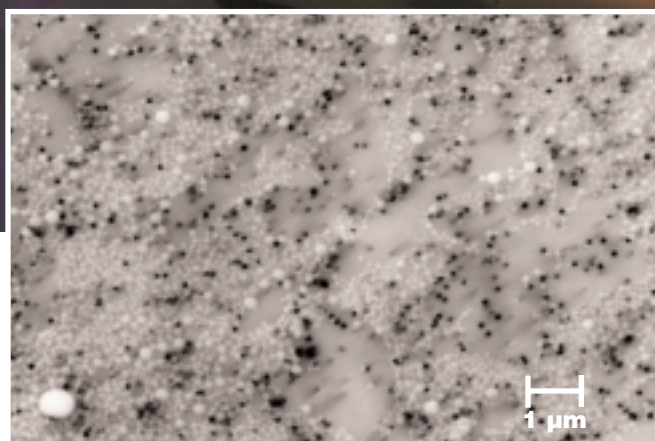


# Chemistry & Chemical Engineering

D015055-0052



SwRI engineers are developing bone-targeting polymer nanoparticles approximately 100 nanometers in size to treat bone cancer and other bone diseases. The nanoparticles (inset) are formulated with fluorescent quantum dots, or semiconducting nanoparticles, to assay uptake of the nanoparticles into bone.



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With advanced facilities and multidisciplinary expertise, Southwest Research Institute creates chemistry and chemical engineering solutions for government and industry problems. Innovations include advanced drug delivery technologies, nanotechnology applications to protect first responders and soldiers, and alternative energy sources.

Our engineers and scientists are studying [bone-targeting nanoparticles](#) to treat myeloma and other metastatic bone cancers for a Department of Defense Congressionally Directed Medical Research Program ([microencapsulation.swri.org](#)). Previous internal research played a significant role in this program and stimulated commercial efforts that explored bone-targeting technologies in the

treatment of osteoporosis. In another pharmaceutical program, SwRI is leading the [process development and manufacture](#) of a new nerve agent antidote, funded by the Department of Defense.

Heightened security concerns have created new technology demands and more performance-based design and analysis. In response, SwRI has developed sophisticated [fire evaluations](#) and increased the use of computer fire modeling as a cost-effective alternative to expensive, large-scale fire experiments ([firetechnology.swri.org](#)). In addition, for the Joint Services Sensitive Equipment Decontamination System Program, we

validated a system that [decontaminates electronic equipment](#) exposed to chemical or biological agents using our chemical surety laboratory and a team member's biosafety level IV facility.

In cooperation with research groups in Texas, New York, Georgia and the U.S. Army Research Laboratories, SwRI is incorporating nano-microtechnology into [intelligent clothing](#) to protect soldiers and first-responders facing chemical, biological or fire threats. Our staff continues supporting U.S. Army Chemical Agent Stockpile destruction programs by

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Coupons representing construction materials are contaminated with chemical warfare agents to validate the effectiveness of new decontamination technologies. A decontamination system aimed at recovering sensitive electronic equipment required contamination, decontamination and determination of surface residuals for the chemical warfare agents HD, GD, VX, and thickened GD and VX.

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Special clean room facilities allow SwRI to analyze samples at ultra-trace levels. An SwRI scientist (background) analyzes seawaters for metals using an inductively coupled plasma mass spectrometer, while a staff member (foreground) analyzes solid samples for surface corrosion contaminants using laser ablation inductively coupled plasma mass spectrometry.

monitoring air, providing analytical services, developing monitoring and analytical methods to reduce false alarms and verifying waste materials are agent free.

SwRI is evaluating new **fire-resistant composite decks and bulkheads** for the next generation of military and commercial seagoing vessels and offshore floating platforms; we also established a fire certification program for shipboard bedding. For another program, we are evaluating failure mechanisms for compressed hydrogen cylinders and the fire performance of other alternative fuel systems.

To help the Department of Energy understand the environmental risks posed by decommissioned facilities, we set up a standardized plant nursery to compare the germination and growth rates of several different plant species in both contaminated and clean soils. We also analyzed soils, water, plants and lower mammals for several organic and inorganic compounds to understand the **distribution and persistence of pollutants**.

In collaboration with the North Carolina A&T Center for Nanoscience and Nanotechnology, SwRI scientists are developing **antifouling coatings** for ship hulls to inhibit the accumulation of biofilms ([materialschemistry.swri.org](http://materialschemistry.swri.org)). We

are using environmentally friendly materials for naval applications, including low flammability composites for below-deck structural components and silver nanoparticle plasmon-enhanced fluorescence sensors for early detection of aluminum surface corrosion.

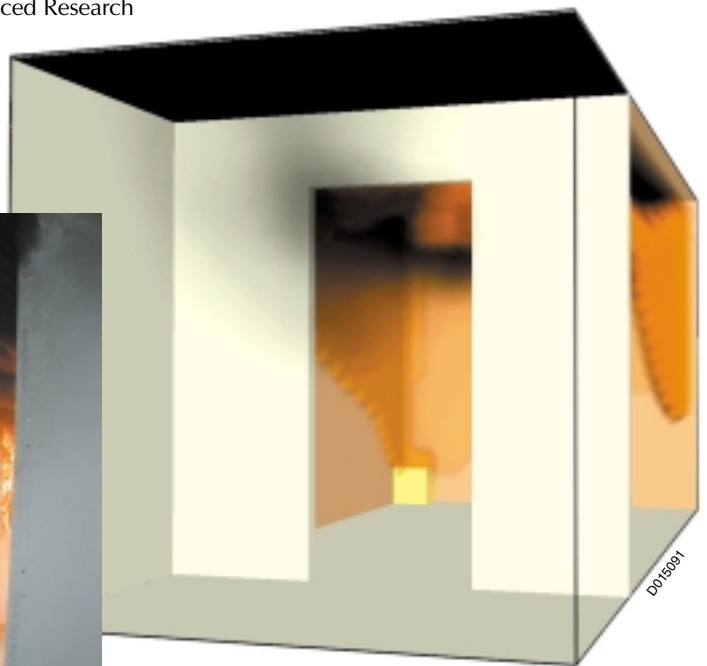
For a Defense Advanced Research Projects Agency program, SwRI is partnering with Honeywell to develop an **atomic clock** that uses micro-electromechanical

systems. Our encapsulation technology will hermetically seal critical components. ❖

Visit [chemistry.swri.org](http://chemistry.swri.org) for more information or contact Vice President Dr. Michael G. MacNaughton at (210) 522-5162 or [mmacnaughton@swri.org](mailto:mmacnaughton@swri.org).



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SwRI engineers can simulate standard room corner tests of wall lining material through advanced computer modeling. This model's prediction time prior to flashover was validated through an actual test (inset).