

# SAUNA II

A fully automated radionuclide continuous monitoring system



## Key Features

- Highly sensitive beta-gamma detection gives low detection limits for  $^{133}\text{Xe}$ ,  $^{135}\text{Xe}$ ,  $^{133}\text{mXe}$ , and  $^{131}\text{mXe}$
- Automatic adjustment of detector energy drift
- State-of-health monitoring
- Remote operation and diagnosis
- Data continuously transferred to user

## SAUNA

Swedish Automatic Unit for Noble Gas Acquisition (SAUNA) is Scientia Sensor Systems fully automated industrial system for sensitive detection of radioactive xenon in the atmosphere.

## Sampling-Processing-Quantification

SAUNA is based on a unique non-cryogenic sampling technique followed by preparative gas chromatography and a high sensitivity beta-gamma detection system.

**Sampling:** Uninterrupted sampling of atmospheric xenon is performed using charcoal beds at ambient temperature. Moisture and carbon dioxide is removed from the air using thermoelectric coolers and molecular sieves.

**Processing:** Sample preparation including radon separation is performed by preparative gas chromatography.

**Quantification:** The Xenon volume is quantified using a thermal conductivity detector.

## Compactness and modularity

Each module individually exchangeable, this facilitates upgrades and service.

## User friendliness

- Clean, logical and intuitive design.
- All components placed in modules according to

functionality – simplifies troubleshooting and system understanding.

- The system has two interfaces for clarity:
  - *Front side:* For system operators with only the most important system parameters displayed on the front panel of each module.
  - *Back:* For service engineers at installation and service.

## Versatility

- Mobile sampling unit available for sampling at any location.
- SAUNA II L: Quantification and detector system suitable for other applications and easily fitted to different laboratory needs, e.g. re-analysis of gas-samples.

## State-of-health monitoring

- An advanced State-of-Health (SOH) system with more than 40 sensors continuously diagnosis the system parameters.
- The system process is graphically displayed on the computer screen and all sensor values can be accessed in real-time, on -site or remote.
- The SOH system automatically sends out an alert message if a sensor is out of range.

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### Detection

The Xenon activity is measured using a beta-gamma coincidence technique recording the energy of the electrons and gamma rays produced in the decay of  $^{133}\text{Xe}$ ,  $^{135}\text{Xe}$ ,  $^{131}\text{mXe}$ , and  $^{133}\text{mXe}$ . The coincidence technique reduces the ambient background and the recording of the beta energy allows for high sensitivity measurements of the meta-stable states. The interior of the lead shield is shown on the right. The NaI is also surrounded by tin and copper to further reduce the background radiation.

### About us

Scientia Sensor Systems markets, installs, and services ultrasensitive systems for detection of radioactive xenon in the atmosphere, e.g. for detection of nuclear explosions or malfunctioning nuclear plants. The company has the biggest installation base of radio-nuclide systems that have been installed in monitoring stations and networks worldwide. Scientia Sensor Systems is engaged in a long term strategic partnership with the Swedish Defense Research Agency (FOI) in the development of technologies for the next generation of systems.

Parameters	SAUNA II
Number of samples/24 h	2
Airflow, m3/hour	1.44
Stable xenon/sample, cm3 at STP	1.25
Stable xenon energy yield, ml/kW	0.83
Stable xenon extraction coefficient	0.95
MDC $^{133}\text{Xe}$ , mBq/m3	0.2
MDC $^{133}\text{mXe}$ , mBq/m3	0.2
MDC $^{131}\text{Xe}$ , mBq/m3	0.2
MDC $^{135}\text{Xe}$ , mBq/m3	0.7
Radon removal coefficient	$>10^5$
Energy calibration stability	QC checked
Historical Data Availability (Jan 1, 2013- Jan 31, 2015), %	$>90^1$
Detector technology	Plastic/NaI
Cross-contamination between subsequent samples	$<0.1\%$
Memory effect, %	$<0.1\%$
Requires certified calibration sources	No
Consumables	0.3-0.45 m3 Helium/day
Power consumption, mean (kW)	3
Power consumption, peak (kW)	5.5
Weight (kg)	$\sim 1800$
Footprint of detector unit (m)	$1.2 \text{ m} \times 0.6$
Footprint of 19" racks (m)	$1.8 \times 0.8$
No of systems installed	29
Available for sale	Yes
Available for installation	Yes

<sup>1</sup>Independent customers with Gold service contracts achieve  $>98\%$ .

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