

Homeland Security Research Program

Jonathan G. Herrmann, P.E., BCEE
National Program Director

<http://www.epa.gov/nhsrsc>

Office of Research and Development

SAB/BOSC Meeting
July 10-11, 2012

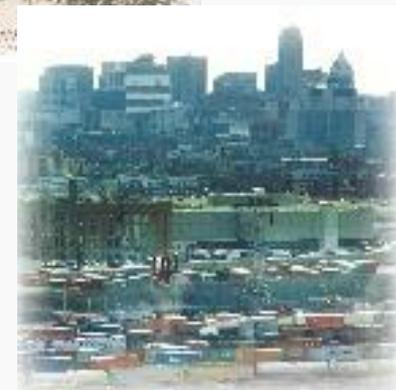




Homeland Security Research Program

Mission: to conduct research and develop scientific products that improve the capability of the Agency to carry out its homeland security responsibilities

**ADVANCING
OUR NATION'S
SECURITY
THROUGH
SCIENCE**





EPA Homeland Security Drivers and Responsibilities

Drivers

Bioterrorism Act (2002)

Homeland Security Presidential Directives (2003-2008)

National Response Framework (revised 2008)

Elements of:

- Comprehensive Environmental Response, Compensation and Liability Act
- Emergency Planning and Community Right-to-Know Act
- Clean Water Act
- Safe Drinking Water Act
- Oil Pollution Act
- Clean Air Act
- Resource Conservation and Recovery Act



Responsibilities

- **Protect water systems from attacks and for detecting and recovering from successful attacks** affecting water systems by leading efforts to provide States and water utilities guidance, tools and strategies. *EPA is the federal government Sector Specific Agency (SSA) lead for water infrastructure.*
- **Decontaminate buildings and outdoor areas** impacted by a terrorist attack by leading efforts to establish clearance goals and clean up.
- **Develop a nationwide laboratory network** with the capability and capacity to analyze for chemical, biological and radiological agents for routine monitoring and in response to a terrorist attacks.

Food Safety Modernization Act of 2010



“provide support for, and technical assistance to, State, local, and tribal governments in preparing for, assessing, decontaminating, and recovering from an agriculture or food emergency”

HSRP Research Themes

Securing and Sustaining Water Systems

Supporting WSi (sensors, software tools, technical assistance)

Infrastructure decontamination

Water treatment

Innovative system designs and management



Characterizing Contamination and Determining Risk

Sampling, analytical methods

Sampling strategies

Determining risk, clean up goals

Microbial risk assessment methodologies



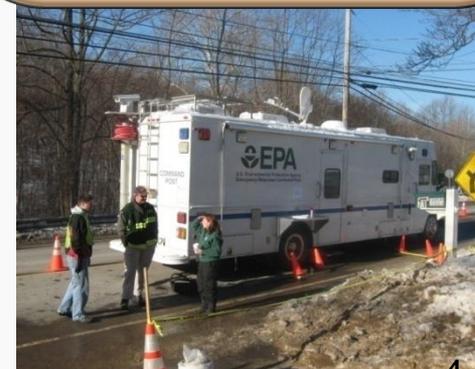
Remediating Indoor and Outdoor Environments

Efficacy, optimization of cleanup technologies

Fate of contamination, resuspension

Wide area cleanup

Waste management





Themes and Science Questions

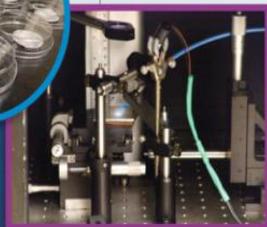
A - Water	B – Methods and Risk	C – Indoor/Outdoor
<p>How can water security technologies for drinking water distribution systems be improved to be faster, more reliable, less expensive, more sustainable, and better integrated into daily operations?</p>	<p>What site characterization methods are needed to inform cleanup decisions and how can methods be optimized to increase laboratory capacity during response and recovery?</p>	<p>After initially settling, will contamination continue to spread?</p>
<p>What approaches are most effective, timely, and sustainable for returning water and wastewater infrastructure to service following a contamination incident?</p>	<p>How can characterization of exposure pathways and health risk from contamination be improved to better inform risk assessment and risk management decisions?</p>	<p>What cleanup technologies are most effective and how are their efficacies changed by real world variations in environmental, process and agent characteristics?</p>
<p>What innovations and new methods are needed to fill technical and knowledge gaps in water infrastructure security and sustainability?</p>	<p>How can the effectiveness of communicating risk to decision-makers and other stakeholders, including the public, be improved?</p>	<p>How can wide area contamination be remediated in the most cost effective and expedient way while still protecting human health and the environment?</p>
		<p>How are contaminated residuals of cleanup operations best managed?</p>

