPD 9, EPA has a requirement to develop ERLN, and the HSRP provides support and technical foundations for both OW and OSWER for this effort as well as development of SAMs.

Containment and mitigation research includes the development of technical information documents for OW provisional needs for the utilities. TEVA also provides a Flushing and Containment Tool. Part of the public health emphasis includes the development of PALs, indicating exposure threshold levels for chemical warfare agents and industrial chemicals that may become an exposure threat during and following a chemical incident. In addition to distribution system flushing, treatment and disposal aqueous decontamination waste also is a research target with crossover to LTG 2.

III.2.1 Response to Charge Questions

PROGRAM RELEVANCE

How consistent are the LTGs of the program with achieving the Agency's strategic plans and the draft Homeland Security Research MYP?

The LTG 1 program is consistent with achieving the Agency's strategic plans and the draft Homeland Security Research MYP, which is to secure the nation's water system through research directed toward the elements of deter, detect, delay, respond, and mitigate.

How responsive is the program focus to EPA program office and regional homeland security research needs?

LTG 1 is responsive to the focus of EPA program office and regional homeland security research needs. Both EPA and DHS have the responsibility to protect Critical Infrastructure/Key Resources (CI/KR).

How responsive is the program to recommendations from outside advisory boards and stakeholders?

The program is responsive to the recommendations from outside advisory boards and stakeholders. It was clear that the American Water Works Association (AWWA), EPA regions, Department of Energy (DOE), and OEM provide guidance and recommendations to program management.

How clearly evident are the public benefits of the program?

It is clearly evident that the water utilities have benefitted or will benefit from LTG 1 research.

This research program supports the Agency's MYP and the HSPDs. Table 2-1 of the MYP provides a crosswalk of EPA roles and responsibilities and the components of LTG 1. Additionally, presentations made by the EPA program office and EPA Region 1 suggest the R&D program is responsive to EPA program office requirements and the EPA field elements.

There are indications, however, that linkage to the first responder community—the ultimate end user of EPA-developed solutions—was not sufficiently clear. Because EPA response elements can only respond to a small percentage of environmental "accidents/incidents," local first responders need to have the benefit of the latest EPA technology assessments and products. To this end, the Subcommittee noted the following points: (1) efficient and effective technology transfer is critical and should be a planned process; (2) it likely would be very useful to develop a baseline assessment of client satisfaction with current NHSRC products and projects; (3) clients may, in fact, be looking for an overall programmatic organization suggestive of an acquisition approach; and (4) in the framework of its role in the Global War on Terror (GWOT), EPA may be looked upon as a materiel (equipment) developer.

One challenge that has emerged from this mission that will demand foresight and compromise is the diverse nature of the end users of EPA's technologies, the involvement level of the regions, state and local environmental response assets, and the water utilities themselves. There is an enormous range in size, complexity, and availability of resources that characterize the client base. Therefore, EPA's challenge is to provide technical or technological solutions that support the broadest possible application within its client base.

PROGRAM STRUCTURE

How logical is the program design, with clearly identified priorities?

For the most part, LTG 1 is logically designed, with clear and identified priorities. The exception is the BVA Tool. This software is considered mature and may have somewhat limited value to most water utilities.

How clear a logical framework do the LTGs provide for organizing and planning EPA's homeland security research and demonstrating outcomes of the program?

The LTG 1 framework provides for organizing and planning EPA's homeland security research and demonstrating outcomes of the program.

How appropriate is the science used to achieve each LTG? (i.e., is the program still asking the right questions, or has it been eclipsed by advancements in the field?)

The science used to achieve LTG 1 is sound. The program is asking the right questions; however, every effort should be made to ascertain if advancements in similar research eclipses, or could eclipse, the work being done at the Center. It appears that much of the research is focusing on current needs, which is understandable; however, some funds may be directed to explore new paradigms for protection. Several such recommendations were provided by the 2007 NRC report. **Although the recommendation for additional research in behavioral science seems to have been addressed initially at a preliminary level, more work in this area should be considered.** It appears that NRC's recommendation that "EPA should take a leadership role in providing guidance for the planning, design, and implementation of new, more sustainable and resilient water and wastewater systems for the 21st century" has not yet been explicitly addressed.

Does the draft MYP describe an appropriate flow of work (i.e., the sequencing of related activities) that reasonably reflects the anticipated pace of scientific progress and timing of client needs?

The MYP describes an appropriate flow of work for LTG 1.

To what extent will the program's work benefit multiple needs? (i.e., will the research, while primarily addressing homeland security needs, be useful in solving other environmental problems?)

The program's work will greatly benefit multiple needs while primarily addressing homeland security needs such as DOD requirements, environmental problems, agriculture, etc.

EPA undertook an excellent front-end analysis of the LTG 1 area. This early planning and review has led to a logical framework for research. Thus far, the scientific approach to LTG 1 is not appreciably different from historical approaches of other agencies in this area (DOD and the DOE national laboratories). This fact is both a strength (selection of capable research partners,

targeting more readily achievable research products via the use of proven analytical and decontamination technologies) and a weakness (missed opportunity to push the technology envelope).

Dual Use: Some areas address homeland security needs, but clearly will support historic OW concerns (i.e., detection of changed water quality and contamination of water), as well as remediation efforts generally.

The VSAT and RAM-W technologies appear to be able to provide useful, but perhaps incomplete, tools to public utilities to conduct their vulnerability assessments.

The SAM will help address jurisdictional issues by leveling technology, and also will increase throughput by "qualifying" more laboratories to address the circumstance of a large number of samples that elements of the ERLN are required to process within a short period of time.

BEHAVIORAL SCIENCE RESEARCH

EPA's work on risk communication is focused primarily on the development of guidance, protocols, and training. Prior to 2006, little emphasis had been devoted to interdisciplinary behavioral science research to better prepare stakeholders for water security incidents or to build confidence in their ability to respond, both on the part of stakeholders and on the part of the public. Ironically, progress in these areas has great potential for dual-use applications, notably in the aftermath of natural disasters. There also is a sparse literature, which could be exploited and certainly extended, regarding the effects of an effective warning and response planning system on the psychological reactions to a catastrophic event (Liu, et al., *Am J Public Health* 1994;86(1):87-89).

Progress in this area has been slow, mostly in the form of new hires. This is evidenced by the fact that no publications, bulletins, or reports are forthcoming. This slow progress is mitigated by the fact that these are new initiatives. Conversely, the major planned initiatives for the next 12 months appear to be a series of interagency meetings. No specific studies were identified. The investigators state that leadership supports them and that is a positive sign. On a negative note, these findings are unchanged from the previous NAS review that was carried out in the 2004-2006 time frame.

PROGRAM QUALITY

How good is the scientific quality of the program's research products?

> The scientific quality of the program's research products meets expectations. The quality of most of the products seems to be good; however, it appears that some products may face difficulties in implementation. In particular, it remains unclear whether the more advanced modeling is capable of providing answers that are within acceptable error limits. **Prior to implementation of the RTMS and TEVA to any more systems, a detailed sensitivity analysis of these technologies to determine the variance of the resulting decisions should be performed.**

What does the program employ to ensure quality research (including peer review, competitive funding, etc.), and how effective are these processes?

To ensure quality research the program employs technical peer review. A review process, however, also should show clear evidence of evaluating programmatic relevance. Moreover, the impact of this two-tiered review on competitive funding should be clear. In fact, the funding "topography" was not presented (to include the ratio of intramural/extramural) so it is difficult to assess at a grassroots level how an individual project was evaluated for funding. A presentation made by the Center Director was informative but did not address funding allocations below the division level.

It was not evident if peer review was determinative in selecting collaborators or if competitive solicitations were part of the process. This point was not addressed in the presentation sessions or in the individual poster presentations. There is scant discussion of university collaborations outside of the relationship with the local university, the University of Cincinnati, whose campus adjoins the EPA complex.

Estimating peer review output and reviewing the bibliometric analysis of scientific impact, one is aware of the relatively immature state of the HSRP, but it appears the program is not yet impacting the broader scientific community involved in addressing these problems. Having said that, all the circumstances are in place to yield a productive program, that is, a vetted, significant problem, a network of effective collaborations, a youthful and vigorous scientific staff, and a significant "technology pull" from the Agency's customer base.

SCIENTIFIC LEADERSHIP

Please comment on the leadership role the research program and its staff have in contributing to advancing the current state of the homeland security science.

The leadership role of the research program and its staff in contributing to advancing the current state of homeland security science, especially in the realm of water system security, is exceptional and needed. Water systems are attractive targets and will continue to be attractive.

Please comment on the leadership role the research program and its staff have in contributing science and expertise to federal homeland security policies and priority setting.

The NHSRC staff is very capable and provides effective leadership on most of its programs. It is clear that EPA's scientists are working within a network of capable collaborators and providing intellectual leadership in driving the results toward satisfying an EPA objective. This was a general, although not universal, finding.

COORDINATION AND COMMUNICATION

How effectively does the program engage scientists and managers from relevant program offices in its planning?

The program effectively engages scientists and managers from relevant program offices in its planning and execution.

How effectively does the program engage outside organizations, both within and outside government, to promote collaboration, obtain input on program goals and research, and avoid duplication of effort?

This issue was not clearly addressed and there was an undertone of Subcommittee opinion that, retrospectively, more information was needed. Clearly, the end-user needs are of concern, but the actual processes involved in goal setting for the program were not clear, and the Subcommittee thought that this element could be improved in the future if, indeed, outside organizations and end-users are involved in goal and research development strategies.

How effective are the mechanisms that the program uses for communicating research results both internally and externally?

The program effectively communicates research results both internally and externally. The program makes excellent use of a network of collaborators. These collaborators include other federal agencies, universities, commercial vendors, and contract laboratories. These collaborators are skilled and responsive. In most instances, EPA performed in a leadership role; in a few cases, EPA played a support role.

A valuable document was the "Summary of Homeland Security Survey Comments." This document represents an attempt to capture "customers" impressions of the appropriateness and utility of agency homeland security products. Several points emerged, but the major one is summarized under "improved linkage to customer base" or in more operational terms, "improved linkage to the field." The second overall point was a "need for greater transparency and stakeholder involvement/input in future research planning." Based on the presentations by AWWA, the presentation from Region 1, and the survey itself, it appears that the NHSRC is working hard to address the first issue of linkage to customer base. There is little evidence, based on the presentations to the Subcommittee, that the Center is working equally hard to improve transparency and stakeholder involvement/input in future research planning.

