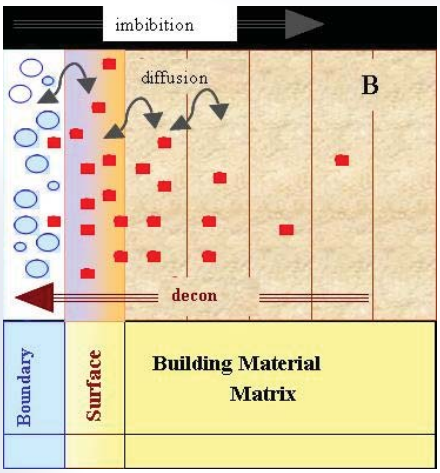
Advanced Building Decontamination Technology

A threat exists that a terrorist group may detonate a radioactivity dispersal device (RDD) generating a cloud of radioactive particles that could contaminate public and private buildings and render them useless for a long time. This is particularly a problem for the military because there are some buildings that must be occupied to carry out mission requirements. In addition, the demolition process turns what started as grams or kilograms of radioactive material into millions of tons of contaminated waste, which would vastly overwhelm the capacity of the radioactive material disposal sites currently in use. The Defense Advanced Research Project Agency (DARPA) in conjunction with the Department of Homeland Security (DHS) sponsored a program to develop decontamination techniques that can decontaminate to below 1 mSv/year at 1 meter distance.



The threat radionuclides are generally metals and many of these metals are highly reactive. Therefore, the radioactive particles have an affinity for the surface of building materials that is higher than that for water. In that case, water is ineffective for decontamination because any radionuclides that are dislodged do not remain suspended in the water but return to bind on the surface of the building materials. A decontamination approach that "shifts the affinity" of the radionuclide from being biased towards the building surface to being biased towards the decontamination solution is needed. The decontamination process must not allow further contamination of the soil or ground water, must be safe for first responder use, and must not remove or deface building surfaces (as typical scabbling processes do).

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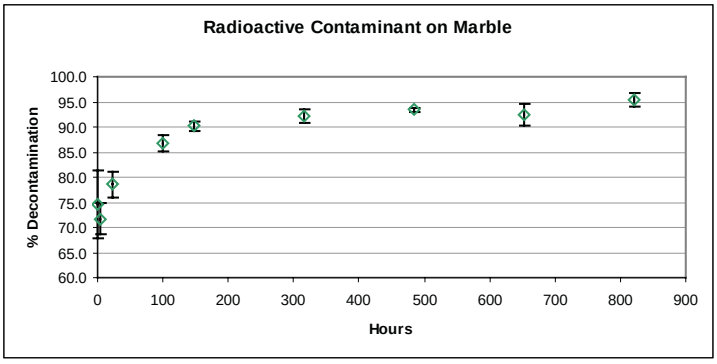
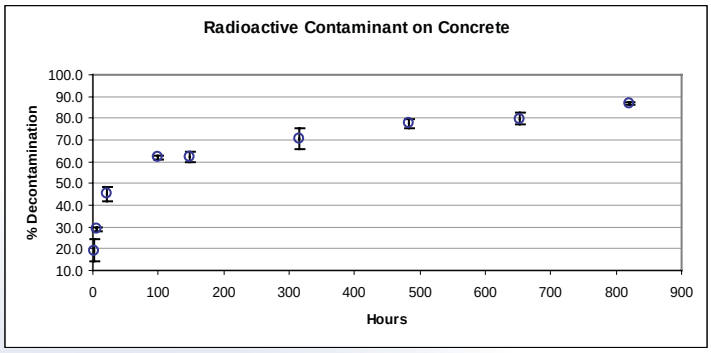
The INL was funded by DARPA/DHS to develop a method of capture and removal of RDD residue. The approach for this project was to develop an advanced chemistry (an affinity shifting chemistry) that was applied in a foam chemical system to capture and remove the radiological contaminants. The long-lasting decontamination foam is sprayed onto concrete, granite, marble or other building surfaces and will remain on the surface for several hours without breaking down. The foam captures the radioactive isotopes from the surface layers of the building materials, after which the foam is vacuumed off and safety disposed.



Graph 1: On marble, up to 88% of the contamination was removed by the foam and within six weeks after paste application approximately 97% of the radioactive contaminant was removed.



Graph 2: On concrete, the foam removed about 30% of the radioactive contaminant and within six weeks after paste application approximately 89% removal was obtained.

In early testing, it was determined that the radioactive contaminates were rapidly distributed several centimeters into the various porous building surfaces. The INL's decontamination foam removed the contaminants on the surface without damaging the surface; however, the contaminants that had migrated into the building surfaces were not removed. The INL then developed a deep surface decontamination process to be used after the foam to remove radioactive contamination from deeper layers of the building surface. This consists of an advanced clay paste that is applied and left on the surface for an extended period (days to weeks) to allow the contaminants to diffuse to the surface and be captured by the paste.

After the combination treatment of foam/clay paste, the radioactive contaminants are removed without harm to the building surfaces. The success of radionuclide removal on several building surfaces is shown in Graphs 1 and 2.

Additional optimization of the decontamination system is expected to be completed by May 2007. Patents have been filed (BA-059, BA-028) on these technologies.

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