

2013 U.S. EPA INTERNATIONAL DECONTAMINATION RESEARCH AND DEVELOPMENT CONFERENCE NOVEMBER 5-7, 2013

INTRODUCTION

The 2013 U.S. Environmental Protection Agency (EPA) International Decontamination Research and Development Conference brought together the scientific community and practitioners tasked with performing on-site data collection and remediation. For three days at EPA's campus in Research Triangle Park, North Carolina, more than 170 national and international participants representing local, state, and federal government agencies, academia, industry, and public advocacy groups viewed presentations and actively engaged in panel discussion and a poster viewing session. This diverse audience brought together experts in emergency response, decision support tools, risk communication, sampling, detection, treatment, decontamination methods, and waste management related to biological, chemical, and radiological agents to explore current and future directions.



This Technical Brief outlines the events and presentations of the conference. The information is organized by topic; the Plenary Session, General Sessions, and Poster Session topics are outlined first, followed by topics covered during the Concurrent Sessions.

Plenary Session

Dr. Shawn Ryan, Division Director of the Decontamination & Consequence Management Division with EPA's National Homeland Security Research Center (NHSRC), Dr. Lukas Oudejans, Chairperson of the NHSRC Conference Organizing Committee, and Dr. Greg Sayles, Acting Director of NHSRC, welcomed participants to the conference and provided opening remarks. Dr. Sayles introduced Mr. Lek Kadeli, the Acting Assistant Administrator of EPA's Office of Research and Development.

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Mr. Kadeli quoted EPA Administrator Gina McCarthy's First 100 Days message: "Each day my goal is to make EPA's work relevant and important to every community in the United States...everyone wants to ensure that their kids are healthy, that their communities and drinking water are safe and that their economies are strong". Mr. Kadeli recognized that these are the hallmarks of community sustainability and that's why EPA's mission to protect human health and the environment now encompasses every facet of preparing communities for the challenges ahead and strengthening their resiliency to bounce back the next time disaster strikes.

Dr. Peter Jutro (EPA) introduced the keynote speaker, the Honorable Dr. Richard J. Danzig, expert consultant to the Departments of Defense and Homeland Security and current Chairman of the Board of Directors for the Center for a New American Security. Previously, Dr. Danzig served as the 71st Secretary of the Navy (November 1998 – January 2001) and was a senior advisor to then Senator Obama on national security issues during the 2008 Presidential campaign. Dr. Danzig underscored the importance of heroes, not only the traditional idea of leaders who step forward in a crisis, but also those who foresee the potential crisis and begin to prepare for it. The preparation for remediation following e.g., a wide area biological release, is fraught with difficulties due to the unpredictable nature of such crises, including the type and amount of pathogen, modality of delivery, and distribution of contamination.

Dr. Danzig commended efforts such as the federal multi-agency Bioresponse Operational Testing and Evaluation (BOTE) study and the Scientific Program on Reaerosolization and Exposure (SPORE) program and stressed the need for similar tools that the scientific community can use to provide definitive answers to policymakers based on conclusive data. Dr. Danzig also discussed the issues of time and scale, emphasizing the importance of identifying priority items, demanding more situational awareness information, and communicating clear and concise information to policymakers now to prepare an "all-hazards" response rather than waiting to respond once a crisis has already occurred.

General Session 1 – Outcome Tabletop Exercise, Guidance, and Response

The first general session consisted of seven presentations from federal agencies of the United States, Canada, United Kingdom, and Japan. The first presentation explained how the private sector in Canada can help with the assessment and remediation process following a chemical, biological, radiological, nuclear or explosive weapon (CBRNE) incident. Representatives from Public Health England outlined guidance available in the United Kingdom including Recovery Handbooks for chemical and biological incidents. These documents are not considered substitutes for specialist advice but would aid decision makers in the development of a recovery strategy.



