Background

- In-Situ uranium hexafluoride
- Dry Cask Storage
- Fuel Fabrication
- enriched uranium
- cooled > 5 years
- Repository
- spent fuel
- spent fuel
- recycling
- Pyro Separations
- Drug Detection
- Pu and U
- Conversion

Direct

- Metal Waste: Solid, insoluble metal fission products.
- Ceramic Waste Electrowinning: Waste salt LiCLO4 contains trace amounts of 135Cs and 137Cs from electrowinning the fuel.
- Vitrified Waste: LiCLO4 salt that contains TRU and Sr alongside rare-earth elements precipitated into glasses and vitrified with borosilicate glass.
- Ceramic Waste Electrodeposition: Through electrodeposition, LiCLO4 is used to separate 135Cs, 137Cs, 137I and 131I which are solidified into ceramic waste.

Indirect

- Power Draw: Sign of overusing centrifuges [7, 2].
- Smoke Production: Reactor producing high power than rated or reported for possible nefarious reasons [7].
- Decay Heat: Lower decay heat in casks signifies.
- Trace Quantities: 135Xe and 85Kr are commonly emitted through processing along with tritium from reactors. Need sensitive equipment but difficult to hide [1, 5].

Prevalent Work

Two new approaches to online diversion detection have recently been proposed [2, 7]. Which rely on power demand signatures. To facilitate online detection properties are as follows [7]:

- Product enrichment
- Frequency of shipments
- Time to production

The first proposed method uses maximum likelihood estimation to determine unreported routes of transport [7].

Cycplus

- Normalized Likelihood Estimation node representation proposed by Hou et al.[2].
- The second approach instead assumes a Poisson distribution.

Signatures and Observables

Detection modes vary between each facility type, requiring a specific analysis of each processing plant to determine effective signatures and observables. For example, pyroprocessing has four major systems with observable waste: electrowinning, electrodeposition, drying, and metal fuel fabrication[1]. These systems have the following signatures:

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Acknowledgements

This research was performed using funding received from the Consortium for Nonproliferation Enabling Capabilities under award number 1-48313-97300-391100.

References