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Pacific Northwest NATIONAL LABORATORY

THE STAX PROJECT: A NEW DATA SOURCE TO AID IN TREATY MONITORING

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Introduction

The Source Term Analysis of Xenon (STAX) project is an effort to better understand the radioxenon background in the environment. As radioxenon is detected every day in the International Monitoring System (IMS), the ability to directly measure the releases from these civilian sources contributing to the background could greatly aid in attributing IMS detections. In conjunction with atmospheric transport modeling (ATM), release data from civilian sources could be used by treaty monitoring scientists to better understand the worldwide radioxenon background routinely detected by the IMS. The STAX project aims to deploy high-resolution stack detector systems at facilities that routinely release radioxenon, such as fission based medical isotope production (MIP) facilities. Data collected will be securely transferred to a central repository, and converted to a standard format. PNNL has begun collaborations with several medical isotope producers and international partners to standardize technology, purchase and install stack monitoring equipment, develop data transfer infrastructure, and design software for data handling and analysis.

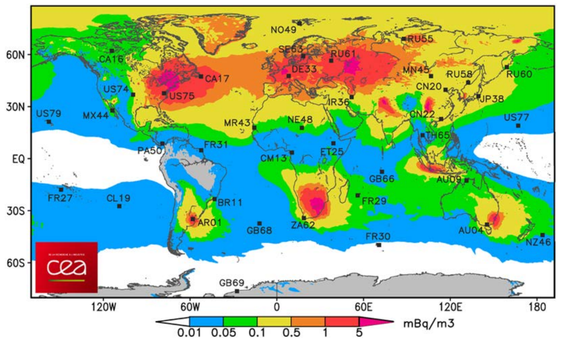
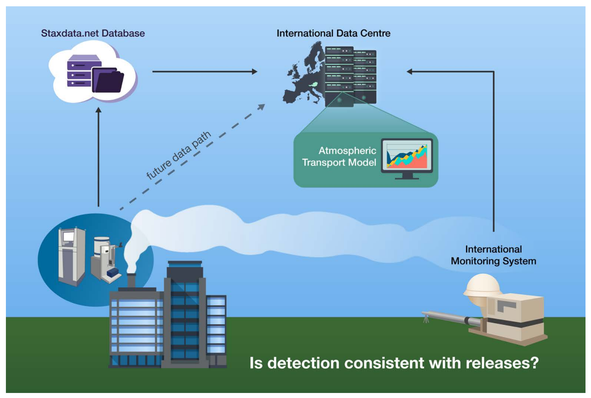


Figure 1 above: Radioxenon background calculated based on a continuous release assumption of 5 x 10^9 Bq/day emissions from Mo-99 producers (including Chalk River)[1].

Figure 2 below: Data collected from MIP facilities is transferred to a central repository and converted to standard data formats. This data will be used to better understand detections at IMS stations.

[1]P. Achim, 2015, *Simulation of Worldwide Xe-133 Atmospheric Background,* WOSMIP V



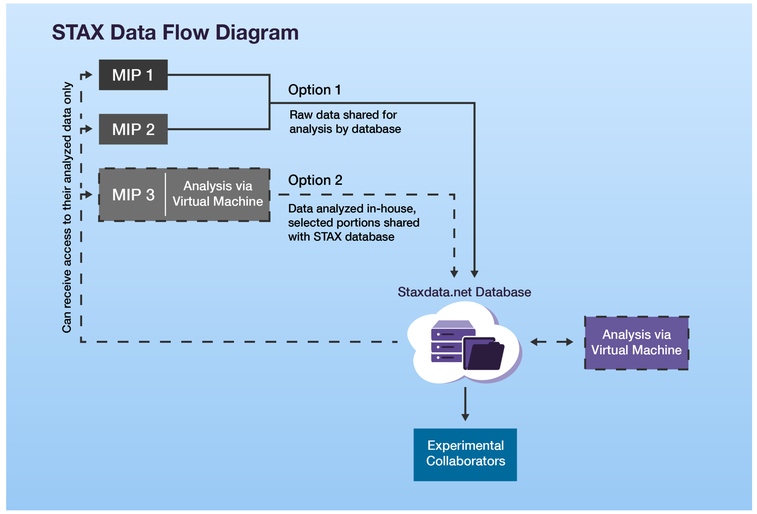


Figure 3: STAX Data Pipeline
Development of data flow from the STAX equipment is on-going. All spectra are analyzed onsite with commercial software to create Statement of Health (SOH), PHD files containing raw spectra, and ATS files containing processes data. Specifics for data sharing are negotiated with each facility.

Preliminary Data

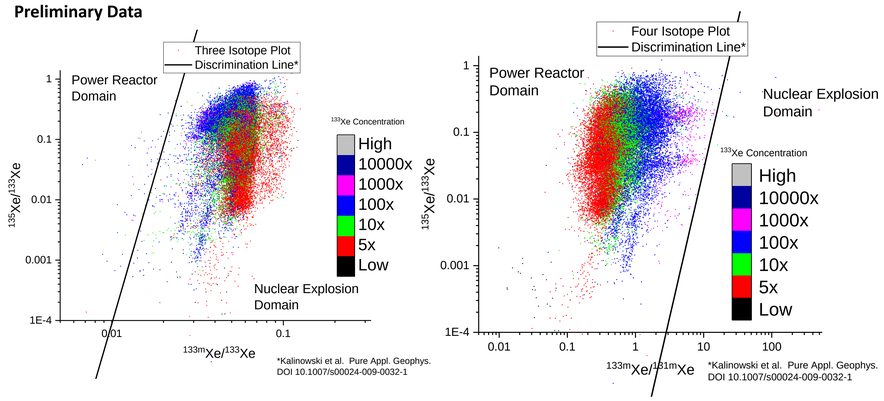


Figure 4: Comparison of 3-isotope (left) and 4-isotope (right) plots. Xe-131m is less likely to be observed and therefore the 3-isotope plot is more likely to be used for analysis of releases. The Kalinowski line (solid line) is used to determine xenon signatures from released from reactors vs. nuclear explosions, however MIP has the potential to overlap the Kalinowski line as demonstrated in these plots.

Figure 5: Stack detector system options from Mirion, Investigación Aplicada (INVAP) and VF

Current Progress

- The 1st STAX system was installed at the Institute for Radioelements (IRE) facility in Belgium (2017)
- A STAX detector was installed at the Australian Nuclear Science and Technology Organisation (ANSTO) in October 2018
- Contracting is ongoing for the purchase of 3rd and 4th detector
- Software development and creation of architecture for secure data transfer and storage has been initiated by Instrumental Software Technologies, Inc. (ISTI)
- Initial automated data transfer from the IRE facility is on-going
- The project continues to engage with many producers and potential producers regarding participation in the STAX project

Installations completed at IRE (left) and ANSTO (right)

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ABOUT

Pacific Northwest National Laboratory

The Pacific Northwest National Laboratory, located in southeastern Washington State, is a U.S. Department of Energy Office of Science laboratory that solves complex problems in energy, national security, and the environment, and advances scientific frontiers in the chemical, biological, materials, environmental, and computational sciences. The Laboratory employs nearly 5,000 staff members, has an annual budget in excess of $1 billion, and has been managed by Ohio-based Battelle since 1965.

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