

# Radiation protection

## Standard sources for calibrating instruments

### Alpha or beta wide area standard sources

These wide area sources are especially designed for calibration of contamination detectors used for radiation protection as Hand and Foot Monitors, Planchet Counters or portable alpha/beta detectors



## • Radionuclides

- Reception control of the radiochemical purity of the isotope used
- Alpha radionuclides  $^{238}\text{Pu}$ ,  $^{239}\text{Pu}$ ,  $^{241}\text{Am}$  - Activity: 400 Bq
- Beta-emitting  $^{14}\text{C}$ ,  $^{147}\text{Pm}$ ,  $^{60}\text{Co}$ ,  $^{137}\text{Cs}$ ,  $^{36}\text{Cl}$ ,  $^{90}\text{Sr}$  - Activity on catalogue: 4 kBq
- Target activity for a surface emission flux between 200  $\text{s}^{-1}$  to 10 000  $\text{s}^{-1}$  (other values on request).

## • Sources with aluminium substrate

CERCA LEA has optimized an efficient process for wide area sources manufacturing on an aluminium substrate in accordance with ISO 8769.

- Category 2 reference sources, and working sources.
- Reference sources are calibrated in total emerging particles flux, expressed in  $\text{s}^{-1}$  within  $2\pi$  sr.
- Measurement uncertainty on emission particles flux 6% at 95% of confidence level.
- Uniformity  $\pm 10\%$
- Activity calculated to  $\pm 10\%$
- Source efficiency : the very fine radioactive layer and the high backscatter with the anodised aluminium substrate enables fabrication of highly efficient sources
- No contamination on contact.
- Stainless steel holders.

## • Calibration certificates

These sources are certified as reference sources for calibration of surface contamination monitors.

The emerging flux is certified COFRAC (ISO 17025) and linked to the National Primary Laboratory of Metrology (BNM) as category 1 standards :

- Reference and ID number of source
- Radionuclide and half-life
- Source category
- Active area of source
- Surface emission flux, uncertainty and reference date
- Activity calculated at reference date



These sources are delivered with a COFRAC calibration certificate, which is equivalent to the European Cooperation for Accreditation (ISO17025).



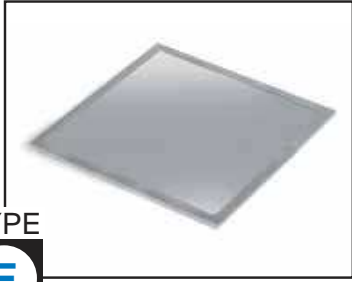
## • Made to measure flux

### Emission flux on request

|  |   |                                    |
|--|---|------------------------------------|
| Radionuclide                                     | ↓ | Dimensions of active area (type E) |
| <b>AM241ESAE1KBQ</b>                             | ↓ | Required activity                  |
| Type of source<br>(Anodised aluminium substrate) |   |                                    |

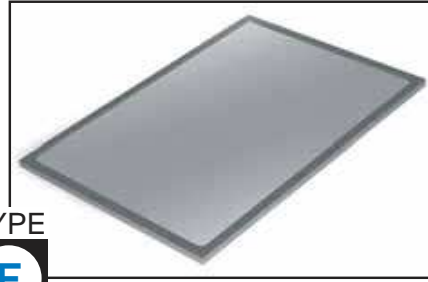
# • Point & wide area sources • Radiation protection •

## • Available source configurations



TYPE  
**E**

*Substrate: Aluminium*  
*Holder: 110 x 110 mm - Stainless steel*  
*Active area: 100 x 100 mm*  
*Total thickness: 3 mm*



TYPE  
**F**

*Substrate: Aluminium*  
*Holder: 120 x 170 mm - Stainless steel*  
*Active area: 100 x 150 mm*  
*Total thickness: 3 mm*



TYPE  
**I**

*Substrate: Aluminium*  
*Tray with retaining ring*  
*Active diameter: 35.5 mm*  
*Outside diameter: 53 mm*



TYPE  
**J**

*Substrate: Aluminium*  
*Simple tray*  
*Active diameter: 51 mm*  
*Outside diameter: 53 mm*



