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BOARD OF SCIENTIFIC COUNSELORS

REPORT OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY BOARD OF SCIENTIFIC COUNSELORS HOMELAND SECURITY SUBCOMMITTEE

RESPONSES TO CHARGE QUESTIONS

BOSC Homeland Security Subcommittee

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LIST OF ACRONYMS

AI	artificial intelligence
AnCOR	Analysis for Coastal Operational Resiliency
API	application programming interface
AWS	Amazon Web Services
BOSC	EPA Board of Scientific Counselors
COTS	commercial off-the-shelf
COVID-19	Coronavirus Disease 2019
CBRN	chemical, biological, radiological, and nuclear
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESER	EPA Center for Environmental Solutions and Emergency Response
DWMM	disaster waste and materials management
EPA	U.S. Environmental Protection Agency
ESAM	Environmental Sampling and Analytical Methods
ESF-10	Emergency Support Function #10
GIS	Geographic Information System
HEART	Homeland Security Emergency Action and Research Times
HSRP	EPA Homeland Security Research Program
IAFC	International Association of Fire Chiefs
NASTTPO	National Association of SARA Title III Program Officials
NIMBY	Not in My Back Yard
NRF	National Response Framework
ORD	EPA Office of Research and Development
OSC	on-scene coordinator
RADAR	RemediAtion Data Repository
RCRA	Resource Conservation and Recovery Act
SBIR	Small Business Innovation Research
SERF	Stormwater Emergency Response Framework
STAR	Science to Achieve Results
StRAP	Strategic Research Action Plan
SWMM	Storm Water Management Model
TOTS	Trade Off Tool for Sampling

INTRODUCTION

The U.S. Environmental Protection Agency's (EPA's) Homeland Security Research Program (HSRP) addresses science gaps related to remediation of environmental contamination that threatens public health and welfare, as well as science gaps related to environmental quality before, during, and after a disaster. HSRP helps EPA carry out its homeland security and emergency response mission by working closely with its partners to understand the potential threats and consequences of hazardous substance, oil, and chemical, biological, radiological, and nuclear (CBRN) releases. HSRP coordinates with partners and stakeholders to conduct the research necessary to provide decision makers with the information they need for their communities and environments to rapidly recover after a disaster.

HSRP is focused on addressing two primary research objectives:

- Advance EPA capabilities to respond to wide-area contamination incidents; and
- Improve the ability of water utilities to prevent, prepare for, and respond to water contamination that threatens public health.

Research to address HSRP partner needs is organized into seven research areas. The research areas are descriptive of the program and align with EPA's response decisions supporting recovery under the National Response Framework (NRF), specifically with respect to EPA's lead role under Emergency Support Function #10 - Oil and Hazardous Materials Response Annex (ESF-10). EPA can also respond, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Oil Pollution Act authorities as appropriate. These response decisions are highly interdependent, with one decision impacting other decisions. The research areas are designed to reflect and support this interdependent system of activities through coordination across the program in support of HSRP's objectives.

HSRP research areas are: (1) Contaminant Fate, Transport, and Exposure, (2) Contaminant Detection/Environmental Sampling and Analysis, (3) Wide-Area Decontamination, (4) Water Treatment and Infrastructure Decontamination, (5) Oil Spill Response, (6) Waste Management, and (7) Tools to Support Systems-based Decision-Making.

The Board of Scientific Counselors (BOSC) Homeland Security (HS) Subcommittee reviewed HSRP program planning in 2019, through its Strategic Research Action Plan (StRAP). The BOSC HS Subcommittee is now charged to review program implementation under each of the research areas. The previous BOSC HS Subcommittee implementation review in 2020 was focused on two research areas: Research Area 4 - Water Treatment Infrastructure Decontamination and Research Area 5 - Oil Spill Response. The focus of the current BOSC review is on research implementation to support wide area incident response, to enhance and inform capabilities for response and remediation of areas contaminated by acute incidents, such as natural disasters or acts of terrorism.

CHARGE QUESTIONS AND CONTEXT

The HS Subcommittee was charged with addressing a series of questions about research implementation to support wide area incident response, focused on Research Areas 1, 2, 3, 6, and 7. Charge questions were as follows:

Q.1. What suggestion(s) or recommendation(s) does the Subcommittee have on balancing/enhancing the use of widely available capabilities with the incorporation of innovative new approaches and technologies to address HS priority sampling and analysis needs?

Q.2. What suggestion(s) or recommendation(s) does the Subcommittee have with respect to ensuring that the decontamination capabilities developed by the program contribute to reliable and field-usable decontamination capabilities, balancing specialized technologies with commercial off the shelf (COTS) equipment?

Q.3. What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable capabilities for waste management in responding to HS incidents and other disasters (hurricanes, wildland fires, tornadoes, etc.)?

Q.4. What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable integrated decision-support tools and ensure applicability to economically, socially, or environmentally disadvantaged communities?

The responses of the HS Subcommittee to the charge questions are provided in the following section.

SUBCOMMITTEE RESPONSES TO CHARGE QUESTIONS

Charge Question 1

Q.1. What suggestion(s) or recommendation(s) does the Subcommittee have on balancing/enhancing the use of widely available capabilities with the incorporation of innovative new approaches and technologies to address HS priority sampling and analysis needs?

