

Information report

28 May 2019

Release of Selenium 75 from the SCK-CEN facilities, in Mol (Belgium)

Following an incident at the BR2 facility in Belgium, some Selenium 75 (^{75}Se) has been released in the atmosphere. This radionuclide has been detected at low concentrations on aerosol filters from several air monitoring stations belonging to IRSN, in the Lille area and in the northwestern part of France, in agreement with the IRSN's atmospheric dispersion modeling analysis. Besides, field samplings and measurements conducted by IRSN in areas located on the route of the plume did not reveal any traces of ^{75}Se . The dose assessment performed by IRSN exhibits very low exposure levels (much lower than 1 microsievert) without any concern for public health and that does not require to take any specific action on a radioprotection level.

Context

The Nuclear Research Centre (SCK-CEN) in Mol (Belgium) and the Belgian Federal Agency for Nuclear Control (FANC) have announced as soon as May 16, 2019 on their respective website, the release event of Selenium 75 (^{75}Se) that arose on May 15, 2019 from the BR2 research reactor in Mol:

https://sckcen.be/en/News/20190516_Selenium

<https://afcn.fgov.be/fr/actualites/rejet-limite-de-selenium-75-au-sck-cen>

The BR2 research reactor located in the Belgian nuclear research centre SCK-CEN in Mol, is in charge of the production of selenium 75 (^{75}Se) sources for gammagraphy tests (for instance for welding checking in the industry). Each source has an activity of about $3.7 \cdot 10^{12}$ Bq.

As a reminder, ^{75}Se is a beta and gamma emitting radionuclide with a half-life of 119.8 days which does not exist naturally. It is not measured in the environment on a routine basis.

Description of the event

On May 15, 2019, during the production process of a ^{75}Se source (welding), a smoke leak has been noticed by the operator. Immediately a contamination in the ventilating system of the hot cell (area where the process is performed) was detected followed by a release through the chimney of the BR2 reactor to which the circuit was connected.

The released activity in the environment has been evaluated by the facility operator to $3.7 \cdot 10^{10}$ Bq, leading to a dose lower than 10 microsievert ($10 \mu\text{Sv}$) for an individual near the release point. Detailed investigations by the facility operator are on the way to understand the reasons of this malfunction.

This event has been rated 1 by FANC on the International Nuclear and Radiological Event Scale (INES) which is a seven-level scale. Based on preliminary results and impact assessments, FANC has estimated that no protective action of the population or of the food chain was necessary due to the limited and point release activity.

Plume trajectory

IRSN has been informed by SCK-CEN on May 21, 2019 about this event and its consequences for the French territory. SCK-CEN has provided atmospheric dispersion modeling computations which showed that the ⁷⁵Se release spread towards France.

As soon as received, IRSN has performed a first modeling investigation of the plume trajectory and has assessed the associated airborne radioactivity levels (Fig. 1). This modeling work shows that the air mass reached the Lille area on May 15 evening, then moved to the English Channel through the Seine-Maritime department, north to Le Havre before reaching the northern part of the Cotentin on May 16, end of the morning, with a gradual decrease in the ⁷⁵Se airborne activity concentrations. The computations give an activity concentration between about 1 to 5 mBq/m³ during the presence of the plume which stayed about 3 hours in the Lille area.

