



2015 EPA International Decontamination Research and Development Conference



EXECUTIVE SUMMARY

The 2015 U.S. Environmental Protection Agency (EPA) International Decontamination Research and Development Conference brought together scientists, practitioners, and policymakers related to chemical, biological, and radiological (CBR) remediation. For three days at EPA's campus in Research Triangle Park, North Carolina, more than 190 national and international participants representing local, state, and federal government agencies, academia, industry, and public advocacy groups viewed presentations and actively engaged in discussions and a poster viewing session. This diverse audience included experts in detection, environmental emergency response, risk communication, sampling, treatment, decontamination methods, waste management, and decision support tool development related to biological, chemical, and radiological agents to explore current issues and future directions.

This Executive Summary outlines the events and presentations of the conference, and references more detailed information in the Conference Report. The information is organized by topic: Plenary Session and General Sessions, followed by Concurrent Sessions by topic area, and the Poster Session.

Plenary Session

Dr. Lukas Oudejans, Chairperson of EPA's National Homeland Security Research Center (NHSRC) Conference Organizing Committee, welcomed participants to the conference and provided opening remarks.

Dr. Shawn Ryan, Division Director of the Decontamination and Consequence Management Division (DCMD) with NHSRC, provided a brief historical perspective of the advances made in the decontamination field in the last ten years. Dr. Ryan applauded the role of the Conference in supporting and sharing those advances among scientists and responders to help with modern decontamination challenges.

Dr. Gregory Sayles, Acting Director of NHSRC, outlined the goals of the Conference, highlighting the importance of bringing together the scientific, regulatory, and response communities to convey the state of the science and continue to foster advances through collaboration. Dr. Sayles emphasized the relevance of this effort in light of recent incidents that have challenged decontamination researchers and practitioners.

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General Session 1

Connecting Response and Research Activities

The first section of General Session 1, “Connecting Response and Research Activities,” consisted of four presentations outlining how decontamination research can inform response practices. The first and second presentations, given by invited speakers Erica Canzler (U.S. EPA) and Joseph Barbera (George Washington University), focused on relationships and collaborations between researchers and emergency responders. They discussed how available data can be quickly and appropriately interpreted to respond to incidents, and how these data could be incorporated into various testing and training scenarios to better prepare responders. Both stressed the importance of leveraging relationships between researchers, responders, and regulators locally, nationally, and internationally to continue to develop practical applications for research in real-world CBR scenarios. The third and fourth presentations recounted recent examples of responses to ricin and *Burkholderia pseudomallei* incidents in the United States, in which research informed sampling and analysis planning and practices. Early and consistent communication between all involved parties was underscored as a crucial part of each of these real-world incident response processes.



"Officials are investigating how a deadly type of bacteria was released from a high-security laboratory at the Tulane National Primate Center in Louisiana. Officials say there is no risk to the public."

EPA Region 6's Two Recent Bio Responses; Slide 4 John Martin | U.S. Environmental Protection Agency

CBR Response Activities and Recovery Handbooks

This “CBR Response Activities and Recovery Handbooks” section of General Session 1 summarized recent CBR responses in two presentations, followed by a third presentation from Public Health England showcasing a UK-developed handbook that aids in recovery after an incident. The first presentation outlined the development and application of a “field deployable hydrolysis system” used by the United States Army to safely destroy 600 tons of declared Syrian chemical agents. The second presentation focused on the continued recovery of the large area affected by the Fukushima, Japan, nuclear accident in 2011. The presentation explored available data and techniques to model indoor radiological exposure from various potential sources, and the impact of these findings on the recovery process for the affected regions. The “UK Recovery Handbook for Biological Incidents” was exhibited in the third presentation of this Session. This handbook follows the previous handbooks developed for chemical and radiological incidents and focuses primarily on the cleanup and restoration phases of recovery with the aim of reducing exposure and returning to ‘normality.’ All handbooks aid decision makers in the development of a recovery strategy

Field Demonstration and (International) Program Review

The final section of General Session 1, “Field Demonstration and (International) Program Review,” consisted of four presentations. The first presentation outlined the benefits of methyl bromide fumigation versus an approach using ethylene oxide and vaporized hydrogen peroxide to respond to *Bacillus anthracis* release. A field demonstration of a patented method of decontaminating entire structures using methyl bromide fumigation was presented. The remaining



three presentations focused on programs and international frameworks for defense and response in the United States, Canada, and the United Kingdom.