Narrative

The HS Subcommittee recognized the importance of finding or optimizing the balance between sampling and analysis approaches and technologies based on widely available materials/methods and more innovative solutions, but also recognized that unguided "balance" can be subjective or misdirected, or if balance was the primary objective, not the effectiveness of a solution, non-optimal solutions might be selected by pursuing balance. The Subcommittee elected to address the more fundamental question raised by Charge Question 1: "What process and what considerations should be used to arrive sampling and analysis solutions that optimize the balance between use of available and innovative approaches in the context of specific solution requirements and available resources?"

HSRP has a strong program for engaging partners to define research and development needs in the sampling and analysis area. However, the Subcommittee found that the approach for making decisions about how solutions are selected, specifically how choices that balance available and innovated methods are made, is not clear. This limitation is reflected in the charge question itself, which asks how best to balance use of widely available and more innovative solutions, instead of asking the more relevant question, "which solutions offer the ideal balance between meeting specific requirements for a solution, and the cost and time available to develop the solution?" More specifically, the EPA PARTNER Process

appropriately engages partners/users to identify needs and the general gap between the intended future state and the current state required to meet the need. What appears to be missing is a clearly articulated, structured analysis that matches a carefully developed list of requirements for a solution, e.g., sampling criteria, analytical criteria, environmental robustness, or applicability, against potential solutions from an array that includes widely available materials/methods and those requiring research and development. Such an analysis is the optimal approach to determine and justify what the ideal balance is between widely available solutions and more innovative approaches that may require resources not available to EPA or require a timeline unsupportable by the current HSRP planning cycle.

Strengths

- EPA's research focus has been on developing practical (field deployable, fit to purpose, Geographic Information System, or GIS integration, leverages existing COTS) response tools as needed. This is mission appropriate and effective. Innovation is employed when needs gaps are identified that require research to overcome.
- EPA has developed a set of impressive, practical, and useful tools (Environmental Sampling and Analytical Methods, or ESAM, Trade Off Tool for Sampling, or TOTS, etc.). These tools were originally innovative but have now progressed, through various enhancements, to widely available capabilities. Widely available capabilities are the goal of research programs. For example, ESAM provides one-stop shopping for sampling and analysis, and to date there have been over 191,000 page views, and 160 countries are using this resource.
- EPA tool enhancements include elements that will help with the management of real events (implementation costs, sample site GIS, etc.).
- EPA leverages existing commercially available platforms to build new tools (virtual reality game engine framework for sample collection training application) in a cost effective and more timely manner.
- EPA has demonstrated a strong ability to effectively respond to emergencies or emerging issues (anthrax, Ebola, Coronavirus Disease 2019, or COVID-19, fentanyl, etc.).
- EPA has a strong, resourceful an entrepreneurial research staff that continue to develop beneficial tools and information, despite significant limitations imposed by COVID-19.

Suggestions

- Detail barriers (non-monetary) to innovation and rapid deployment (especially this) and briefing EPA's Office of Research and Development (ORD) leadership or engaging them in a solution. The Subcommittee heard about slow adoption of drones, of new software, etc. What other barriers are there, and what is the opportunity cost to partners if these issues are not addressed?
- Assess the completeness, timeliness, and effectiveness of HSRP's approach to identifying COTS and other technologies (U.S. Department of Defense, U.S. Department of Homeland Security, or DHS, industry) and what could improve the approach, e.g., a network of experts to engage and consult with.
- Assess the effectiveness of processes in place for moving innovations from development to field use. For example, what is that process for rapidly operationalizing something in a real-time emergency response scenario?
- Evaluate how effectively HSRP builds first responder familiarity with the sampling and analysis tools and methods used in emergencies. Determine if there is a need for EPA to enhance its efforts in this area, initially via key professional associations and its large members (cities, utilities, waste management companies, regulators).

Recommendations

The Subcommittee offers these recommendations to support the relevant Agency priorities:

Recommendation 1.1: Engage critical end user professional associations* to both increase awareness of capabilities and inform the balance between off-the-shelf and more innovative solutions based on field needs and requirements defined by responders. This could involve:

- Initial research planning including goal development and project
- Ongoing research (peer review - Project Advisory Committee)
- Tool and information outreach

*Professional associations might include **water** (American Water Works Association), **wastewater** (Water Environment Federation), **mass transit** (American Public Transportation Association), **landfill operators** (Solid Waste Association of North America), laboratories (Association of Public Health Laboratories or American Council of Independent Laboratories), and others (State Emergency Response Commissions and Local Emergency Response Personnel).

Recommendation 1.2: Develop and articulate a formal process for a structured analysis to select solutions with the greatest impact in the context of available resources (time, funding) based on a comparison of a prioritized list of performance requirements for a solution (e.g., sampling criteria, analytical criteria, environmental robustness or applicability), against an array of potential solutions that includes widely available materials/methods and those requiring research and development. Identify barriers to innovation and engage leadership in finding solutions.

Charge Question 2

> Q.2. What suggestion(s) or recommendation(s) does the Subcommittee have with respect to ensuring that the decontamination capabilities developed by the program contribute to reliable and field-usable decontamination capabilities, balancing specialized technologies with commercial off the shelf (COTS) equipment?