The fourth presentation summarized ongoing research surrounding the accident at the Fukushima Daiichi nuclear power plant. The behavior of the radionuclides emitted into the environment and the appropriate treatment and disposal technologies for the radioactively contaminated waste were described. The fifth presentation showed the Hazard Mitigation Science and Technology Program for the U.S. Department of Defense (DoD), which funds research to find new technologies and methods with goals to limit the spread of contamination, return equipment to normal mission operation, and enable operations at reduced levels of protection, among other goals. The DoD presentation was followed by a presentation on the United Kingdom Government Decontamination Service. In addition to providing an overview of the agency's ongoing activities, this presentation identified efforts of developing and testing standard operating procedures in response to a wide area biological release. A discussion on the Biological Response and Recovery Science and Technology Roadmap wrapped up the first general session. This working document helps categorize key scientific gaps in the response to a biological incident, identify specific technological solutions, and prioritize research activities to enable government to make decisions more effectively.

General Session 2 – Decision Support Tools

The common theme for the nine presentations in this session was to provide the conference attendees with information on available software tools that can be used as part of a structured decision-making process for response and remediation.

Presenters described the tools and applications related to

- quick urban and industrial complex (QUIC) dispersion modeling,
- prioritization analysis tool for all-hazards/analyzer for wide-area restoration effectiveness (PATH/AWARE),
- visual sampling plan (VSP) tool,
- decision support toolset for weapons of mass destruction crisis management,
- utility of the tactical dynamic operational guided sampling (TAcDOGS) tool,
- decontamination strategy and technology selection tool (DeconST),
- decision support tool for use in carcass management,
- update of the waste estimation support tool (WEST),
- interactive all hazards waste management plan development tool.



Plume map following a radiological agent release

All tool developers participated in a one-hour panel discussion regarding the use, training, inter-connectivity, and future of these tools. Conference participants then attended demonstrations of these tools.

General Session 3 – Risk Communication and Systems Approach & Food Safety-Decontamination and Disposal Issues

The second day of the conference began with a general session focused on risk communication and systems approach. The importance of professional and public perception, risk communication messaging, and social media following a contamination event and subsequent decontamination and remediation was emphasized. The first presentation compared professional and public assessments of critical information needs and evaluated messages developed during previous workshops for appropriateness and effectiveness. The second presentation focused on the research need for risk communication practices during the remediation phase of a biological incident. One conclusion of that study was that emergency management personnel may benefit from including the influence of social media in their risk communication, a tool that is not fully utilized at this time.

A third presentation on a systems approach to characterize the social environment for decontamination and resilience concluded that meeting technical clearance goals after remediation may not be enough to ensure re-occupancy and reuse of an area as social factors such as community ties and sense of place influence re-occupancy decisions.

The final presentation of the third general session focused on food defense defined as efforts to prevent the intentional contamination of food products by biological, chemical, physical, or radiological agents. The presentation highlighted the current research and challenges in the detection, decontamination, and disposal of contaminated food.

General Session 4 – Low Tech/Self Help

The third and final day of the conference commenced with the fourth general session highlighting low tech and self-help approaches to decontamination. The first presenter discussed laundering of radioactively contaminated materials to reduce exposure to radiation. Washing clothing was found to be effective in removal of radiological contamination with the majority of contamination transferred to the wastewater.

The second presenter reported an experimental study in which high efficiency particulate air (HEPA) vacuuming and compressed air dusting were used to remove radiological contamination from sensitive (electronic) devices such as cell phones,



Example of a (radiologically) contaminated keypad

numerical keypads, and responder bags. Both approaches were highly effective to remove contamination although the compressed air had a tendency to spread contamination.