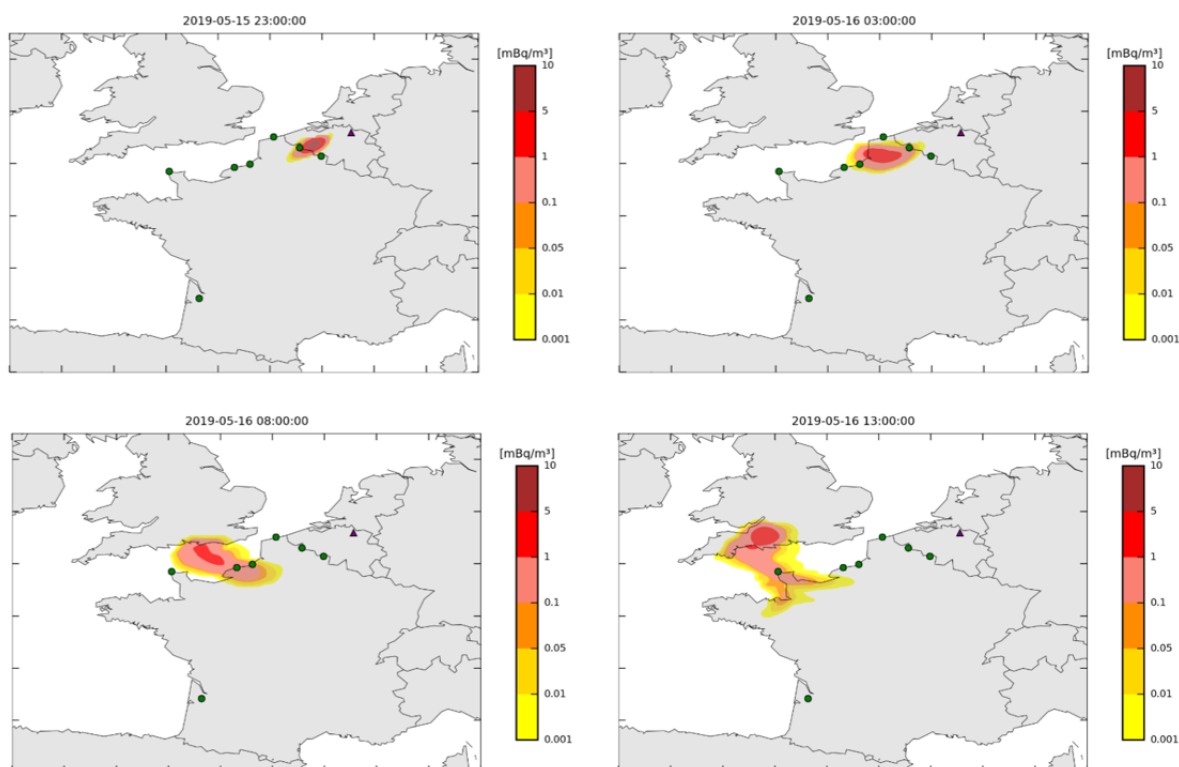


Figure 1: Modeling of the ⁷⁵Se plume dispersion.

Measurements performed by IRSN

Measurement of aerosol filters

As a priority, IRSN has conducted the analyses on aerosol filters from its atmospheric monitoring stations in areas potentially concerned by the release: Villeneuve d'Ascq, Maubeuge, Paluel, Penly, Omonville-la-Petite, and Flamanville (cf. Fig. 2 and Table 1)

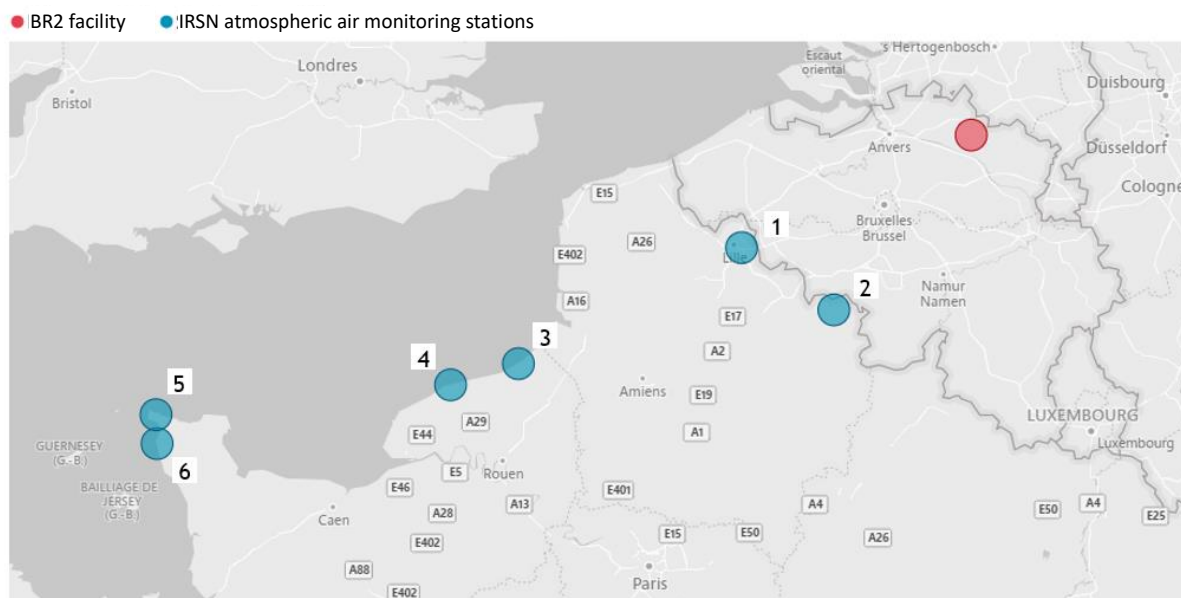


Figure 2: In blue, IRSN atmospheric air monitoring stations (OPERA network). In red, location of the BR2 facility.