Narrative

HSRP has made significant strides in meeting its mission to provide accurate, timely, and value-added solutions to stakeholders. Their dedication to developing off-the-shelf products and modifying their application for use in decontamination from the bench-scale to field-scale is notable.

Strengths

- HSRP has conducted exemplary work developing data, products, and tools for responders using COTS. HSRP publishes an informative online magazine documenting these tools for regions and program offices, the Homeland Security Emergency Action and Research Times (HEART).
- HSRP has developed significant technical applications, such as the Decontamination Selection Tool and Stormwater Emergency Response Framework (SERF), providing value for planning, and increasing public capacity to conduct self-rescue and self-decontamination. These efforts are critical to ensure the provision of appropriate guidance for the use of appropriate existing tools and methods.

- The Subcommittee recognizes HSRP's strong record of effectively conducting operational research and implementing practical solutions, and is impressed with the extent to which HSRP dedicates resources to leveraging partnerships such as the Idaho National Laboratory to examine material variability.
- Considerable progress has been made to ensure HSRP research associates gain field-level experience through participation in actual responses in support of the EPA Center for Environmental Solutions and Emergency Response (CESER) mission. Further, this field-level experience provides a vehicle to ascertain impressions of solution effectiveness from stakeholders.
- Successful stakeholder capacity-building efforts in the field of emergency management have been made through utilizing stakeholders to train their peers (train-the-trainer). Consideration should be given to using similar peer-to-peer methods to engage stakeholders and to inform them of these useful tools and resources.
- HSRP has a strong focus on assessing customer need and developing practical solutions that are field-deployable and a good balance between research and development.
- HSRP has developed an effective method of maintaining support with deployed responses. HSRP should ensure this effective method of communication and provision of support so accurate response plan development continues.

Suggestions

- Successful efforts have been made in the emergency response community through utilizing stakeholders to train a broad and diverse population of stakeholders (train-the-trainer). HSRP should consider utilizing peer-training (train-the-trainer) for stakeholders to train a broad and diverse population of additional stakeholders, including vulnerable and marginalized populations, and to inform them of tools and resources developed for informed decision-making during emergency response.
- HSRP has a strong record of effectively conducting research from the bench-scale to pilot-scale and ultimately to field-scale. While all research is conducted within the certain constraints, consideration should be given to leveraging partnerships with other public and private entities to scale-up projects, widening test variables such as material variation, environmental conditions, and other conditions.
- There are recognized similarities between various decontamination methods, including the commonalities among some pesticides and certain chemical warfare agents. HSRP should consider leveraging decontamination studies of common pesticide contamination to inform on decontamination methods for chemical warfare agents.
- HSRP should continue partner engagement and publication and dissemination of methods and planning models. They should continue to focus on innovation that seeks to use COTS creatively or research integration of COTS for new purposes.

Recommendations

The Subcommittee offers these recommendations to support the relevant Agency priorities:

Recommendation 2.1: HSRP has developed significant technical applications; however, they should develop a complimentary social science research program that produces data, analyses, and knowledge that can be used to assess and improve the field effectiveness of HRSP-produced

decontamination capabilities by understanding the critical role community members play in implementation. Among many others, this might include studying the public's willingness and ability to purchase off-the-shelf products from offers in their community.

Recommendation 2.2: HSRP should provide additional resources and supporting research to bolster the public's ability to perform self-rescue and self-decontamination, ensuring inclusion of vulnerable and marginalized populations. During a community-scale disaster, these efforts could result in lives saved.

Recommendation 2.3: The Subcommittee recommends HSRP dedicate resources to ensure information about developed tools and resources is effectively communicated to responders and the concerned public, including vulnerable and marginalized populations. HSRP has implemented the online magazine HEART, but efforts should be made to ensure this resource is effectively distributed. Communication of this information may include conference presentations (e.g., National Association of SARA Title III Program Officials, or NASTTPO, the International Association of Fire Chiefs, or IAFC, Hot Zone, etc.), public outreach, and social media outlets (see also, Recommendation 1.2).

Charge Question 3

> Q.3. What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable capabilities for waste management in responding to HS incidents and other disasters (hurricanes, wildland fires, tornadoes, etc.)?

Narrative

Deliberate pre-incident planning of waste management in anticipation of CBRN disasters is essential to waste minimization and safe handling. This concept is the driver of HSRP modeling, laboratory experiments, and field-scale activities related to waste management. Decontamination and waste management responses to CBRN incidents will vary with contaminant types, location, spatial distribution, and the availability of remediating resources. The decontamination approaches used dictate the types of wastes and amounts generated and how they should be handled and disposed. Waste characterization is core to all waste management activities including minimization, on-site and off-site treatment, transport, and disposal. Operationally relevant focus areas related to waste management include social science considerations related to implementation challenges, waste and materials management planning and response tools, waste treatment, and decision making.

CBRN disaster response decision making is enabled by web-based support tools. Originally, the tools were standalone solutions that addressed particular needs. HSRP is currently migrating legacy tools and databases, plus developing new ones, to https://cloud.gov/ where government agencies and stakeholders will access them through a common dashboard. User and tool access to supporting information and data will be through a new online RemediAtion Data Repository (RADAR).

Another new research area considers social issues in disaster waste and materials management (DWMM) in determining how to dispose of wastes in ways that do not further disadvantage overburdened populations. Staff are currently reviewing literature to identify relevant documents, social variables, and case studies, and holding interviews or focus groups to identify DWMM decision points and conflicts for

different waste streams. Results are expected to aid state and local capabilities in avoiding or mitigating conflicts during a response.

