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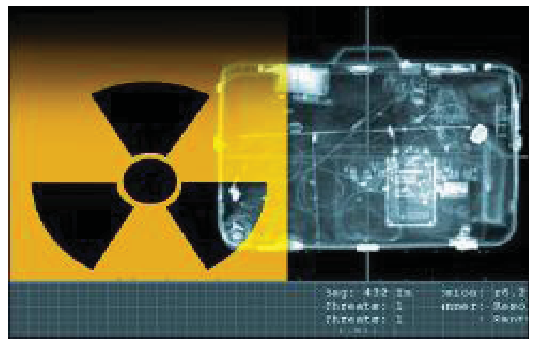
EPA www.epa.gov/nhsrc technical BRIEF

Evaluation of Five Technologies for the Mechanical Removal of Radiological Contamination from Concrete Surfaces

Background

Because of its potential for deployment as a terrorist weapon in an urban setting, the radiological dispersion devise (RDD), the "dirty bomb," is a very real and significant danger. The National Response Framework, the federal document that details how the nation responds to such threats, identifies the U.S. Environmental Protection Agency (EPA) as a lead federal agency for decontamination following a radiological incident. This response to a radiological incident could include decontamination of buildings, equipment, and outdoor areas.



Thus, to support its designated role, EPA's National Homeland Security Research Center evaluated the performance of five mechanical decontamination tools for their ability to remove the radioactive isotope Cs-137 (Cesium-137) from the surface of unpainted concrete. In addition, NHSRC evaluated these tools for various deployment-related characteristics.

The work, completed in 2010, is described in a series of reports. *These peer-reviewed reports provide rigorous evaluations of the efficacy of five commercially-available surface cleaning tools of the type that could be employed to decontaminate concrete surfaces following an RDD incident releasing Cs-137.* These reports can be accessed via the NHSRC website (www.epa.gov/nhsrc/). The reports provide information that emergency responders can use in recommending or selecting appropriate technologies for use during cleanup operations. This information can also be used to assist federal, state, and local emergency management authorities and emergency response planners to prepare for radiological homeland security events.

As part of U. S. EPA's Office of Research and Development, the National Homeland Security Research Center (NHSRC) provides products and expertise to improve our nation's ability to respond to environmental contamination caused by terrorist attacks on our nation's water infrastructure, buildings and outdoor areas.

NHSRC conducts research related to:

- Detecting and containing contamination from chemical, biological, and radiological agents
- Assessing and mitigating exposure to contamination
- Understanding the health effects of contamination
- Developing risk-based exposure advisories
- Decontaminating and disposing of contaminated materials.

Results

A summary of the decontamination efficacy results is presented in Table 1. Unpainted concrete coupons (standardized samples) were contaminated with Cs-137 and the amount of contamination (radiological activity) deposited on each coupon was measured. Each coupon was then treated with the decontamination technology under investigation and the amount of contamination was re-measured. The efficacy of the decontamination technology is expressed as percent of contamination removed (%R) and decontamination factor (DF). These efficacy measures are determined based on the following relationships:

$$\%R = (1 - Af/Ao) \times 100\%$$

$$DF = Ao/Af$$

%R = percent of contamination removed

DF = decontamination factor

Ao = radiological activity from the surface of the coupon before decontamination

Af = radiological activity from the surface of the coupon after decontamination

For each technology, the product name in Table 1 is hyperlinked to the corresponding report in the EPA's Science Inventory database. Deployment-related characteristics are presented in Table 2 grouped by type of technology (grinding vs. ablative).

Table 1. Decontamination Efficacy

Product	Technology Type	Decontamination Efficacy	
		%R	DF
Dust Director with Wire Brush	Grinding	38 ± 7	1.6 ± 0.2
Dust Director with Diamond Flap Wheel	Grinding	89 ± 8	14 ± 8.5
CS Unitec Sander	Grinding	54 ± 10	2.3 ± 0.07
River Technologies Rotating Water Jet	Ablative	36 ± 4	1.6 ± 0.09
Empire Abrasive Blast n'Vac	Ablative	96 ± 3	41 ± 21

%R, percent of contamination removed; DF, decontamination factor

Table 2. Deployment Characteristics

Parameter	Grinding Technologies	Ablative Technologies
Decontamination Rate	Approximately 1-3 m^2/hr	Approximately 5 m^2/hr
Applicability to irregular surfaces	Irregularities kept some grinding heads from making good contact with the surface; the more aggressive the grinding head the greater the final contact area	Very applicable as surface is receiving a pressurized blast of abrasive or water; ablative technologies are not dependent on the surface terrain
Skilled labor requirement	Brief training session adequate	Brief training session adequate
Utilities required	110V for both grinder and vacuum	High pressure air compressor, hot water pressure washer
Extent of portability	Very portable	Equipment requirements more significant, but hoses would likely allow access to most locations
Setup time	30 minutes	2 days to assemble equipment, but once together setup would be minimal

Table 2. Deployment Characteristics (con't)

Parameter	Grinding Technologies	Ablative Technologies
Secondary waste management	Very little waste as vacuum very effective in dust collection	Water spray during water blasting was difficult to contain and could cause contaminant re-aerosolization which would be a safety concern; grit blasting vacuum worked well
Surface damage	CSU Sander – minor visible surface damage DD Wire Brush – minor visible surface damage, discoloration of surface DD Diamond Flap Wheel – top 1-2 millimeters of coupon removed leaving exposed aggregate	RT Rotating Water Jet – no visible surface damage EA Blast n'Vac – 1-2 mm of coupon surface removed leaving exposed aggregate

Technology Evaluation Reports Referenced

Drake, J. 2011. *CS Unitec ETR180 Circular Sander for Radiological Decontamination.* Technology Evaluation Report. Washington, D.C.: U.S. Environmental Protection Agency. EPA/600/R-11/018.

Drake, J. 2011. *Empire Abrasive Blast N'Vac for Radiological Decontamination.* Technology Evaluation Report. Washington, D.C.: U.S. Environmental Protection Agency. EPA/600/R-11/014.

Drake, J. 2011. *Industrial Contractors Supplies, Inc. Surface Dust Guard with Diamond Wheel for Radiological Decontamination.* Technology Evaluation Report. Washington, D.C.: U.S. Environmental Protection Agency. EPA/600/R-11/013.

Drake, J. 2011. *Industrial Contractors Supplies, Inc. Surface Dust Guard with Wire Brush for Radiological Decontamination.* Technology Evaluation Report. Washington, D.C.: U.S. Environmental Protection Agency. EPA/600/R-11/016.

Drake, J. 2011. *River Technologies LLC 3-Way Decontamination System for Radiological Decontamination.* Technology Evaluation Report. Washington, D.C.: U.S. Environmental Protection Agency. EPA/600/R-11/015.

Contact Information

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