EMERGENCY RESPONSE

緊急時対応 放射線防護 機器ガイド



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Radiation Protection Instruments

まず始めに

原発非常事態時の放射線防護のために

- ·表面汚染計測
- ·線量/線量率計測
- アクティビティ計測

の測定が非常に重要です。

これらの測定値は、核危険性の定量的な説明を提供します。法定規制値と安全値の比較は、現在の状況とその危険性の評価を与えます。測定値はその規模によって変化し、そして人間は電離放射線を感じることが出来ないので測定はいずれにしる絶対に必要です。ベルトールドテクノロジー社は60年以上の経験による放射線機器のドイツメーカーとして、以下の機器を推奨します。

表面污染計測 (Contamination Measurement)

表面汚染計測とは表面に広がった1つもしくは複数の放射性核種の量を測定し、Bq/cm2の単位で表示します。表面は、たとえば床、壁、物、装置、布または手や足の皮膚です。それが少しでも見つけられれば汚染除去は簡単になります。発見出来なければそれらは恐らく拡散し続けることになります。表面汚染は電池式コンタミネーションモニターで簡単に測ることができます。

線量/線量率計測 (Dose and Dose Rate Monitoring)

線量は、放射線のエネルギー堆積物量を表します。等価線量は電離放射線への曝露による人への影響の程度を表し、そしてそれはシーベルト[Sv]で表示します。個々の線量は人に及ぼす影響を測定、エリア線量は特定の場所での線量を測定します。様々な放射線により様々な線量がありますが通常、それはガンマ線量だけを考慮すれば十分です。線量率はSv/hで表示されます。線量は人への放射線の影響を測定しドーズメーターを用います。

アクティビティー計測 (Activity Measurement)

アクティビティーとは材料/試料中の時間あたりの自然発生した放射線崩壊の数を表します。これは国際標準単位としてベクレル[Bq]を用い、1Bqは1秒間あたり1個の崩壊が起こったことを表します。それは、電離放射線を発している材料の放射性核種の総量になります。アクティビティーは材料/試料の源を測定し、アクティビティモニターを用います。

Berthold Technologies

CONTAMINATION MONITORS



SCINT Contamination Monitor LB 124 SCINT for α - and β ymeasurement

Simultaneous measurement of alpha, beta and gamma contaminations on surfaces, high sensitivity and uniform response, no counting gas necessary because of new scintillation technology, wide temperature range.

Easy handling over function keys, different user profiles (password-protected), numerous software functions (utilities, measurement modes, parameters), large data memory, program download and data transfer to a Pc/printer are possible. Calibration factors for more than 50 nuclides. calibration selectable according to ISO 7503-1 or related to activity on 100 cm² area, protective grid with high transparency.

Detector

Sensitive area 170 cm² Entrance window's 118 x 145 mm

dimensions

Entrance window's material 6 µm Plastic metallized (approx. 0.4 mg/cm²)

Transmission of grating 80%

Efficiency (related to the activity of a source with an area of 100 cm²) ¹⁴C ³⁶CI (Beta channel) 44% (Beta channel) ⁶⁰Co 29% (Beta channel) ¹³⁷Cs 43% (Beta channel) ²³⁹Pu 18% (Alpha channel) ²⁴¹Am 21% (Alpha channel) Background approx. 0.1 cps (Alpha channel) Background approx. 10 cps (Beta channel)

Gamma sensitivity in external ¹³⁷Cs field with 1 µSv/h:

not detectable Alpha channel Beta channel < 100 cps

Spillover < 20 % with 210 Po Alpha to beta channel

Spillover

 $< 2 \times 10^{-5}$ with 90 Sr Beta to alpha channel

0 to 5000 cps Measuring range (Alpha channel) 0 to 50000 cps (Beta channel) (dead time < 10 %)

Surface response max. ± 20 %

(α channel with 241 Am and βγ channel with 14 C point sources) uniformity

Instrument

Display Monochrome LCD 192 x 64 pixels, Electro-luminescence illumination

Radiation Detector ZnS - Scintillator

Detection of light Photomultiplier (PMT) Measurement modes

Alpha and beta measurement simultaneous and separate, ratemeter, scaler-timer-mode

Max. operating time (without illumination)