HSRP performs laboratory research to develop sampling, analysis, and decontamination methods, which are then field tested to determine efficacy and needed improvements. The development of waste handling methods is generally more speculative. Smaller scale incidents can be addressed with ad hoc waste management solutions such as the semi-permeable bags used in the Analysis for Coastal Operational Resiliency (AnCOR) field test; however, a truly wide area, urban incident could require new approaches not yet fully considered. For all these incidents, it will be critical to characterize the waste to inform decisions about waste transport and disposal and to evaluate the effectiveness of waste treatment. Ultimately decisions come down to distance necessary for transportation of waste and the costs associated with moving that waste from one location to another (the underlying cause of Not in My Back Yard, or NIMBY). Further, the availability of tools to manage wide-scale contamination all-hazards incidents is important, but these tools must be well integrated, supported, and updated frequently. Simulating wide-area incidents at full scale would disrupt local populations and be prohibitively expensive; therefore, HSRP is developing a virtual reality-based software tool to simulate wide-area CBR incidents to identify technology gaps, train response personnel, and evaluate alternative response strategies whenever needed. The functionality of each tool is developed between EPA principal investigators and intended end-users. In some instances, tool development and maintenance is contracted out. Alternatively, tools are developed internally and can involve post-doctoral researchers and interns, potentially with some sharing of intellectual property.

Responding to the struggle to keep stakeholders engaged is important because waste management is not a day-to-day priority for them. There might be local concerns about accepting waste from these events. The waste management plans are developed at the local level and there could be environmental justice implications. Early and broad stakeholder engagement will elevate challenges to location usage issues and waste acceptance and even laboratory selection by developing consensus on staging, analysis, and disposal locations, prior to actual need. Stakeholders should include federal, state, and local governmental agencies plus private partners such as stadiums, hospital parking lots, park owners, etc.

The future research directions shown by HSRP point to a need for greater technical diversity among its research contributors. For example, software projects are a growing part of HSRP's portfolio and resources are limited. Advanced knowledge/skills in this area could benefit HSRP's software processes in terms quality and costs. This could be obtained from industry-leading advisors via consulting and/or BOSC membership. Additionally, competitive hiring constraints might be mitigated by looking into other hiring authorities (e.g., Title 42), partnering with commercial entities (possibly through Small Business Innovation Research, or SBIR, funding), and via academia through the EPA Science to Achieve Results (STAR) program.

Also, there are apparent knowledge gaps and opportunities in decontamination and waste management for wide-area incidents. For example, combined chemical and biological decontamination and waste volume reduction (for disposal efficiency) from some waste streams should be feasible. Knowledge from leading industrial, chemical, and mechanical engineers and scientists experienced in developing large scale combined chemical and mechanical processes in industries, e.g., mining and pulp and paper, could be transformative. Advisors could be identified through relevant professional societies.

Strengths

- Clarity of research direction and relationships to needs.

- HSRP staff gain experience and expertise in collaborations with state, federal, and foreign agencies in exercises and, invaluably, actual incidents such as Ebola, Fukushima (Japan), and the Novichok poisonings (United Kingdom).
- Integration of computer-based planning tools and databases. Migrating legacy tools and developing new tools for deployment on https://cloud.gov/ to improve access.
- Use of widely available materials and equipment to develop CBRN remediation techniques.
- Leveraging GIS and visualization technology in tools. Investigating virtual reality approaches for data visualization and training.
- Anticipatory field research that supports international concerns related to carcass disposal.
- Beginning social science research on issues such as effectively communicating with locals and getting them involved in cleanup. It is exciting for all scientists to be thinking about social science aspects.
- Use of interns and post-doctoral students to develop necessary software tools for waste management and disposal modeling and calculations.

Suggestions

- Waste management plans should consider competing uses of facilities (buildings, parking lots, roads, etc.) identified in local response plans (emergency shelters, food/water distribution, etc.). Consideration must be given to who has the authority to designate or take control of these needed staging areas. It is important to have a pre-established incident command structure predetermined.
- Expand efforts to explore reuse or recycling of disinfected and cleaned personal protection equipment.
- Resolve barriers to accepting demolition materials at the Resource Conservation and Recovery Act (RCRA) Subtitle D facilities without testing and limiting long-term liability.
- Involve the U.S. Department of Transportation to ensure treated contaminated waste can be safely transported.
- Social consideration research needs to clarify what outcome it seeks, make a strong case for the impact, choose something specific to focus on that meets a specifically defined need, bring in social scientists who might have immediate knowledge about the research, and clearly define the product that stakeholders can and will use.
- Before the Configured Fireside Simulator is pursued any further, resolve all software licensing and use issues to ensure it can be broadly used similar to other tools HSRP has developed.

Recommendations

The Subcommittee offers these recommendations to support the relevant Agency priorities:

Recommendation 3.1: Establish clear priorities for research and development of solutions for environmental cleanup challenges in wide urban settings from the large list of those challenges: methods to sample the waste such that they meet criteria (e.g., temperature, preservation, size) for laboratory acceptance for analysis; building trust and social relationships in resilience and remediation work; social impact of remediation activities; decontaminating the surfaces and media when the effectiveness might vary depending on surface characteristics and environmental conditions; potential impact to the material (especially critical equipment and high value structures) from decontamination; guiding individuals or privately hired contractors in their efforts to clean-up their properties; managing the large amount of data from wide-area cleanup; and fate and transport of biological agents in urban settings.

