NEW DEVICES FOR RADIATION MEASUREMENTS

M. Gelev, A. Mishev, O. Penchev, E. Hristova

Institute of Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia

F. Spurný, K.Turek

Nuclear Physics Institute - Department of R D,

Academy of Sciences of the Czech Republic, Prague

NEW DEVICES FOR RADIATION MEASUREMENTS

- **ALPHA SPRECTROMETER**
- **RADON ANALAZER**
- **MDU “LULIN” SPECTROMETER**

1. ALPHA SPECTROMETER

- **ADC – type Wilkinson, 4 K**
- **Nonlinearity < 0,25%**
- **Interface - USB**
- **Max. count rate – 5000 s^{-1}**
- **PIPS detector 450 cm^2**
- **Resolution – 17 keV (^{241}Am)**

- **Price – 10 k€**

2. RADON ANALYZER - purpose

Integrated determination of each of the short-lived ^{222}Rn progeny (^{218}Po, ^{214}Pb, ^{214}Bi+^{214}Po) in air using rotating filter and passive detectors - TLDs or SSNTDs (track detectors)

- **Bulgarian Patent No 49948, 04.01.1991;**
- **United States Patent, Patent Number 5,225,673, Date of Patent Jul. 6, 1993;**
- **Deutsches Patent, Patentschrift DE 42 00 187 C2, 29.2.1996**

RADON ANALYZER - modifications

- **Adding alpha-spectrometry detectors allowing on-line use**

- **Mechanical improvements**
- **Better control of the rotation velocity**
- **Better control of the air flow-rate**
- **Heating of the electronics and the air**
- **Standardized software (in HP VEE)**

RADON ANALYZER - specification

Detectors:

- 3 surface barrier detectors or
- Kodak LR 115 track detectors

Filter rotation:

- Fixed - 1 rph or 1 rp12h
- PC controlled –adjustable from 1 to 1/24 h

Air aspiration flow-rate:

- Adjustable from 0,5 to 2,5 l/min

RADON ANALYZER - ideology

For radiation protection purposes:

- Time-integrated measurement
- Radon progeny concentrations

For use in atmospheric processes models:

- Discrete measurements
- Radon concentration

RADON ANALYZER – use on Moussala

Average Rn concentration: 4 – 6 Bq. m^3

(CR-39 , exposure time - 3 months)

Estimation of the Rn concentration on the base of ^{218}Po – several times per day

More comprehensive data for the Rn progeny (Rn origin, caves) – once a week

RADON ANALYZER - tests

Track detectors: MDC ~ 1 Bq m^{-3},

flow rate – 1 l min^{-1}, exposure time – 24 h

α-spectrometry detectors: MDC ~ 3 Bq m^{-3},

flow rate – 1 l min^{-1} , exposure time – 4 h

RADON ANALYZER – tests(TED)

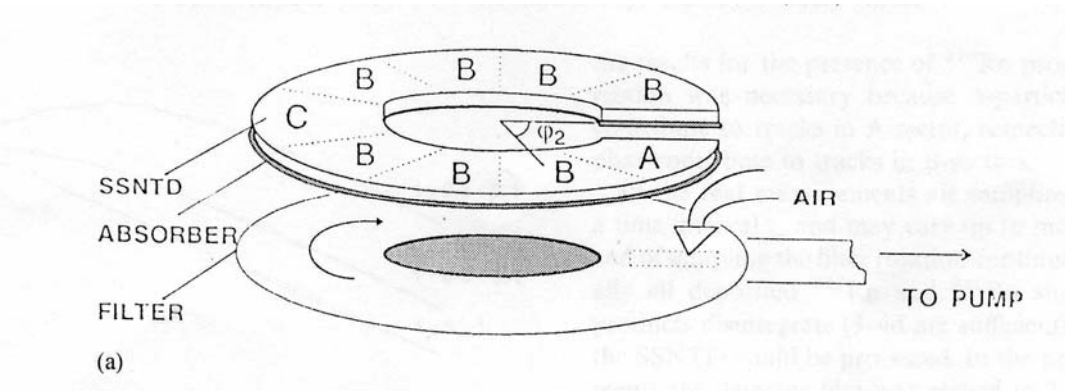
Place of measurement	Exposure time [h]	Nuclide	Rotating filter Bq m^{-3}	Ref. value Bq m^{-3}
INRNE Laboratory for radiation protection	***117,7***	***Po-218***	***11,1±1,0***	-
		Pb-214	***7,7±0,7***	-
		Bi-214	***6,6±0,9***	-
Faculty of physics Laboratory of dosimetry	***35,5***	***Po-218***	***4,4±0,6***	***3,5±1,6***
		Pb-214	***2,2±0,4***	***2,1±0,4***
		Bi-214	***3,4±0,5***	***<2,4***

RADON ANALYZER – tests(α-det.)