Apropos of the presentations by AWWA and Region 1, it appears that the NHSRC program is, in general, effectively providing guidance for planning and implementing research leading to sustainable, resilient water systems. The Sensor Network Design work has been well received by the community—it has advanced the knowledge of optimal sensor placement and time-to-detect parameters.

From the OW perspective, it appears as though the reliance on syndromic surveillance to enhance the detection and response capabilities of the Water Sector is promising. The NHSRC

has pushed the envelope by: (1) identifying the types of syndrome data useful for detection of different classes of contaminants; (2) increasing coordination among the utilities and other key partners; and (3) pushing forward some pilot studies (not really presented during this meeting).

There was good discussion of the attempts to supplement and strengthen water contaminant detection and monitoring by additional information from public health surveillance with particular reference to the ESSENCE and RODS programs. Discussions pointed out that sensors and monitors remain limited in terms of optimal placement, sensitivity, and response lag time. The Subcommittee recognizes, however, that public health surveillance suffers from the same or analogous limitations. Furthermore, these systems were not designed to answer the question, "Is the water safe?" Rather, these systems were designed to answer the question, "Which medical interventions do I need to employ at this time?"

PROGRAM PERFORMANCE AND EFFICIENCY

How much are the program results being used by environmental decision makers to inform decisions and achieve results?

Three lines of research "products" seemed to have attracted great user acceptance: BVA Tool, TEVA Software, and Support to EPA's Laboratory Network. This latter topic was extremely well thought out. In fact, the Region 1 representative gave a recent example of where EPA's SAMs were of great value in harmonizing a solution where the potential exposure would impact two states. Beyond these examples, too little information was available to fully inform the Subcommittee.

How well defined are the program's measures of outcomes?

The program results are well defined. It appears that in many cases, the research products are still in development; thus, it is hard to provide an answer to this question in terms of outcomes. The program seems to be providing solid technical support and assistance to the EPA offices and stakeholders. Future technology developments may want to consider the formation of product teams that involve end-user stakeholders at the beginning and duration of the development process to ensure the practical applicability of the developed technologies. It is unclear in some cases, (e.g., software and RTMS development) whether that has been accomplished fully.

How efficiently has the program invested and managed resources to achieve the LTGs?

Given resource limits, the program has efficiently invested and managed resources to achieve the LTG; however, the process of allocating invested resources is not transparent nor is the process for investment life cycle determination. For example, it is not clear that the BVA Tool is sufficient to meet the intended purpose. **A review of its value should be undertaken, and the process used to conduct this review and analytically quantify the merits of further investment should be made transparent as a model for project life cycle determinations.**

The presentations made by AWWA and Region 1 suggest that operational level users are aided by the program's efforts. In addition, the presentation by Dr. Diederick, Director of EPA's OEM, contained expressions of appreciation for support by the NHSRC but provided a limited number of examples.

The containment area of LTG 1 lags behind other elements of the LTG 1 program. One reason involves research related to Risk-Based Advisory Levels for Homeland Security Use. The utility of the PALs is not in dispute. It is likely that these would be welcomed by environmental decision makers and of practical importance to material developers in the area of decontamination and treatment. Unfortunately the PALs are not as far along as presented in the research overview of the poster sessions. **A clearer presentation of milestones for this subgoal is desirable and the NHSRC should undertake an analysis of what needs to be accomplished for a more timely release of useful information derived from this research.**

III.2.2 Thematic Areas

PROTECTION

Protecting Water Systems

RAM-W was identified under Selected Future Research as an assessment methodology that should be evaluated and updated. This effort is appropriate as the RAM-W Risk Equation (***R=Pa*(1-Pe)*C***) does not provide an accurate evaluation of risk. Water utilities have limited resources and must prioritize their assets based on risk. RAM-W, employed as is, does not provide enough granularity in the water asset risk prioritization process.

The Probability of Attack (***Pa***) has been given a constant of 1, which means that all assets have the same probability of attack regardless of that asset's security system effectiveness (***Pe***) or consequence (C). A more accurate (***Pa*)** number is required to meet the demands of asset prioritization.

It is recommended that the Center look at the CARVER methodology as a means of generating *Pa*. CARVER is an acronym for Criticality, Accessibility, Recoverability, Vulnerability, Effect and Recognizability. The CARVER methodology is a unique tool because it quickly and clearly defines the "Likelihood of Attack" (***Pa***), a critical element needed for calculating potential risk effectively, as illustrated in Figure III-1. The Center already is familiar with CARVER and the methodology could easily be employed in the RAM-W process.

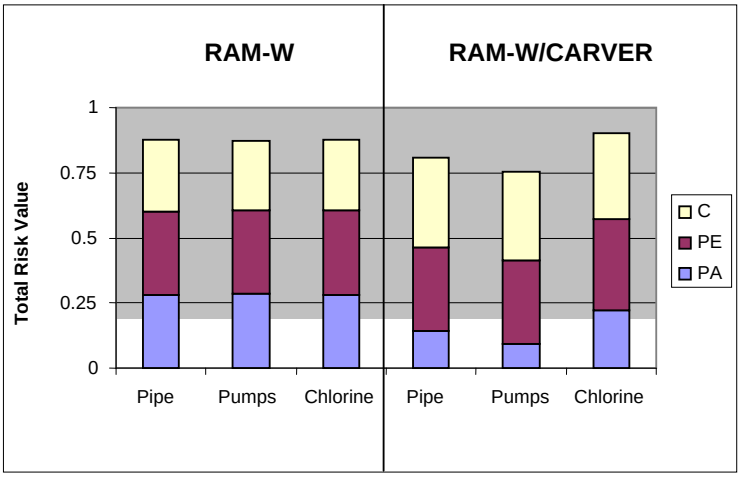

Figure III-1. CARVER influence on RAM-W risk allocation

Blast Vulnerability Assessment Tool

The value of the BVA Tool to the vast majority of water utilities should be assessed. The tool currently is designed to determine blast effects against a wide variety of water utility assets and provide guidance on risk reduction measures. Reducing the risks posed by an Improvised Explosive Device (IED) or Vehicle Borne Improvised Explosive Device (VBIED) can be extremely costly and scarce resources would prohibit many water utilities from complying. If the tool is used to determine risk and countermeasures from an IED or VBIED, are there liability issues if they do not comply? If that were the case, water utilities would be forced to expend resources against a very unlikely threat; funds that could be used to reduce the threats with a higher likelihood.

The threat (Probability of Attack) of an explosive attack by terrorists against a water utility asset is very unlikely. The use of a VBIED against the wide variety of water utility assets depicted in the model does not, generally, meet the goals of those using this form of an attack (e.g., terrorist) and is even more unlikely. Attacks typically are based on intent/history (prior targets), effect or consequence, economic/political considerations, and matching the threat to the target.

The Threat Spectrum faced by water utilities is based on a comprehensive threat assessment that identifies the impact and likelihood of threats (see Figure III-2).

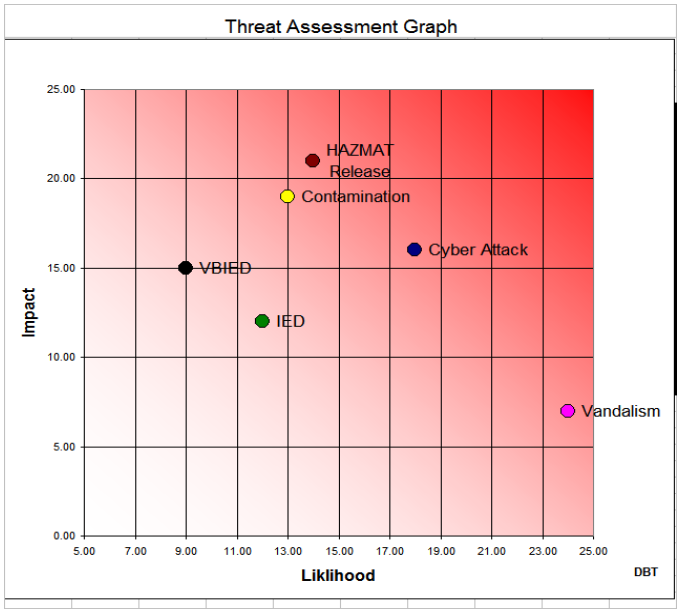

Figure III-2. Threat spectrum assessment for water utilities (prepared by L.E Labaj)

Contamination and Hazmat Release are threats with the highest impact, and are relatively more likely to occur than an explosive attack against other utility assets such as pumps, reservoirs, water mains, etc. A more productive tool would be one addressing various explosive attacks against chlorine and chlorine operations. Using explosives as a method of attack against chlorine is very high on the threat spectrum, as it accomplishes multiple goals such as destruction of a critical utility asset and causing fear, panic, death, or injury in the surrounding population.

DETECTION

Detecting Contaminants in Water, Online Sensor Testing and Development, TEVA

This program seems to be relatively mature. A wide range of sensors are being tested. Typically, when detection occurs, the process then would involve assessment, communication of the results, delay of the effect, and then response and mitigation. Thus, rapid assessment is critical. Typical utilities do not have the laboratory infrastructure to analyze an alarm sample. **A rapid assessment process needs to be put in place as the timeline from detection to public notification is slower than the contamination event progress. More effort should be placed on assessment methodologies following detection.**

TEVA, Tools for Detection

The TEVA research program "Tools for Detection" is a very good, mature, research effort and it appears close to, or ready for, deployment.

Supporting EPA's Laboratory Network

- ✧ Should extend to a nationwide network for sample assessment/analysis.

- ✧ A shipping/transportation process for unknown/known samples should be developed and made available to water utilities.

- ✧ Expediting analysis is a national need and should be a priority.

- ✧ All Hazards Recipient Facilities (AHRFs) will not provide the necessary analysis support for water utilities.

Development and Validation of Sample Collection and Analytical Methods and Protocols.

The development of a laboratory model for water contaminants and a communication/shipping model for the analysis of unknown samples are recognized needs. As indicated above, this should be a national policy and can be led by the Center. As previously noted AHRFs will not provide the necessary analysis support for most water utilities.