Recommendation 3.2: Develop early engagement plans for meeting with local stakeholders to develop staging and disposal plans for CBRN events prior to actual incidents. This will elevate challenges to location usage issues and waste acceptance and even laboratory selection by developing consensus on staging, analysis, and disposal locations, prior to actual need. Stakeholders should include federal, state, and local governmental agencies plus private partners such as stadiums, hospital parking lots, park owners, etc.

Recommendation 3.3: Develop a set of non-traditional solutions for meeting staffing needs, overcoming knowledge gaps for consideration in the development of the next StRAP. This might include partnerships, consultants, advisors, or unique ways of hiring or leveraging other EPA employees.

Charge Question 4

Q.4. What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable integrated decision-support tools and ensure applicability to economically, socially, or environmentally disadvantaged communities?

Narrative

To advance the capabilities of EPA as well as state, tribal, and local partners to prepare for, respond to, and recover from incidents involving large-scale contaminated areas and water systems, HSRP/CESER has developed tools to support systems-based decision making (HSRP STRAP 2019–2022). The response community, for instance, benefits from tools and models that:

- Facilitate rapid assessment, including access to emerging technologies that enable responders to survey, detect, and monitor the event in the case of a wide-area incident;
- Provide metrics and decision support to inform decision makers readily and rapidly on appropriate technologies for characterizing or remediating environments contaminated with various CBRN agents, thus improving the timeliness of the recovery process;
- Consider the timeframes and costs (both social and economic) associated with viable remediation approaches, and maintain flexibility given the complex, dynamic, and uncertain character of a wide-area incident; and
- Enable stakeholders to assess their community environmental resilience to disaster.

Strengths

- HSRP manifests a development culture in which user input comes early and often. There is a feedback loop that gathers user comments on reliability and field usability of tools and products to drive improvements. This user-centric, continuous development culture is very positive.
    - Ex: HSRP researchers have incorporated artificial intelligence (AI) in decision-support tools in a way that respects the fact that their main customers, the on-scene coordinators (OSCs), "don't want to have a computer telling them what to do. Using it for recommendations seems more acceptable."

- HSRP has more fully adopted a social science/human factors perspective. By working systematically to understand both product end users and the broader social contexts in which they operate, HSRP is well equipped to develop decision-support tools that are behaviorally realistic, and are thus, "field usable," and that can also apply to disadvantaged communities.
    - Ex: HSRP systematically surveyed OSCs to understand the social networks in which OSCs operate so that products address the interpersonal and organizational dynamics that underlie successful cleanup (e.g., public trust).
- Over the past few years, the HS Subcommittee has witnessed a marked improvement in the software tool and product development capability in the program. Modern development methods employing up-to-date application hosting platforms deliver highly useful software, and often, 'voice of the customer' is captured to ensure that end-user feedback makes it back to those who need to hear it so the software can be continuously improved. Among notable achievements:
    - Adoption of Cloud.gov platform on Amazon Web Services (AWS): This will lend to interoperability, and more young developers will be engaged by using modern development platforms.
    - Intention to go "open source when possible" and on the advancement of AI, machine learning, neural network modeling principles.
    - Google Partnership: Tapping into wealth of technical expertise is to be encouraged further.
    - Emerging data and application programming interface (API) standards: Partner engagement should inform future developments.
    - HSRP's simulation tools capture/convey the complexity of managing low-probability, high-consequence events. These products constitute the most efficient way to plan, evaluate, and assess the response to events; they also represent the future of training first responder personnel. HSRP has successfully integrated dispersion modeling, fate and transport, and human actions (treatment, remediation, waste removal, cleanup etc.).
- AnCOR is a great example of a long-term effort from bench-to-field and of integration and partnership (e.g., EPA, DHS, U.S. Coast Guard). The full spectrum of tools and approaches comes together in a systems approach. A process of starting at that bench, and then building out to an ultimate test in the field, leads to a realistic assessment of capability, gaps, etc. The anthrax fate part of the Storm Water Management Model (SWMM) in a field study with surrogates is commendable.
- RADAR on Cloud.gov will be the single place to find tools and data. This will increase adoption and consumption of both by stakeholders, remediating a prior statement that it was difficult for end-users to find things, especially during a crisis.

Suggestions

- Incorporate the potential social costs (e.g., the disproportionate exposure of specific disadvantaged groups to potentially hazardous materials) of waste staging/storing location suitability, into the all-hazards waste logistics tool, putting environmental justice-related data alongside factors such as land use and soil types.
- Recruit more to 'build the bench.' The HSRP team is highly talented, deeply engaged, and delivers excellent and innovative research. At the same time, research opportunities might go unmet due to lack of staff. In addition, conducting future HSRP hires with diversity and inclusivity principles in mind can foster an environment conducive to innovation and ensure that the workforce is even more representative of the populations that they seek to protect.
- Break procurement logjams that prevent very talented people from simply getting the tools they need (or even scare off prospective hires). The right technologies are being used to do the science, but researchers are often hamstrung due to the lack of flexibility or appropriately modern lab and

computing tools. For example: a researcher should not be forced to do AI and machine learning on an elderly, 10-year-old PC. Modern, high-performance hardware is quite inexpensive.
- Migrate legacy application development 'ways of working' to new ways and platforms. Using modern "dev platforms" and tools like Python and GitHub for code versioning and repository, etc., are exactly what young developers would be expecting to find in a professional work environment. It will also be easier to maintain and improve application code by keeping it in a modern code repository.
- Balance automation through integration and AI with customer-driven decision making. Using it for recommendations seems more acceptable.
- Evaluate opportunities to establish a longer time horizon; the 4-year funding cycle is too short for meaningful development.

