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A Laser-based Method for Onsite Analysis of UF6 and Environmental Samples at Enrichment Plants

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The International Atomic Energy Agency's (IAEA) long-term R&D plan calls for more cost-effective and efficient safeguard methods to detect and deter misuse of gaseous centrifuge enrichment plant (GCEPs). The IAEA's current safeguards approaches at GCEPs are based on a combination of routine and random inspections that include environmental sampling (ES) and destructive assay (DA) sample collection from UF6 in-process material and selected cylinders. Samples are then shipped offsite for subsequent laboratory analysis. Onsite analysis could provide timely screening of ES samples, and help to meet challenges in transportation and chain of custody for UF6 DA samples. PNNL's development of the Laser Ablation, Laser Absorbance Ratio Spectrometry (LAARS) method is aimed at these two applications. For both ES and DA samples, a LAARS analysis instrument could be temporarily or permanently deployed in the IAEA control room of the facility, for example in the IAEA data acquisition cabinet. Sample collection concepts include a PNNL-designed handheld DA sampler with a small sampling planchet to collect micrograms of adsorbed UF6 gas directly from a process line tap and potentially, from a cylinder headspace. The sample planchet could then be assayed onsite by LAARS; some portion of the sample could be reserved for laboratory analysis (low sample activity should mitigate shipping restrictions). A second sampling concept collects aerosol particles from facility surfaces using a small backpack aerosol collector based on a PNNL rotating drum impactor design, which offers the possibility of sample segregation by sampling location and particle size. Some portions of the collector drums could be characterized onsite by LAARS to provide early sample screening and to guide additional sampling. The remaining drum samples could be transported to offsite laboratories for comprehensive analysis need to confirm or refute initial onsite findings.

Country or International Organization

United States of America

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