IN-HOUSE RESEARCH FACILITIES

HIGH BAY FACILITIES

RESEARCH TRIANGLE PARK, NORTH CAROLINA

Research Triangle Park, North Carolina, is home to one of EPA's high bay facilities. NHSRC research at this location is conducted in the facility's decontamination, aerosol and combustion laboratories.



Laser-Induced Breakdown Spectrometry (LIBS) detection device and samples.



Testing of low-tech cleaning/ washing/ bleaching decontamination methods on large coupons of indoor and outdoor materials



Rotary kiln used in combustion studies to investigate waste disposal issues.

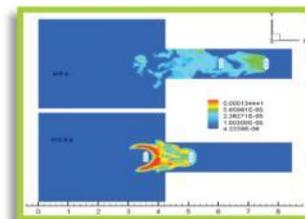
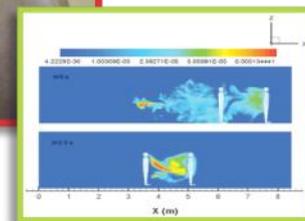
COMMANDER test chamber for evaluating decontamination technologies.



Diagram of large wind tunnel used in aerosol studies.



Digitally captured data (right) from wind tunnel aerosol studies using heated, breathing, adult-sized manikins (above).



IN-HOUSE RESEARCH FACILITIES TEST AND EVALUATION FACILITY CINCINNATI, OHIO*

The Test and Evaluation (T&E) Facility is located in Cincinnati, Ohio. T&E is a multipurpose, high bay research facility. Some experiments are performed under laboratory conditions (bench-scale), while others are conducted in large system simulators or in the field (pilot-scale).

Examples of interior pipe corrosion and sediment deposition, which can inhibit decontamination efforts.



Clear pipe loop water distribution system simulator.



“Once through” water distribution system simulator, with sampling points (right).



Various sensors being tested for their ability to detect contaminants.



* Other facilities include a BSI-2 and BSL -3 (accessible but not operated by EPA).



HSRP Partners and Stakeholders

EPA Office of Water

responsible for carrying out water
sector-specific lead agency
duties

EPA Office of Solid Waste and Emergency Response

broad responsibilities in response to
indoor and outdoor areas incidents of
national significance

Regional Offices

responsible for responding to
many types of incidents



Other HSRP Stakeholders

EPA Program Offices

Office of Homeland Security
Office of Chemical Safety and Pollution Prevention
Office of Air and Radiation

Public Sector

States and local authorities
Water utilities



HSRP and Interagency Collaboration

- Department of Defense
 - TSWG, DTIC, DTRA, Army, ECBC, Army Corps
- Department of Energy
 - National Labs (Argonne, Sandia, Idaho, Livermore, Oak Ridge)
- Health and Human Services
 - CDC, NIOSH
- Department of the Interior
 - USGS
- Department of Agriculture
- Department of Homeland Security
- Intelligence Community



Communications

External

PARTNER – customer involved research planning and project teams

HSRP website- www.epa.gov/nhsrc

Semi-annual stakeholder new product notifications

Contributions to Science Matters newsletter

Participation in numerous multi-agency workgroups

Hosting of advanced computing webinars

Initiated webinar series open to EPA customers

Internal

Contributions to the Research Compass newsletter and science blog

HSRP intranet site available to all of ORD

NHSRC intranet available to NHSRC staff only

Initiated webinar series open to all ORD

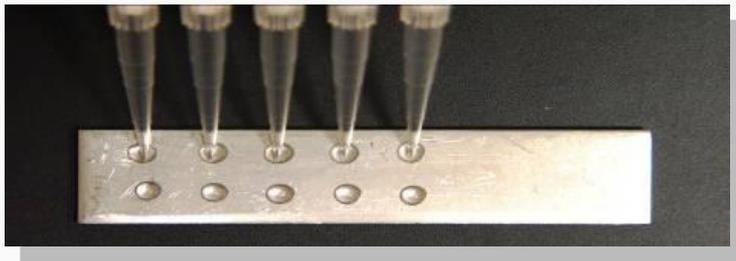
Conducting focus groups to explore improvements to internal communications

