The TTEP Quarterly

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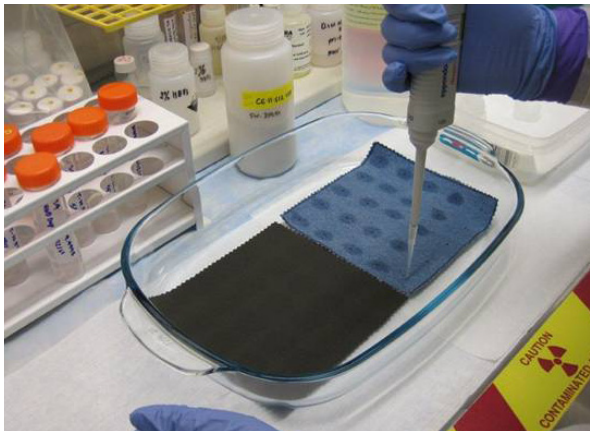
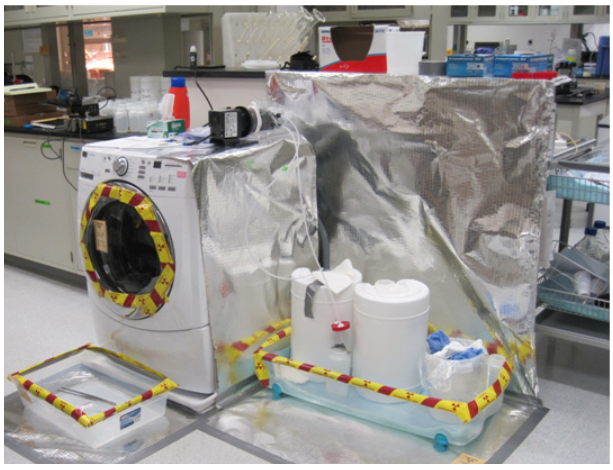
Assessment of RDD Contamination Removal from Laundering

EPA is responsible for environmental cleanup after the release of a radiological dispersal device (RDD), including recommendations on how the general public outside of the evacuation zone can reduce their exposure to this contamination. The current recommendation for handling clothing radioactively contaminated by an RDD is to remove the clothing and bag it. It is unknown how effective washing with water is for removing RDD contamination from clothing items and perhaps, more importantly, the impacts of the general public knowingly or unknowingly washing contaminated clothing are not characterized. NHSRC is investigating the efficacy of machine washing for removing RDD contamination - specifically cesium 137 (Cs-137) and determining the fate of Cs-137 contamination after washing. The results of this work could also potentially inform self-help recommendations for the general public after a nuclear power plant accident.

In this work, polyester and cotton material is contaminated with a known amount of Cs-137 (see accompanying photo), then washed in a standard front load, low volume, home-use washing machine using a common liquid detergent (see accompanying photo). Various wash temperatures are being investigated. The amount of Cs-137 on the material before and after laundering is measured to determine removal efficiency. As well, the amount of Cs-137 that exits the washer in the wastewater and remains on the washing machine is being measured. Preliminary results suggest that washing is effective for removing RDD contamination – with most of the contamination displaced from the material to the wastewater. Washing appears slightly more effective for polyester than for cotton. Some additional parameters are still to be evaluated with complete results on this work expected to be available in early 2012. For more information, contact Dr. Emily Snyder, EPA, at 919-541-1006 or snyder.emily@epa.gov.



Contaminating polyester and cotton swatches with Cs-137.



Washing machine used for laundering experiments.

Welcome to TTEP

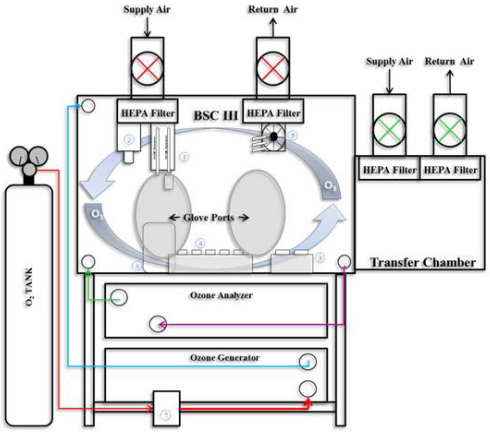
The U.S. Environmental Protection Agency (EPA) is actively participating in the national homeland security effort by ensuring the protection of the nation's drinking water systems and is focused on improving the nation's ability to respond to terrorist attacks affecting indoor and outdoor environments. The National Homeland Security Research Center (NHSRC) under EPA's Office of Research and Development has established the TTEP to assist this effort. TTEP is conducting unbiased third-party performance evaluations of commercially available homeland security technologies, incorporating stakeholder guidance and a high degree of quality assurance oversight. Completed TTEP documents may be found at www.epa.gov/nhsrc/ttep.html. Questions about TTEP should be directed to Mr. Eric Koglin (koglin.eric@epa.gov or 702-798-2332).