It is commendable that the HSRP has continued to improve the capabilities of EPANET by adding a Multi-Species component in MS-EPANET. However "the large number of parameters required by both MS-EPANET and TEVA will necessitate a significant investment in sensitivity analysis to quantify the accuracy of model predictions" (NRC, 2005). **Additionally, a comprehensive model verification process should be followed in order to ensure the accuracy of the various components in both models.**

Additional work needs to be done to quantify the sensitivity of TEVA outputs to various model parameters such as: pipe roughness, hydraulic boundary conditions, demand loadings, and water quality parameters. Although normally not an issue for standard hydraulic modeling, the issue of the effective diameter of every pipe in the system becomes much more important and much more difficult to quantify when considering water quality modeling. For example, while the associated head loss through a particular pipe is attributable to the effective pipe diameter and pipe roughness, both variables are normally incorporated into a singular roughness coefficient that can be calibrated adequately to reflect observed pressures and flows. When considering water quality calibration, however, the impact of the effective diameter becomes much more important, given its direct influence on the velocity of flow in a pipe and the associated travel time through the pipe, which may have a direct effect on the water quality. As a consequence, such calibration may require twice as much work as for a simple hydraulic calibration. **The importance of these issues and their potential impacts on the predictive capabilities of the advanced TEVA model need to be quantified and documented. Further, the sensitivity of TEVA to predict the potential occurrence of an attack on the system needs to be evaluated in terms of the exact time and duration of a potential contaminant insertion.**

Consistent with the NRC Report, the HSRP should investigate explicit ways to incorporate uncertainty in the TEVA modeling environment. Potential methods suggested by the NRC included both fuzzy logic and Bayesian Maximum Entropy modeling. In the event that such expertise does not reside within the Agency, "EPA should investigate ways to expand extramural support for research, particularly within the university community" (NRC, 2005).

The ability of the currently installed sensor system in Cincinnati to yield reasonable predictive results should be evaluated before embarking on a significant program of applications in other cities. Current plans to implement sensor technology or apply TEVA to sites other than Cincinnati should incorporate components to collect additional field data for use in validating the model and its capabilities. Although not directly under the control of EPA's Homeland Security Research Program, it would be hoped that the program would be able to provide some leadership or guidance to EPA's OW in the implementation of such studies.

It remains unclear how TEVA is planned to be used or distributed to the utility industry. Some consideration should be given to obvious security issues associated with such a distribution. How can or will EPA ensure that these technologies are not acquired by enemies of the United States nor used to optimize an attack on water distribution systems? EPA may want to consider performing such analyses for individual utilities for a fee, or consider contracting with a company in the private sector to perform such services without a wholesale distribution of the technology to the public or private sector.

It would seem unlikely that real-time monitoring devices developed specifically for an associated chemical or biological agent will find widespread acceptance in the water utility industry. Instead, it is anticipated that the water industry would be more receptive to monitoring devices that could be used in support of day-to-day operations while still providing enough information to provide some measure of foreign agent detection. In those situations where a particular city may become a higher target due to the nature of activities occurring in that city (e.g., conferences, conventions, etc.), it may be more reasonable and economically feasible to implement more specialized sensors for use over a limited time frame.

Although research into the development of more sophisticated real-time sensors is a logical research objective, EPA may find it more efficient to pursue more sophisticated research through extramural funding vehicles such as the National Science Foundation or the Homeland Security Advanced Research Projects Agency. Additional partnerships with private industry may be warranted when such technologies are sufficiently developed for mass production.

As previously pointed out in the NRC 2005 report, "Research on detection methods for RTMSs should proceed with careful consideration of the likelihood of implementation of the monitoring devices." As such, a more reasonable short-term objective might be the determination of ways to use existing sensor technologies already employed in the water industry for use in detecting the possibility of a system intrusion. For example, it is possible that the monitoring of flows, pressures, and chlorine residuals may provide a sufficient data set to indentify the possibility of such an occurrence. Alternatively, there may be a way to instrument hydrants or other physical assets within the system such that any tampering could be detected and information transmitted back to a central security system. **EPA also should continue to investigate ways in which false positives may be reduced or eliminated, either by using a data fusion approach, in which multiple indicators must all occur before tripping an alarm, or by incorporating uncertainty analysis into the design or placement of such sensors.** At a minimum, some understanding of the probability of false positives must be quantified so as to provide a realistic expectation of sensor performance as well as a mechanism to quantify the costs of such events to the overall operational cost of the system.

CONTAINMENT

Automatic shut down procedures/technologies on contamination alarms should be developed to reduce contamination progress. This could be linked to TEVA.

The procedures outlined under "Science Questions" for the detection and mitigation of a contamination event do not adequately define the timeline. The time between detection and public notification is slower than the contamination event progress. Every effort should be made to speed up the assessment and containment process.

As with any sophisticated software, EPA needs to ensure that the advances and added capabilities of EPANET and TEVA do not outstrip the capacity of the end users to understand or properly implement such technologies. As such, EPA needs to give serious consideration to the most efficient way to disseminate such technologies as well as providing a mechanism for user support. As an alternative to using in house resources, EPA may consider contracting such services through outside vendors or research translation organizations. In the latter case, such costs could be borne directly by the end user.

Consistent with the findings of the NRC report, "advances in the TEVA model add significant complexity to the EPANET model, which may limit its widespread implementation. EPA should work to communicate the capabilities of EPANET, MS-EPANET, and TEVA to utilities, emphasizing their value for routine water quality concerns, advanced homeland security planning, and contamination assessment and response activities. Until TEVA and MS-EPANET are developed further and widely available, EPA should consider an interim strategy to better inform water utilities on the value and use of existing distribution system models such as EPANET. Progressive water utilities already are using EPANET to examine possible locations of attack and to track the concentration of contaminants within the distribution system. Training in the use of MS-EPANET and the proposed TEVA model also is needed. Water utility managers need to be convinced that the costs for adapting a new model for their respective distribution systems are worthwhile, because many utilities already have invested heavily in development, verification, and calibration of existing models. The complexity of the TEVA model may increase these costs further, because many more implementation steps follow those for EPANET to adapt the TEVA 'template' to the specifics of each water utility" (NAS, 2005).

REMEDIATION

Cleanup Goals

Cleanup goals and associated treatment technologies were not well addressed by ongoing research efforts at the NHSRC. This appears to be an area that would have significant benefit to the public should a large-scale contamination event occur. Radiological levels generally are defined due to previous work by DOE and other agencies. Currently, no official primary drinking water standard exists for at least one chemical agent of concern, and maximum contaminant levels (MCLs) generally are lacking for biological warfare agents. Efforts should be made to fill these and other gaps and to integrate this effort with the ongoing efforts to define the PALs. To develop dose-response information and better assess the human risk of exposure to biological

agents, targeted research should be directed toward ways to extrapolate dose-response data between species. EPA should work jointly with CDC to address this area.

Those who develop the Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) drinking water standards must consider not only scientifically based information but also public perceptions about what is safe. The risk communication techniques that recently have been used in association with the demilitarization of the United States' chemical weapons stockpiles may provide a useful framework on which to build. This supports the Subcommittee's previous recommendation for additional research in the risk communication and behavioral science areas.

During a mass contamination event, prioritization of the cleanup process would be required. A cost-benefit analysis methodology should be developed to assist in prioritization. In many cases, large-scale contamination of reservoirs and/or lakes will need to rely on natural attenuation for remediation. The evaluation and/or development of specific "point of use" contaminant-specific treatment methods, however, should be an important research objective. The NHSRC should have such a database available for use in the event that a water security incident occurs. This database also could include larger scale treatment options, if feasible.

III.3 Descriptive Overview for LTG 2: Improving the Capability to Respond to Terrorist attacks Affecting Buildings and the Outdoor Environment

EPA has the responsibility for remediation of contaminated sites via legacy legislation and the fall 2001 events focused on the need for unprecedented cleanup of public facilities contaminated with *B. anthracis* spores. EPA was directly involved with this cleanup and has built off of those efforts to extend research objectives in support of CBRNE remediation for both buildings and outdoor environments. The overall goal is to provide tools for better preparedness aimed at reducing the timeline needed for effective remediation should such an incident occur.

LTG 2 supports HSPDs 9 and 10. HSPD 9 directs EPA to develop a fully coordinated surveillance and monitoring program to provide early detection and support the U.S. Department of Agriculture (USDA) in response and recovery, and requires EPA to develop a nationwide laboratory network to support the routine monitoring and response requirements. HSPD 10 addresses bio-defense in the 21st century and reaffirms EPA's role, adding a clear directive for the Agency's lead in site remediation efforts. Additionally, there are several regulatory drivers that include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); and the Solid Waste Disposal Act. All of the ongoing research efforts addressed one or more of these mandates.

The Subcommittee was impressed by the enthusiasm and level of expertise exhibited by the researchers presenting LTG 2 research, goals, and science outputs. The NHSRC appears to have assembled a very good group of scientists who are very engaged with the overall mission of the organization. The objectives for LTG 2 seem well defined and the organization has done a good

job of reaching out to other collaborators, especially other federal agencies and the national laboratories. Additional interactions with universities/academia engaged in similar efforts are suggested. All of the individuals at the meeting were helpful and responded well to questions.

III.3.1 Response to Charge Questions

PROGRAM RELEVANCE

How consistent are the LTGs of the program with achieving the Agency's strategic plans and the draft Homeland Security Research Multi-Year Plan (MYP)?

The LTG 2 objectives and scope, as described in the MYP, are clear and consistent with EPA's overall strategic plan. The MYP is very well done and thought out with good focus in key target areas. Because the strategic plan is written very broadly, however, it is not all that difficult to be within the scope of the overall strategic plan. The Agency's strategic plan for homeland security should be more focused and quantitatively specific.

How responsive is the program's focus to EPA program office and regional homeland security research needs?