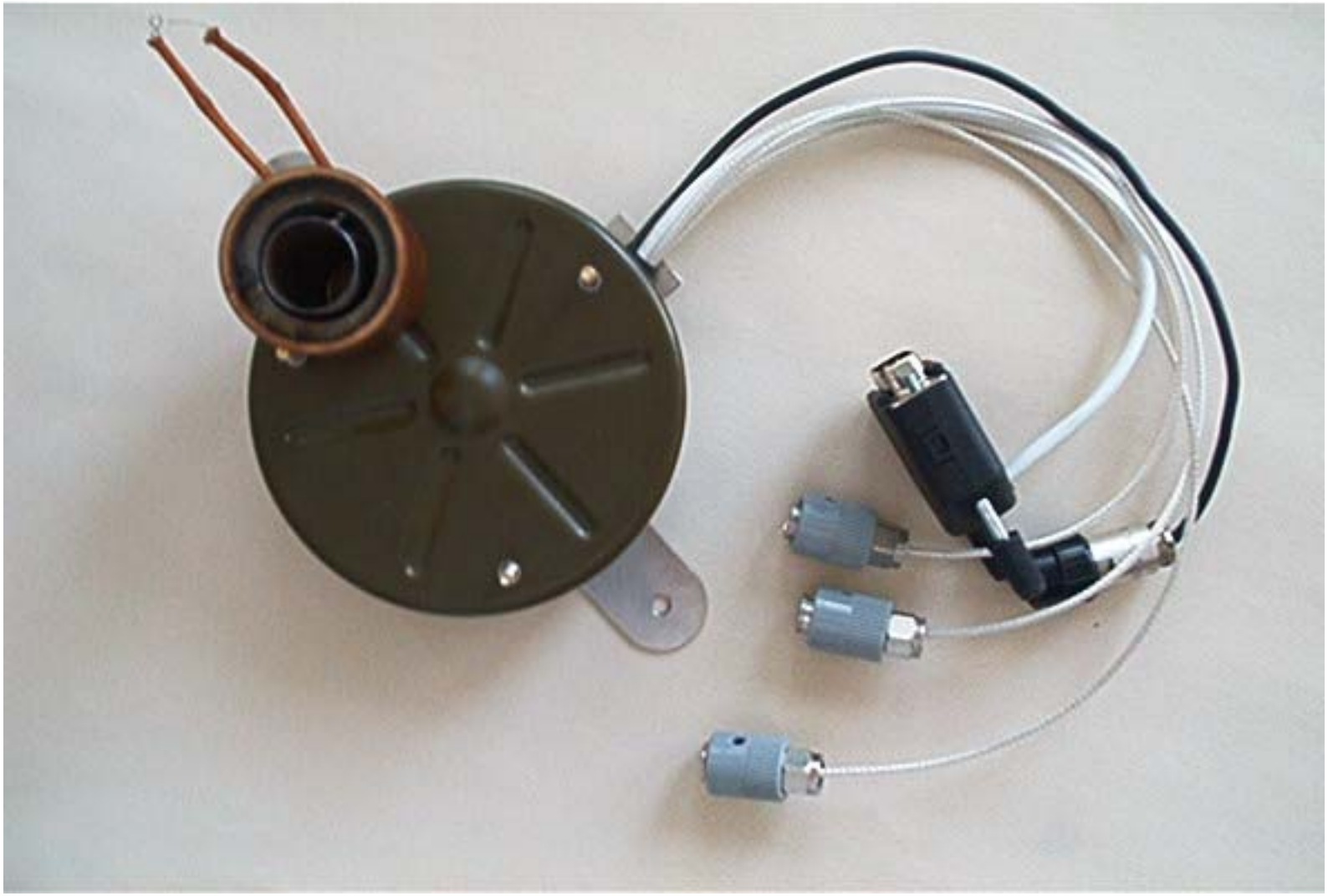
Place of measurement	Exposure time [h]	Nuclide	Rotating filter Bq m^{-3}	Ref. value Bq m^{-3}
INRNE Laboratory for radiation protection	***3,0***	***Po-218***	***17,3±2,7***	-
		Pb-214	***8,3±2,0***	-
		Bi-214	***6,6±0,9***	-
Radon box	***2,5***	***Po-218***	***853±36***	***Rn***
		Pb-214	***61±14***	***950±40***
		Bi-214	***<24***	

RADON ANALYZER

Principle scheme



Radon analyzer



3. MDU "LULIN"