3.5 Ah Ni-MH

rechargeable batteries > 25 h 7.8 Ah alkaline batteries > 50 h

Data memory 1000 measured values with date & time

Serial interface RS232

240 x 140 x 110 mm **Dimensions Instrument**

Weight with batteries 1300 g

Temperature range

(operation) -20°C to +40°C

Temperature range

(storage) -40°C to +60°C

External pressure

500 to 1300hPa (operation)

External pressure

100 to 1300hPa (storage/transport)

Relative humidity 0% to 80 % (no condensation)

Protection class IP 53

CONTAMINATION MONITORS



Gas filled Contamination Monitor LB 124B (Xenon) for βγ-measurement

Measurement of radioactive contamination on surfaces based on well proven Xenon filled proportional counter technology. High sensitivity for beta particle and for gamma and especially for measurement of photon emitting radionuclides.

Easy handling over function keys, different user profiles (password-protected), numerous software functions (utilities, measurement modes, parameters), large data memory, program download and data transfer to a Pc/printer are possible. Calibration factors for more than 50 nuclides, calibration selectable according to ISO 7503-1 or related to activity on 100 cm² area, protective grid with high transparency.

Detector

Sensitive area 150 cm² Entrance window's 100 x 150 mm

dimensions

Entrance window's material 10 µm Titanium (approx. 5 mg/cm²)

Transmission of grating 80%

Efficiency (related to the activity of a source with an area of 100 cm²) $^{14}\mathrm{C}$ 2%

18F 2% 18F 17% 36CI 24% 60Co 26% 99mTc 2.6% 131I 17% 137Cs 20% 241Am 11%

Background approx. 10 cps

Instrument

Display Monochrome LCD 192 x 64 pixels,

Electro-luminescence illumination

Radiation detector sealed proportional counter tube with Xenon

filling

Measurement modes Search mode, ratemeter, scaler-timer-mode,

clearance mode, half-life

Max. operating time (without illumination)

3.5 Ah Ni-MH

rechargeable batteries > 25 h 7.8 Ah alkaline batteries > 50 h

Data memory 1000 measured values with date & time

Serial interface RS232

Dimensions Instrument 240 x 140 x 110 mm

Weight with batteries 1620 g

Temperature range

(operation)

-15°C to +50°C

Temperature range

(storage)

-20°C to +70°C

External pressure

(operation)

500 to 1300hPa

External pressure 100 to 1300hPa

(storage/transport)

Relative humidity 0% to 80 % (no condensation)

Protection class IP 64

DOSE AND DOSE RATE MONITORING



Doserate Monitor LB 123D-H10

The proportional counter probe LB 1236 is used for dose and dose rate measurements. It has been tested and approved by the German Office of Standards (PTB).

Easy handling over softkeys, data memory, bidirectional interface for computer and printer and automatic detector control.

Basic Unit LB 1230

Result display high-contrast dot-matrix display

with 32 x 84 pixels

Operating elements membrane keypad comprising

1 On/Off button and 4 softkeys

Detector connection 8-pin connector socket Fischer 04

Data output (Option) FSMA connector, via beam waveguide and

beam waveguide interface LB 75306 with

D 25 connector

Temperature range -15°C to 50°C

Dimensions 145 x 170 x 45 mm (H x W x D)

Weight approx. 800 g (with batteries)

Power supply 3 x IEC-R14 (baby cell) or

3x rechargeable cells Varta NiCd # 5014

Operating life with R14 > 150 hours

Doserate Probe LB 1236-H10

Dimensions and weight

Max.diameter50 mmLength275 mmWeight0.46 kg

Temperature range -10°C to 60°C

Calibration factor 0.214 µSv/h per 1 cps

Measuring range 50 nSv/h to 10 mSv/h

Energy range

(± 30% relative to ¹³⁷Cs)

30 keV to 1.3 MeV

COMBINED SYSTEM: CONTAMINATION AND DOSE/DOSERATE MONITOR



Doserate Monitor LB 123D-H10 and Contamination Probe LB 1231

LB 1231 contains the beta/gamma contamination detector with Xenon fill gas and titanium window. The calibration factors for 25 radionuclides are stored in the instrument. Several free memory locations are available for the customer to enter his or her own calibration factors.

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Easy handling over softkeys, data memory, bidirectional interface for computer and printer and automatic detector control.

