Technology and Tools for Disaster Decision-Making in Environmental Extremes

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Addressing Different Disaster Stages

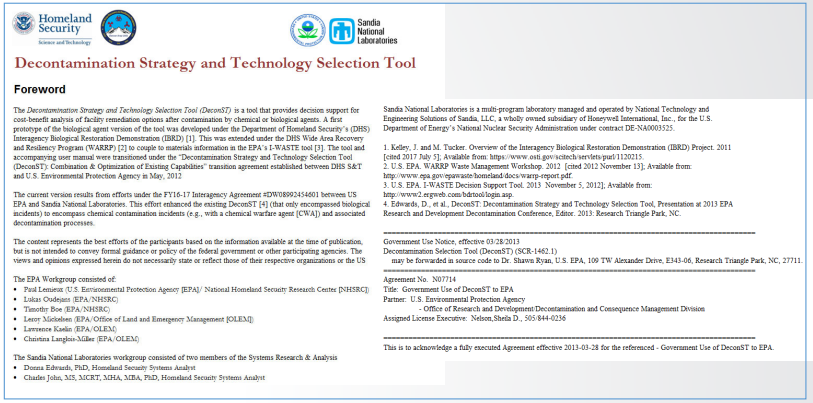
- Pre-Incident Preparedness
  - Need for resilient infrastructure
  - Exercises and other planning activities
  - Develop scenarios for exercises
  - Waste estimates for planning activities
  - Identify treatment/disposal facilities, waste staging areas, transportation routes
- During Disaster/Incident
  - Develop post incident waste management plans
  - Identify treatment/disposal facilities, waste staging areas, transportation routes following a disaster
  - Develop remediation strategies (decon vs disposal vs demolition)
- Recovery/Resilience
  - Identify recycling facilities

Waste Management & Resiliency Tools

- **DeconST:** provides information on tactical approaches to evaluate pros and cons of decon options for different building types (including efficacy, cost, waste)
- **I-WASTE:** provides information on types and volumes of waste materials and potential contaminants generated during an incident, location and contact information for potential treatment/disposal facilities
- **Waste Estimation Support Tool (WEST):** Estimates waste generated from remediation and cleanup activities from bio and rad incidents
- **Waste Storage and Staging Tool:** Identifies/prioritizes potential locations for staging and storing waste
- **Waste Logistics Tool:** Estimates optimal routes associated with transporting large volumes of waste
- **Disaster Debris Recovery Tool (DDRT):** Provides geolocated treatment, disposal, and recycling facilities
- **Waste Management Planning Tool (WMPT):** Generates a pre-incident waste management plan
- **Community Resilience Tool**: Self-assessment tool for communities to measure resilience & take action

DeconST – Decontamination Selection Tool

- MS Excel – based tool
- Chemical/Biological incidents
- Emphasizes tactics vs strategy
- Currently supports HD, VX, and *Ba*
- Compare decon technology efficacies
- Includes crude sampling strategy
- Multiple building types
- Allows material-based decisions
- Relative cost-basis comparison
- Accounts for waste generation and handling
- Prioritizes potential decon approaches; does not tell user what to do



Homeland Security

Sandia National Laboratories

Decontamination Strategy and Technology Selection Tool

Foreword

The *Decontamination Strategy and Technology Selection Tool (DeconST)* is a tool that provides decision support for cost-benefit analysis of facility remediation options after contamination by chemical or biological agents. A first prototype of the biological agent version of the tool was developed under the Department of Homeland Security's (DHS) Interagency Biological Restoration Demonstration (IBRD) [1]. This was extended under the DHS Wide Area Recovery and Resiliency Program (WARRP) [2] to couple to materials information in the EPA's I-WASTE tool [3]. The tool and accompanying user manual were transitioned under the "Decontamination Strategy and Technology Selection Tool (DeconST): Combination & Optimization of Existing Capabilities" transition agreement established between DHS S&T and U.S. Environmental Protection Agency in May, 2012

The current version results from efforts under the FY16-17 Interagency Agreement #DW08992454601 between US EPA and Sandia National Laboratories. This effort enhanced the existing DeconST [4] (that only encompassed biological incidents) to encompass chemical contamination incidents (e.g., with a chemical warfare agent (CWA)) and associated decontamination processes.