The program's focus is generally responsive, but there are some areas where it needs to be even more responsive. In particular, the program should get information out more quickly to the end users, either in electronic form or in databases that can be accessed easily by those at the front line. **In particular, it is not clear if the timelines associated with the end-user needs are being adequately met with the research products, as in the case of the OSCs, and perhaps also with respect to the regional offices.** It appears, however, that efforts are underway with respect to the regional laboratories to address their needs with the roll-out of the ERLN efforts and related procedures and training, which seems to be going well. **A recommendation is made to better understand and evaluate time limitations in research requests and address them in a way that will be appropriate for some level of implementation, if possible (i.e., a 50% solution may be better than no solution at all).** Engagement of the broad range of decision makers, particularly those outside EPA, who will use the information generated by ORD research is essential to inform research priorities. It is not clear that the current pathway for this information to ORD through EPA regional staff is the most efficient method. **Direct engagement by ORD of outside decision makers through workgroups that include a full range of local and state responders for cities of varying size is recommended.**

How responsive is the program to recommendations from outside advisory boards and stakeholders?

Some stakeholders appear happy, but the commentary on the survey was not that positive. The Subcommittee recommends broadening the overall scope of the survey and providing some follow-up assessment information for the outside boards so that they can better understand what recommendations have been addressed by the Center and how the responses

have been received by the end-user community. This would be beneficial for follow-on BOSC evaluations and peer review activities.

How clearly evident are the public benefits of the program?

Homeland security efforts have been ongoing within EPA primarily since the events of 2001. The Center is a relatively new component to EPA and as such there have not been as many clear benefits as with a more established program. That said, EPA is reaching out to many of the other government organizations and trying to step up to these new responsibilities in a positive and proactive way. Everything is still somewhat developmental (PALs need to be advanced at a faster pace, and fate and persistence should be a key driver for establishing follow-on research objectives). As this program matures, the research will be very beneficial if the research goals as stated in the MYP are accomplished with continued end-user involvement and with coupling to changing threat assessments. Because LTG 1 is more mature, there is public benefit already evident with those research efforts. LTG 2 is still very early in the research timeline.

PROGRAM STRUCTURE

How logical is the program design, with clearly identified priorities?

The program seems very logical in design and the flowcharts provided described the relationships quite well.

How clear a logical framework do the LTGs provide for organizing and planning EPA's homeland security research and demonstrating outcomes of the program?

The frameworks are fairly general, as are most frameworks, and some additional detail of the interrelationships with regard to the existing threat and technology gaps would be helpful. The LTGs provided an ample basis to judge the individual program components. A more systems or systems engineering approach to understanding the overall problem, however, may allow for different approaches or solutions to be identified that would be applicable, but this may be overlooked within the current framework structure presented. For example, the MYP identified the technology gap with regard to the lack of wide-area decontamination methods for anthrax. The human health issue, however, really should be focused on eliminating the inhalation risk, which can be addressed by decontamination as well as by other approaches. These include addressing other research questions, such as understanding whether reaerosolization of viable spores is a significant problem and, if it is, then additional thinking about methods for mitigating that reaerosolization may be just as effective as decontamination for eliminating the health risk. Thinking in terms of a broader system may result in more "out-of-the-box" thinking and result in more short-term and long-term solutions that are better targeted to the specific need. **It is recommended that the NHSRC take a more systems-oriented approach when evaluating key research objectives to ensure that the correct question(s) are being addressed in the context of real risk assessment and risk management.**

How appropriate is the science used to achieve each LTG (i.e., is the program still asking the right questions, or has it been eclipsed by advancements in the field)?

The science used to achieve LTG 2 appears appropriate in most areas of the research. The EPA team is asking the right questions for LTG 2, but they need to do some "out-of-the-box" thinking as described above. The questions are good and were summarized well in the presentation by Dr. Sayles; they are focused and well thought out. Additionally, there are some areas where more research on the relative analysis of current state-of-the-art methods should be evaluated for feasibility, such as potentially looking at smaller sampling volumes or shorter sampling and analysis times.

Does the draft MYP describe an appropriate flow of work (i.e., the sequencing of related activities) that reasonably reflects the anticipated pace of scientific progress and timing of client needs?

The plan seems to follow a reasonable path that anticipates scientific progress; however, it will be important to revisit this at least on an annual basis as the technology and threats are changing. It is not clear that the plan for LTG 2 matches up with threat assessments that were being done for LTG 1. The threat needs to be better defined in the same manner, and specific performance measures should be identified from that threat assessment. Additionally, target scope and timelines need to be better identified as a function of national security need.

It also would be very beneficial for the Center to take a more active role in identifying and evaluating existing technologies that are "field ready" and/or commercially available. Advancements to the LTG 2 areas are numerous, many are oversold and EPA is the right agency to evaluate these products for the civilian sector. This is a very different evaluation and has quite different requirements than those for the military sector. For example, the military test for decontamination of 30 minutes is not at all relevant for the civilian sector, where waiting days or weeks or months may be better (less environmental impacts) and far more cost effective. Additionally, just evaluating U.S. technologies or products that are proposed by a specific company for testing is shortsighted. In several areas, more outreach is needed to ensure that the best products are available for homeland security needs. The Subcommittee believes that EPA is trying to do this, but significant progress still needs to be made. Taking a more active approach along these lines may help timing of client needs. **It is recommended that the NHSRC initiate a technology evaluation mechanism/board to allow for civilian sector product testing related to both LTG 1 and LTG 2 to ensure that appropriate technologies are used for these objectives.**

To what extent will the program's work benefit multiple needs (i.e., will the research, while primarily addressing homeland security needs, be useful in solving other environmental problems)?

All of the plans appear to have multiple needs, at least on an international level. For example, although the United States does not have an anthrax cleanup problem, the United Kingdom and Russia certainly do. It is not clear, however, if the work actually benefits the broader

EPA mission or if it should or needs to. The homeland security needs are very difficult and could be diluted easily if too much focus is put on "one size fits all."

PROGRAM QUALITY

How good is the scientific quality of the program's research products?

Based on the technical credentials of the staff, it appears that the research products are of good to very good quality scientifically. Those products that have been published and reviewed are very good. Based on the detailed questions that the staff was able to answer, the research appears well thought out and there is good attention to details and quality. The work is performed in a conscientious way and there is attention to quality management objectives.

What does the program employ to ensure quality research (including peer review, competitive funding, etc.), and how effective are these processes?

The Subcommittee members did not think that they had enough information to adequately answer this question. There were a number of research publications in the peer-reviewed literature, thereby demonstrating good quality research. There are rigorous quality assurance procedures in place for the overall program, and these also suggest high quality.

SCIENTIFIC LEADERSHIP

Please comment on the leadership role the research program and its staff have in contributing to advancing the current state of the homeland security science.

The NHSRC is in a good position to lead with respect to both LTG 1 and LTG 2. Clearly, the consequence management area is within the Center's mission space and LTG 2 clearly falls directly under CERCLA. NHSRC personnel appear to be active on numerous committees and working groups that are providing guidance to national security initiatives. They continue to become more and more involved at the national level and are actively partnering with key agencies and collaborators. The staff has continued to look for ways to leverage research dollars by seeking out expertise and leveraging/sharing existing core technology where appropriate. This is very positive.

Please comment on the leadership role the research program and its staff have in contributing science and expertise to federal homeland security policies and priority setting.

EPA is an organization of consensus and this sometimes takes far longer than the time available to end-users and stakeholders. This causes EPA to lag behind the rest of the agencies when it comes to setting priorities. Many of the priorities that have been set recently for the MYP were discussed by DHS and other agencies as priorities even before the 2001 anthrax incidents. Because the NHSRC is so good at leveraging and collaborating, as indicated above, it still can play a leadership role on application of the program to EPA's needs. The reviewers believe that the documentation/manuals for the various themes are valuable. **It is recommended that the Center try to supply these materials as draft**

documents while further development is underway so that the procedures and directions for actions relating to the CBR events are more quickly available to the clients and response community. This would allow for more initial feedback and products would be supplied to the end user in a timelier manner, which appears to be a criticism of the existing program by the end users. This would help the Center to be viewed as having a stronger proactive leadership role with respect to other agencies involved with national preparedness and consequence management.

COORDINATION AND COMMUNICATION

How effectively does the program engage scientists and managers from relevant program offices in its planning?

As previously stated above, engagement of the broad range of decision makers, particularly those outside EPA, who will use the information generated by the Center's research, is essential to inform research priorities. It is not clear that the current pathway for this information to ORD through EPA regional staff is the most efficient method. The Subcommittee recommends that an additional parallel path for information be considered directly to the end-user community, possibly through the OSCs and/or appropriate working groups. **Direct engagement by the Center of outside decision makers through workgroups that include a full range of local and state responders for cities of varying size is recommended.** There appear to be good interactions and collaborations with colleagues at other EPA sites and with EPA regional offices.

How effectively does the program engage outside organizations, both within and outside government, to promote collaboration, obtain input on program goals and research, and avoid duplication of effort?

The NHSRC does an excellent job with regard to this item. There is significant involvement by almost all researchers with outside organizations, including EPA regional offices. Additionally, interactions with clients such as city fire departments, water utilities, and transportation facilities are ongoing. There also is substantial engagement of NIST scientists and scientists at national laboratories. This was especially evident from discussion and highlights at the poster session. This involvement is recognized and of good value. On a side note, there does not appear to be much interaction with universities, except for one STAR grant.

How effective are the mechanisms that the program uses for communicating research results both internally and externally?

Some of the ongoing research appears to be strongly communicated to the regional offices and industry in the form of manuals and operational procedures in the case of an event. Communication of some products/results, however, is much delayed as final products are awaiting approval and/or final review. **The Subcommittee believes that this area needs improvement and recommends some type of electronic database or clearinghouse so that information is more accessible to end users, even in a series of versions that can be**

updated as necessary. For example, PALs when distributed will be very helpful to scientists and responders. Perhaps the draft PALs could be distributed until formal ones are established, as this type of guidance is strongly needed now.

PROGRAM PERFORMANCE AND EFFICIENCY

How much are the program results being used by environmental decision makers to inform decisions and achieve results?

A more detailed survey of OSCs, the National Decontamination Team, other state and local responders, decision makers, and key policy makers is needed to really address this question. It is recommended that the NHSRC initiate such a process.

How well defined are the program's measures of outcomes?

For the specific goals as identified, the measures of outcomes seem well defined. The question that should also be asked, however, is: How well defined and how quantitative are the markers that are identified by the researchers, managers, and end users as measures of success? The answer to that question is "average"; the measures/targets could be more accurately defined.

