

MONITORING OF INTERNAL EXPOSURES CAUSED BY ALPHA EMITTERS FROM NATURALLY OCCURRING URANIUM AND THORIUM CHAINS



Individual alpha dosimeter

❖ DESCRIPTION

The individual dosimeter is designed to be worn at the belt, and is made up of:

- ❖ an air sampler associated to a battery powered centrifugal pump,
- ❖ an integrated head for the measurement of:
 - short-lived decay product of radon 222 and 220 isotopes,
 - long-lived alpha emitters from uranium and thorium chains

In the event of both external and internal exposures a thermo luminescent detector is integrated in the measuring head.

❖ Insertion of the device inside its charging dock will recharge its battery and turn off the sampling pump.

The individual sampler associated with the measuring head acts as a forward data reading integrating dosimeter.

❖ APPLICATIONS

- Monitoring of workers in uranium mines,
- Professional occupations making use of radionuclides that are not used for their radioactive properties,
- Exposure to radon 222 and its decay products in workplaces.

❖ Application :

In general the exposure period commonly used is 30 days.

At the beginning of the exposure period, the measuring head is inserted in the sampler.

For each work station, sampling begins when the device is taken out of its charging dock and ends when it is put back on charge.

At the end of the exposure period the measuring head is sent back to our Environmental and Dosimetric Laboratory for analysis of the different detectors.



As a standard procedure it is recommended to allow for 3 measuring heads: one in preparation, one in use, the remaining head being processed for analysis.

INDIVIDUAL ALPHA DOSIMETER



Pump type: centrifugal turbine
Nominal sampling flow rate: 4 l.h⁻¹

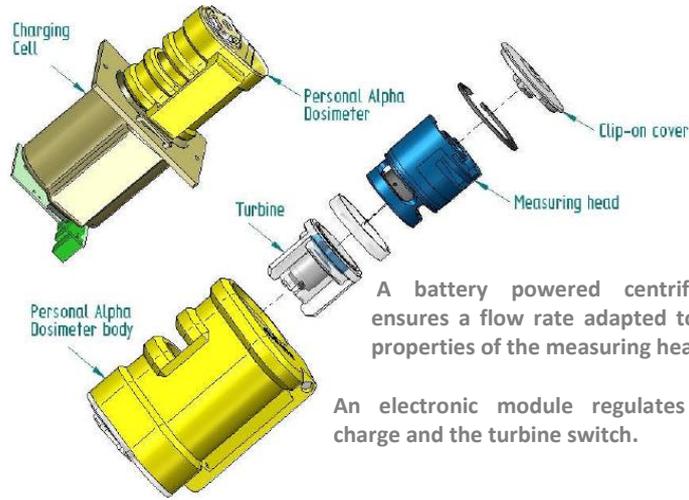
Powered by a Cd-Ni 1.2V 1.7Ah Battery
 Recharge by induction
 Charge indicator by LED
Charging time: 12 hours
Discharge time: > 12 hours

Yellow polycarbonate housing
 Dimensions: 94 x 79 x 63 mm

Operating conditions:
 +5°C to +40°C, 10-90 % relative humidity.
 Protection Rating IP55.(measuring head excluded)

Automatic On/Off switch by insertion in the charging dock.

Optional:
 Physical On/Off switch on the sampler.



Sampler

A battery powered centrifugal turbine ensures a flow rate adapted to the aerolic properties of the measuring head.

An electronic module regulates the battery charge and the turbine switch.

The battery recharges by means of a wireless connection based on the use of two coils.

A magnet incorporated in the body of the sampler activates a reed switch in the charging dock, linked to a timer giving the total operating time of the dosimeter.