A third presentation summarized the efficacy of sporicidal wipes and addressed the question of whether or not these wipes can be used to treat anthrax “hotspots” on nonporous surfaces. Sporocidal wipes containing bleach were found to be more efficacious than others. The presenter also noted that disinfecting wipes showed no sporicidal activity. The final presentation in this session commented on the use of chlorine bleach solution to treat contaminated wastewater. Results showed that both pH-adjusted bleach (as per National Response team (NRT) guidelines) and diluted bleach are both highly effective for inactivation of *B. atrophaeus* spp. *globigii* (Bg), a surrogate for *B. anthracis*, in wash waters.

General Session 5 – Foreign Animal Disease Research

The fifth and final general session wrapped up the conference with a focus on foreign animal disease-related research. The first presenter reported on lessons learned from low pathogenic avian influenza outbreaks in Virginia and their relevance to an agro-terror attack or foreign animal disease (FAD) outbreak. Transportation and disposal issues following a large scale FAD outbreak were the main topic of the second presentation in this session. The third presenter showed an approach to decontaminate vehicles using a fully autonomous and portable wash tunnel. Although originally designed to be used in response to an FAD outbreak, the system could also be used during the response phase following a biological or radiological incident. The last presenter in this session described the findings from a contaminated livestock combustion study using a pilot-scale air curtain burner. Initial results showed no viable spores in the exhaust gases, indicating satisfactory combustion conditions.



Image of an air curtain burner

Mr. Juan Reyes, Acting Associate Administrator with EPA’s Office of Homeland Security and Lukas Oudejans (EPA) made final remarks, thanked the conference planning team, and dismissed the conference.

Poster Session

An afternoon poster session on the second day of the conference provided a break between sessions, with 18 posters representing a range of decontamination related issues. Topics included techniques for decontamination of various surfaces and environments, emerging technologies that allow faster and more accurate evaluation of onsite contamination and fate and transport studies of various contaminants in environmental and municipal systems.

Concurrent Sessions

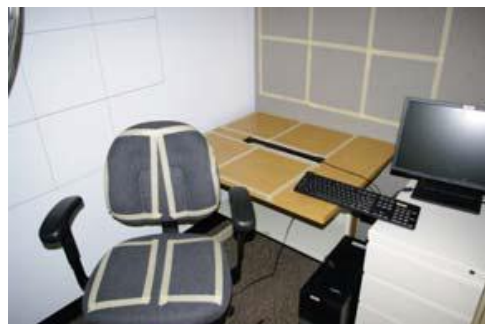
The following biological, chemical and radiological agent sessions were conducted concurrently during the second and third day of the conference to allow broader topic

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area coverage. The concurrent sessions focused on various aspects of biological, chemical, and radiological contaminants and decontamination techniques, including sessions specifically covering water and wastewater management.

Decontamination

The first of two biological agent decontamination sessions opened with a presentation on new processes for decontamination using aqueous gels and foams. Various products were described with specific mechanisms (e.g., self-drying and cracking gels or gelified foams) to decontaminate surfaces or volumes contaminated with radiological, biological, or chemical agents. Next, the results of a study assessing efficacy of low level chlorine dioxide fumigation anthrax decontamination techniques in a mock office environment were presented to allow more companies who can generate low concentration chlorine dioxide to assist in remediation efforts. The next presentation explored efficacy of methyl iodide fumigation techniques for a variety of anthrax contaminated surfaces with a focus on irreplaceable historical artifacts. Methyl iodide was found to be more detrimental to historic pictures than methyl bromide while methyl iodide may be more appropriate for nonporous surfaces. The session was concluded with a video about returning Gruinard Island, Scotland, to an environmentally acceptable state appropriate for civilian use following a biological warfare test by the British military in 1942.



Mock office as used during fumigation study

Biological agent decontamination was also covered during a second concurrent session, on the following day. This session opened with a presentation of the results of research evaluating six decontamination technologies used to inactivate anthrax in soils. Four of the tested approaches resulted in better than 6 log reduction in both *B. anthracis* and the surrogate *B. subtilis* spores. Another study examined various chlorine dioxide formulations as a biocide alternative to methyl bromide in the decontamination of soil. A third presentation elaborated on survival of anthrax after exposure to hot humid air as a decontamination method for sensitive equipment with no impact on the functionality. The final presentation during this session explored aerosol delivery of liquid decontaminants (oxidants, enzymes) as an aid in decontaminating complex, confined, or “hard-to-reach” spaces.