Recommendations

The Subcommittee offers these recommendations to support the relevant Agency priorities:

Recommendation 4.1: To maintain an edge in the development of reliable and field-usable integrated decision-support tools, take the following steps that to help ensure that HSRP staff (current and future) have access to modern lab equipment, computing resources, and other technical inputs:

- Create and deliver to management a report on the threat to the research activities that is posed by aging technology components, including lab equipment, PCs, etc., because it is unacceptable to run critical research on legacy equipment; and
- Restart the stalled "3-year tech refresh program" to ensure that all staffers have appropriately recent end-user computing resources.

Recommendation 4.2: Expand the universe of HSRP state/local partners beyond emergency management, public health, and water utility associations to include groups/leaders (e.g., state directors for minority health or health equity) who can provide unique insights into environmental health challenges of disadvantaged populations.

SUMMARY LIST OF RECOMMENDATIONS

Charge Question 1: What suggestion(s) or recommendation(s) does the Subcommittee have on balancing/enhancing the use of widely available capabilities with the incorporation of innovative new approaches and technologies to address HS priority sampling and analysis needs?

- **Recommendation 1.1:** Engage critical end user professional associations* to both increase awareness of capabilities and inform the balance between off-the-shelf and more innovative solutions based on field needs and requirements defined by responders. This could involve:
    - Initial research planning including goal development and project
    - Ongoing research (peer review - Project Advisory Committee)
    - Tool and information outreach

  *Professional associations might include water (American Water Works Association), wastewater (Water Environment Federation), mass transit (American Public Transportation Association), landfill operators (Solid Waste Association of North America), laboratories (Association of Public Health Laboratories or American Council of Independent Laboratories), and others (State Emergency Response Commissions and Local Emergency Response Personnel).

- **Recommendation 1.2:** Develop and articulate a formal process for a structured analysis to select solutions with the greatest impact in the context of available resources (time, funding) based on a comparison of a prioritized list of performance requirements for a solution (e.g., sampling criteria, analytical criteria, environmental robustness or applicability), against an array of potential solutions that includes widely available materials/methods and those requiring research and development. Identify barriers to innovation and engage leadership in finding solutions.

Charge Question 2: What suggestion(s) or recommendation(s) does the Subcommittee have with respect to ensuring that the decontamination capabilities developed by the program contribute to reliable and field-usable decontamination capabilities, balancing specialized technologies with commercial off the shelf (COTS) equipment?

- **Recommendation 2.1:** HSRP has developed significant technical applications; however, they should develop a complimentary social science research program that produces data, analyses, and knowledge that can be used to assess and improve the field effectiveness of HRSP-produced decontamination capabilities by understanding the critical role community members play in implementation. Among many others, this might include studying the public's willingness and ability to purchase off-the-shelf products from offers in their community.
- **Recommendation 2.2:** HSRP should provide additional resources and supporting research to bolster the public's ability to perform self-rescue and self-decontamination, ensuring inclusion of vulnerable and marginalized populations. During a community-scale disaster, these efforts could result in lives saved.
- **Recommendation 2.3:** The Subcommittee recommends HSRP dedicate resources to ensure information about developed tools and resources is effectively communicated to responders and the concerned public, including vulnerable and marginalized populations. HSRP has implemented the online magazine HEART, but efforts should be made to ensure this resource is effectively distributed. Communication of this information may include conference presentations (e.g., National Association of SARA Title III Program Officials, or NASTTPO, the International Association of Fire Chiefs, or IAFC, Hot Zone, etc.), public outreach, and social media outlets (see also, Recommendation 1.2).

Charge Question 3: What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable capabilities for waste management in responding to HS incidents and other disasters (hurricanes, wildland fires, tornadoes, etc.)?

- **Recommendation 3.1:** Establish clear priorities for research and development of solutions for environmental cleanup challenges in wide urban settings from the large list of those challenges: methods to sample the waste such that they meet criteria (e.g., temperature, preservation, size) for laboratory acceptance for analysis; building trust and social relationships in resilience and remediation work; social impact of remediation activities; decontaminating the surfaces and media when the effectiveness might vary depending on surface characteristics and environmental conditions; potential impact to the material (especially critical equipment and high value structures) from decontamination; guiding individuals or privately hired contractors in their efforts to clean-up their properties; managing the large amount of data from wide-area cleanup; and fate and transport of biological agents in urban settings.
- **Recommendation 3.2:** Develop early engagement plans for meeting with local stakeholders to develop staging and disposal plans for CBRN events prior to actual incidents. This will elevate challenges to location usage issues and waste acceptance and even laboratory selection by

developing consensus on staging, analysis, and disposal locations, prior to actual need. Stakeholders should include federal, state, and local governmental agencies plus private partners such as stadiums, hospital parking lots, park owners, etc.