Technology

- Can be applied using fire trucks and/or existing dispensing equipment available to first responders
- Formulation
 - Water-based formulation
 - Cocktail of ion exchange and chelating agents
 - Can be mixed with firefighting foams (Class A or B) and other ingredients



Environment
Canada

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Canada

Canadian Safety and Security Program Project for Infrastructure Mitigation for Rapid Response after a Radiological Incident; Slide 8

Konstantin Volchek | Environment Canada

The first of these three presentations showed that in the United States, the Department of Defense is working to improve many technologies that aid in detection and decontamination of agents, including improving resistance of response-vehicle coatings to agents and wide-area anthrax decontamination using germination of spores as a mitigation approach, among others. In the UK, the Government Decontamination Service, with input from other suppliers, has developed a framework process for sampling and analysis, decontamination, and waste management and disposal in response to CBR incidents, including provisions for responder health and safety throughout the process. The fourth and final presentation stressed the importance of developing mitigation techniques to address radiological contamination in the short term to facilitate further and more complete decontamination afterward. Environment Canada, along with other collaborators, developed and demonstrated a water-

based formulation technology that can be dispersed using fire trucks.

General Session 2 - Data Models, Research Overviews and Remediation Plans

The first presentation in General Session 2 offered an analysis of the data and models used to inform federal response in the United States. Data used in the event of hurricanes and earthquakes were organized, characterized, analyzed for data gaps and compiled into an interactive resource inventory. The second and third presentations provided perspectives on biological decontamination research and remediation plans from EPA and the New York City Department of Health and Mental Hygiene (NYC DOHMH). The EPA's Homeland Security Research Program presentation included recent work in decontamination, including improving demonstration and implementation of fumigants, new application methods for liquid sporicides, and progress with emerging decontaminants. The NYC DOHMH outlined their work, in collaboration with other organizations, to develop a biological incident remediation plan for New York City from incident preparation through recovery and re-occupation of the affected area. In the process, they also detailed important data gaps and challenges associated with decontamination of a city the size of New York. The fourth and final presentation in this session provided an update on available water decontamination strategies, including a report on the progress of the 2008 Critical Infrastructure Partnership Advisory Council Recommendations, resources for water utilities in the event of an incident, an overview of recent decontamination tabletop exercises, and other projects.



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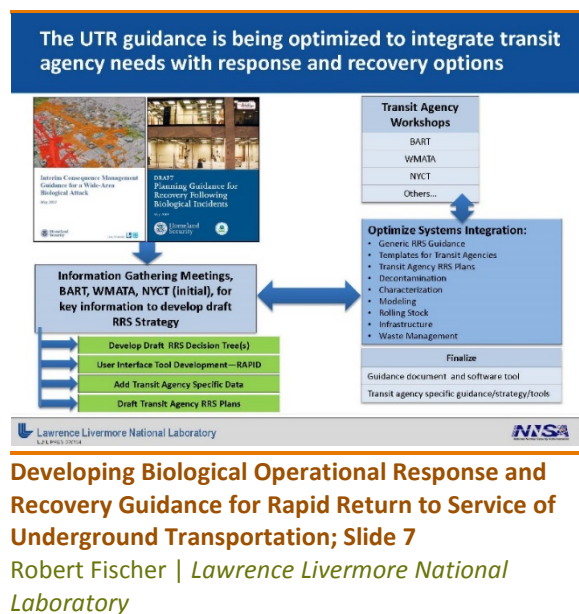
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General Session 3 – Biological Agent Reaerosolization

General Session 3 featured a presentation that provided an update on the Scientific Program on Reaerosolization and Exposure (SPORE), which explores the relationship between reaerosolization and continued exposure to inform risk-related decision making.