Sampling and Detection

The biological agent sampling and detection session opened with two presentations that provided results of evaluations of various vacuum sampling methods for extracting anthrax spores. The first presentation evaluated previously identified vacuum technologies by optimizing sample processing protocols while the second presentation focused on sampling results obtained using robot cleaners in an effort to cover larger areas with one sample which would result in lower cost and risk to the sampling personnel. This presentation was followed by a

summary of findings after assessing available commercial off-the-shelf (COTS) hand-portable biodetection equipment. The session concluded with a presentation on the effects of various agents (i.e., pH-adjusted bleach, chlorine dioxide, and vaporous hydrogen peroxide) used for anthrax decontamination on the rapid viability polymerase chain reaction (RV-PCR) method of anthrax spore detection. Data showed that the RV-PCR method could allow higher throughput analysis of post-decontamination clearance samples as compared to the traditional culture-based analysis.



Microbiological sampling using vacuum sock

Fate and Transport

The biological agent fate and transport session kicked off with a presentation on the quantification of the re-aerosolization of bacterial spores deposited on flooring (carpet and vinyl) by decontamination personnel walking across the surfaces.

The next three presentations were associated with the Scientific Program on Reaerosolization and Exposure (SPORE), a multiple federal agency effort. The first presentation provided an overview of the SPORE initiatives and objectives. Four priority gaps were identified, namely, development of appropriate and validated air sample collection methods for reaerosolized viable and inhalable spores, determination of reaerosolization, determination of suitable surrogates or simulants and determination of sampling and analytical methods as well as sampling strategies. This presentation was followed by a detailed description of a SPORE project focused on quantitative resuspension of anthrax spores from common surfaces. This session was wrapped up with the description of another SPORE project to evaluate suitability of *Bacillus thuringiensis* var. *kurstaki* (Btk) as a behaviorally representative surrogate for *B. anthracis*.

Persistence

The biological agent persistence session began by presenting the results of a large-scale sampling of soil across the U.S. for *Bacillus* sp. and *Bacillus anthracis*. Threshold values were identified as prospective investigative tools in determining whether an anthrax outbreak was 'potential' or 'probable' at any given geographic location in the contiguous United States. This presentation was followed by an assessment of the persistence of vegetative *B. anthracis* in the environment as a function of relative humidity and after ultra violet (UV) exposure.

Sampling and Detection

The chemical agent sampling and detection session began with a presentation reviewing methods used at U.S. Army chemical agent disposal facilities for decontamination, waste management, and verification techniques to allow closure of facilities and return to public use. Near real time and/or sorbent tube monitoring was used to detect residual agent, and unventilated air monitoring was used to verify

whether decontamination was effective. The presentation also discussed the events and lessons learned from the ESS Pursuit incident. The next speaker described the results of a study conducted to evaluate analytical laboratory protocols for identifying and measuring chemical warfare agents (CWAs) in environmental matrices. The speaker also discussed the shelf lives of the ultra-dilute solutions which allow EPA to handle CWAs.

The third presentation introduced EPA's mobile laboratory asset, the Portable High-Throughput Integrated Laboratory Identification Systems (PHILIS). The presentation explained how its successful on-site analysis aided the cleanup of residential areas in Vermont.



This application illustrates the dual use of these mobile assets as their mission includes the ability to analyze CWAs and toxic industrial chemicals (TICs) in environmental samples. The next presentation wrapped up the session with a description of EPA's Trace Atmospheric Gas Analyzer (TAGA) mobile laboratory containing a direct air monitoring instrument employing triple quadrupole mass spectrometry. Work on the real-time detection of CWAs will have the potential to help first responders in the event of such releases.

