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INVAP STAX monitor installation at La Reina RR (CCHEN,Santiago, CHILE)

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INTRODUCTION AND MAIN RESULTS

A newly commissioned STAX series monitor, developed by INVAP, has successfully completed Factory Acceptance Tests (FAT) and demonstrated reliable data transmission in accordance with STAX project requirements.

The monitor is scheduled for installation at the La Reina RECH-1 Research Reactor facility in Santiago, Chile, during the first half of 2025. This unit represents an upgraded version of the monitor currently operating continuously since November 2021 at the Radioisotope Production Facility in Ezeiza, Buenos Aires, Argentina, including improvements on SW User Interface and equipment accessibility.

The system has undergone calibration and fine-tuning of its electronic setup and detection system, which features an ORTEC Coaxial P-type HPGe Gamma-Ray Detector with 10% efficiency, an ICS Integrated Cryo-cooling System, and an Ultra-High Count-Rate Preamplifier. These optimizations enhance measurement performance, allowing for precise monitoring of high-activity concentration emissions even in low-dilution conditions. The presentation covers the technical characteristics, performance metrics and first operative tests with this advanced monitoring system.

SnT 2025 CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
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Introduction/Objectives

The STAX Project was borne with the objective of monitoring the radio-Xenons emitted from MIPF's stack in order to discriminate those emissions related to nuclear explosions sources.

As developer and manufacturer of Radiation Monitoring Systems INVAP joined the STAX Project in 2017.

A new STAX monitor from INVAP has been optimized for its installation at CCHEN's RECH-1 RR facilities in Santiago - CHILE.

The RECH-1 is a pool-type reactor (5 MW) which is operative since 1974. Pictures below does show the reactor Control Room as well as location and schematic (see Fig.1) of the penetrations to sample noble gas samples from the stack ducts, and the location of equipment rack.

Fig. 1

Methods– Main General Requirements

To identify and quantify stack emissions of strategic radioxenons (and other NG isotopes) aimed with STAX Project.

To acquire raw spectrums with an HPGe detector and to obtain activity concentration values of key isotope releases through gamma spectrum analysis.

Energy resolutions of: ≤ 1.0keV at 122keV and
≤ 2.0keV at 1332keV

Measures ^{133}Xe activity concentration releases in the range of **1E9 Bq/day to 1E13 Bq/day**.

Send the acquired data to authorized users in a standart format (i.e. N42).

To verify additionally:

- Small deployment area-reduced dimensions
- Low weight
- Unattended service.
- Ease to maintain
- Measurement of emissions in a low dilution regime (low flow rate - high activity concentration peaks)

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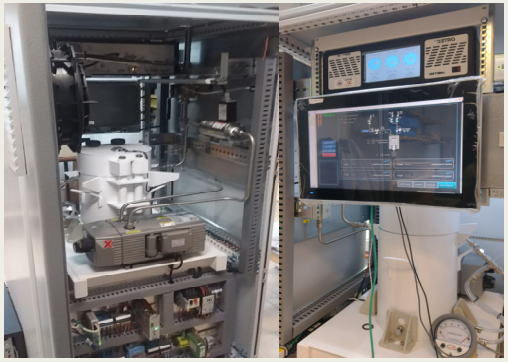


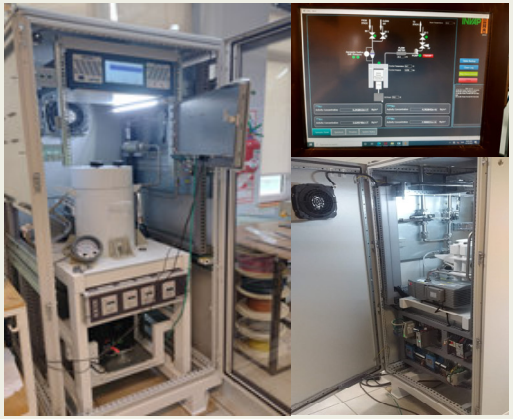
Methods- Improvements

New STAX monitoring unit to be installed at La Reina RR presents several improvements with respect to former INVAP STAX models.

SW User Interface has been modified, improving and making easier the Data acquisition as well as recognition of key technological parameters, relevant to successful operation.

Movable display for data and graphic presentations facilitates easier access to key hardware electric and pneumatic components of air sampling circuit for maintenance.