General Session 4 – Decision Support Tools and Guidance Documents

The four presentations given during General Session 4 focused on the resources available to aid decision-makers in the wake of emergencies or incidents. The first presentation focused on availability and functionality of the Prioritization Analysis Tool for All-Hazards/Analyzer for Wide-Area Restoration Effectiveness (PATH/AWARE), which was developed to address CBR scenarios involving weapons of mass destruction. There are plans to expand PATH/AWARE to address hurricanes, floods, and earthquakes in the future. The second presentation provided an overview and short demonstration of the GIS-based Waste Estimation Support Tool (WEST), designed to inform waste management strategies for wide-area contamination scenarios. The next presentation turned the focus to recovery after a specific scenario – an incident involving underground transportation. The joint U.S. DHS-EPA Underground Transportation Restoration (UTR) project goals, including developing the first federal guidance to decrease subway restoration down time after a biological event, were outlined. The final presentation explored the potential applicability of data from historical incidents to modern urban response and recovery and the challenges involved.



Concurrent Sessions

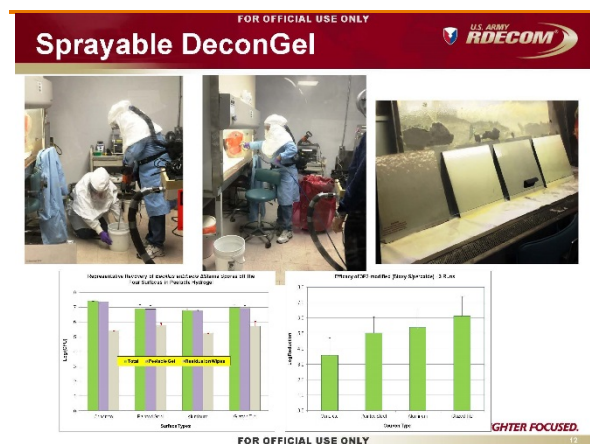
Sessions were conducted concurrently throughout the duration of the conference to allow broader coverage of topic areas. The concurrent sessions focused on various aspects of biological, chemical, and radiological contaminants and decontamination techniques, including sessions specifically covering water and wastewater management. Biological agents were a recurring theme while other sessions transitioned between radiological, chemical, water, and waste.

Biological Agent Decontamination

The first Biological session included five presentations that outlined methodologies used for decontamination of biological agents, and the experimental evaluation of various factors affecting the efficacy of these methods. The first of these



presentations focused on a relatively nontoxic novel micro emulsion decontaminant option for use on chemical as well as biological agents. Performance of the technique on both chemical and biological agents, detector interference, and material compatibility of the technique were all evaluated. A second presentation expounded on a novel decontamination concept involving use of a viscous hydrogel polymer. Some unique advantages of this approach include a reduction in hazardous waste, preservation of forensic evidence locked in the gel, and multiple application options for complete coverage of complex surfaces.



Novel Bio-decon Approach – DeconGel; Slide 12
 Vipin Rastogi | U.S. Army, Edgewood Chemical
 Biological Center

A new method of generating chlorine dioxide by photochemically activating chlorite ions was explained in the third presentation. This method was found to have extended benefit over time and was presented as a potential consumer product due to its ease of use and low operator risk. The next presentation examined the advantages and disadvantages of various wide-area decontamination methods and presented reason to question the viability of simple “pass/fail” tests of decontamination methods using only small coupons. The fifth and final presentation in this session outlined the results of experimental investigation of the efficacy of methyl bromide fumigation as a decontamination technique under various ambient conditions, on various surfaces, and on various potential surrogate microorganisms for *Bacillus anthracis*. Each of these presentations summarized the outcomes of the experimental testing performed.

Biological Agent Detection

The second Biological session focused on methods and research associated with detection of biological agents. The first of these four presentations described efforts to independently and systematically evaluate various hand-portable biological indicator, immunoassay, and PCR techniques of detection to better inform the first-responder community. The importance of using the best possible rapid-detection techniques in the event of a “suspicious white powder” incident was emphasized. The next two presentations explored the development of rapid viability PCR methods for detecting *Bacillus anthracis* and *Yersinia pestis*. The first of these two presentations offered an overview and historical perspective of rapid viability PCR method development. The second focused on recent efforts to develop a reliable method of detecting *Y. pestis* in water samples and on refining sample preparation protocols to optimize *Y. pestis* cell recovery and growth. The final presentation in this session explored in more detail the challenges associated with obtaining consistent “standard samples” from real-world environments. Established methods of sampling were revisited with proposed revisions that may optimize their use in detection.