The content represents the best efforts of the participants based on the information available at the time of publication, but is not intended to convey formal guidance or policy of the federal government or other participating agencies. The views and opinions expressed herein do not necessarily state or reflect those of their respective organizations or the US

The EPA Workgroup consisted of:

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The Sandia National Laboratories workgroup consisted of two members of the Systems Research & Analysis

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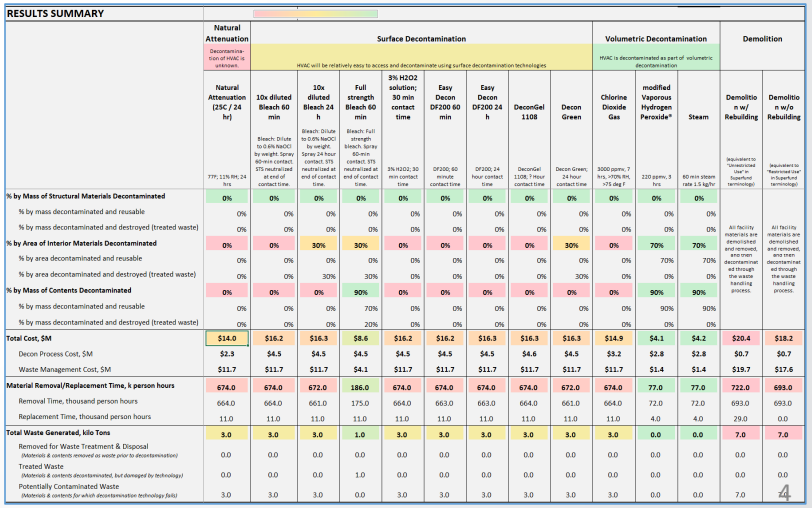
1. Kelley, J. and M. Tucker. Overview of the Interagency Biological Restoration Demonstration (IBRD) Project. 2011 [cited 2017 July 5]; Available from: https://www.osti.gov/scitech/servlets/purl/1120215.
2. U.S. EPA. WARRP Waste Management Workshop. 2012 [cited 2012 November 13]; Available from: http://www.epa.gov/sparwaste/homeland/docs/warrp-report.pdf.
3. U.S. EPA. I-WASTE Decision Support Tool, 2013 November 5, 2012]; Available from: http://www2.ergweb.com/bdtool/login.asp.
4. Edwards, D., et al., DeconST: Decontamination Strategy and Technology Selection Tool, Presentation at 2013 EPA Research and Development Decontamination Conference, Editor. 2013: Research Triangle Park, NC.

Government Use Notice, effective 03/28/2013
Decontamination Selection Tool (DeconST) (SCR-1462.1)
may be forwarded in source code to Dr. Shawn Ryan, U.S. EPA, 109 TW Alexander Drive, E343-06, Research Triangle Park, NC, 27711.

Agreement No. N07714
Title: Government Use of DeconST to EPA
Partner: U.S. Environmental Protection Agency
- Office of Research and Development/Decontamination and Consequence Management Division
Assigned License Executive: Nelson,Sheila D., 505/844-0236

This is to acknowledge a fully executed Agreement effective 2013-03-28 for the referenced - Government Use of DeconST to EPA.