TYPE  
**K**

*Substrate: Aluminium thickness 0.3 mm*  
*Holder: Stainless steel*  
*Active diameter: 110 mm*  
*Outside diameter: 120 mm*  
*Total thickness: 3 mm*



TYPE  
**L**

*Substrate: Aluminium thickness 0.3 mm*  
*Holder: Stainless steel*  
*Active diameter: 44 mm*  
*Outside diameter: 50 mm*  
*Total thickness: 2,6 mm*



TYPE  
**M**

*Substrate: Aluminium thickness 0.3 mm*  
*Holder: Stainless steel*  
*Active diameter: 15 mm*  
*Outside diameter: 30 mm*  
*Total thickness: 2,6 mm*



TYPE  
**N**

*Substrate: Aluminium thickness 0.3 mm*  
*Holder: Stainless steel*  
*Active diameter: 36 mm*  
*Outside diameter: 47 mm*  
*Total thickness: 2,6 mm*

# • Point & wide area sources • Radiation protection •

## Reference alpha and beta sources for radiation protection

| Radionuclide<br>Half-life   | Radiation<br>energy(MeV)<br>$\alpha / \beta$   | Product code | $\alpha/\beta$ flux within<br>$2 \pi$ sr<br>$s^{-1}$ (*) | Approximate<br>activity<br>kBq | Active diameter/<br>active area<br>mm | Type      | Measurement<br>uncertainty<br>% |
|---|--|--------------|--|--------------------------------|---------------------------------------|-----------|---------------------------------|
| <b><sup>241</sup>Am</b><br><i>4,33 x 10<sup>2</sup> years</i>   | 5,443  | AM241ESAE20  | 200  | 4 x 10 <sup>-1</sup>           | 100 x 100                             | E         | 6                               |
|   | 5,486  | AM241ESAF20  | 200  | 4 x 10 <sup>-1</sup>           | 100 x 150                             | F         | 6                               |
|   |  | AM241ESAI20  | 200  | 4 x 10 <sup>-1</sup>           | 35,5                                  | I         | 6                               |
|   |  | AM241ESAJ20  | 200  | 4 x 10 <sup>-1</sup>           | 51                                    | J         | 6                               |
|   |  | AM241ESAK20  | 200  | 4 x 10 <sup>-1</sup>           | 110                                   | K         | 6                               |
|   |  | AM241ESAL20  | 200  | 4 x 10 <sup>-1</sup>           | 44                                    | L         | 6                               |
|   |  | AM241ESAN20  | 200  | 4 x 10 <sup>-1</sup>           | 36                                    | N         | 6                               |
| <b><sup>14</sup>C</b><br><i>5,73 x 10<sup>3</sup> years</i>   | 0,156  | C14ESAE20    | 1500   | 4                              | 100 x 100                             | E         | 6                               |
|   |  | C14ESAF20    | 1500   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | C14ESAI20    | 1500   | 4                              | 35,5                                  | I         | 6                               |
|   |  | C14ESAJ20    | 1500   | 4                              | 51                                    | J         | 6                               |
|   |  | C14ESAK20    | 1500   | 4                              | 110                                   | K         | 6                               |
|   |  | C14ESAL20    | 1500   | 4                              | 44                                    | L         | 6                               |
|   | <b><sup>36</sup>Cl</b><br><i>3,01 x 10<sup>5</sup> years</i>                                 | 0,709        | CL36ESAE20   | 2500                           | 4                                     | 100 x 100 | E                               |
|   |  | CL36ESAF20   | 2500   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | CL36ESAI20   | 2500   | 4                              | 35,5                                  | I         | 6                               |
|   |  | CL36ESAJ20   | 2500   | 4                              | 51                                    | J         | 6                               |
|   |  | CL36ESAK20   | 2500   | 4                              | 120                                   | K         | 6                               |
|   |  | CL36ESAL20   | 2500   | 4                              | 50                                    | L         | 6                               |
| <b><sup>60</sup>Co</b><br><i>1,93 x 10<sup>3</sup> days</i>   |  | 0,318        | CO60ESAE20   | 1900                           | 4                                     | 100 x 100 | E                               |
|   |  | CO60ESAF20   | 1900   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | CO60ESAI20   | 1900   | 4                              | 35,5                                  | I         | 6                               |
|   |  | CO60ESAJ20   | 1900   | 4                              | 51                                    | J         | 6                               |
|   |  | CO60ESAK20   | 1900   | 4                              | 110                                   | K         | 6                               |