Biological Agent Sampling

The third Biological session was dedicated to exploring topics related to bio-sampling, through four presentations. The first of these focused on efficiency of various sampling methods, regarding the number of samples necessary to clear an area after decontamination. Various tools and sampling techniques were described and evaluated for efficiency of detection. The second presentation discussed current research developing and evaluating a composite sampling method



using cellulose sponges. The established method of sponge wiping surfaces was compared to a new modified method and evaluated for collection efficiency and potential for cross-contamination. A third presentation described work to assess the potential of using commercial robotic vacuums as sampling as well as decontamination tools. Recovery efficiency and variability due to the sampling pattern were experimentally examined on a variety of flooring materials. The fourth presentation summarized the various laboratory sampling and analysis capabilities that could provide rapid support for large scale environmental response.

Biological Agent Decontamination Equipment

The three presentations given in the final Biological session focused on equipment used to decontaminate biological agents. A portable system specially designed to decontaminate vehicles was introduced in the first presentation. The system, redesigned from an original prototype, is operable by a single person and is entirely self-contained, including all runoff and reclaimed liquid. The second presentation examined the efficacy of a mobile pressure washer with and without additional biocides for decontaminating equipment. Many variables, including pressure washing time, presence or absence of grease on the surface, and type of additive disinfectant used were evaluated. The third and final presentation offered results of research on efficacy of a variety of nozzle types used for wide-area spray decontamination. Spray patterns created by different nozzles were evaluated on types of horizontal and vertical surfaces, and results were presented.

Biological Agent Aerosols and Morphology of Spores

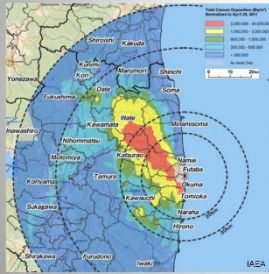
The final concurrent session focusing on biological agents examined biological aerosols and spore morphology. The first of four presentations introduced a reaerosolization study method designed to minimize common errors in these types of studies. The study itself examined the differences in reaerosolization of anthrax and its surrogates from common outdoor surfaces, like asphalt, concrete, and glass. A second presentation examined the flaws in the usual assumption associated with modeling bodily fluid aerosols: that most droplets fall to the ground, with limited evaporation. A more realistic modeling scenario was presented, taking into account the effects of various conditions on droplet evaporation. The third presentation expounded on a study designed to test the reproducibility and consistency of methods used to uniformly deposit bacteria on coupons using aerosol, harvest bacteria, and accurately determine bacterial surface decay. The methods presented are expected to help generate relevant data for post event planning and response. The final presentation focused on the use of atomic force microscopy (AFM) to examine structure-function relationships of pathogens, specifically the morphology of *Bacillus anthracis* spores. The in vitro use of AFM could fill an analytical gap in the characterization of pathogens, and could significantly improve understanding of decontamination methods and approaches.



Radiological Agent Response and Recovery

Problem

After an intentional radiological release or nuclear power plant accident, contamination is likely to spread across a large urban area with complex variety of surfaces.



Radiological Contaminant Stabilization Technologies; Slide 2

Mark Sutton | Lawrence Livermore National Laboratory

This session examined response to and recovery from radiological incidents. The first of five presentations summarized the guidance and tools available to radiological first responders. The importance of identifying responder needs through discussion and stakeholder input was emphasized. The second presentation examined technologies designed to contain radiological agents after an incident, which could allow time and consideration for decision makers. That work involved grouping available technologies into tiers, based on their availability and the time needed for deployment. The third presentation emphasized the importance of exploring gross mitigation methods, which would reduce first-responder exposure and reduce resources needed for full decontamination later on. Various techniques on a variety of surfaces were investigated, with more research on the topic forthcoming in the future. A summary of various available radiological mitigation technologies was given in the fourth presentation. These technologies were to be demonstrated during a DHS/EPA Technology Demonstration for radiological responders in June 2015. The final presentation in this session focused on the importance of developing and implementing early-phase waste management plans. Emphasis was placed on including waste management strategies in the Area Contingency Plan.