- **Recommendation 3.3:** Develop a set of non-traditional solutions for meeting staffing needs, overcoming knowledge gaps for consideration in the development of the next StRAP. This might include partnerships, consultants, advisors, or unique ways of hiring or leveraging other EPA employees.

Charge Question 4: What suggestion(s) or recommendation(s) does the Subcommittee have on the current and planned direction of HSRP's research to provide products that contribute to reliable and field-usable integrated decision-support tools and ensure applicability to economically, socially, or environmentally disadvantaged communities?

- **Recommendation 4.1:** To maintain an edge in the development of reliable and field-usable integrated decision-support tools, take the following steps that to help ensure that HSRP staff (current and future) have access to modern lab equipment, computing resources, and other technical inputs:
    - Create and deliver to management a report on the threat to the research activities that is posed by aging technology components, including lab equipment, PCs, etc., because it is unacceptable to run critical research on legacy equipment; and
    - Restart the stalled "3-year tech refresh program" to ensure that all staffers have appropriately recent end-user computing resources.
- **Recommendation 4.2:** Expand the universe of HSRP state/local partners beyond emergency management, public health, and water utility associations to include groups/leaders (e.g., state directors for minority health or health equity) who can provide unique insights into environmental health challenges of disadvantaged populations.

APPENDIX A: MEETING AGENDA

Monday, May 17, 2021

Time	Agenda Activity	Presenter
12:00 - 12:10	Introduction and FACA rules Welcome and Opening Remarks Introduction of BOSC HS Subcommittee Members	Tom Tracy, Designated Federal Officer Paula Olsiewski, BOSC Homeland Security (HS) Subcommittee Chair
12:10 - 12:25	ORD Welcome – 10 min CESER Welcome – 5 min	Jennifer Orme-Zavaleta, PhD ORD Principal Deputy Assistant Administrator for Science Chris Frey, PhD ORD DAA for Science Policy Greg Sayles, Director Center for Environmental Solutions and Emergency Response (CESER)
12:25 - 12:50	Homeland Security Research Program Overview	Shawn Ryan, HS National Program Director Sang Don Lee, HS Principal Assoc. NPD
12:50 - 13:10	**CQ1: Overview of Sampling and Analysis Research** ***Additional Resource:*** Sampling & Analysis Webpage	Sarah Taft, CESER
13:10 – 13:20	Break (10 min)	
Lightning session for Characterization		
13:20 - 14:45	*1-Environmental Sampling & Analytical Methods Program (ESAM) Video (Play YouTube Video by host) - 8 min* *Additional Resources:* ESAM Webpage, ESAM Webinar	*Kathy Hall*, CESER
	2-Trade-Off Tool for Sampling (PI screen share Demo) - 15 min	Tim Boe, CESER
	3-Development of Sampling and Analysis Methods for Outdoor Environments (Video in slide) - 8 min *Additional Resource: B. anthracis* Story	*Worth Calfee*, CESER
	4-Resuspension of B. anthracis Surrogates on Underground Subway Surfaces - 8 min	*John Archer*, CESER
	5-Development of Activity-Based Aggressive-Air Contained Sampling System - 8 min	*John Archer, CESER*
	6-Bio-Agent Analytical Methods Development - 8 min	*Sanjiv Shah, CESER*
	7-Bio-Sampling Training Simulator (PI screen share Video) - 15 min *Additional Resources:* Virtual Reality Story, Virtual Reality Webinar	*Tim Boe*, CESER
	8-Fentanyl Sampling and Analysis - 8 min	*Stuart Willison,* CESER

Time	Agenda Activity	Presenter
	9-Innovative Sampling Methods for HS Chemicals (Video in slide) - 8 min	*Lukas Oudejans*, CESER
14:45 - 14:55	Break (10 min)	
14:55 – 15:10	*10-Sampling and Analysis Plan Resources - 5 min*	*Erin Silvestri*, CESER
	11-Data Visualization/Management (PI screen share Demo) - 10 min	*Timothy Boe, CESER*
15:10 – 15:50	**Partners Round Table**	Larry Kaelin, EPA Office of Emergency Management (OEM) Leroy Mickelsen, EPA OEM Jim Mitchell, EPA Region 5
15:50 – 16:00	Break (10 min)	
16:00 – 17:00	Additional Q&A, Discussion, and Subcommittee Worktime	