|   |  | CO60ESAL20   | 1900   | 4                              | 44                                    | L         | 6                               |
|   | <b><sup>137</sup>Cs + <sup>137</sup>Ba<sup>m</sup></b><br><i>3,02 x 10<sup>1</sup> years</i> | 0,511        | CS137ESAE20  | 2400                           | 4                                     | 100 x 100 | E                               |
| 1,173   |  | CS137ESAF20  | 2400   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | CS137ESAI20  | 2400   | 4                              | 35,5                                  | I         | 6                               |
|   |  | CS137ESAJ20  | 2400   | 4                              | 51                                    | J         | 6                               |
|   |  | CS137ESAK20  | 2400   | 4                              | 110                                   | K         | 6                               |
|   |  | CS137ESAL20  | 2400   | 4                              | 44                                    | L         | 6                               |
| <b><sup>147</sup>Pm</b><br><i>9,58 x 10<sup>2</sup> days</i>  |  | 0,225        | PM147ESAE20  | 1900                           | 4                                     | 100 x 100 | E                               |
|   |  | PM147ESAF20  | 1900   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | PM147ESAI20  | 1900   | 4                              | 35,5                                  | I         | 6                               |
|   |  | PM147ESAJ20  | 1900   | 4                              | 51                                    | J         | 6                               |
|   |  | PM147ESAK20  | 1900   | 4                              | 110                                   | K         | 6                               |
|   |  | PM147ESAL20  | 1900   | 4                              | 44                                    | L         | 6                               |
|   | <b><sup>238</sup>Pu</b><br><i>8,77 x 10<sup>1</sup> years</i>                                | 5,456        | PU238ESAE20  | 200                            | 4 x 10 <sup>-1</sup>                  | 100 x 100 | E                               |
| 5,499   |  | PU238ESAM20  | 200  | 4 x 10 <sup>-1</sup>           | 15                                    | M         | 6                               |
| <b><sup>239</sup>Pu</b><br><i>2,41 x 10<sup>4</sup> years</i>   | 5,105  | PU239ESAE20  | 200  | 4 x 10 <sup>-1</sup>           | 100 x 100                             | E         | 6                               |
|   | 5,143  | PU239ESAF20  | 200  | 4 x 10 <sup>-1</sup>           | 100 x 150                             | F         | 6                               |
|   | 5,156  | PU239ESAI20  | 200  | 4 x 10 <sup>-1</sup>           | 35,5                                  | I         | 6                               |
|   |  | PU239ESAJ20  | 200  | 4 x 10 <sup>-1</sup>           | 51                                    | J         | 6                               |
|   |  | PU239ESAK20  | 200  | 4 x 10 <sup>-1</sup>           | 110                                   | K         | 6                               |
|   |  | PU239ESAL20  | 200  | 4 x 10 <sup>-1</sup>           | 44                                    | L         | 6                               |
| <b><sup>90</sup>Sr + <sup>90</sup>Y</b><br><i>2,82 x 10<sup>1</sup> years</i><br><i>Values given in <sup>90</sup>Sr<br/>only on calibration<br/>certificate</i> | 0,546  | SR90ESAE20   | 2500   | 4                              | 100 x 100                             | E         | 6                               |
|   | 2,284  | SR90ESAF20   | 2500   | 4                              | 100 x 150                             | F         | 6                               |
|   |  | SR90ESAJ20   | 2500   | 4                              | 51                                    | J         | 6                               |
|   |  | SR90ESAI20   | 2500   | 4                              | 35,5                                  | I         | 6                               |
|   |  | SR90ESAI1KBQ | 600  | 1                              | 35,5                                  | I         | 6                               |
|   |  | SR90ESAK20   | 2500   | 4                              | 110                                   | K         | 6                               |
|   |  | SR90ESAL20   | 2500   | 4                              | 44                                    | L         | 6                               |
|   |  | SR90ESAN20   | 2500   | 4                              | 36                                    | N         | 6                               |

(\*) Manufacturing tolerance  $\pm 30\%$

### Legend:

Alpha sources