Quarterly NHSRC staff meetings

Matrix interfaces facilitate communications with other ORD programs

Research Planning, Execution, and Delivery

- Applied Research and Technical Support (*Oriented to Solutions*)
- Customer and Stakeholder Responsiveness (*Focused on Needs/Gaps*)
- Systems-based Approaches (*Increased Relevance and Utility*)
- Realistic Schedules (*Timely Delivery*)
- High Quality Scientific and Technical Data (*More Informed Decision Making*)
- Engagement Opportunities (*Involved Partners*)





ORD's Commitment to Success of HSRP

Developed Research Action Plan (RAP)

- Identified relevant science questions
- Designed projects to address data gaps
- Codified commitments to customers
- Documented all research activities
- Described all planned research products

Accountability and Performance

- Accountability involves all work, products, and commitments to partners/stakeholders
- Performance involves the number of commitments met



Projects to Build Resiliency in Water Security

A.3.1 Innovative design and management of drinking water systems of the future

A.1.1 Testing, evaluation and enhancement of existing or emerging detection technologies

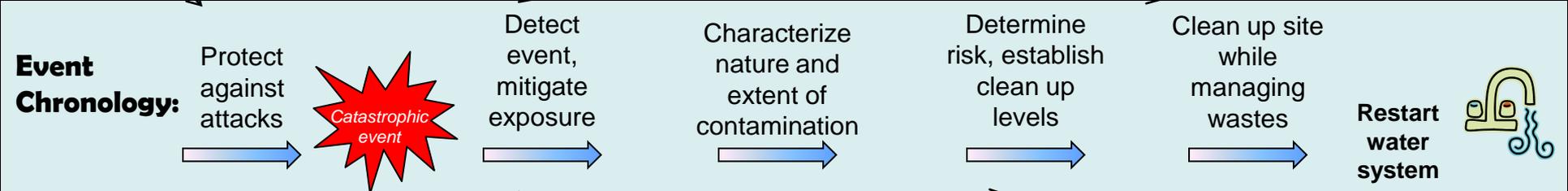
A.2.3 Development and enhancement of decision-making tools and information to enhance community response and resilience to drinking water contamination incidents

B.1.2 Innovative Site Characterization Approaches to Improve Field Sampling

B.1.1 Site Characterization of Chemical, Biological and Radiological (CBR) Contamination to Inform Risk Management Strategies

A.2.1 Development, testing, of methods for decontaminating water or wastewater infrastructure

A.2.2 Evaluation of the effectiveness of conventional or green treatment methods



A.1.2 Technical support and application of detection technologies in pilot demonstration projects