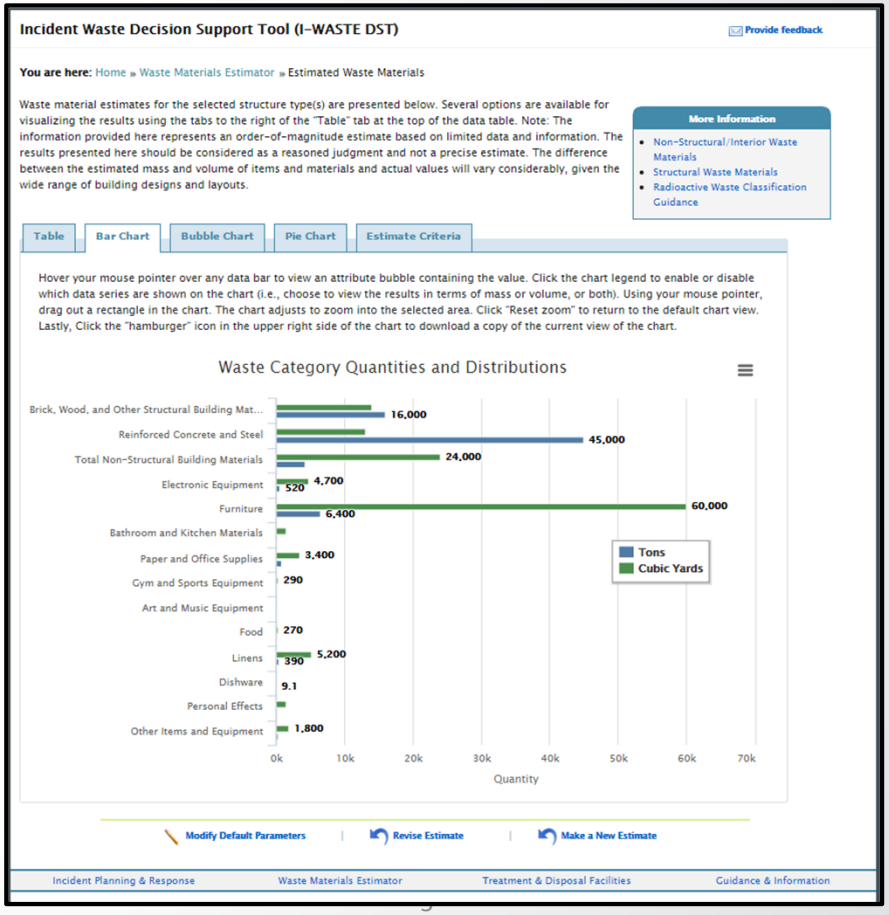


RESULTS SUMMARY

	Natural Attenuation	Surface Decontamination								Volumetric Decontamination			Demolition	
	Decontamination of HVAC is unknown.	HVAC will be relatively easy to access and decontaminate using surface decontamination technologies								HVAC is decontaminated as part of volumetric decontamination				
	Natural Attenuation (25C / 24 hr)	10x diluted Bleach 60 min	10x diluted Bleach 24 h	Full strength Bleach 60 min	3% H2O2 solution; 30 min contact time	Easy Decon DF200 60 min	Easy Decon DF200 24 h	DeconGel 1108	Decon Green	Chlorine Dioxide Gas	modified Vaporous Hydrogen Peroxide*	Steam	Demolition w/ Rebuilding	Demolition w/o Rebuilding
	77F, 11% RH, 24 hrs	Bleach: Dilute to 0.6% NaOCl by weight. Spray 60-min contact. STS neutralized at end of contact time.	Bleach: Dilute to 0.6% NaOCl by weight. Spray 24 hour contact. STS neutralized at end of contact time.	Bleach: Full strength bleach. Spray 60-min contact. STS neutralized at end of contact time.	3% H2O2; 30 min contact time	DF200; 60 minute contact time	DF200; 24 hour contact time	DeconGel 1108; 7 Hour contact time	Decon Green; 24 hour contact time	3000 ppmv; 7 hrs, >70% RH, >75 deg F	220 ppmv; 3 hrs	60 min steam rate 1.5 kg/hr	(equivalent to "Unrestricted Use" in Superfund terminology)	(equivalent to "Restricted Use" in Superfund terminology)
% by Mass of Structural Materials Decontaminated	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
% by mass decontaminated and reusable	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
% by mass decontaminated and destroyed (treated waste)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
% by Area of Interior Materials Decontaminated	0%	0%	30%	30%	0%	0%	0%	0%	30%	0%	70%	70%		
% by area decontaminated and reusable	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	70%		
% by area decontaminated and destroyed (treated waste)	0%	0%	30%	30%	0%	0%	0%	0%	30%	0%	0%	0%		
% by Mass of Contents Decontaminated	0%	0%	0%	90%	0%	0%	0%	0%	0%	0%	90%	90%		
% by mass decontaminated and reusable	0%	0%	0%	70%	0%	0%	0%	0%	0%	0%	90%	90%		
% by mass decontaminated and destroyed (treated waste)	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%		
Total Cost, $M	$14.0	$16.2	$16.3	$8.6	$16.2	$16.2	$16.3	$16.3	$16.3	$14.9	$4.1	$4.2	$20.4	$18.2
Decon Process Cost, $M	$2.3	$4.5	$4.5	$4.5	$4.5	$4.5	$4.5	$4.6	$4.5	$3.2	$2.8	$2.8	$0.7	$0.7
Waste Management Cost, $M	$11.7	$11.7	$11.7	$4.1	$11.7	$11.7	$11.7	$11.7	$11.7	$11.7	$1.4	$1.4	$19.7	$17.6
Material Removal/Replacement Time, k person hours	674.0	674.0	672.0	186.0	674.0	674.0	674.0	674.0	672.0	674.0	77.0	77.0	722.0	693.0
Removal Time, thousand person hours	664.0	664.0	661.0	175.0	664.0	663.0	663.0	664.0	661.0	664.0	72.0	72.0	693.0	693.0
Replacement Time, thousand person hours	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	4.0	4.0	29.0	0.0
Total Waste Generated, kilo Tons	3.0	3.0	3.0	1.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0	0.0	7.0	7.0
Removed for Waste Treatment & Disposal (Materials & contents removed as waste prior to decontamination)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treated Waste (Materials & contents decontaminated, but damaged by technology)	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potentially Contaminated Waste (Materials & contents for which decontamination technology fails)	3.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0	0.0	7.0	7.0

