



Ultra-sensitive Measurements

World-class sensors and techniques for threat monitoring

Pacific Northwest National Laboratory (PNNL) is a world leader in environmental monitoring of ultra-trace and low-level radionuclides for detecting proliferation of weapons of mass destruction.

CAPABILITIES

- » **Electrochemical Purifications:** Starting with the most pure materials available, PNNL scientists have developed electrochemical methods for preparing materials and components for radiation detection systems of unprecedented purity.
- » **Detector Production:** Ultra-low background detector design, fabrication, and assembly is a signature capability of PNNL. Application includes detection systems for basic research in dark matter science. New limits on the properties of dark matter have been obtained; dark matter is thought to be an important component in the overall mass of the universe.

INSTRUMENTATION

- » **High-purity Germanium Detector Arrays:** PNNL's expertise in the construction of High-Purity Germanium (HPGe) detector arrays enables this high-efficiency, high-selectivity, gamma-ray spectrometer. This instrument will ultimately enhance verification for the Comprehensive Nuclear Test Ban Treaty and similar applications.
- » **Ultra-low-background Proportional Counter:** This measurement system can analyze up to twelve samples simultaneously, detecting at low levels beta-emitting radionuclides like ^{37}Ar , tritium, and ^{14}C for environmental and treaty monitoring applications.

SHALLOW UNDERGROUND LABORATORY

The Shallow Underground Laboratory supports critical environmental and national security challenges, as well as materials purity and detector research and development for basic science applications. The facility is used to store and fabricate materials for building highly sensitive radioactivity detectors. The facility is

- » 6,600 square feet
- » Located 39-feet (12 meters) under grade level
- » Overburden of more than 42 feet (19 meters), resulting in a depth of more than 81 feet above the grade berm

Specialized Laboratories

- » **Ultra-Sensitive Measurements Laboratory:** The only room in the Shallow Underground Laboratory where measurements are made on samples. Low-background measurements are made on a variety of samples, addressing applications that span from environmental age-dating to verifying compliance with the Comprehensive Nuclear Test Ban Treaty.
- » **Electrochemical Purification Laboratory:** PNNL scientists developed an electrochemical method for



purifying copper, a key material that makes possible radiation detection systems of unprecedented sensitivity. The method begins with the purest copper materials available, and results in the lowest-background copper in the world.

- » **Assembly Laboratory for Ultra-Low-Background Detectors:** Here detectors like the HPGe and the ultra-low-background proportional counters are assembled. In the process, researchers assemble the copper with other materials, like radiation-detecting elements, to make ultra-low-background radiation detectors.

ABOUT PNNL

Interdisciplinary teams at PNNL address many of America's most pressing issues in energy, the environment and national security through advances in basic and applied science. Founded in 1965, PNNL employs 4,400 staff and has an annual budget of nearly \$1 billion. It is managed by Battelle for the U.S. Department of Energy's Office of Science.

CONTACT

For more information, contact:

Bob Runkle

Chief Science & Technology Officer
National Security Directorate
(509) 375-1966
robert.runkle@pnnl.gov

Randy Hansen

Director, Signatures Science & Technology Division
National Security Directorate
(509) 375-1787
randy.hansen@pnnl.gov



Proudly Operated by **Battelle** Since 1965