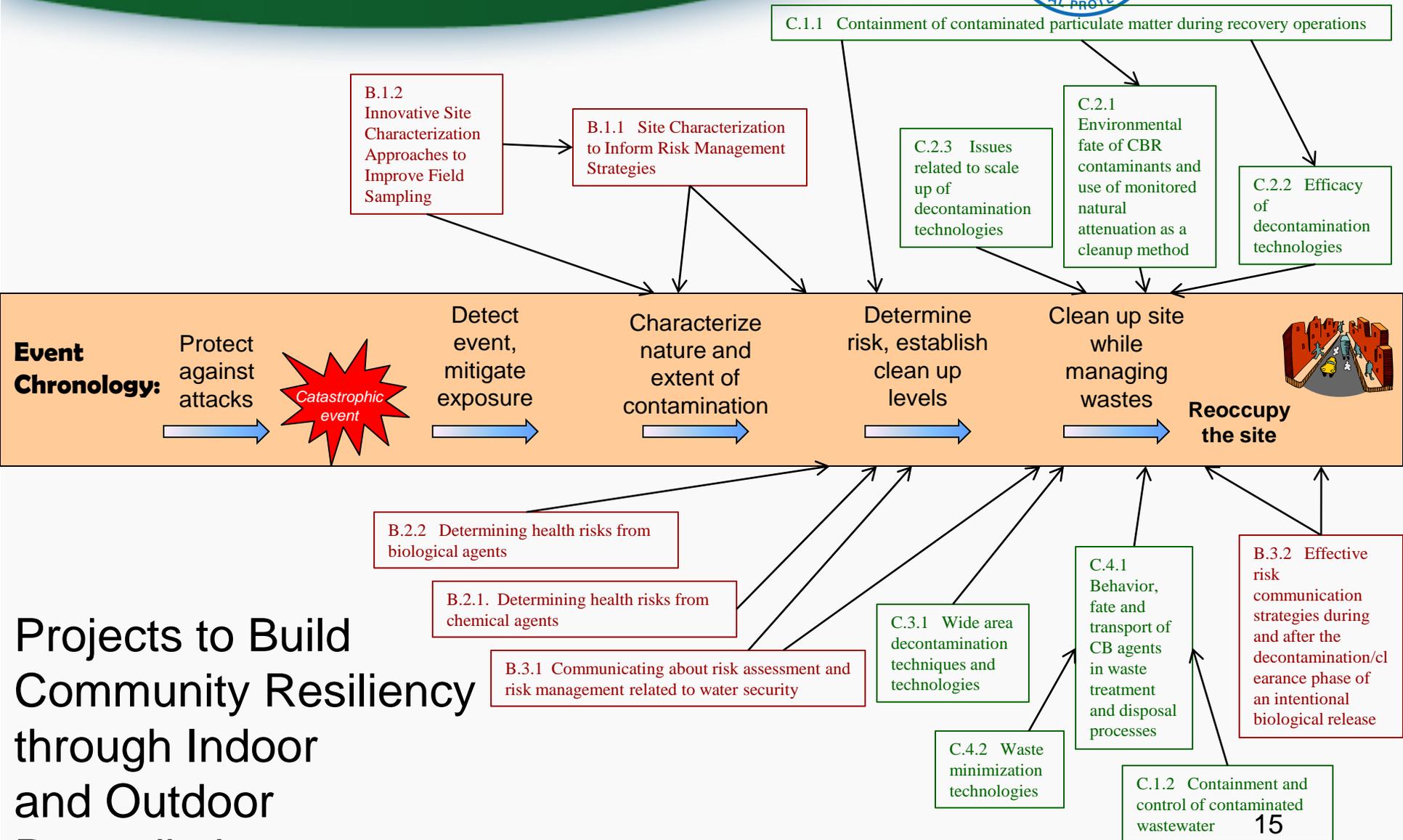
B.2.2 Determining health risks from biological agents

B.2.1. Determining health risks from chemical agents

B.3.1 Communicating about risk assessment and risk management related to water security

C.1.2 Containment and control of contaminated wastewater

B.3.2 Effective risk communication strategies during and after the decontamination/clearance phase of an intentional biological release



Projects to Build Community Resiliency through Indoor and Outdoor Remediation

B.3.2 Effective risk communication strategies during and after the decontamination/clearance phase of an intentional biological release

C.1.2 Containment and control of contaminated wastewater



HSRP's FY 2012

- **Approximately 80 new products are planned for delivery to customers in 2012**
 - Several are outputs: readily applied products that are distillations of a large body of work. These include software and other computer based tools, and technical briefs.
 - Reports and journal articles provide the scientific underpinnings for outputs



FY2012 Deliverable:

CANARY Quick Start Guide



- CANARY is a software package developed by EPA and Sandia National Lab
 - Rapidly detects anomalous water quality changes in distribution systems
 - Pilot tested in several cities
 - Available for free on EPA's website
 - EPA has trained more than 150 consultants, utilities, and researchers
- The CANARY Quick Start Guide helps new users to download, install, and get started
 - Supports national voluntary adoption of contamination warning systems
 - Assists private sector companies who provide direct support to water utilities