Easier Maintainance: 2 way Access to key components



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DATA- configuration & measurements

On Fig. 2 at the right, a “gas-like” calibration source, normally used, according equipment measuring geometry is shown

Fig.2

Using this source, the energy calibration spectrum, obtained with STAX monitor, is presented below, on

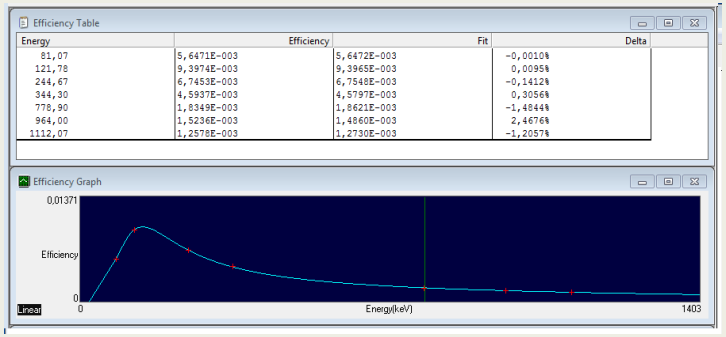

Fig.3

According these Efficiencies and the Background being expected, the corresponding equipment Detection Ranges able to be detected (in terms of key Xe-

Activity Concentration Detection Capabilities		
Xe133	bq/m3	1.63E+04 up to 2.61E+11
Xe135	bq/m3	4.51E+03 up to 1.00E+11
Xe133M	bq/m3	4.71E+04 up to 7.36E+11
Xe131M	bq/m3	2.40E+05 up to 3.13E+12

Fig.4

Expected Performance

A typical noble gas emission spectrum, obtained with a former STAX model at a MIPF is presented below (see Fig.5):

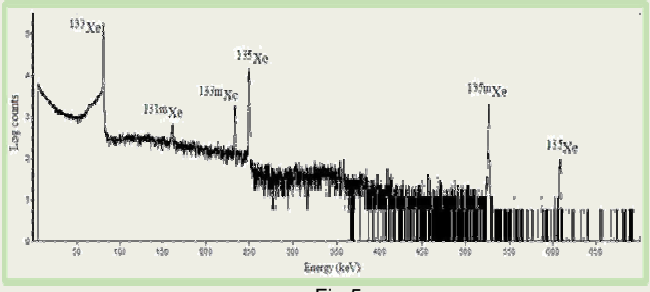

Fig.5

A typical timeline emission spectrum, obtained with an INVAP STAX monitor at a MIPF is also shown below.

Key Xe-isotopes can be recognized at different times along the production run (see Fig.6).

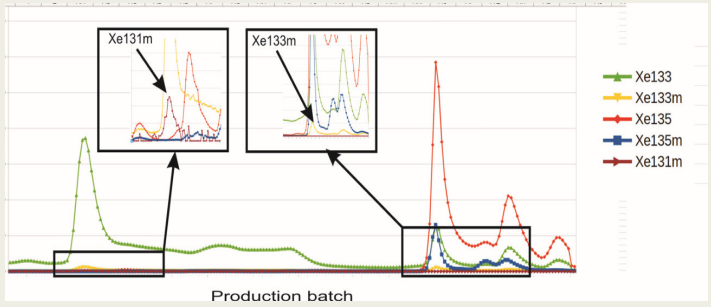

Fig.6

NOTE to Fig.6: In the case of RRs (such as La Reina CCHEN facilities) the dominant isotope to be expected is actually ^{41}Ar.

Results/Conclusions

A new INVAP STAX monitor was issued and is ready to be installed at La Reina RR (CCHEN –Santiago /Chile).

Successful Factory Acceptance Test (FAT) and Preoperational Tests were ran on this new equipment, complying with all detection and operational requirements.

Equipment calibration results obtained using a radioactive source with the same measurement geometry – “gas-like”- as the STAX monitor, enabled to verify spectrometric parameters requirements.

Aliveness test, calibration, verification and Site Acceptance Test (SAT) are scheduled at the site in order to verify equipment full operative status.

Acknowledgements

We wish to thank PNNL for financial support under PNNL Contract Nr. 634869.

Thanks are due also to CCHEN and its technical personnel at RECH-1 (La Reina RR – Santiago CHILE), for collaboration and support in designing and coordinating the installation requirements for INVAP’s STAX monitor at La Reina RR site.