



LAWRENCE  
LIVERMORE  
NATIONAL  
LABORATORY

# New Technologies for Standoff Assessment of Radiological Contamination

N. Cherepy, C. Stevens, R. Wurtz, R. Sanner, M. Frank,  
T. Tillotson, L. Hrubesh, D. Dietrich, J. Dignon, R. Soufli

May 12, 2005

IEEE Nuclear Science Symposium  
San Juan, PR, United States  
October 23, 2005 through October 29, 2005

## **Disclaimer**

---

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

## New Technologies for Standoff Assessment of Radiological Contamination

Nerine Cherepy, Charles Stevens, Ronald Wurtz, Robert Sanner, Michael Frank, Thomas Tillotson, Lawrence Hrubesh, Daniel Dietrich, Jane Dignon and Regina Soufli

[cherepy1@llnl.gov](mailto:cherepy1@llnl.gov), 925-424-3492, Lawrence Livermore Natl Laboratory, Livermore, CA 94550

Technologies to rapidly quantify surface activity with minimal worker contact would dramatically decrease the radiation dose a radiation worker receives in assessment and cleanup operations, while obtaining a clear image of exactly where dispersed contamination is located. LLNL efforts in the development of the Photochromic Radiation Dosimeter and the Imaging Assessment System will be described. Initial use of these technologies in decontamination and decommissioning of contaminated facilities demonstrates several significant advantages over standard techniques such as survey meters and swipes.

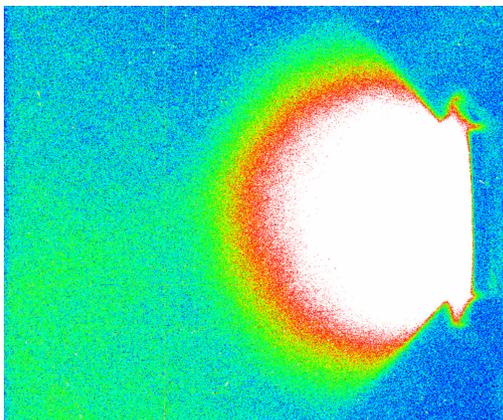
**The Photochromic Radiation Dosimeter.** We are developing a fieldable standoff dosimeter that is read out using active laser interrogation at distances exceeding 10 m. This dosimeter combines scintillation with a photochromic medium that converts upon absorption of scintillation light. The radiation dose is stored in the photochromic layer and read out by a laser. We synthesized and characterized more than a dozen different photochromic materials (two are shown in Figure 1) before identifying the ideal candidate currently being used for the sensors.

**The Imaging Assessment System.** An optical viewer capable of imaging surface activity, even within a sunlit background, is also under development. Specialized optical elements allow imaging of airglow from radiological materials at standoffs of 3-10 m. An example of the glow emanating from the surface of an alpha particle source is shown in Figure 2. We are also formulating scintillating encapsulating coatings that can be deposited on radioactive surfaces to enhance their optical signals, allowing imaging at low activity levels using the same viewer.



**Figure 1. (Left)** A photochromic material in which a permanent dose may be stored in the form of green molecules.

**(Right)** A reversible photochromic material that may store a dose as the purple form but can be converted back to the yellow “unwritten” form upon laser readout.



**Figure 2.** Side-on view of an alpha-contaminated surface shows a bright optical signal emanating from the surface.