Decontamination of Materials with Ozone Gas in the Presence of Vaporous Organic Compounds

In previous NHSRC testing, ozone (O_3) was used as a fumigant for inactivation of spores of *Bacillus anthracis* and other organisms. However, some unsaturated organic compounds are known to react rapidly with O_3 to produce highly reactive species (e.g., hydroxyl radicals, OH•) and stable products (e.g., formaldehyde) which may be effective sporicides. Consequently, it was hypothesized that mixtures of O_3 and reactive organic compounds may be more effective sporicides than O_3 by itself. NHSRC has investigated the effectiveness of O_3 combined with a reactive gas phase organic compound for inactivating spores of *B. anthracis* and the surrogate organism *Bacillus subtilis*.

Test coupons of glass, bare pine wood, and galvanized metal ductwork were inoculated with spores of *B. anthracis* or *B. subtilis* and then decontaminated by exposure to O_3, or to a mixture of O_3 and one of two reactive organic compounds:

- 2,3-dimethyl-2-butene (also known as tetramethylethylene [TME])
- 1-hexene



In all tests an O_3 concentration of 9,000 parts per million by volume (ppmv) was maintained over a 4-hour contact time in a laboratory test chamber, at room temperature (~25 °C) and a pre-selected controlled relative humidity (RH) of 70% to 80%.

Preliminary results indicate that the efficacy of 9,000 ppm of O_3 for inactivating *B. anthracis* and *B. subtilis* spores over 4 hours was not clearly increased by the addition of TME or 1-hexene. A possible exception for *B. anthracis* is the addition of 1,000 ppmv 1-hexene to the O_3 at 80% RH, which produced efficacy values exceeding 4 log reduction. Those efficacy values may result from both the impact of 1-hexene reaction products and the reported effect of RH on O_3 decontamination efficacy for *B. anthracis*. However, elevated humidity with O_3 in the absence of an added organic compound did not increase efficacy for *B. anthracis*. A final report on this work is in preparation and should be available late 2011. For more information, contact Dr. Sang Don Lee (919-541-4531) or lee.sangdon@epa.gov.

Evaluation of Surface Decontamination Foam for Removal of Radiological Contamination

The National Response Framework, Nuclear/ Radiological Annex, published in June of 2008, designates EPA as the coordinating agency for long term recovery following terrorist incidents involving radioactive materials. Consistent with EPA's legislated mission, this directive gives the EPA the governmental responsibility for environmental response following releases of radiological materials which impact non-coastal private property.

To meet the expected technology needs associated with acts of radiological terrorism, NHSRC is conducting evaluations of various decontamination technologies. Currently, NHSRC is evaluating the original formulation of Surface Decontamination Foam (SDF)™, a product that may be used for radiological decontamination as well as a modified formulation of Surface Decontamination Foam (MSDF) to enhance effectiveness for radiological decontamination. SDF was originally developed by Defense Research and Development Canada and is sold by Allen Vanguard, Inc. (Ogdensburg, NY). The effectiveness of both SDF formulations is being evaluated for removing radiological contamination from surfaces and compared with decontamination using water only.

This technology evaluation involves:

- Use of two representative building materials - concrete and anodized aluminum (see accompanying photo).
- Deposition of cesium 137 (Cs-137) to test coupons in the form of CsC1;
- Measurement of Cs-137 contamination present on coupons following deposition;
- Application of the SDF decontamination technologies (or water as a control);
- Removal by vacuum and water rinsing;
- Subsequent measurement of residual Cs-137 contamination to determine the decontamination efficacy attained by each SDF technology and water.

To test these technologies in a manner that simulates their use in a real-world setting, a stainless steel test stand is used to hold coupons in a vertical orientation (see accompanying photo). The stand was situated within a tent in a radiological buffer area during these tests. SDF and MSDF were applied using a backpack-sized foamer equipped with a spray gun that projects foam up to 3 to 4 meters away from the target.

Environment Canada is providing technical and financial support for this evaluation. Results are expected to be available by February 2012. John Drake, EPA, can be contacted for additional information at 513-569-7164 or drake.john@epa.gov.

Representative concrete coupon.

Testing staff apply SDF to concrete coupons in test stand

EPA through its Office of Research and Development funded and managed the research described herein under Contract EP-C-10-001 to Battelle. It has been reviewed by the Agency but does not necessarily reflect the Agency's views. No official endorsement should be inferred. EPA does not endorse the purchase or sale of any commercial products or services.