THORON-SCOUT The first diffusion based Radon and Thoron active monitor for long term measurements in buildings

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content

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SARAD - Introduction

- Company with established reputation and many years of experience, located in Dresden, Germany.
- The core competence of the company is the design and the production of devices and systems for environmental radioactivity measurements and radioactivity analysis.
- SARAD offers a unique spectrum of Radon, Radon progeny and aerosol monitors for nearly any application.
Equipment for R&D and production

Assembly line

Rapid prototyping

Bonding

R&D debugging
Radon and Radon/Thoron instruments

**Doseman**
Rn individual dosimeter

**RadonScout/Plus**
Rn long term measurement

**RTM 1688 Radon/Thoron monitor**
for any kind of Rn measurements (e.g. Soil gas-water measurements)

**RadonScout PMT**
High sensitivity

**Indoorsensor**
Rn indoor monitoring

**RTM1688 Geostation**
Air and soil gas
long term measurements for extreme conditions
Radon progenies & radioactive aerosoles

**EQF 3220**
Particle size specific Rn/Th gas and dauther monitor

**poCAMon new development**
online air sampler (flow rate > 2lpm)

**EQF 3220**
Rn/Th gas and dauther product monitor

**Myriam**
Personal dosimeter for inhalation dose

**Doseman Pro**
Rn dauther product dosimeter
Standard Applications Based on DACM Technology

- RTM-2200
- EQF-3220, RPM-2200
- poCAMon
- EQF-3200
- NucScout
- A²M-4000

Based on DACM Data Acquisition and Control Module
Why was it necessary to develop the ThoronScout

Up to now

various spectroscopy-based instruments available (e.g. RTM 1688)

But

Pumps are necessary to draw the thoron gas fast enough into the measurement chambers. (noise, vibration, high power consumption)
RTM1688 + RSC+ → TSC !!!
About Thoron

- Isotope Rn-220
- half-live period: 55 s
- emerge within the Thorium decay chain
  - high concentration in Th-232 enriched areas
    - e.g. in clay, coal, monazite minerals

How to get the air fast enough into the measurement chamber?
The solution

perforated measurement chamber

Covered with a special treated leather for dust and light protection
Fast diffusion of measurement gas in Thoron-Scout

the pros:

- No pump necessary!!
  - smaller power consumption
    - longer measurement time
  - no vibrations
  - no noise
  - longer device reliability (no movable mechanical parts)

and cons:

- Measurements only at the device exact localization
  - no water or soil analysis possible
<table>
<thead>
<tr>
<th>Parameters/ Device</th>
<th>Thoron-Scout</th>
<th>RTM 1688</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detectors</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Thoron sensitivity</td>
<td>0,670 cpm/(kBq/m$^3$)</td>
<td>2,120 cpm/(kBq/m$^3$)</td>
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<tr>
<td>Rn-222 Measurement</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Spectral Analysis</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>Data records</td>
<td>2047</td>
<td>2047</td>
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<tr>
<td>Pump</td>
<td>NO</td>
<td>0,3 l/min</td>
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<tr>
<td>Operating Time</td>
<td>1 Month</td>
<td>5 Days</td>
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<tr>
<td>Display</td>
<td>4 line x 20 characters</td>
<td>3 line x 16 characters</td>
</tr>
<tr>
<td>Size</td>
<td>135 x175 x90</td>
<td>232 x182 x135</td>
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<tr>
<td>Weight</td>
<td>1,1 kg</td>
<td>3,5 kg</td>
</tr>
</tbody>
</table>

Other features of Thoron-Scout:

- Power supply by AC/DC wall adapter possible
- Measurement cycle time adjustable: from 1 minute up to 240 minutes
- One button control (lock-function)
- RS232 and USB interface for set-up and data transfer (also via modem or ZigBee)
- Additional sensors: temperature, relative humidity, barometric pressure, movement detector
- Fast/ slow mode for Radon Measurements
- Radon Vision Software for data measurements results presentation
Reference device  Device under test  Measurement Sources
Scenario 1. Continuous Thoron Measurement

- Short injection interval, 1 min.
- Continuous gas injection
- 30 min. measurement cycle
Radon measurement, 21.5 hours exposure time, 30min measurement cycle

TSC

RTM1688
Thoron measurement, 21.5 hours exposure time, 30min measurement cycle

TSC

RTM1688
The ratio between counts Toron Scout and counts RTM1688 for all daughters is nearly constant.
Scenario 2. Interval Thoron Measurement

- **Rn-222** Radon
- **Rn-220** Thoron

Source gas flow in Test Chamber

- Short injection interval, 1 min.
- 1 hour gas injection
- 15 min. measurement cycle
Radon measurement, 7 hours exposure time, 15 min measurement cycle

TSC

RTM1688
Thoron measurement, 1 hour exposure interval time, 15min measurement cycle

TSC

RTM1688
The ratio between counts Toron Scout and counts RTM1688 for all daughters is nearly constant.

\[
\begin{align*}
\text{Po}^{218}_{\text{TSC}}(\text{cts}) / \text{Po}^{218}_{\text{RTM1688}}(\text{cts}) &= 1742 / 5534 = 0.315 \\
\text{Po}^{216}_{\text{TSC}}(\text{cts}) / \text{Po}^{216}_{\text{RTM1688}}(\text{cts}) &= 748 / 2549 = 0.293 \\
\text{Po}^{214}_{\text{TSC}}(\text{cts}) / \text{Po}^{214}_{\text{RTM1688}}(\text{cts}) &= 1602 / 5555 = 0.288 \\
\text{Po}^{212}_{\text{TSC}}(\text{cts}) / \text{Po}^{212}_{\text{RTM1688}}(\text{cts}) &= 238 / 683 = 0.348 \\
\text{Po}^{21X}_{\text{TSC}}(\text{cts}) / \text{Po}^{21X}_{\text{RTM1688}}(\text{cts}) &\approx \text{constant}!!
\end{align*}
\]
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Conclusion

• The losses by diffusion process are negligible, otherwise the ratio of Po218 would be different from the Po-216 ratio.

• During interval tests Thoron gas source is attached / detached from the system circulation. There is no significant change in measurement response between system with active gas flow and system with diffusion principle of work.

• Both Radon and Thoron measurement results for TSC and reference device RTM1688 are equal
Hazard-Detection and Management

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