How efficiently has the program invested and managed resources to achieve the LTGs?

This is difficult to judge because return on investment is not an option. Based on the budget and the large number of research objectives, however, it appears that the resources are being managed effectively to meet the LTGs.

III.3.2 Thematic Areas for LTG 2

PROTECTION

This theme was not well represented with respect to LTG 2, but that is to be expected, as this is not really EPA's primary mission. Actual protection and prevention for LTG 2 is really not under EPA's jurisdiction and falls more within the roles and responsibilities of the first responder (e.g., firefighters, HAZMAT responders, civil support teams) as well as the Federal Bureau of Investigation (FBI). It is important for EPA to stay coordinated with ongoing national efforts and there are some activities that should be undertaken to ensure that this happens. Ongoing efforts regarding technical assistance and support are indicative of the key role that EPA needs to play during real-world situations and events. The fact that EPA was needed and played such a key role in the 2001 anthrax incidents is indicative of the future roles that are important for the Agency to lead. To do this in a more responsive and efficient way, it is important for EPA to consider potential realistic scenarios and to have preplanned approaches where reasonable.

Specifically, building response capabilities in advance of a catastrophic incident should be an important research goal. Advance consideration of critical and predictable response needs, such

as development of permitted disposal capacity for various waste types, predevelopment of crisis exception applications, and related efforts are extremely important preparedness tools. The HSRP should consider the best means to expand the immediate crisis response capability and to develop procedures and/or preplanning or operational tools that would allow for "bridging the gap from response to consequence management." This is an important area, as it ultimately will speed up the timeline for remediation and recovery.

It was noted with great interest that the threat assessment work that was done for LTG 1 contributed directly to setting overall research goals and this resulted in an excellent correlation between these areas. It is highly recommended that a similar threat assessment be done for the LTG 2 area to ensure that research goals are aimed at the key threat areas. **In particular, realistic sources terms for key threat agents need to be determined to effectively set research objectives for detection (characterization), mitigation, and decontamination. This would add value for establishing research priorities for those theme areas.**

It also was noted that "detect to warn" and/or "treat" is a key issue and is considered under Theme 2 Detection. The Subcommittee concurs that research objectives in that area are important as well as establishing research objectives for supporting information aimed at providing guidance for "evacuation" or "shelter-in-place." Two areas of particular note that should be considered for the future include:

1. **Research aimed at coordinating indoor/outdoor modeling efforts that can potentially answer the question of whether to evacuate or shelter-in-place. Excellent models exist for outdoor and indoor modeling; however, these modeling capabilities have never been linked to allow for a 24/7 integrated response capability. Having such a capability would aid overall protective measures (providing guidance as to "evacuate or shelter-in-place" as well as more quickly and effectively allowing for implementation of containment options and could assist OSCs in an expedited way in characterization activities).**

2. **Development of protocols for establishing sampling playbooks for key infrastructure facilities that are based on statistical modeling and utilize site/area specific characteristics. This is considered as a preplanning tool.**

DETECTION

This theme of research is focused on the detection of contaminants in air and on surfaces and has two major research areas: (1) real-time detection of biological and chemical agents, and (2) support to EPA's Laboratory Network (which also is relevant to LTG 1). Specific comments on ongoing research efforts are addressed below.

The ERLN research activities are well integrated with national expertise and the reviewers note that EPA has cooperative efforts with the two U.S. laboratories (Edgewood and Lawrence Livermore National Laboratory) that can handle actual chemical weapon (CW) agent materials under the Organisation for the Prohibition of Chemical Weapons (OPCW) agreements. Additionally, other laboratories are involved, as appropriate, and expertise has been very well

integrated to address EPA LTG 2 missions. The Subcommittee notes that the SAM is a very useful and excellent past accomplishment. The overall ERLN program has excellent QC/QA methods and is structured to meet EPA's broader mission as described in the strategic plans. The development and evaluation of SAPS and SCPS are of key importance to meet national end-user needs. The ongoing research to improve detection limits for CBRN in environmental samples in a cost-effective way seems well organized and proactive to the needs of the end users.

The evaluation and/or enhancement of analytical characterization tools for CBRN seems well thought out and integrated with end users. Of particular note is the water sampling concentrator (which applies to both LTG 1 and LTG 2) and the work in reverse transcriptase polymerase chain reaction (RT-PCR) for biological agents of concern in environmental samples, eliminating the need for costly and time-consuming culturing.

Air and surface contamination, detection, and characterization are difficult to judge. Although there were posters on this work, actual data were not presented by the analysis group, so it was difficult to evaluate the quality of the results and the follow-on interpretations and conclusions. The combustion group did present data in its destruction tests and this appeared to be consistent with the conclusions drawn. Some additional research attention should be directed to prediction, fate, and transport of the unique products, including admixtures of contaminated materials from a conjunctive attack, or media with unknown contaminant CBR classes that may be produced by intentional catastrophic events, and the confounding effect that these unique mixed media may have on attempts to characterize, handle, and dispose of this media. Elements may include effects of pulverization, high heat, ultraviolet (UV) exposure, humidity, and pressure.

Several Detect-to-Warn systems are under development, commercially available, or being evaluated. **The Subcommittee members believe that the NHSRC should focus its efforts in evaluating existing commercially available real-time or near real-time detection systems and making some modifications to enhance specific needs, rather than on the development of new sensors and analytical equipment, which is best left to the commercial sector.** This recommendation also applies to LTG 1. Several of the projects appeared to be doing exactly this and it is encouraged. Partnerships with the commercial sector also are encouraged, and the NHSRC can play a key national role in the evaluation of technologies because so many are over-marketed, and many have not been evaluated effectively. This also is true with regard to Theme 3 and Theme 4. The NHSRC is encouraged to pursue options to institute a program that provides for an independent evaluation and potential approval by EPA for environmental monitoring purposes.

CONTAINMENT

A key area of ongoing research is directed toward the development of PALs and related action levels for use in response, treatment, decontamination, and remediation. This is a critical core activity. The NHSRC work in this area is commended and continuation and advancement of these research efforts is strongly advised. PALs are an essential work product of EPA and continued research toward prompt development of PALs for remaining parameters is strongly encouraged. **Development of PALs for additional media beyond water and air are recommended to assist consequence management.** Examples include surface soil, surface

water, and groundwater. PAL exposure research should include the combined effects of multiple exposure routes within incident scenarios. This would include primary exposures to initially impacted media (e.g., ingestion from a contaminated water source) and secondary exposures (e.g., inhalation of suspended contaminants released from showers and water contact areas and dermal contact with contaminated surfaces). It appears that significant progress has been made with respect to CW and toxic industrial chemicals/toxic industrial materials (TICs/TIMs), but this needs to be finalized and/or made available to state-level regulatory agencies within the immediate future, as is not currently the case. Preplanning is occurring and without the use of these draft values, other options are being pursued and preplanning is proceeding without value from this useful product. **Additionally, it is recommended that EPA pursue advances in microbial risk assessment and do this in partnership with CDC.** Although it was mentioned that the NHSRC was involved in this work, little was presented at the time of this meeting. The continued aim of developing cleanup goals is a key technical gap and should evoke a focused effort from EPA. Faster progress needs to be made in this area, but it is especially important to set values that are technically attainable and not overly conservative (NAS, 2004, Reopening Public Facilities after a Biological Attack, a Decision Making Framework).

Additional research in technical mitigation measures appears to be lacking and it is recommended that some efforts be pursued in this area. The one research area that addressed this topic had numerous associated past accomplishments and suggestions for continuing research, but funding appeared to be very limited for this area. Key suggestions for expansion and/or new needed research based on EPA's strategic goals for this theme are described below:

- **Development of sequestration coatings and related research products that provide additional response options for consequence management are a valuable component of NHSRC research. Although some has been ongoing as part of Theme 3, additional options should be pursued for wide area events to minimize the potential for reaerosolization in the case of radiological dispersion device (RDD) and/or biological weapon (BW) attacks (specifically with regard to spores such as anthrax). The continued dispersion of particulate-based agents represents a health threat that should be evaluated for mitigation options. Some options could include environmentally acceptable materials that would allow for entrainment, adsorption, and/or agglomeration with outdoor surfaces and soils. These materials might be similar to those used as soil amendments for stabilization and/or "dust bowl" stabilization treatments.**

- **Expansion on research for outdoor bio-reaerosolization is needed. Although some work has been initiated to evaluate indoor aerosolization (Poster #7), additional research should be undertaken specifically to address whether outdoor bio-reaerosolization will occur, and if so, under what conditions. This understanding is key for determining whether to evacuate or shelter-in-place. Additionally, it is important in the overall characterization of a contaminated area and impacts the strategy for wide area outdoor decontamination. Indoor aerosolization research focusing on understanding issues such as function of particle size, electrostatic charge, and preparation (in the case of bio-agents) also should continue.**

Consideration should be given, however, to heavily coupling/leveraging ongoing work with that being done in Canada.

- **Additionally, a review and summary of the lessons learned from multi-jurisdictional management of large and complex catastrophic events is a relatively short-term and valuable research effort that may help in the overall approach to risk mitigation. Of particular importance are those events that involve principal management by law enforcement or other officials who do not have environmental management training. Behavioral dynamics of complex situations can greatly impede proper and appropriate environmental management of an event (for instance, the response to the World Trade Center disaster). Research to assist environmental responders to function effectively in these complex situations is recommended and may include effective communication techniques. A better understanding of potential risk communication and perception strategies may help in overall mitigation from a behavioral standpoint and should be further evaluated. It appears that EPA is starting to do some work in this area, but additional effort is needed.**

REMEDIATION

The NHSRC has initiated a very good program in the area of remediation to date. Most of this work has occurred since the 2001 anthrax incidents and much of this was fast-tracked to specifically address building decontamination for this very persistent BW agent. Since that time, efforts have expanded to include decontamination aimed at CW and radiological agents. A core component of consequence management research is work in the area of CBRN contaminant fate, residence, and persistence in infrastructure and outdoor environmental settings. Current efforts and plans by the NHSRC for research in this area are commended. Again, the Center has done an excellent job collaborating with several national laboratories/federal agencies and building off ongoing research efforts to meet EPA's needs. Much additional work is required, however. **An examination and report on the environmental settings and media that are likely to be impacted by various threat scenarios and the basic research needs to address fate, residence, and persistence is strongly recommended.** The new ongoing work is aimed at BW, CW, and radiological fate on indoor and outdoor surfaces and addresses key gaps within EPA's strategic mission areas, but it is limited. The Subcommittee suggests that some of this work needs to be completed on a faster timescale and that EPA try to augment some of the existing collaborative studies by providing additional funding, if appropriate, to some of the key collaborators.