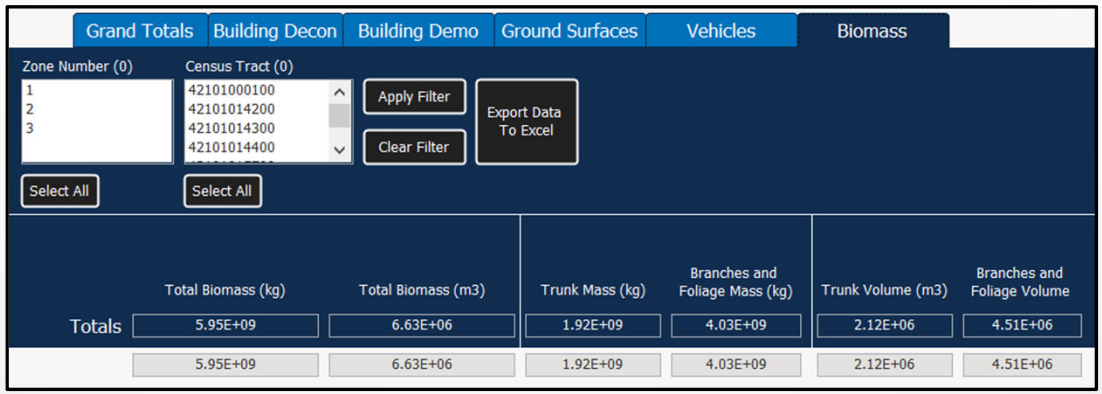
I-WASTE Overview – Current Features

- Web-based tool with restricted access
- Chemical/biological/radiological and All-Hazards incidents
- Series of inputs defining scenario
- Calculators to estimate mass & volume of disaster-generated waste and debris
- Databases of treatment/disposal facilities (location, technical information, permits, geolocation)
- Access to contaminant and decontaminant information
- Guidance for worker safety, packaging and storage, and transportation



