Building Future Safeguards Capabilities
SYMPOSIUM
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Laser-Based Measurement Tools for Future Enrichment Plant Safeguards

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The International Atomic Energy Agency (IAEA) has a long history of testing and using laser-based technologies for a variety of safeguards applications. Notable laser-based on-site applications include, 3-dimensional laser range (3DLR) instruments used for facility design information and verification (DIV), laser measurements to verify unique labels and detect signs of tampering, and laser spectroscopy for non-contact process monitoring. IAEA is also evaluating analytical laboratory instruments, such as laser ablation, inductively coupled plasma mass spectrometry (LA-ICP-MS) for interrogating individual particles to determine uranium isotopic ratios in collected environment samples. Recent laser technology advancements will likely continue to fuel future IAEA adoption of new and novel laser-based safeguards tools. The Pacific Northwest National Laboratoy (PNNL) is currently developing one such tool, called laser ablation, absorption ratio spectrometry (LAARS), for quantitative measurements of uranium material. LAARS uses three tunable diode lasers to simultaneously measure atomic 235U and 238U absorption in an ablation plume created by a forth pulsed laser. Commercial availability of compact pulsed ablation lasers and the extreme wavelength accuracy and stability of PNNL's tunable diode laser architecture play a pivotal role in achieving high fidelity LAARS assay measurements. The LAARS method is ultimately targeted for either on-site or laboratory-based 235U relative abundance measurements of destructive assay (DA) samples in support of uranium enrichment plant safeguards. DA is currently collected on-site, and then shipped to an analytical laboratory for mass spectrometry (MS) assay, because the measurement uncertainty requirements for this application are quite challenging. This paper will present the key elements of the LAARS laser system design, recent assay results on collected uranium hexafluoride (UF6) DA samples, and future operational configurations that may provide immediate on-site DA inspection results or rapid laboratory DA sample screening to prioritize further analysis by MS.

Which "Key Question" does your Abstract address?

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Topics

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