EPA has spent a considerable amount of time and resources in evaluating surface and fumigant decontamination methods for indoor applications. Although some of the surface decontamination methods can be applied for outdoor use, they appear to be applicable only on a relatively small scale. The Subcommittee thought that the decontamination studies for surfaces could be making more rapid and dynamic progress. **Parallel studies with one or two other active chemicals such as chlorine oxides, bromine oxides, ozone, hydrogen peroxide, hydroxyl radical, ionic liquids, possibly other chemicals, and reasonable kinetic analysis are some possible recommendations to consider.** Some of the ongoing research starts to address some of these possible radiological decontamination approaches for equipment, building contamination, and

small-scale outdoor contamination. This needs to be expanded to include other options for larger scale areas as discussed below.

The NHSRC's involvement in national level conferences and participation on interagency working groups is commendable.

EPA is not yet addressing outdoor wide-scale decontamination approaches, which is especially important for large-scale BW persistent attacks such as an attack with anthrax similar to National Planning Scenario #2. To date, most of the methods under investigation will work only on a somewhat limited scale, and the approaches being considered involve only limited chemical treatment. The overall experimental approach that has been used for indoor evaluations needs to be significantly modified. Several key suggestions for this research theme follow:

- **A large-scale outdoor decontamination approach needs to take into account an understanding of the hydrogeologic/site-specific characteristics of the area. These include resonance time, porosity, permeability, etc., and involve a different set of tests than currently have been undertaken by EPA. An experimental approach needs to be designed to include this type of testing in order to further research objectives and meet overall goals for the end user.**

- **A review of commercially available products also needs to include the application method(s) and a good understanding of the cost effectiveness of that approach. There are, for example, some products used in Europe (such as Virkon S) that may have applicability for this application. Many of these companies, however, are not necessarily interested in investing in biocide product development for the United States. The NHSRC is encouraged to conduct testing of its own under some of the conditions stated above to see if suitable products are available.**

- **The NHSRC is encouraged to pursue other non-chemical approaches and options for outdoor bioremediation (such as Phage approaches).**

- **Outdoor larger-scale radiological decontamination may not be technically feasible and other mitigation options (e.g., chelation) may be necessary in lieu of standard decontamination approaches. The NHSRC is encouraged to consider other options as part of its overall research strategy.**

Research and related efforts to develop procedures for waste staging that will be required in decontamination and remediation efforts following an event of consequence is an important contribution and the NHSRC work in this area is commended and strongly endorsed. The tool presented has had widespread visibility at workshops and meetings and has received good reviews from response and planning agencies. This work should be continued. It is noted that studies on thermal and incineration technologies are producing interesting and somewhat surprising results on the stability of contaminants.

Some general observations and suggestions for enhancement regarding overall themes follow:

- ✧ The behavioral psychology of environmental threats to national security does not seem to have received sufficient attention. The Subcommittee doubts that people will wait to be told whether to evacuate, they may not shelter-in-place, and it is unclear whether people will be able to construct safe rooms with duct tape and plastic. Defense research that is not robust to noncompliance of this kind will be irrelevant to practice. The Subcommittee believes that more emphasis needs to be put into this area in a realistic way. As indicated in the general recommendation section, the areas of behavioral science and risk communication are key areas for investment. **ORD should ask the question, "are there any lessons learned from the Katrina experience that could help inform the Agency on this issue?"**

- ✧ In assessing response strategies, one needs to be alert for critical or tipping points when the optimal plan changes. For example, usually the sickest person in a hospital gets treated first. In a catastrophe, however, physicians must triage, allocating resources to those who have the best chance of quick recovery. In that spirit, there is a big difference between the research program(s) one undertakes in order to decontaminate a building versus the program needed to decontaminate a city. LTG 2 needs to be revisited with this in mind. Many of the approaches discussed would work for building decontamination, but do not seem appropriate for urban area events. This type of R&D was somewhat lacking.

- ✧ The public is looking to EPA to "set the standards and procedures," not just give them a process to do so. The Agency should at least make a recommendation with the understanding that each incident will be incident-/site-/area-specific. It would be good to start now to educate the public about these risks. The radiation risk has been explained and has some degree of public acceptance. Building on that approach for both chemical and biological risks may be an effective way to go forward.

- ✧ Periodic assessment of the NHSRC's broad research agenda should consider optimizing the leveraging of limited resources to acquire the greatest level of response capability across all sectors (prevention, detection, mitigation and containment, and decontamination) in as short a time as possible. As discussed in open session, pursuit of easy gains and development of preparedness to a 25 to 50 percent level in all sectors in parallel is preferable to directing resources to sectors in series, leaving some sectors without coverage while more advanced research is taking place in other sectors. In each sector, emphasis of initial research efforts should be directed to those areas that can yield the greatest short-term gains until these "easy wins" are exhausted. **It is recommended that the NHSRC more formally establish a program to develop and periodically evaluate the priorities for evaluating research goals and also for determining product delivery within research programs.** Within the larger objectives for long-term research, two additional priorities for the short-term include: (1) emphasis on product delivery that has direct and near-term applied use in prevention, detection, and consequence response; and (2) development of an approach for release of interim deliverables/research products for use in incident response in the short term. This

approach will increase the preparedness in the near-term and also enable early feedback on interim research products.

- ✧ Delivery of basic scientific and technical information compiled and summarized during NHSRC research to decision makers operating on the front lines is an important priority to prepare for possible high impact scenarios. **It is recommended that the NHSRC develop specific goals to include development of well-defined digital "clearinghouses" of technical information that are easy to search and cover each of the major topics (prevention, detection, mitigation, etc.).** Some research effort should be directed to establishing the best methods for delivery of this information to decision makers and first responders working in compromised field settings.

- ✧ Large catastrophic events create very complex project management scenarios that can undermine the basic tenets of appropriate field response. The site is a "crime scene" as well as an environmental and public health responsibility and can cross numerous jurisdictional boundaries, result in unclear management structures, and in some cases, result in primacy over environmental issues assumed by less appropriately qualified personnel (i.e., law enforcement personnel and elected officials). **Research is recommended on the social and behavioral dynamics of command of complex, catastrophic incidents as a means to improve success in future events.** Evaluation of past events and lessons learned from these events may be of value.

- ✧ It is important to understand the role and the effect of limited resources and how EPA prioritizes those resources. The various presentations offer an overall indication that vulnerability-based objectives (prevention and detection) are much more highly prioritized by EPA and the NHSRC than consequence-based objectives (mitigation, treatment, decontamination, and remediation). **Greater explanation is needed in the MYP of the current priority of NHSRC research efforts, and how these priorities may change over the duration of the plan and realized budget is recommended.** An explanation of the basis of these decisions should be included. The presentations make very subtle allusions to the role that the limited availability of resources plays in setting research objectives in the MYP. It is recommended that the full role that resource availability plays in setting the multi-year research agenda should be defined, particularly where research objectives of high and immediate importance are deferred due to limited resources.

- ✧ **It is strongly recommended that the NHSRC pursue the release of interim deliverables in all research programs.** Restructuring the research priorities to include an early yield of useful information, tools, resources, and/or guidance will render the response capability of EPA and first responders more robust in the short term and will enable useful feedback in the developmental stage.

- ✧ **More direct engagement of state and local incident responders and decision makers is an essential step that the NHSRC should take in order to best identify their unique needs.** Existing protocol seems to delegate this engagement function to regional staff members who then convey these needs to the NHSRC. It is not clear that this

process is effective in conveying the full set of local needs to the Center. Examples of direct engagement include workshops and symposia and involvement on TRIO workgroups. Additionally, some regional and emergency response program managers have expressed concern over the need for a closer match between the NHSRC research priorities and those of first responders and incident managers. **A mechanism to gauge the degree to which these priorities are heard and addressed in research activities is recommended.** An expanded client survey process that specifically addresses this need and a named liaison for this purpose are examples of possible mechanisms that could be employed for this purpose.

IV. APPENDICES

Appendix A: BOSC NHSRC Subcommittee Members

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Appendix B: Subcommittee Charge

Program Review Charge

Homeland Security Research Subcommittee

1.0 Objective

The Board of Scientific Counselors (BOSC) Homeland Security Research Subcommittee will conduct a prospective and retrospective review of the Office of Research and Development's (ORD) Homeland Security Research Program (HSRP) evaluating the program's relevance, quality, progress, scientific leadership, communication, coordination, and impact. The BOSC's evaluation and recommendations will provide guidance to ORD to help:

1. Plan, implement, and strengthen the HSRP;
2. Compare the HSRP with other programs designed to achieve similar outcomes both in other parts of EPA and in other federal agencies;
3. Make ORD investment decisions over the next 5 years;
4. Prepare EPA's performance and accountability reports to Congress under the Government Performance and Results Act; and
5. Respond to assessments of federal research and development programs such as those conducted by the Office of Management and Budget (OMB highlights the value of recommendations from independent expert panels in guidance to federal agencies.)[1,2]

2.0 Background Information

Independent expert review is used extensively in industry, federal agencies, Congressional committees, and academia. The National Academy of Sciences has recommended this approach for evaluating federal research programs.[3]

Because of the nature of research, it is not possible to measure the creation of new knowledge as it develops—or the pace at which research progresses or scientific breakthroughs occur. Demonstrating research contributions to outcomes is very challenging[4] when federal agencies conduct research to support regulatory decisions, and then rely on third parties[5]—such as state environmental agencies—to enforce the regulations and demonstrate environmental improvements. Typically, many years may be required for practical research applications to be

[1] Budget Data Request 04-31. Executive Office of the President, Office of Management and Budget. March 22, 2004. "Completing the Program Assessment Rating Tool (PART) for the FY06 Review Process," pages 50-56.
[2] Memorandums for the Heads of Executive Departments and Agencies. Executive Office of the President, Office of Management and Budget. June 5, 2003. "FY 2005 Interagency Research and Development Priorities," pp. 5-10.
[3] Evaluating Federal Research under the Government Performance and Results Act (National Research Council, 1999).
[4] The House Science Subcommittee. Letter to Dr. Bruce Alberts, President of the National Academy of Sciences, from F. James Sensenbrenner, Jr. and George E. Brown. October 23, 1997.
[5] The Government Performance and Results Act: 1997 Government Wide Implementation Will Be Uneven. U.S. General Accounting Office. (GAO/GGD, 1997)

developed and decades may be required for some research outcomes to be achieved in a measurable way.

