

# Real-Time Monitoring of Actinides in Chemical Nuclear Fuel Reprocessing Plants

**A low-cost, portable sensor utilizing tensioned metastable fluid technology provides near real-time, high-efficiency monitoring of special nuclear materials by distinguishing between neutrons, alpha particles, and fission fragments in high-radiation environments.**

Nuclear reprocessing is a technology used to recover the unused uranium and plutonium from spent nuclear waste, reduce the volume of high-level waste, and close the nuclear fuel cycle. The waste is composed of a variety of actinides and byproducts of the fission process, which continues to emit dangerous levels of radiation and requires monitoring. Tracking the emitters provides the operators with the concentrations of the various compounds present, allowing for better accountability in overall yields. Unfortunately, current emitter detection requires off-site laboratory analysis, which increases reprocessing time and is unsuitable for real-time safeguard applications.

Researchers at Purdue University have developed a new device for monitoring special nuclear materials in near real-time. The sensor has a high intrinsic efficiency (> 90%) and is able to distinguish between neutrons, alpha particles, and fission fragments to estimate the composition of nuclear waste. It can remain selectively blind to beta emitters and gamma photons, allowing it to work in a high radiation environment without saturation. The sensor uses tensioned metastable fluid technology, previously developed at Purdue University, which makes it low-cost and portable.

## **Advantages:**

- Can distinguish between neutrons, alpha particles, and fission fragments
- Low-cost and portable.

**TRL:** 4

## **Intellectual Property:**

## **Technology ID**

66321

## **Category**

Energy & Power Systems/Power  
Generation  
Robotics &  
Automation/Perception &  
Sensing

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**Keywords:** nuclear material monitoring, real-time sensor, spent nuclear waste, neutron detection, alpha particle detection, fission fragment detection, tensioned metastable fluid technology, nuclear reprocessing, low-cost portable sensor, radiation environment sensor, Analytics, Chemical Engineering, Chemistry and Chemical Analysis, Electrical Engineering, Nuclear Materials, Sensors