Basic Unit LB 1230

Result display high-contrast dot-matrix display

with 32 x 84 pixels

Operating elements membrane keypad comprising 1 On/Off button and 4 softkeys

Detector connection 8-pin connector socket Fischer 04

Data output (Option) FSMA connector, via beam waveguide and beam waveguide interface LB 75306 with

D 25 connector

Temperature range -15°C to 50°C

Dimensions 145 x 170 x 45 mm (H x W x D)
Weight approx. 800 g (with batteries)
Power supply 3 x IEC-R14 (baby cell) or

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Doserate Probe LB 1236-H10

Dimensions and weight

Max.diameter50 mmLength275 mmWeight0.46 kg

Temperature range -10°C to 60°C

Calibration factor 0.214 µSv/h per 1 cps

Measuring range 50 nSv/h to 10 mSv/h

Energy range 30 keV to 1.3 MeV

(± 30% relative to ¹³⁷Cs)

Contamination Probes LB 1231

Window area 120 x 190 mm² Window thickness 5 mg/cm²

Efficiency (including protection grid with 70% transmission): $^{14}\mathrm{C}$ 3.6%

 14C
 3.6%

 90Sr
 30%

 241Am
 11%

Temperature range -15°C to 50°C

Transport Case

Dimensions 180 x 450 x 350 mm (H x W x D)

ACTIVITY MEASUREMENT



Bequerel-Monitor LB 200

Scintillation measuring system for assessment of gamma activity in foodstuffs, liquids, bulk goods in Bq/I

- Detection limit approx. 20 Bq/l
- small dimensions
- easy and error-free operation
- display of the statistical accuracy for each measuring result
- operated by dry batteries or mains supply

Detector Unit

Weight

Radiation detector Nal(TI) - crystal (25 mm Ø x 25 mm)

Bottom 95 x 120 mm **Dimensions**

Height 185 mm (with lead shielding 240 mm)

approx. 0.8 kg

Measuring Unit

Display bright transmitted light LCD,

2 x 16 character, 74 x 28 mm

Measuring ranges 0.1 to 999 cps or 1 to 9999 Bq/l

Calibration factor Preset inside the instrument via code

switches.

the factors for individual radionuclides are

listed in the Operating Manual; manufacturer's setting for ¹³⁷Cs

Voltage supply Via 6 V mains adapter or built-in dry

batteries (4 x LR 20 Mono)

Operation life time batteries approx. 80 h

Box casing with combined

handle/support

220 x 230 x 70 mm (W x D x H)

Connections for mains adapter, probe cable, printer or

computer

Lead shielding

Wall thickness 15 mm Height 115 mm Diameter 120 mm, Weight approx. 8 kg

Beaker

Plastic, useful volume 0.5 I



Activity Monitor LB 2045/LB 742

Modern gamma spectroscopy system for nuclide-specific activity measurements activity in foodstuffs, liquids, bulk goods in Bq/I

- Detection limit approx. 1 Bq/l
- Connection for scintillator probes
- 3 different energy ranges
- Spectrum presentation (1024 channels)
- One or two energy windows
- Nuclide library
- Storage of spectra or ROI data
- Half-life correction
- Weight entry and spillover correction.

Intuitive user guidance: operation via softkeys on the display

Several service functions are available: background measurement, energy calibration and spectrum recording

Measurement/Spectrum

ADC 1024 channels, 7 µs max. conversion time

Energy ranges 0-256 keV, 0-1024 keV, 0-2048 keV non-linear empirical function

Region of interest max. 2 ROIs

Nuclide library max. 50 nuclides

Data Acquisition/Computer

Processor Motorola MC68340 32 bit 16 MHz
Diplay/Touch panel Graphical LC display 320 x 240 pixels
Memory max. 70 spectra or 800 ROI values

Serial interface RS232

General Specifications

High voltage supply 0-1300 Volt, polarity positive,

resolution 12 bit 85-264 VAC, 47-65 Hz

(wide-range input)

Power supply

Protection class IP 54

Temperature range -5°C to +40°C

Relative humidity 0% to 90% (no condensation)

External dimensions 245 x 145 x 325 mm (W x H x T)

Weight 3.3 kg

SZ 50 U 8S8/2E-X scintillation probe

Detector Nal crystal 2" x 2",

with photomultiplier and voltage divider
Resolution 7.5 % (FWHM) for ¹³⁷Cs 661 keV

External diameter 65 mm,

Complete cable set 2 m

Shielding LB 7428 A

Lead chamber for 2" probes

50 mm lead shielding for 0.4 I Marinelli beakers

Weight approx. 75 kg

日本代理店

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