Most of ORD's environmental research programs investigate complex environmental problems and processes—combining use-inspired basic research[6,7] with applied research, and integrating several scientific disciplines across a conceptual framework[8] that links research to environmental decisions or environmental outcomes. In multidisciplinary research programs such as these, progress toward outcomes cannot be measured by outputs created in a single year. Rather, research progress occurs over several years, as research teams explore hypotheses with individual studies, interpret research findings, and then develop hypotheses for future studies.

In designing and managing its research programs, ORD emphasizes the importance of identifying priority research questions or topics to guide its research. Similarly, ORD recommends that its programs develop a small number of performance goals that serve as indicators of progress to answer the priority questions and to accomplish outcomes. Short-term outcomes are accomplished when research is applied by specific clients (e.g., to strengthen environmental decisions). These decisions and resulting actions (e.g., the reduction of contaminant emissions or restoration of ecosystems) ultimately contribute to improved environmental quality and health.

In a comprehensive evaluation of science and research at EPA, the National Research Council[9] recommended that the Agency substantially increase its efforts to both explain the significance of its research products and to assist clients inside and outside the Agency in applying them. In response to this recommendation, ORD has engaged science advisors from client organizations to serve as members of its research program teams. These teams help identify research contributions with significant decision-making value and help plan for their transfer and application.

For ORD's environmental research programs, periodic retrospective analysis at intervals of 4 or 5 years is needed to characterize research progress, to assess how clients are applying research to strengthen environmental decisions, and to evaluate client feedback about the research. Conducting program evaluations at this interval enables assessment of: research progress, the scientific quality and decision-making value of the research, and whether research progress has resulted in short-term outcomes for specific clients.

A description of the OSTP/OMB *Research and Development Investment Criteria* is included in Appendix I (this appendix is not included in the Subcommittee's report).

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[6] Building a Foundation for Sound Environmental Decisions. (National Research Council, 1997).

[7] Renewing the Compact between Science and Government, Stokes, D.E., in 1995 Forum Proceedings, Vannevar Bush IIScience for the 21st Century. Pages 15-32. Sigma Xi, 1995.

[8] Risk Assessment in the Federal Government: Managing the Process. (National Research Council, 1983).

[9] Strengthening Science at the U.S. Environmental Protection Agency. (National Research Council, 2000, p 141).

3.0 Background Information on the Homeland Security Research Program/Charge Questions

Following the terrorist attacks of September 11, 2001, and the mailing of anthrax-contaminated letters later that year, the U.S. Environmental Protection Agency (EPA) developed a Strategic Plan for Homeland Security[10] committed to enhancing national security and protection of human health and the environment. The Strategic Plan and several Homeland Security Presidential Directives (HSPDs)[11,12,13] provided the basis for creation and mission of ORD's National Homeland Security Research Center (NHSRC) in 2002. Originally formed with a 3-year life, NHSRC was faced with addressing scientific and technical issues that required longer than 3 years to resolve. Reviews of NHSRC programs by the National Academies of Science (NAS)[14,15] as well as commentaries by other federal organizations, recommended that NHSRC continue as an organization within EPA to address national security research needs related to protecting human health and safeguarding the environment. NHSRC became a permanent part of ORD in late 2004. NHSRC plans and implements the EPA's Homeland Security Research Program (HSRP).

The HSRP is a component of the Agency-wide homeland security program that carries out the following responsibilities defined by law and Presidential Order:

1. Protecting water systems and detecting and recovering from terrorist attacks affecting water systems. EPA is the federal government's Sector Specific Agency (SSA) for water.
2. Decontaminating buildings and outdoor areas impacted by a terrorist attack.
3. Developing a nationwide laboratory network to support routine monitoring and response requirements.

The HSRP conducts research to meet the science needs of other components of EPA's homeland security program, primarily the Office of Water (in association with water utilities) and the Office of Solid Waste and Emergency Response (in association with EPA Regions). The HSRP describes the research it plans to conduct for these clients over the next 3 to 4 years in the HSRP Multi-Year Plan (MYP), consistent with commitments published in the EPA-wide Homeland Security Work Plan.

[10] EPA (2003). Strategic Plan for Homeland Security.
[11] HSPD 7: Critical Infrastructure Identification, Prioritization, and Protection designates EPA as the sector specific agency for critical water infrastructure. Designation of EPA as the lead agency for these activities is consistent with the President's National Strategy for Homeland Security (July 2002), which designates EPA as the lead agency for protecting U.S. water resources, from source water through use, treatment, and discharge.
[12] HSPD 9: Defense of the United States Agriculture and Food directs EPA to develop a robust, comprehensive, and fully coordinated surveillance and monitoring program to provide early warning in the event of a terrorist attack using biological, chemical, or radiological contaminants. HSPD 9 also requires EPA to develop a nationwide laboratory network to support the routine monitoring and response requirements of the surveillance and monitoring program.
[13] HSPD 10: Biodefense in the 21st Century, currently a classified document, reaffirms EPA's responsibilities under HSPD 9 while adding a clear directive regarding the Agency's responsibilities during decontamination efforts.
[14] NAS (2003). Review of EPA Homeland Security Efforts: Safe Buildings Program Research Implementation Plan.
[15] NAS (2003). Review of the EPA Water Security Research and Technical Support Action Plan: Parts I and II.

The HSRP conducts a broad program of research and development in the following areas:

1. Tools to help protect water systems from attack;
2. Systems to detect attacks on water utilities;
3. Sampling and analytical methods for chemical, biological and radiological (CBR);
4. Methodologies to assess risks and to determine risk-based cleanup goals;
5. Strategies to contain CBR agents following release and to minimize exposure to the public;
6. Technologies to clean up CBR agents following attacks on water systems, buildings or outdoor areas.

4.0 Charge Questions

(1) Program Assessment (evaluate entire research program)

The responses to the program assessment charge questions below will be in a narrative format, and will capture the performance for the *entire* research program and all the activities in support of the program's long-term goals (LTGs).

Program Relevance

1. How consistent are the Long Term Goals (LTGs) of the program with achieving the Agency's strategic plans and the draft Homeland Security Research Multi-Year Plan (MYP)?
2. How responsive is the program focus to EPA program office and regional homeland security research needs?
3. How responsive is the program to recommendations from outside advisory boards and stakeholders?
4. How clearly evident are the public benefits of the program?

Program Structure

1. How logical is the program design, with clearly identified priorities?
2. How clear a logical framework do the LTGs provide for organizing and planning EPA's homeland security research and demonstrating outcomes of the program?
3. How appropriate is the science used to achieve each LTG? (i.e., is the program still asking the right questions, or has it been eclipsed by advancements in the field?)
4. Does the draft MYP describe an appropriate flow of work (i.e., the sequencing of related activities) that reasonably reflects the anticipated pace of scientific progress and timing of client needs?

5. To what extent will the program's work benefit multiple needs? (i.e., will the research, while primary addressing homeland security needs, be useful in solving other environmental problems?)

Program Quality

1. How good is the scientific quality of the program's research products?
2. What means does the program employ to ensure quality research (including peer review, competitive funding, etc.), and how effective are these processes?

Scientific Leadership

1. Please comment on the leadership role the research program and its staff have in contributing to advancing the current state of the homeland security science.
2. Please comment on the leadership role the research program and its staff have in contributing science and expertise to federal homeland security policies and priority setting.

Coordination and Communication

1. How effectively does the program engage scientists and managers from relevant program offices in its planning?
2. How effectively does the program engage outside organizations, both within and outside government, to promote collaboration, obtain input on program goals and research, and avoid duplication of effort?
3. How effective are the mechanisms that the program uses for communicating research results both internally and externally?

Program Performance and Efficiency

1. How much are the program results being used by environmental decision makers to inform decisions and achieve results?[16]
2. How well-defined are the program's measures of outcomes?
3. How efficiently has the program invested and managed resources to achieve the LTGs?

(2) Summary Assessment (rate program performance by LTG)

The responses to the three summary assessment charge questions below will rate the performance for each LTG. For each LTG, a qualitative score will be assigned that reflects the quality and significance of the research as well as the extent to which the program is meeting or making measurable progress toward the goal—relative to the information and evidence provided to the BOSC. The scores will be given in the form of adjectives that are clearly defined and which are intended to promote consistency among reviews. The adjectives will be used as part of a narrative summary of the review of each LTG so that the context of the rating and the rationale for selecting a particular rating will be transparent. The rating may reflect considerations beyond

[16] For this question, the BOSC should focus on the extent to which the program results are being used by EPA and related stakeholders in carrying out their homeland security responsibilities.

the summary assessment questions, and will be explained in the narrative. The adjectives to describe progress are:

- Exceptional: indicates that the program is meeting all and exceeding some of its goals, both in the quality of the science being produced and the speed at which research results, tools, and methods are being produced. An exceptional rating also indicates that the program is addressing the right questions to achieve its goals. The review should be specific as to which aspects of the program's performance have been exceptional.
- Exceeds Expectations: indicates that the program is meeting all of its goals. It addresses the appropriate scientific questions to meet its goals and the science is competent or better. It exceeds expectations for either the high quality of the science or for the speed at which work products are being produced and milestones met.
- Meets Expectations: indicates that the program is meeting most of its goals. Programs meet expectations in terms of addressing the appropriate scientific questions to meet their goals, and work products are being produced and milestones are being reached in a timely manner. The quality of the science being done is competent or better.
- Not Satisfactory: indicates that the program is failing to meet a substantial fraction of its goals, or if meeting them, that the achievement of milestones is significantly delayed, or that the questions being addressed are inappropriate or insufficient to meet the intended purpose. Questionable science is also a reason for rating a program as unsatisfactory for a particular long-term goal. The review should be specific as to which aspects of a program's performance have been inadequate.

