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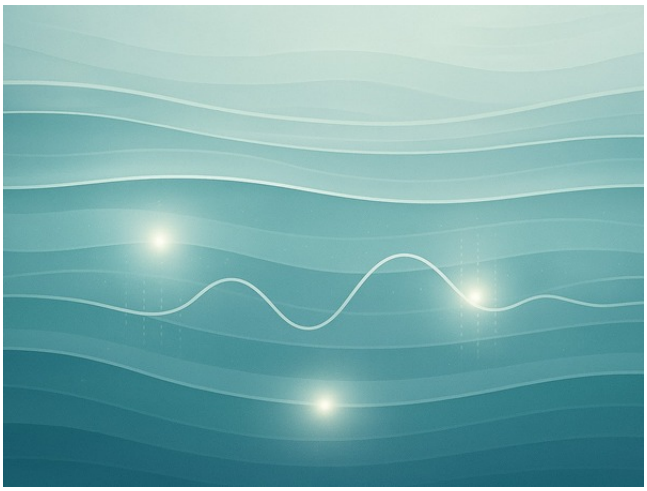
Rapid Low Cost EPA Mandated High-Safety Significant (U,Ra,Rn,..)Radionuclide Monitoring System e

TMFD-based system provides near-real-time, low-cost alpha radionuclide monitoring in water (and mixed fields), cutting prep/equipment needs for EPA compliance.



Researchers at Purdue University have developed a low-cost, near-real-time solution for monitoring hazardous radionuclides in water. In the U.S., local governments are EPA-mandated to annually monitor and report safety-significant radionuclides in drinking water. Some radionuclides, such as U, Ra, and Rn-Po, are of particular concern since even trace (pCi/L) levels are set as thresholds. Current monitoring methods and apparatus require lengthy sample preparation followed by examination for radioactive nuclides using costly gamma or mass spectrometers. This can be a heavy burden for local municipalities and often leaves small, unregulated water sources such as wells with unsafe levels of carcinogenic radionuclides. To fill this gap in public health, Purdue researchers have developed an alternative monitoring solution that is rapid, low-cost, and eliminates much of the need for specialized equipment. Using adapted tensioned metastable fluid detector (TMFD) technology, they can accurately detect alpha activity in airborne and fluid streams bearing mixed (alpha-beta-gamma) emitters. In addition, an automated detection and quantification system was developed to perform

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Category

Aerospace & Defense/Defense Electronics & Surveillance Technologies

GreenTech/Water & Resource Management

Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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measurements of gross alpha activity tied to cavitation detection events (CDEs).

Technology Validation:

Tests were completed at Purdue University with Radon and progeny-bearing liquids and later with liquids bearing Uranium. All experiments demonstrated that in vials containing alpha emitters, cavitation detection events (CDEs), which are used in the system as a measure of alpha particles, were clearly being produced even at 1 dpm/mL alpha activity levels. In control vials containing no alpha emitters, little to no CDEs were produced. The same apparatus also successfully allows monitoring of neutrons â€“ another tell-tale radiation of widespread significance.

Advantages:

-Low-cost

-Reduces the need for specialized equipment

-Distinguishes trace alpha radiation in extreme mixed radiation fields

-Can sample vapor or liquid streams

-Shorter sample preparation time

-Near real-time monitoring

-Enhanced monitoring for potentially carcinogenic radionuclides, special nuclear materials, safety-security, and -nuclear medicine/therapy

-Improved public health, diagnoses, treatment, safety

Applications:

-EPA-mandated monitoring for hazardous radionuclides in -public drinking water.

-In-home monitoring for well water users

Publication:

1. A full paper invited for inclusion in the forthcoming special issue of Nature Springer Group's J. Radioanalytical and Nuclear Chemistry (JRANC) was submitted on June 18, 2025 and awaits publication.

2. An earlier (published in JRANC) invited overview paper on TMFD sensor technology and its applications covering diverse fields (ranging from energy, medicine, fundamental physics, combating nuclear terrorism, safeguards-security, etc.) is entitled "Tensioned metastable fluid detector sensing technology for multifarious-multiscale applications in the nuclear fuel cycle," https://doi.org/10.1007/s10967-024-09583-7, June 2024.

TRL: 4

Intellectual Property:

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