Pacific Northwest NATIONAL LABORATORY

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Battelle Number(s):

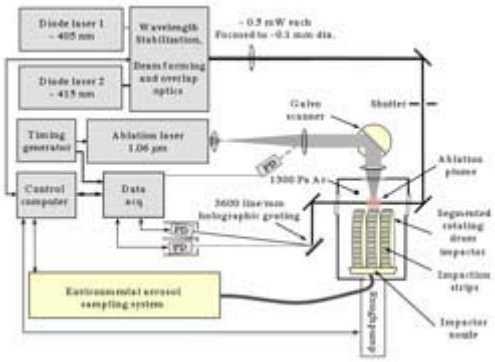
16419-E

Patent(s) Issued

Available for licensing in all fields

Available Technologies

Onsite Environmental Aerosol Collection and Laser Isotope Analysis for Uranium Enrichment Safeguards



SUMMARY

Nuclear power is enjoying rapid growth as government energy policies and public demand shift toward low-carbon energy production. Pivotal to the global nuclear power renaissance is the development and deployment of robust safeguards instrumentation and new environmental sample collection and analysis methods for the detection of highly enriched uranium (HEU). Undeclared production of HEU remains a primary proliferation concern for modern enrichment plants.

Environmental sample collection and ultrasensitive laboratory analysis has proven to be an effective deterrence to undeclared enriched uranium production within a gaseous centrifuge enrichment plant (GCEP). Researchers at Pacific Northwest National Laboratory are developing an unattended safeguards instrument, combining continuous aerosol particle collection with uranium isotope assay, to provide timely detection of HEU production within a GCEP. This approach, which meets International Atomic Energy Agency (IEAE) international safeguards standards, is based on laser vaporization of aerosol particles, followed by laser spectroscopy to characterize the uranium enrichment level. Samples can be automatically collected for a pre-determined period of time, and time-stamped for traceability back to facility declarations.

With this new method, an entire surface can be continuously scanned on-site, collecting, evaluating, and interpreting millions of samples an hour; absorbents can be converted into U-235 on-site, within minutes. Current GCEP misuse monitoring has a very long timescale often months between an actual product enrichment change and final analysis of collected environmental samples. The on-site safeguards approach featuring continuous, automated aerosol particle collection has proven to provide timely detection of HEU production within a low enriched uranium production facility. Combining PNNL & Laser Ablation, Absorbance Ratio Spectrometry (LAARS) method for uranium isotope analysis with an aerosol collection capacity would enable facility-wide environmental sampling that targets micron-size uranyl fluoride (UO2F2) particles produced during atmospheric hydrolysis of trace uranium hexafluoride (UF6) process emissions.

U.S. DEPARTMENT OF ENERGY

ADVANTAGES

* Ability to detect trace particles of uranium in predominantly background particles

* Provides enhanced single-shot detection sensitivity —1% or better precision and accuracy in determining unknown isotopic ratios

* Enrichment analyzed without handling particles

* Time stamps the collection allowing for correlation back to the facility declaration

* Quickly and cost-effectively collects and analyzes particles on-site within minutes

Patents & Intellectual Property

» Patent pending #: 2011/0164248

Technology Portfolio(s)

» Nuclear Power

» Nuclear

Potential Industry Applications

» Energy & Utilities

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