Nanoparticles, super-absorbent gel clean radioactivity from porous structures

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Porous structures, such as brick and concrete, are notoriously hard to clean when contaminated with certain types of radioactive materials. Now, thanks to researchers in Argonne 's Chemical Engineering Division, a new technique is being developed that can effectively decontaminate these structures in the event of exposure to radioactive elements.

Researchers are using engineered nanoparticles and a super-absorbent gel to design a clean-up system for buildings and monuments exposed to

radioactive materials. Having this system available will allow the nation to be more prepared in case of a terrorist attack with a "dirty bomb" or other radioactive dispersal device.

“If a radioactive device were activated in public, the primary concern would be widespread contamination,” said Michael Kaminski, lead scientist of the project. “This contamination is particularly hard to remove in buildings made from brick or concrete, where the pores, or holes, in those materials make it easy for radioactive materials to become trapped.”

Enter Kaminski and his team of Argonne scientists, whose decontamination system could safely capture and dispose of radioactive elements in porous structures in an outdoor environment. Using a simple, three-step procedure, the system operates much like an automated car wash, where remote spray washers apply a wetting agent and a super-absorbent gel onto the contaminated surface. The wetting agent causes the bound radioactivity to resuspend in the pores. The super-absorbent polymer gel then draws the radioactivity out of the pores, and fixes it in the engineered nanoparticles that sit in the gel. Finally, the gel is vacuumed and recycled, leaving only a small amount of radioactive waste.

“The polymer gel we use to absorb the radioactivity is similar to the absorbent material that's found in disposable diapers,” Kaminski explained. “When exposed to a wetting agent, the polymers start to cross-link, forming something like a structural scaffold that allows the gel to absorb an incredible amount of liquid.”

The Argonne technique would overcome many of the shortcomings of current radioactive decontamination operations.

“Right now, it is common practice to demolish the contaminated

materials in hopes of getting rid of the radioactivity. Our technique would allow surfaces to be preserved, which means that we wouldn't have to deface monuments or buildings just to remove the radiation," said Kaminski.

The group has 18 months to complete development of the decontamination method. The project will culminate in a prototype demonstration of the technology using real contaminated concrete samples. This work is being done as part of an interagency Technical Support Working Group project selected from more than 3,000 submitted in May 2003 and funded by the Department of Homeland Security.

Kaminski's group is also developing other technologies for biomedical and military applications, using magnetic nanoparticles. Experience in that work, funded by the U.S. Department of Energy, led to the super-absorbent gel project and other work for defense and homeland security applications.

"Within our group, we are combining our experience from the past several years in areas of nuclear power plant decontamination, engineered nanoparticles and polymer gels to develop this new decontamination technology," Kaminski says. "It has provided a potential solution to one of the key challenges in counter-terrorism."

Source: Argonne National Laboratory