Measuring Head

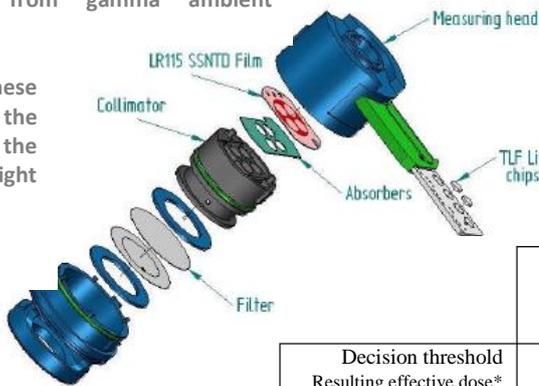
Long-lived alpha emitters of the airborne dust are collected on the sampling filter. At the analysis stage they are counted in a laboratory on a photomultiplier associated to a scintillator or on a silicon junction.

A solid state nuclear trace detector (cellulose nitrate LR115) ahead, facing the sampling filter, collects the alpha emissions of radon 222 and 220 short-lived decay products.

A setup of 4 energy-absorbing screens associated to collimators acts as a mechanical spectrometer able to differentiate Po218, Po214, Po212 and Bi212 isotopes.

A thermo luminescent detector (TLD) made up of two lithium fluoride pellets collects equivalent doses from gamma ambient radiations.

When heated up these crystals release the stored energy in the shape of visible light pulses.



Filter: cellulose acetate
 Porosity 1.2 μm
 usable filter diameter: 18 mm
 Aerosol collection efficiency: 80%
Collimator : carbone filled polypropylene
Energy-absorbing screens 8, 23 and 36 μm thick PET
Body: PEHD / red / green / blue
 Weight: 28g
 Pressure drop at nominal flow rate : 20 mbar

Solid state nuclear trace detector: LR115 type 2 (KODAK patent), "DOSIRAD17" format, made up of a 100 μm polyester substrate coated with a red tinted 12 μm cellulose nitrate sensitive layer. To improve rigidity, the assembly is glued on a 100 μm polyester support.

***according to the French IRSN DRPH/DIR/2008-188 report.*

	External Exposure	Potential alpha energy from decay product of Radon 222	Radon 220	Long lived products from Uranium and Thorium chains
Decision threshold	50 μSv.	80 nJ.	80nJ	14mBq
Resulting effective dose*	50μSv.	28 μSv**	10 μSv.	40 μSv.

* according to ICRP60 and European Directive 96-29, based on a work duration of 160h and a sampling flow rate of 4l.h⁻¹. Conversion factor of 1,4 mSv/mJ.m⁻³.h for PAE Rn222et 0,5 mSv/mJ.m⁻³.h for PAE Rn220

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Charging unit

Charging Unit of 1, 5, 10 or 25 charging docks according to requirements.

The charging dock is made up of the housing receiving the dosimeter and an electronic module to recharge the battery of the sampler.

An associated timer gives the operating time duration of each dosimeter.



A continuous 12V supply is available from a connector at the front of the unit.



SPECIFICATIONS

Power supply: 220-230V AC / 50 Hz
 Operating temperature: 0°C to 50° C
 Housing: Fiberglass

Charge regulator



Charge regulator: checks and adjusts the charge current supplied by the charging dock to the sampler's battery. The charge current is assessed on a led display.

Power supply: 12V DC supplied by the charging unit.

One charge regulator is sufficient for the needs of an industrial site.

Mass flowmeter

Mass flowmeter: measures the sampling flow rate of each dosimeter.

One mass flowmeter is sufficient for the needs of an industrial site.



Type	x1	x5	x10	x25
Dimensions (mm)	200*200*140	500*500*300	750*500*300	1250*1000*300
Weight (kg)	2	15	21	40
Power (W)	10	30	50	100
Protection Rating	IP55	IP55	IP55	IP54



References to order:

Individual Sampler	P-510-131	x5 docks charging unit	P-511-101
Individual Sampler with switch	P-510-130	x10 docks charging unit	P-511-102
Measuring head without TLD	P-510-200	x25 docks charging unit	P-511-103
Measuring head with TLD	P-510-201	Charge regulator	P-511-107
Single dock charging unit	P-511-100	Flowmeter	P-550-108