

## Incorporation Monitoring

### Quick Determination of Incorporation of Radionuclides and Dose Assessment

#### Challenge

The monitoring of on-site workers is required for personnel in nuclear facilities, for example in decommissioning and dismantling projects, in order to detect an incorporation of radioactive material or to exactly determine the type of incorporation and the amount of incorporated radioactive nuclides.

In some cases, a possible incorporation must be assessed very quickly.

This may also be required for reasons related to the protection of the population after severe nuclear accidents.

#### Solution

Our Incorporation Monitoring Service determines the incorporated radionuclides and offers speedy in-house analyses. Two basic methods are used:

- Excretion analysis for  $\alpha$ -emitting and  $\beta$ -emitting radionuclides (in vitro method) and
- Body counter measurement for  $\gamma$ -emitting radionuclides in the whole body and, if necessary, in the thyroid gland (in vivo method).
- At customer's request we determine the resulting radiation dose caused by the incorporations.



$\alpha$  spectrometry of excrement samples



Body counter measurement

#### Customer benefits

- 24/7 service on request, rapid result
- Accredited laboratory according to DIN EN ISO/IEC 17025
- Approved laboratories for incorporation monitoring according to the BfS (Federal Office for Radiation Protection)
- Reliable result of measurement, usable for dose calculation

**Your performance**  
is our everyday **commitment**

#### Technical information

##### Excretion Analyses (Approved Laboratory for Incorporation Monitoring, ID No. BY03)

###### Typical sample spectrum:

Urine, stool

###### Analysis spectrum:

$^3\text{H}$ ,  $^{89/90}\text{Sr}$ ,  $^{234}\text{U}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$ ,  $^{238}\text{Pu}$ ,  $^{239/240}\text{Pu}$ ,  $^{241}\text{Am}$ ,  $^{243/244}\text{Cm}$ , other nuclides at request

###### Measuring techniques used:

LSC,  $\alpha$ -spectrometry, ICP-MS

###### Detection limits:

Uranium: 0.2 mBq/daily urine for  $^{238}\text{U}$

Actinides: 1 mBq/daily urine or stool;

Sr: 0.1 Bq/daily urine

###### Duration of analysis:

10 working days (in special cases 5 working days) after receipt of the samples

##### Body Counter (Approved Laboratory for Incorporation Monitoring, ID No. BY04)

###### Detectors:

- Pure Ge detector with electrical cooling (relativ efficiency 80%)
- $\text{LaBr}_3$  scintillation detector

###### Measurable nuclides:

$^{51}\text{Cr}$ ,  $^{54}\text{Mn}$ ,  $^{57}\text{Co}$ ,  $^{59}\text{Fe}$ ,  $^{60}\text{Co}$ ,  $^{65}\text{Zn}$ ,  $^{95}\text{Zr}$ ,  $^{103}\text{Ru}$ ,  $^{106}\text{Ru}$ ,  $^{110\text{m}}\text{Ag}$ ,  $^{123}\text{I}$ ,  $^{124}\text{Sb}$ ,  $^{125}\text{Sb}$ ,  $^{131}\text{I}$ ,  $^{134}\text{Cs}$ ,  $^{137}\text{Cs}$ ,  $^{140}\text{Ba}$ ,  $^{144}\text{Ce}$

###### Typical limits of detection (10 min measurement):

$^{60}\text{Co}$  (whole body, 70 kg) 120 Bq

$^{131}\text{I}$  (thyroid gland) 90 Bq

#### Key figures

**20 000** in vitro (excretion) measurements and  
**> 9 000** in vivo (body counter) measurements performed so far

Contact: [radiochemistry@framatome.com](mailto:radiochemistry@framatome.com)  
[www.framatome.com](http://www.framatome.com)

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