Tuesday, May 18, 2021

Time	Agenda Activity	Presenter
13:00 - 13:15	**CQ2: Overview of Wide Area Decontamination Research** ***Additional Resource:*** *Wide-area Remediation Webpage*	Lance Brooks, CESER
	Lightning session for Decontamination	
13:15 – 13:45	Biological Decontamination 1- Soil Decontamination for Non-spore agents -10 min 2- Material compatibility of Sporicides Neutralization of Ricin Toxin - 10 min 3- Personnel Decontamination Systems - 10 min *Additional Resource:* Ricin Webinar	Worth Calfee, CESER Joe Wood, CESER John Archer, CESER
13:45 – 14:10	Chemical Decontamination 4- Personnel Chemical Decontamination Line Options for the Responder – 5 min 5- Surface Decontamination Methods for Pesticides – 5 min 6- Decontamination of persistent Chemical Warfare Agents & DeconST (PI screen share for demo) – 15 min *Additional Resources:* Pesticide Story, CWA Webinar, Fentanyl Story, DeconST Webinar	John Archer, CESER Lukas Oudejans, CESER
14:10 – 14:40	Radiological Decontamination 5- Integrated Wash-down, Treatment, and Emergency Reuse System (IWATERS) - 10 min 6- Roofing Material Decontamination - 10 min 7- Integrated Rad Remediation Decision Support - 10 min	Matthew Magnuson, CESER Kathy Hall, CESER Tim Boe, CESER
	Break (15 min)	
14:40 – 15:10	8- Stormwater & Washdown Research -15 min (PI screen share for videos) 9- Supporting CBRN Cleanup Decisions -15 min (PI screen share for demo)	Anne Mikelonis, CESER Tim Boe, CESER

Time	Agenda Activity	Presenter
15:10 – 15:50	**Partners Round Table**	Mark Durno, Region 5 Jason Musante, Region 9 Scott Hudson, EPA OEM
15:50 – 16:00	Break (10 min)	
16:00 – 17:00	Additional Q&A, Discussion, and Subcommittee Worktime	

Wednesday, May 19, 2021

Time	Agenda Activity	Presenter
13:00 - 13:20	**CQ3: Overview of Waste Management Research** ***Additional Resource:*** Waste Management Webpage	Emily Snyder, CESER
	Lightning session for Waste Management	
13:20 – 14:20	*1-Configured Fireside Simulator – Simulations for Treatment of Biologically and Chemically Contaminated Waste - 10 min* *2-Biological Waste Treatment: A Scalable Approach-AnCOR - 10 min* *3-Carcass Management: Assessment of Methods to Support Outbreaks of Foreign Animal Disease (ASFv example) - 10 min* *4-Demo of Waste Staging and Logistics Tools - 20 min (PI screen share for demo)* *5-Social Considerations of Disaster Waste Management - 10 min* *Additional Resources:* I-WASTE Webinar, Waste Tools Story	*Paul Lemieux*, CESER *Paul Lemieux* *Paul Lemieux* *Tim Boe*, CESER *Keely Maxwell*, CESER
14:20 – 15:00	**Partners Round Table**	Alan G. Woodard, Ph.D., NY Dept. of Environmental Conservation Catherine Young, EPA Region 1 Gary Flory, VA Dept. of Environmental Quality Kim M. Kirkland, EPA Office of Land and Emergency Management
15:00 – 15:10	Break (10 min)	
15:10 – 16:00	Additional Q&A, Discussion, and Subcommittee Worktime	

Thursday, May 20, 2021

Time	Agenda Activity	Presenter
12:00 – 12:15	**CQ4: Overview of HSRP Systems and Resilience Tools**	Sang Don Lee, HS Principal Assoc.
	Lightning session for Systems and Resilience Tools	
12:15 - 13:00	**Systems Tools** **1-Simulation for Evaluating Decision Making Following a Large-Scale Incident** *(Video in slide) - 10 min* **2-Evaluating the Use of Commercial-off-the-shelf (COTS) Three-dimensional (3D) Engines** *(Video in slide) - 10 min*	*Tim Boe*, CESER

Time	Agenda Activity	Presenter
	3-Tool Integration/Dashboard - *10 min* **4-Remediation Data Repository** *(PI screen share Demo) - 15 min*	
13:00 – 13:30	**Resilience Tools** **5-Social science of decontamination & environmental cleanups** - *10 min* **6-Environmental Resilience Tools Wizard** *(PI screen share Demo) - 10 min* **7-Equitable Resilience Builder** - *10 min*	*Keely Maxwell*, CESER
13:30 – 13:45	Break (15 min)	
13:45 – 14:25	**Analysis for Coastal Operational Resiliency (AnCOR) Field Study with Partners** *(Videos in slide)* ***Additional Resources:*** AnCOR Webpage, AnCOR Story	Shannon Serre, EPA OEM Worth Calfee, CESER
14:25 – 14:45	**Operational Testing and Evaluation of Chemical Remediation Activities (OTECRA) Field Study with Partners**	Larry Kaelin, EPA OEM Lukas Oudejans, CESER
14:45 – 15:05	**Managing Research during Emerging Challenges** ***Additional Resource:*** COVID-19 Research Webpage	Shawn Ryan, HS National Program Director Sang Don Lee, HS Principal Assoc.
15:05 – 15:20	Break (15 min)	
15:20 – 16:00	Questions and Answers; Final Remarks	
16:00 - 17:00	Subcommittee Worktime	

APPENDIX B: MATERIALS

Material Provided in Advance of the Meeting

- Meeting Agenda
- Charge Questions
- Zoom Virtual Participation Guide

Material Provided During or After the Meeting

- Homeland Security Research Program – Links to Products
- Homeland Security Research Program – Meeting Presentation
- COAB Meeting 2021 Homeland Security Research Program Partner – Homeland Security Research Program FY20-21 Annual Update Presentation
- 2012 Partner Process Fact Sheet
- 2021 Decontamination and Waste Management Tools: HEART (Homeland Security Emergency Action and Research Times for Regions and Program Offices)