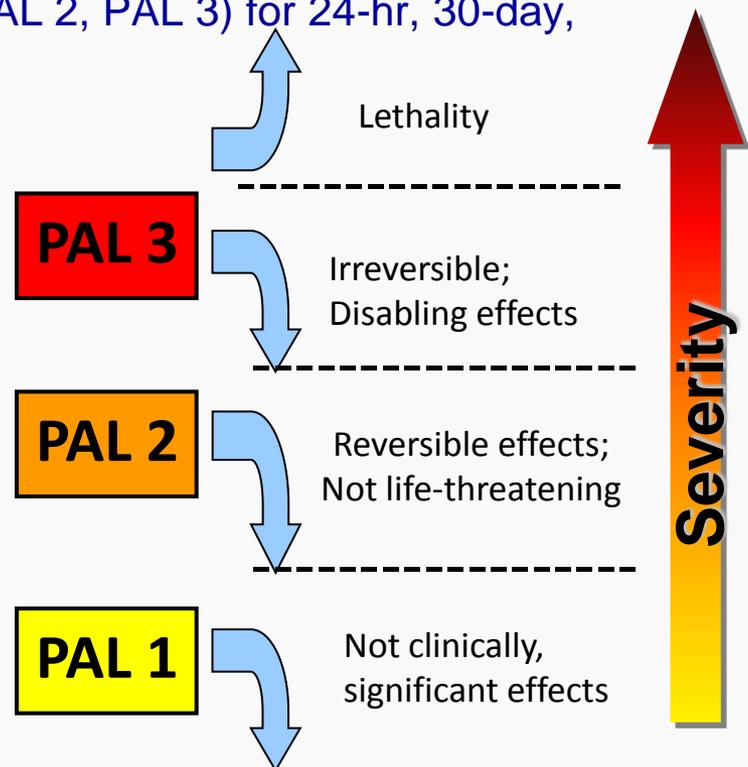
FY2012 Deliverable: *Provisional Advisory Levels (PALs)*

What

- Threshold exposure limits for general public for use in national emergency response programs and community planning
- Exposure levels for industrial chemicals and warfare agents in air and water
- Correspond to three severity levels (PALs 1, PAL 2, PAL 3) for 24-hr, 30-day, 90-day, and 2-year exposure durations

Application

- Short-term exposure levels to:
 - Help identify situations where short-term re-entry or water use is possible
 - Aid decision-makers during cleanup operations





2011 SAB/BOSC Recommendation and Best Practices

Recommendations:

Clarify the linkage between HS research topics and Sustainability

Align HSRP with other regional needs such as natural disasters

Best Practice:

NHSRC's internal coordination and ability to catalyze and complement environmental science programs outside EPA



HSRP Working Definitions

Sustainability is a goal and effort to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations (definition used in NRC Green Book, from NEPA, 1969).

All Hazards defined by the Office of Homeland Security, moves the Agency "towards preparedness that allows us to respond effectively to all types of incidents, whether natural, accidental, or deliberate in origin.



SUSTAINABILITY

- Plan seminar series to inform staff about sustainability principles and tools
- Consider revisions to mission/vision to incorporate sustainability/resiliency
- Incorporate criteria for planning or prioritizing research projects including sustainability and resiliency principles (systems-thinking, benefit-cost analysis, triple bottom line)
- Increase in-house expertise to conduct sustainability assessments, and to produce relevant synthesis outputs



The Homeland Security Challenge

- Disasters, natural or man-made, are inevitable
- Sustainability of our communities requires resiliency to disasters
- Resiliency is improved with EPA guidance, tools and support
- Research is conducted to fill scientific gaps in our ability to prepare for and recover from environmental disasters





HSRP Supports Sustainability

Contributes to a larger government-wide effort to build resilience to terrorist attacks, natural disasters, and other types of emergencies

- Resilience means that a community can absorb the effects of an attack , enact necessary changes, and yet retain essential functions, structure, and identity (Resilience Alliance)
- Resilience requires the capability to anticipate risk, limit impact, and bounce back rapidly in the face of turbulent change (Community and Regional Resilience Institute)
- Resilience is important at all levels (local, state, regional, national)



How Does HSRP Enhance Resiliency?

Limiting impacts – HSRP develops new mitigation strategies, including drinking water detection technologies, safe disposal strategies, and building material coatings that bind contaminants

Anticipating risk – HSRP develops data and methods to determine and communicate risks to human health and to infrastructure

Bouncing back rapidly – HSRP develops capacity and capability for sampling and analysis, and rapid decision support tools based on solid scientific data, including a decontamination selection tool, I-WASTE tool, message mapping tools, and water security response tools



HSRP and “All Hazards”

- Provides support to damaged communities that results in a resilient response and a return to normalcy.
- Accommodates more input from disaster recovery organizations to expand mission
- Demonstrate the multiple benefit features of the tools and information generated to date
- Lead a “New” National Emergency Reach Back Capability Team for all of ORD



