T2.4-P14

Start-up and Calibration of INVAP Stack Air Effluent Monitor

Mariana di Tada [1,2], Federico Fernandez Baldis [1], Eduardo Nassif [1], Roman Pino [1], Ignacio Scarinci[1]

[1]INVAP S.E., RMS-I&C, Nuclear Projects Division- Bariloche, Argentina, [2]CONICET, Argentina

CTBT: SCIENCE AND TECHNOLOGY 2017 CONFERENCE

Abstract

The new Air Effluent Monitor (AEM) that INVAP has developed for nuclear facilities stacks, with the combination of a NaI scintillator and a CdTe semiconductor detector, has been assembled, started-up at factory, and will be installed in a new facility in the next months.

- Calibration performed with tailored radioactive sources to cover: ^{133}Xe, ^{133m}Xe, ^{135}Xe, ^{135m}Xe, ^{85}Kr.
- Tests of the monitor performance were carried out in a real stack environment.
- Full information on all process variables and spectrometric data is available through a local communication interface. This data is also available in a format suitable to be shared with IMS.

General Description

- Sampling and monitoring:
  - **Aerosols**: continuous sampling and measuring in laboratory
  - **Iodine**: continuous sampling and measuring in laboratory
  - **Noble Gases**: real-time monitoring and reporting
    - **CdTe** detector
    - **NaI** detector
    - On-line spectrometry
- The range of measurement is covered by the NaI on the low end and the CdTe on the high end (fig. 1)

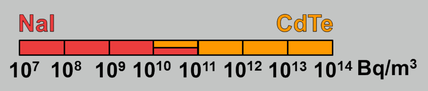
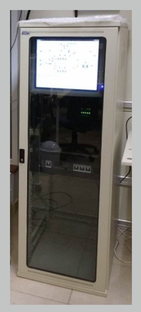
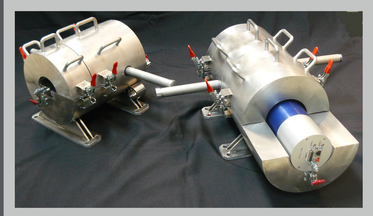


Figure 1

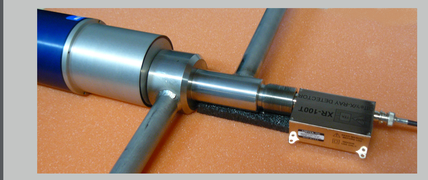




Tests in a real stack environment

Calibration with tailored radioactive sources

- Set-up used in lab for calibration



- Gas-like calibration source: ^{152}Eu 20μCi, 30-sept-2016

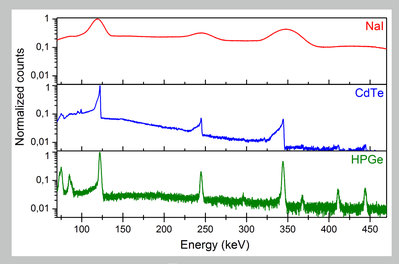


Figure 2

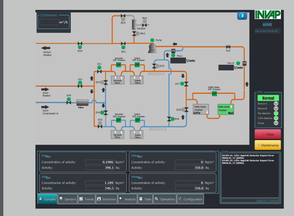
- Figure 2 shows the results obtained for the energy calibration of the NaI, CdTe and HPGe detectors.

Set-up used in real stack environment measurement

- XR-100-T CdTe detector and PX5 AMPTEK
- GAMMA RAD NaI Amptek
- CdTe Stainless Steel chamber
- Experimental system in series with the plant monitoring system
- 24 hs of CdTe and NaI 2 minute-spectra acquisition

Software

- Historical spectra is stored for future analysis in a relational database
- Evolution of each peak is followed in time
- Number of counts under peaks is calculated with background subtraction
- Communication with Control & Monitoring System of Plant
- Interactive mimic panel on touch screen
- Real time data on operator's screen in cell front



Results

- Figures 3 and 4 show the spectra taken with the NaI and CdTe with the corresponding ^{133}Xe and ^{135}Xe ROI's.
- The effect of the high efficiency of the CdTe detector at low energies can be appreciated in figure 4 as compared with the same energies in the NaI detector (figure 3).

Figure 3

Figure 4

- In figures 5 and 6 it can be seen that the time line obtained with the CdTe detector follows the same trend that the one obtained with the NaI detector.
- The CdTe time line is more fluctuating for ^{135}Xe because of the low efficiency for this peak energy (249 keV).

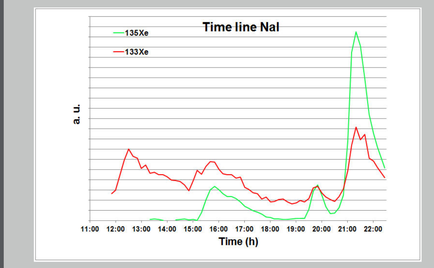


Figure 5

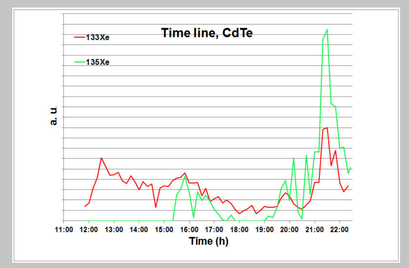


Figure 6

Conclusions

- The CdTe and NaI detectors have been calibrated with tailored gas like sources.
- Chambers and filter holder have been manufactured and are being installed in the measurement system.
- Software is already running and tests of its performance are being conducted with the data obtained in real stack measurement.
- Time lines obtained for real emissions have been obtained and show the characteristics expected for the range of activity released.
- CdTe is a good choice for the high activity range due to its lower efficiency, compared to NaI which will work properly in the low activity range.

mditada@invap.com.ar