Fate, Persistence and Transport

The chemical agent fate, persistence, and transport session began with a presentation that focused on efforts to model and predict fate and transport processes of chemical warfare agents on surfaces following chemical contamination. Modeling efforts of laboratory experiments were successful in many cases. However, some data suggest transport limitations within droplets or reactivity, leading to the conclusion that modeling and experimentation must be coupled to become more useful.

The second and last presentation in this session discussed the effects of temperature and humidity on adsorption and desorption of CWAs by activated carbon beds which informs the engineering controls required during hot air decontamination. Results for sulfur mustard and sarin indicate that breakthrough times are affected by temperature, but not in a consistent manner across various carbon types.

Decontamination

The chemical agent decontamination session kicked off with a presentation explaining the issues and potential evaluation of sampling and decontamination techniques associated with improper indoor use of pesticides to control pests (e.g., bed bugs). Three project goals were identified: develop sampling and modeling approaches to evaluate surface residues, develop surface threshold values, and determine efficacies of decontaminants. Challenges associated with the analysis of Lewisite during decontamination studies were discussed in a second presentation. Various analytical approaches including cool on-column inlet gas chromatography and derivatization of Lewisite with gas chromatography were discussed as possible aids to determine Lewisite decontamination.

The third presentation focused on the effectiveness of various textile technologies (wipes) in decontaminating skin and personal protective equipment. Wipes were evaluated against various chemical warfare agents, and the results indicate performance equal to a Fuller's Earth pad. The session closed with a presentation explaining the development of the Hazard Mitigation, Material and Equipment Restoration (HaMMER) advanced technology demonstration program, designed to advance the assessment and integration of new products into hazard mitigation. Results from this DoD program indicate that the decontamination processes and products tested can significantly reduce remaining chemical agent hazards to well below military requirements if used in a synergistic manner.

Fate, Transport, and Decontamination

The radiological agent fate, transport and decontamination session started with a presentation exploring the fate and transport of radionuclides on common urban surfaces, followed by a presentation of an investigation of the sorption and speciation of the same radionuclides. The third presentation explained the challenges and knowledge gaps involved in applying various tested radiological decontamination technologies to urban environments. The session concluded with a presentation on humic acid-based sorbents applied to toxic substances.

Water and Waste Water Management

The first water and waste water management session began with a presentation outlining an investigation of the United Kingdom's capability to manage contaminated water in drinking water treatment facilities and sewage treatment plants. Water treatment facilities generally know what treatment processes to use; however, with many counties participating, no data harmonization occurs, hence detailed information would be required on actual capacities to identify any area at risk. An update on water decontamination activities followed, including an outline of the Critical Infrastructure Partnership Advisory Council's (CIPAC's) framework for decision-makers to aid in decontamination of chemical, biological, and radiological agents from water systems. A disposal guide and preparedness tool that serves as a reference to assist water utility actions was discussed.

The second waste and waste water management session opened with the author presenting selected results from the US EPA Homeland Security Research Program's projects to evaluate treatment and system decontamination options for water and wastewater. Of particular interest is the design and development of a water security test bed (WSTB) to investigate chemical, biological, and radiological detectors, decontaminants, and decontamination procedures at full scale. The next presenter outlined a report released by the National Homeland Security Research Center titled "Decontamination of Drinking Water Infrastructure: A Literature Review and Summary." The same presenter also provided a more detailed description of aforementioned planned WSTB experiments.

This presentation was followed by a presentation elaborating on the Irreversible Wash Aid Additive Process, which washes radioactive cesium from surfaces and renders the radionuclide environmentally immobile. The presentation on the Irreversible Wash Aid Additive Process also included results from a full scale demonstration to decontaminate a vehicle while preventing the release of contaminated water into the environment through the use of rapidly deployable barriers. The session concluded with a presentation on the fate of radionuclides deposited on various components of drinking water distribution systems.

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