Introduction
With increased interest in the radioxenon emissions from radiopharmaceutical production, it has become important to study the best methods to incorporate the data into the International Data Center (IDC) analysis of radioxenon stations. A first step is to actually obtain spectroscopy from stack emissions and to apply atmospheric modeling and isotopic ratios to best screen out mundane medical isotope signatures from daily normal and transient events can be more easily observed and flagged for further analysis. Multiple spectra can be integrated over time and specific regions of interest investigated.

From the automated data analysis trend charts were generated that showed the trending of radioxenon emissions that were due to processing within the facility (see chart below). While there were several interesting emissions that included short-lived radiokrypton isotopes, the objective was to quantify the radioxenon emissions only. These emissions could then be used in forward atmospheric transport models (ATMs) to calculate the impact on the regional network and the nearby Transportable Xenon Laboratory (TXL).

New Stack Monitor
The new stack monitor was placed in line with the current system to comply with the monitoring requirements for the facility. The nuclear detector was purchased by the European Union III Project, proposed by the Provisional Technical Secretariat of the CTBTO. The nuclear detector consisted of a 5x5cm LaBr
crystal with matching photomultiplier and data acquisition system. Readout was via a stand-alone laptop and data files were saved every 10 minutes automatically. PNNL assembled a whole-air sampling system that presented a known volume of air to the detector from the stack. See diagram:

Spectral Data
The choice of a mid-range energy resolution gamma detector made it possible to measure several important gamma rays from radiokrypton and short-lived radiokrypton isotopes. In addition, the detector has an internal gamma-ray source, which provides several gamma rays for energy calibration. The spectra below shows the response of the detector to both normal background (no stack emissions) and during stack emissions.

Data Analysis
Automatic Data Viewing and Analysis software was developed for the rapid processing of very large sets of data. Data sets are animated and presented to the user in an accelerating manner, allowing the rapid observation of analyzed samples over a large time scale. Off normal and transient events can be more easily observed and flagged for further analysis. Multiple spectra can be integrated over time and specific regions of interest investigated.

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The week-long trend data chart above shows the transient nature of the 133Xe (250-kev) and 131Xe (81-kev). Included is a gamma from 137Cs which is a stable background gamma line and a gamma line from 131I which is trapped on a nearby charcoal filter. It is clear from the chart that the processing gives both long and very rapid releases during the course of the work week.

Local TXL Hits
The CTBTO deployed a SAUNA-based TXL to Jakarta during March of 2012. The unit was placed at the BATAN facility and was located about 25km from the BaTek isotope facility. A strong hit of 133Xe, 131Xe, and 135Xe was detected by the system on April 05, 2012, and was supported by ATM backtracking. The chart below shows the beta-gated gamma spectra.

The ATM modeling (seen in the diagram below) clearly shows that the plume from the BaTek site (dark circle), was encompassed by the ATM back track calculation done at the TXL site (star). This data was taken several months before the deployment of the stack monitor and so it is not possible to compare the concentration of the plume with what was released at the stack.

Integrated 12-hour concentration near the surface in a plume based on hypothetical release of 1x10^11 Bq of 133Xe released uniformly over 24 hours on April 4, 2012.

Unfortunately, there have been no measured releases from the stack that have been detected by the TXL to date due to weather patterns and equipment failure.

Conclusions
The stack monitor developed by a joint CTBTO-IDC/ BATAN/PNNL effort has provided several months of high-quality spectral data. These data sets have provided invaluable information that will be used to develop future stack monitoring equipment and more importantly reduce the impact that stack emissions from medical isotope production has on the IMS radioxenon network.