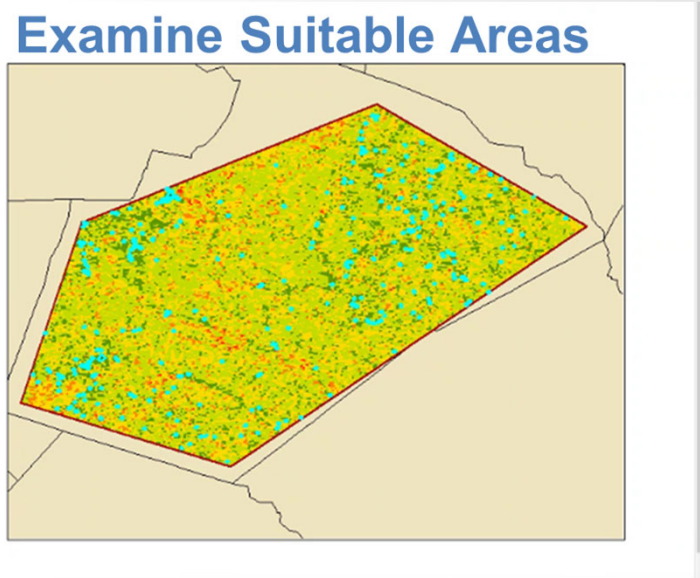
Waste Estimation Support Tool

- GIS-based tool that can assist in planning/preparedness activities at all levels of government
- Mainly for biological and radiological incidents, but can be used for All-Hazards
- First-order estimate of waste quantity and activity
- Identify potential triage/staging/storage/disposal options
- Assess impact of decontamination strategies on waste generation
- Identify starting points for policy discussions