For each program review, the summary assessment charge questions below will be tailored to the specific review and LTG:

1. How appropriate is the science used to achieve each LTG? (i.e., is the program still asking the right questions, or has it been eclipsed by advancements in the field?)

2. How good is the scientific quality of the program's research products?

3. How much are the program results being used by environmental decision makers to inform decisions and achieve results?[17]

[17] For this question, the BOSC should focus on the extent to which the program results are being used by EPA and related stakeholders in carrying out their homeland security responsibilities.

Appendix C: Reference Materials to Inform the Subcommittee

Materials Used by the BOSC Homeland Security Research Subcommittee		
Date	**Subcommittee Materials**	**Description**
April 2	Proposed list of background materials	This table
	Subcommittee Handbook	Covers FACA basics, background on the Executive Committee and its subcommittees; roles and responsibilities for Chair, subcommittee members, DFO, contractor, and agency staff at BOSC FACA meetings; guidelines for BOSC report summaries.
April 23	ORD 101 presentation **Email**	Presentation given by ORD to introduce Subcommittee members to the structure, organization, and function of EPA and ORD
	Subcommittee Charge **Email & Binder & Website**	Outlines the purpose, background, and charge questions.
	Homeland Security Research Program overview presentation **Email**	Presentation introducing the Subcommittee to the overall program
	Strategic plans **Binder & Website**	Excerpts from various strategic plans that shape the mission of the HSRP
	Multi-Year Plan preview **Website**	A brief introduction to the Multi-Year Plan (MYP). The draft, complete MYP will be delivered later – see below.
	Bibliography of program products **Binder & Website**	Organized list of the program products
	Program Resources **Binder & Website**	Summary of resources allocated to the HSRP by year
	Biosketch summary tables and staff biosketches **Website**	Summary tables of program staff disciplines/awards/leadership activities linked to the compilation of individuals' biosketches
	SAB Homeland Security Review Reports **Website**	Will also include EPA responses
May 7	Multi-Year Plan (draft) **Binder & Website**	The Multi-Year Plan details the purpose, design, and science questions being addressed by the HSRP currently and over the next 3 to 4 years.
	Multi-Year Plan overview presentation **Email & Website**	Presentation given by HSRP to highlight material in the program's draft multi-year plan.

Materials Used by the BOSC Homeland Security Research Subcommittee		
Date	**Subcommittee Materials**	**Description**
	Example of BOSC Subcommittee Final Report **Email**	
	Program Performance Measures and Goals **Binder & Website**	Summary of the long-term goals, annual goals, annual performance measures, and past performance
	Extramural coordination summary **Binder & Website**	Summary of the HSRP's involvement in: • Interagency homeland security workgroups and committees • Cooperative research endeavors
	External reviews accomplished and the reports **Binder & Website**	A summary of the various reviews by external expert panels. Reviews published in bound volumes will be provided to the Subcommittee (e.g., NAS reports)
May 7	Peer Review and Quality Assurance Processes **Binder & Website**	Summary of the processes in place to ensure that the program's products are of the highest quality
	Stakeholder feedback on program outcomes **Binder & Website**	A compilation of unsolicited statements about the HSRP and its products received from clients and partners
	Bibliometric analysis results **Binder & Website**	The HSRP's first bibliometric analysis is currently being run. Given the short time the HSRP has been in existence and even a shorter time that our journal articles have been available to cite by others, the results of this analysis may be of limited value. However, in the least, the results will serve as a baseline for comparison to future analyses.
	Poster Book **Binder & Website**	Scaled-down copies of each poster for review before the face-to-face meeting
	Summary by long term goals **Binder & Website**	Summaries of the relevancy, progress, quality, outcomes of the work in each LTG showing links to the posters
	CD-ROM of posters and other items suited for delivery on CD **Binder**	Electronic copies of these materials
May 28-29	Client survey results **Handout at Meeting**	The HSRP plans to conduct its first client survey in Spring 2008. Given the short time the HSRP has been in existence and delivering products to clients, the results of the survey may be of limited value. However, in the least, the results will serve as a baseline for comparison to future surveys.
	Classified Information Briefing	Presentation of classified information that the HSRP uses to help set priorities and that the program has produced.

Materials Used by the BOSC Homeland Security Research Subcommittee		
Date	**Subcommittee Materials**	**Description**
	LTG Overview Presentations	Presentations given by the HSRP to provide information on the purpose, rationale, and content of the LTGs and introduction to the posters
	Posters	Posters on HSRP science and its impact on the program's clients, presented in sessions organized by LTG and theme
	Presentations by Program Clients	Presentations by clients on the responsiveness of the HSRP to client needs and the use of the program's research products and expertise

Appendix D: NHSRC Face-to-Face Meeting Agenda

B·O·S·C
BOARD OF SCIENTIFIC COUNSELORS

HOMELAND SECURITY (HS)
SUBCOMMITTEE MEETING
May 28 – 30, 2008

Marriott Kingsgate Conference Hotel
151 Goodman Street
Cincinnati, Ohio

AGENDA

Wednesday, May 28, 2008

CLOSED session:

9:00 a.m. – 12:00 p.m.	Presentation of classified information on threat agents and scenarios as context for the ORD Homeland Security Research Center's research	
12:00 p.m. – 1:00 p.m.	Lunch	

Begin PUBLIC session:

12:30 p.m. – 1:00 p.m.	Registration	
1:00 p.m. – 1:10 p.m.	Welcoming Remarks - Roll Call - Overview of Agenda	Dr. Gary Sayler Subcommittee Chair
1:10 p.m. – 1:15 p.m.	DFO Remarks	Greg Susanke Subcommittee DFO
1:15 p.m. – 1:20 p.m.	Introduction to Long-Term Goals (LTG)	Dr. Greg Sayles ORD/NHSRC
1:20 p.m. – 1:30 p.m.	Overview of LTG 1 – Water	Dr. Hiba Ernst ORD/NHSRC
1:30 p.m. – 3:30 p.m.	Poster Session for LTG 1 research	

3:30 p.m. – 3:45 p.m.	Break	
3:45 p.m. – 4:15 p.m.	LTG 1 Poster Discussion Session	HS Subcommittee
4:15 p.m. – 4:40 p.m.	Perspectives from Office of Water	David Travers Director WSD, OW
4:40 p.m. – 5:00 p.m.	Perspectives from Water Utilities	Alan Roberson AWWA

Thursday, May 29, 2008

Continue PUBLIC session:

9:00 a.m. – 10:00 a.m.	Subcommittee Working Session	HS Subcommittee
10:00 a.m. – 10:15 a.m.	Overview of LTG 2 – Buildings and Outdoor Areas	Dr. Shawn Ryan ORD/NHSRC
10:15 a.m. – 12:00 p.m.	Poster Session for LTG 2 research	
12:00 p.m. – 12:30 p.m.	LTG 2 Poster Discussion Session	HS Subcommittee
12:30 p.m. – 1:30 p.m.	Lunch	
1:30 p.m. – 1:50 p.m.	Perspectives from Office of Emergency Management	Debbie Dietrich Director, OEM
1:55 p.m. – 2:15 p.m.	Perspectives from EPA Regions	Ira Leighton, Reg. 1 Deputy Regional Administrator
2:15 p.m. – 2:30 p.m.	Public Comment Period	
2:30 p.m. – 3:30 p.m.	Subcommittee Working Session	HS Subcommittee
3:30 p.m.	Adjourn	

Friday, May 30, 2008

CLOSED session:

8:00 a.m. – 9:00 a.m.	Opportunity to clarify SECRET information	

In PUBLIC session:

11:00 a.m. – 1:30 p.m.	Subcommittee Working Session	HS Subcommittee

1:30 p.m. – 2:00 p.m.	Subcommittee Report Out of Preliminary Findings	Dr. Gary Sayler Subcommittee Chair
2:00 p.m.	Adjourn	

Appendix E: List of Acronyms

AHRF	All Hazard Recipient Facility
APG	Annual Performance Goal
APM	Annual Performance Measure
AWWA	American Water Works Association
BOSC	Board of Scientific Counselors
BVA	Blast Vulnerability Assessment
BW	Biological Weapon
CARVER	Criticality, Accessiblity, Recoverability, Vulnerability, Effect and Recognizability
CBR	Chemical, Biological, and Radiological
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosive
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CI/KR	Critical Infrastructure/Key Resource
CW	Chemical Weapon
CWS	Contamination Warning System
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
ECAT	Emergency Consequence Assessment Tool
EPA	Environmental Protection Agency
ERLN	Environmental Response Laboratory Network
FACA	Federal Advisory Committee Act
FBI	Federal Bureau of Investigation
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GWOT	Global War on Terror
HSPD	Homeland Security Presidential Directive
HSRP	Homeland Security Research Program
IED	Improvised Explosive Device
LTG	Long-Term Goal
MCL	Maximum Contaminant Level
MS-EPANET	Multi-Species EPANET
MYP	Multi-Year Plan
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NCER	National Center for Environmental Research
NHSRC	National Homeland Security Research Center
NIST	National Institute of Standards and Technology
NPD	National Program Director
NRC	National Research Council
OEM	Office of Emergency Management
OMB	Office of Management and Budget
OPCW	Organisation for the Prohibition of Chemical Weapons

ORD	Office of Research and Development
OSC	On-Scene Coordinator
OSTP	Office of Science and Technology Policy
OSW	Office of Solid Waste
OSWER	Office of Solid Waste and Emergency Response
OW	Office of Water
Pa	Probability of Attack
PAL	Provisional Advisory Level
RAM-W	Risk Assessment Methodology for Water Utilities
R&D	Research and Development
RDD	Radiological Dispersion Device
RTMS	Real-Time Monitoring System
RT-PCR	Reverse Transcriptase Polymerase Chain Reaction
SAB	Science Advisory Board
SAM	Standardized Analytical Method
STAR	Science To Achieve Results
TEVA	Threat Ensemble Vulnerability Assessment
TICs	Toxic Industrial Chemicals
TIMs	Toxic Industrial Materials
USDA	U.S. Department of Agriculture
UV	Ultraviolet
VBIED	Vehicle Borne Improvised Explosive Device