Water Infrastructure Decontamination

This session examined the obstacles and solutions associated with decontamination of water and wastewater infrastructure through four presentations. The first gave an overview of selected projects exhibiting techniques of water and wastewater decontamination and restoration and featured a few facilities capable of unique water decontamination and treatment research, including a new water security test bed (WSTB) in Idaho. The second presentation offered a more in-depth look at this WSTB, providing background information and status updates of ongoing research. Both of these presentations stressed the importance of the WSTB and the opportunities it provides to address gaps in water infrastructure protection. The third presentation experimentally examined the persistence of radioactive particles on drinking water pipework to better inform responders about the effectiveness of various decontamination methods. The last presentation also focused on adsorption of particles to sediments that settle in drinking water storage tanks. Samples were collected and analyzed for adherence of various CBR substances.



Water and Waste Water Treatment

The subject for this session was treatment of water and waste water. The first of four presentations provided an overview of selected ongoing research projects designed to make water systems more resilient, to detect and mitigate contamination, and to treat water and water structures. Highlighted projects included investigation of the fate of organophosphates in municipal wastewater treatment systems, prediction of hydrolysis rates of organophosphates, and managing and treating large amounts of CBR-contaminated water and wastewater residuals. The second presentation shared research on the inactivation of vegetative *Bacillus anthracis* in drinking water using free available chlorine and monochloramine. Various conditions were tested, and results were presented. The third presentation addressed the need for development of a deployable CBR water treatment system that would minimize the volume of contaminated effluent generated from the decontamination process. An update of the results, findings, and products developed to accomplish this minimization to date was given. The fourth presentation focused on large-volume contamination events and presented findings from development of a toolbox of strategies for disposal of contaminated water and exploring the challenges that wastewater utilities face when accepting water pre-treated with advanced oxidation processes.



Contaminant Persistence in Waste Water Treatment Systems



Activated sludge experimental set-up: assessing how contaminants travel through waste water treatment systems



Waste water test bed: assessing persistence of contaminants on sewer infrastructure

Management and Treatment of Copious Amounts of CBR Contaminated Water and Wastewater; Slide 12
Matthew Magnuson | U.S. Environmental Protection Agency

Waste Treatment and Disposal

This presentation addressed management and disposal of waste after an event. Specifically, research was presented on the behavior of biomass-bound cesium in an incinerator environment. Different variables affecting this behavior were examined, and results were presented.

Chemical Agent Decontamination

The four presentations given during this session focused on various techniques of chemical decontamination. The first of these presented findings from the site remediation of a penicillin production facility using chlorine dioxide gas. This successful six-day endeavor, which cost approximately \$327,000 USD, was explained in detail from start to finish, including placement throughout the building of fans, humidity generators, and samplers, and sealing the building in preparation for gassing. The second presentation in this session examined the potential use of common household materials and cleaning agents like hydrogen peroxide, baking soda, and rubbing alcohol, among others, to decontaminate VX, GD, and HD without leaving toxic residue on surfaces. These techniques would aid in speeding first response, because necessary materials are easily accessible in large quantities. The Integrated Decontamination Test and Evaluation System was introduced in the third presentation. This test facility enables systematic evaluation of the efficacy of decontamination methods under various experimentally controlled conditions. Survivability of decontamination equipment and gear can also be examined. The final presentation in this session investigated the ability of four solutions to decontaminate materials in response to



sulfur mustard, Lewisite, and agent yellow contamination. This bench-scale study examined these solutions for wood, metal, glass, and sealed concrete, and analyzed for efficacy as well as residual byproducts.

Poster Session

An afternoon poster session on the second day of the Conference provided a break between oral sessions with 31 posters representing a range of remediation-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.

Contact Information

For more information, visit the EPA Web site at www2.epa.gov/homeland-security-research

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