BALANCING IMMEDIATE PROGRAM NEEDS AND EMERGING ISSUES

- Support extension of multiple benefits of applied research to other applications/competitions in ORD
- Encourage proposals/collaborations with other government entities (in line with HSRP StRAP)
- Engage with Labs/Centers in areas where staff have critical expertise that encourages ITR
- Build relationships across the other five NPDships to leverage knowledge and expertise both ways
- Make innovation the responsibility of every person in HSRP



Partner/Stakeholder Considerations

- Providing applied research and technical support to Partners/Stakeholders
- Striving to address research needs and fill critical scientific and technical data gaps
- Recognizing that the highest priorities of the Programs and Regions are those that are most immediate
- Finding ways to address emerging issues and develop new lines of research by challenging technical and administrative staff

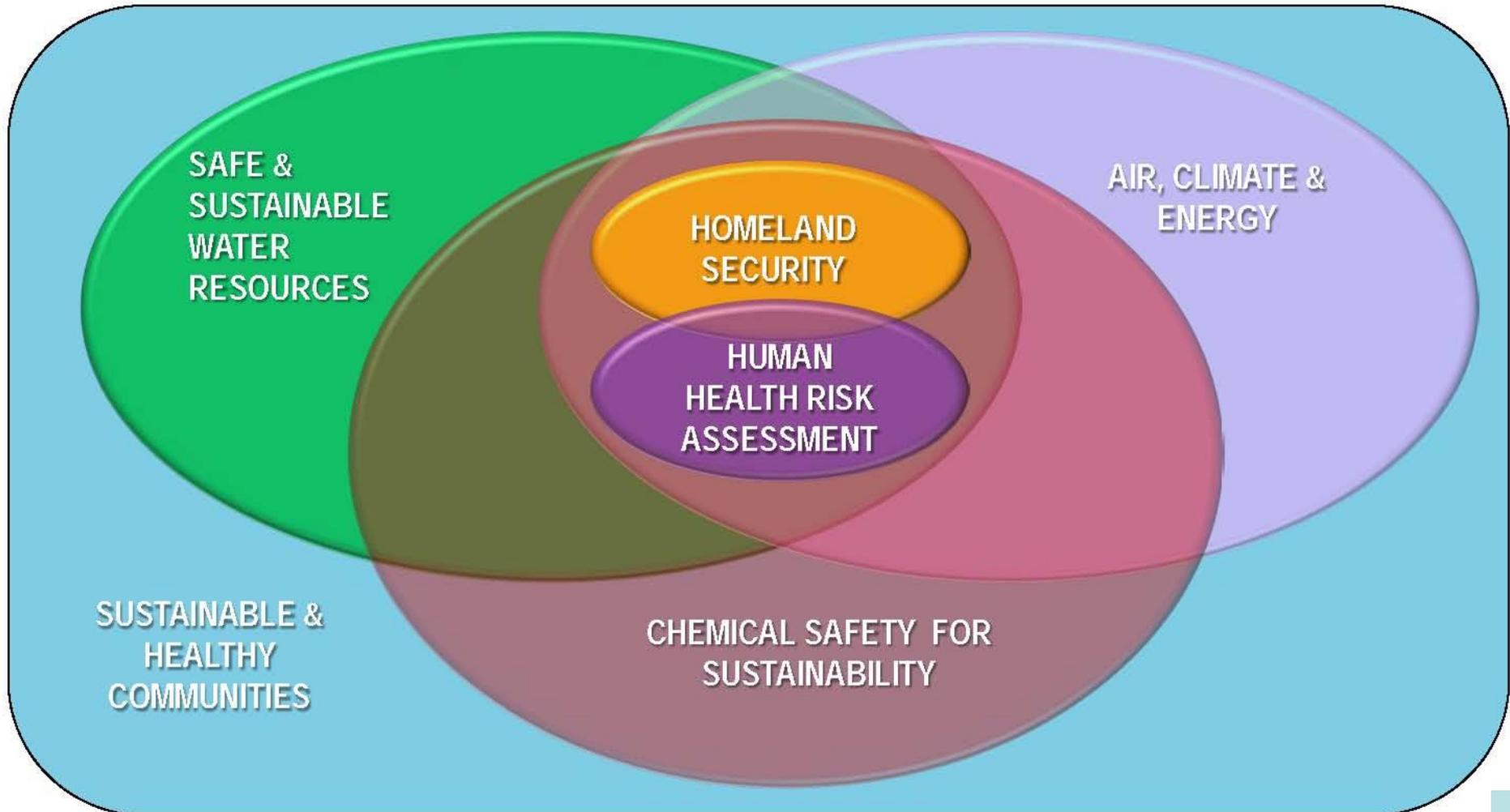


Innovation in HSRP

HSRP and NHSRC staff are always striving to be leaders in Innovation:

