New glass could store unused plutonium

Since the demise of the Soviet Union, the nuclear nations have been dismantling weapons. So far, however, they haven't solved the problem of long-term storage of the highly radioactive materials, particularly plutonium, in these weapons.

The most toxic element known to man, weapons-grade plutonium can remain hazardous for thousands of years. John K. Bates, a chemist at Argonne (Ill.) National Laboratory, and his colleagues are engineering an alkali-tin-silicate glass that does not deteriorate, as normal glass does, when plutonium is dissolved into it.

Speaking at a meeting of the Materials Research Society in Boston this week, Bates said the new glass composition can hold 7 percent of its weight in dissolved plutonium.

In formulating this new glass, chemists have taken into account information gathered from studies of degradation of natural and commercial glasses. When buried, commercial glass reacts with water and soil, slowly eroding into clay and zeolites, Bates says.

"Because we have good test methods to accelerate glass' reactions over a wide range of conditions, we can predict which compositions will perform best for long-term storage," Bates says.

The new alkali-tin-silicate glass melts at a relatively low temperature and then can be mixed with melted metals, such as those of plutonium-bearing warheads. In the current recipe, a dash of sodium, for instance, helps dissolve the plutonium, low concentrations of silicon and aluminum inhibit clay formation, tin and zirconium stabilize the glass, and gadolinium absorbs neutrons emitted by the plutonium, guarding against uncontrolled nuclear reactions.

Tests exposing the glass to hot, caustic vapors simulate thousands of years of natural degradation. Based on early results, Bates' team says the glass does not produce clay and retains plutonium, uranium, and neutron absorbers.

"They've gone about this process the right way," says Virginia M. Oversby, a chemist at the Lawrence Livermore (Calif.) National Laboratory. "They didn't just take an existing material and force it to perform in a way for which it wasn't designed. On the other hand, because this glass hasn't been around a long time, it's harder to predict its long-term performance."

Is this glass the optimal storage material? "We don't know yet," Bates says. "We need to do more testing." He adds that other glass recipes may prove superior, as may other types of ceramics or synthetic rock. — *R. Lipkin*

Mutation location may predict cancer type

Some mutations stop genes cold, preventing them from producing proteins; others force genes to create abbreviated or misshapen molecules that function incorrectly. Consequently, different mutations in the same gene can lead to radically disparate outcomes.

Researchers now have evidence that the site of mutations in the *BRCA1* gene, which are responsible for most familial cases of ovarian and breast cancer, may partially determine whether an individual will suffer a particular type of cancer. A new statistical analysis of 32 British families with *BRCA1* mutations suggests that when the genetic flaw occurs in one portion of the gene, family members face a lower chance of developing ovarian cancer than when it occurs elsewhere.

If confirmed, the finding may illuminate the roles of *BRCA1*'s protein in breast and ovarian cells and enable physicians to inform patients more accurately of their cancer risks.

"It would be of great clinical importance if this result could be supported by a lot more data," says Simon A. Gayther of the Cancer Research Campaign in Cambridge, England. Gayther and his colleagues discuss their work in the December NATURE GENETICS.

Cloned about a year ago, *BRCA1* has quickly become one of the most thoroughly studied genes of all time. In February, for example, a large group of researchers reported on an extensive survey of *BRCA1* mutations in women with breast or ovarian cancer (SN: 2/25/95, p.119). Though the result was not statistically significant, says Gayther, the survey "hinted" that the site of *BRCA1*'s mutation might make a difference in cancer type.

In their study, Gayther and his coworkers found 22 different mutations in *BRCA1*, including 14 not previously identified. When the investigators considered the mutations' locations in relation to the cancers affecting each family, they found a statistically significant correlation. Mutations in the final third of the gene appeared less likely to create ovarian cancer than were mutations in other areas of *BRCA1*. The mutation's site did not seem to change breast cancer risk.

The variation in outcomes of *BRCA1* mutations may reflect the different duties the gene's protein performs in breast and ovarian cells, the researchers suggest. The importance of a mutation's position within the gene isn't unprecedented in cancer research, notes Gayther. The aggressiveness of colon cancer depends on where the *APC* gene is mutated, he says.

Gayther and other breast cancer researchers caution that further studies in more diverse populations must be done to solidify the *BRCA1* finding. Perhaps, says Gayther, the mutation's position may become important only in the context of a particular lifestyle or a particular genetic background.

In fact, Steven Narod of the University of Toronto says that his unpublished research and that of others do not support the idea that the site of *BRCA1*'s mutation significantly changes the risk of either cancer. "I don't think the differences are very strong," asserts Narod. "I don't expect it will change the way we practice medicine." — *J. Travis*

When not to photocopy

On Oct. 28, 1994, a U.S. appellate court ruling—twice amended, most recently this July—found that researchers at Texaco photocopied too much from the scientific journals routed around the office. The court argued that routinely archiving photocopied papers instead of the journals themselves violates a fair use provision of copyright law. The practice makes it unnecessary to buy subscriptions for many employees who rely on the journals.

The court concluded that corporations must restrict their photocopying or buy into licensing arrangements with journals. Though some analysts have interpreted this ruling as exempting universities and nonprofit institutions from the need to curb photocopying, the National Conference of Lawyers and Scientists (NCLS) argues otherwise in the Dec. 1 SCIENCE.

In fact, anyone who photocopies extensively from a journal "may be in hot water" and open to costly litigation, argues Barbara Miskin, an attorney with Hogan and Hartson in Washington, D.C., and a cochair of NCLS. Even photocopying articles from a journal to which one subscribes and distributing them for educational purposes may violate the fair use clause.

"Initially," she says, "distinctions were drawn between corporate and nonprofit entities, with the notion that nonprofits worked purely to advance scientific knowledge," not personal gain. "But that's not true anymore," she observes. "Even in government and academia, individuals can have patents and royalty interests if they develop a commercially useful product."

NCLS is planning workshops to explore how the ruling's unresolved issues may affect authors and the dissemination of research. — *J. Raloff*