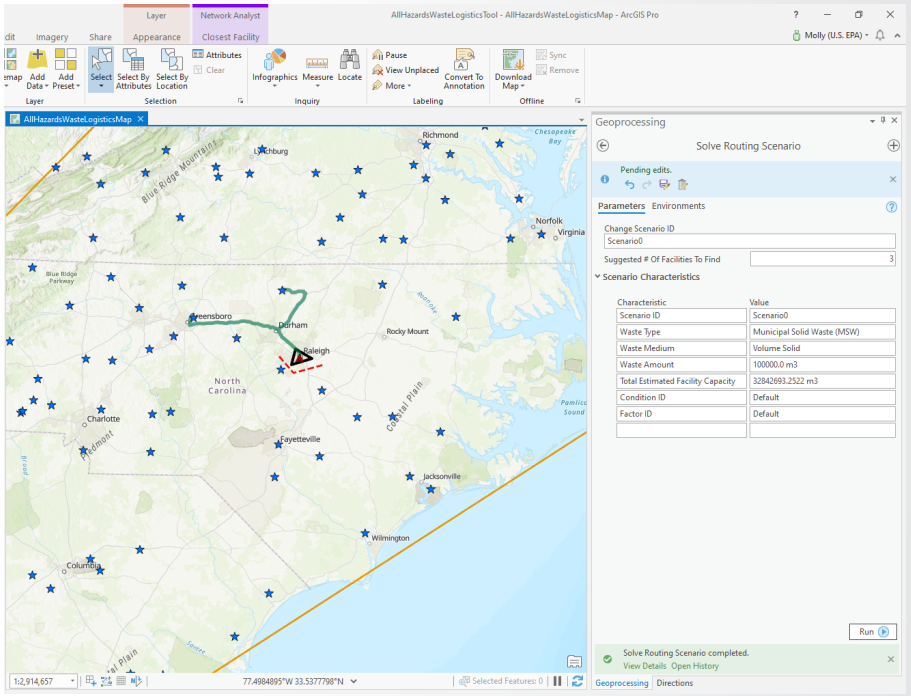
Waste Storage & Staging Tool

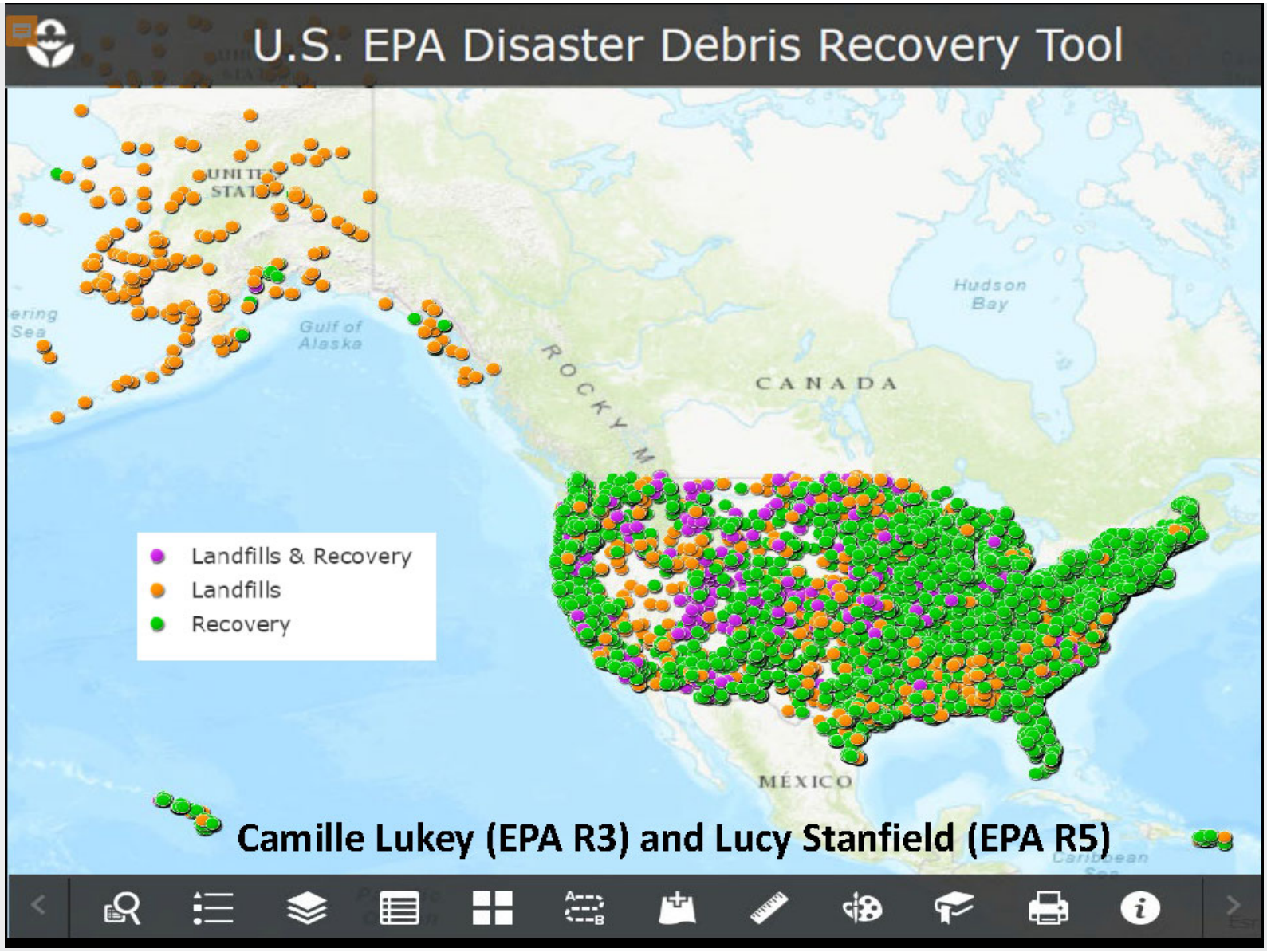
- GIS-based decision support tool for identifying and prioritizing potential waste staging and storage sites
- Chemical/biological/radiological incidents and All-Hazards
- Includes fate and transport considerations
- Conducts suitability analyses to determine implicating factors



Waste Logistics Tool

- ArcGIS-based tool to estimate resource demands and logistics associated with transporting large volumes of waste
- Chemical/biological/radiological incidents and All-Hazards
- Apply spatial information and analysis technologies to locate and prioritize potential waste staging, storage, and disposal sites
- Support systems-based decision making based on interdependency of response and recovery




U.S. EPA Disaster Debris Recovery Tool
Hudson Bay
Gulf of Alaska
CANADA
MÉXICO
Landfills & Recovery
Landfills
Recovery
Camille Lukey (EPA R3) and Lucy Stanfield (EPA R5)

All Hazards Waste Management Planning Tool

- **Purpose**: To assist users in generating a pre-incident waste management plan.
- **Audience**: State and local planners
- **Features**:
  - Walks a user through the various issues which should ideally be addressed in a pre-incident waste management plan. Provides sample language to assist user.
  - Prompts the user to choose an incident type (e.g., Chemical, Radiological, Animal disease, All Hazards) and a location/incident size (e.g., wide area, single building).
  - Provides the user with information on potential waste streams, estimated waste volumes, and potential facility types (e.g., incinerators, landfills), based on information entered by the user and data from I-WASTE
  - All information stored in tool, allowing for updating as new data is obtained
  - Allows for sharing of plans between users (with user permission only)
- **Status**:
  - Currently “quick start” version of the tool is available.
  - Full featured tool, integrated with other waste management tools is currently under development
- wasteplan.epa.gov