- InnoCentive prize-based research challenge was initiated for a more efficient method to recover anthrax spores from sponge/swab sampling sticks (\$30K prize)
- InnoCentive project on sensors and applications involves an NHSRC staffer on detail to the Chief Innovation Officer
- Water Technology Innovation Cluster (WTIC) project is being planned to transfer and commercialization the CANARY event detection software
- WTIC project is being planned for a field scale demonstration of real-time water infrastructure monitoring and data fusion
- NetZero project with the U. S. Army is being developed and discussed with Ft Riley partners today
- Always working with other federal Departments and Agencies in the HLS arena
- Looking for new ways to expand relationships and programs with other Labs/Centers in ORD
- Regional Applied Research Effort (RARE) project is being conducted with other Labs/Centers on bedbug decontamination practices

Integrated ORD Research Programs





HSRP Relationship to other National Programs

SSWR – Water systems and water infrastructure

SHC – Community resiliency, decontamination and disposal

HHRA – Microbial and chemical exposure, dose/response and risk assessment

CSS – Innovative methods for understanding chemicals and their characteristics

ACE – Energy—Water nexus and climate change

Across the Board – social and economic factors related to the triple bottom line, systems analysis, decision science



HSRP CHARGE QUESTIONS

FIRST YEAR PROGRESS/FUTURE ACTIVITIES

How have the realigned ORD research programs progressed from early design stage (Frameworks June 2011) to first year of implementation (July 2012)? Are the research activities planned for FY 2013 and future years appropriate for answering the science questions in the Strategic Research Action Plan?

SUSTAINABILITY

How are ORD programs incorporating aspects of sustainability into their research plans and activities?



HSRP Charge Questions (cont)

BALANCING IMMEDIATE PROGRAM NEEDS AND EMERGING ISSUES

As we consider science for the future, while budgets continue to shrink, how should ORD balance its commitments in the Strategic Research Action Plan with the need to advance science on emerging issues?



HSRP Charge Question (cont)

PROGRAM SPECIFIC QUESTIONS

HSRP has conducted research primary to support EPA's homeland security mission, i.e., response to acts of terrorism. In 2011, the SAB and BOSC stated that “the program should consider expanding research and capabilities in relation to natural disasters...”

What advice (e.g., strategic, tactical, structural) can the SAB give to guide the program toward this broader role?



HSRP Key Products for FY 2012

#		#	Title
1	CANARY Quick Start Guide	9	Provisional Advisory Levels (PALs) for 12 Chemical Contaminants
2	Update to Threat Ensemble Vulnerability Assessment- Sensor Placement Optimization Tool (TEVA-SPOT) Graphical User Interface Software and User Manual	10	Low dose Bacillus anthracis inhalation exposures in the rabbit
3	Chemical Contaminant Persistence and Decontamination in Drinking Water Pipes: Results using the EPA Standardized Persistence and Decontamination Experimental Design Protocol	11	Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Development and Evaluation of the Decontamination Procedural Steps
4	Decontamination of Drinking Water Infrastructure Scoping Report: A Literature Review and Summary	12	Enzymatic Decontamination of Chemical Warfare Agents
5	Need to Know: Anticipating the Public's Questions during a Water Emergency	13	Inactivation of Bacillus anthracis Spores in Soil Matrices with Chlorine Dioxide Gas
6	Further Optimization of Rapid Viability Polymerase Chain Reaction (RV-PCR) Protocols for <i>Bacillus anthracis</i> and Application to Vacuum Sock and Vacuum Filter Sample Types	14	Effectiveness of Physical and Chemical Cleaning and Disinfection Methods for Removing, Reducing or Inactivating Agricultural Biological Threat Agents
7	Recovery and Detection of Botulinum Toxin Type A from Drinking Water	15	Decontamination of Indoor and Outdoor Materials with Aqueous Chlorine Dioxide Solutions
8	Rapid Radiochemical Method for Phosphorous-32 in Water Samples for Environmental Remediation		