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Determining Uranium Mass in Powder Samples with Spectral Radiography

One important dimension of safeguards innovation is leveraging emerging technologies in other domains and bringing them to bear on safeguards problems. The International Atomic Energy Agency (IAEA) is responsible for verifying the mass of elemental uranium in various forms (powders, pellets, scrap) as part of inspections in different facilities. Current methods require in-field dissolution chemistry, which imposes operational challenges and requires chemistry experts. A method that could nondestructively measure materials such as powders in their original form could streamline inspections, reduce burdens on operators and inspectors, and be complementary with existing methods. We have adapted spectral x-ray radiography, an emerging technique from medical and industrial imaging, to quantify uranium mass in powder samples. This technique relies on an inverse problem approach with regularization that is useful for a wide range of problems. We will describe a new experimental system, which includes an spectral x-ray detector, a 160 kVp x-ray source, and a custom material estimation algorithm. A pixelated CdTe detector measures the energy spectrum of x-rays transmitted through a sample. The energy spectra of each pixel are processed with the material estimation algorithm to calculate the elemental mass of the uranium in a powder sample. In this paper, we present detector characterization and response modeling, experimental results, and an overview of the system operation. PNNL-SA-132821.

Which ”Key Question” does your Abstract address?

NEW1.2

Topics

NEW1

Which alternative ”Key Question” does your Abstract address? (if any)

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