Community Resilience Tool

METRO-CERI

Problem: Current tools don't adequately address: socio-environ. connections, local knowledge and data, actionability, changing environmental conditions / extreme events AND CBRN

Product: Online self-assessment tool for communities to measure resilience & take action

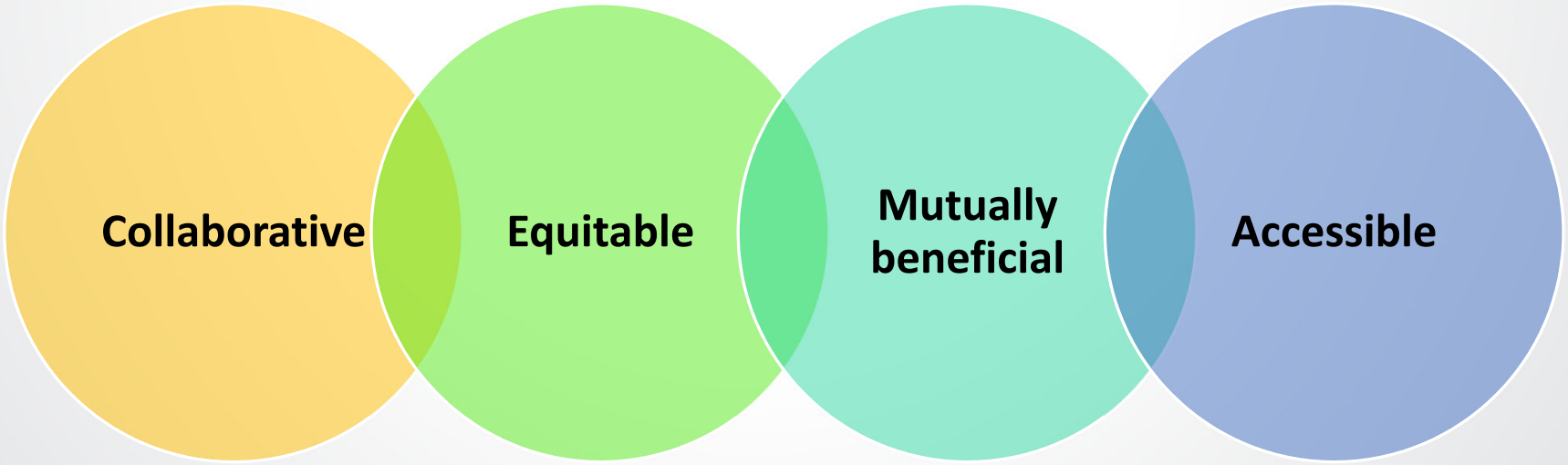
Intended End-users: Municipal offices planning resilience

Adapted from Maxwell 2018

Our Approach to Tool Development

- Human Centered Design
- Iterative interaction with case study communities
- Assessing the science of resilience indicators and social vulnerability

The guiding principles:



Case Studies

- **In-depth case studies**
  - Develop partnerships with communities to gain insights for tool design and development, e.g., participating in HCD process
  - Provide technical assistance as requested by community, e.g., resilience indicators, social vulnerability assessment, watershed planning
  - Possible locations: Collaboration with Urban Waters Partnerships, Baltimore, Phoenix, St. Louis, smaller Maryland communities
- **Application case studies**
  - After the tool is completed, work with communities for beta-testing
  - Provide limited training, support and guidance materials on using the tool
  - Possible locations: TBD

How And When To Use It

- To identify and prioritize areas to take action
- To facilitate dialogues about becoming more resilient
- To ensure voices are heard
  - Listen to different populations and community groups
  - Reach out to historically underrepresented
  - Engage multiple sectors
- To assess progress in resilience planning
- When you're data poor but information rich

Summary

- EPA has a collection of tools to help decision-makers plan for and respond to natural disasters or chem/bio/rad incidents
  - Estimation of waste quantities and characteristics
  - Locate and acquire contact info for treatment, disposal, and recycling facilities
  - Support identification of staging areas and transportation logistics
  - Develop waste management plans
  - Identify areas to build resilience
- The tools have been developed by several EPA Program Offices
- There is an ongoing effort to integrate the various tools to eliminate duplication and merge features of the tools

Contact Info

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