Table 1: Measurement results on aerosol filters sampled at IRSN air monitoring stations

Location	Sampling period	Activity concentration (mBq/m ³)
1 - Villeneuve d'Ascq	14/05/19 au 17/05/19	0,096 ± 0,009
	17/05/19 au 21/05/19	< 0,0008 ¹
2 - Maubeuge	13/05/19 au 16/05/19	< 0,0016 ¹
3 - Penly	13/05/19 au 20/05/19	0,0053 ± 0,0007
4 - Paluel	13/05/19 au 20/05/19	0,0027 ± 0,0004
5 - Omonville-la-Petite	13/05/19 au 20/05/19	0,0011 ± 0,0002
6 - Flamanville	13/05/19 au 20/05/19	< 0,0006 ¹

¹ Activity below the decision threshold of the measurement devices.

These results confirm the expected data from the dispersion simulation, i.e. the plume entered France in a very localized way through the Lille area (detection on the aerosol filter in Villeneuve d'Ascq between 14 and 17 May, 2019) then moved towards the coastal zone of the Seine Maritime department (detection

on the aerosol filters in Paluel and Penly), and finally crossed the North Cotentin area (Omonville-la-Petite) where ^{75}Se was detected in minute amounts (due to the gradual dispersion of the plume).

Besides, no significant increase of the ambient gamma dose rate has been detected by the probes of the Teleray¹ network (IRSN), which is consistent with these very low activity concentrations.

Plant sampling along the plume trajectory

In addition to aerosol filters, IRSN has rapidly engaged two specific field sampling campaigns:

- In the Lille area on May 22, 2019 with in situ gamma spectrometry, and soil, grass and leafy vegetables (rhubarb and salad) samplings; exposed to the plume;
- In Omonville-la-Petite (Manche department) on May 23, 2019: sampling of grass exposed to the plume.

Figure 3 shows the various sampling sites in the terrestrial compartment performed by IRSN around Lille.

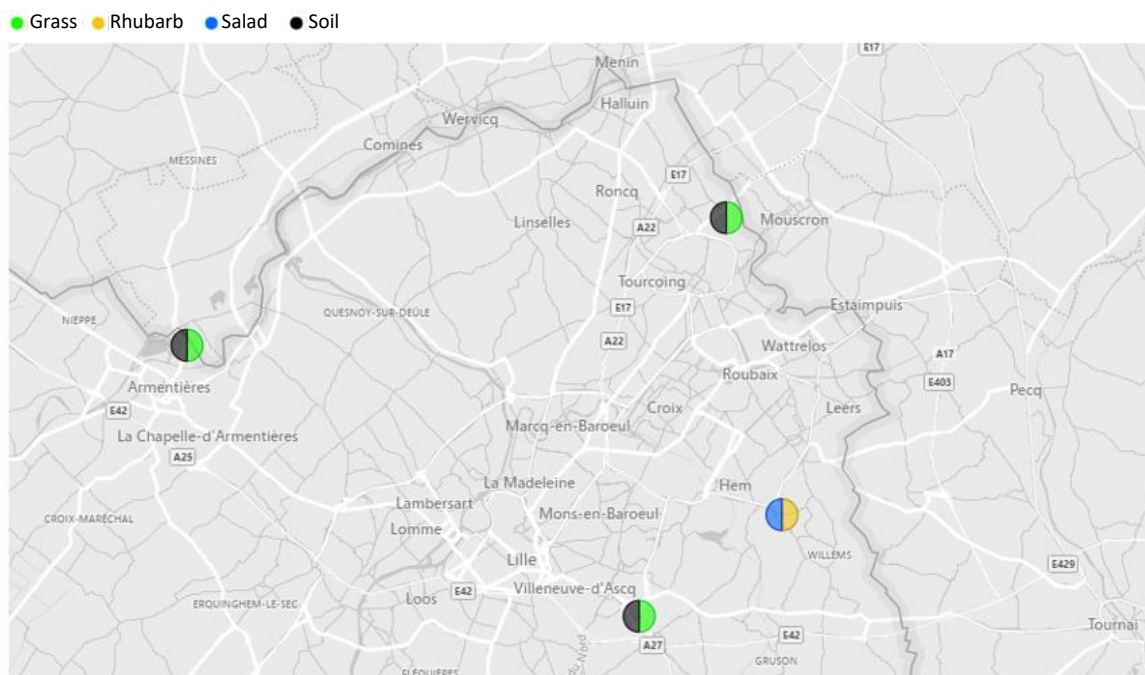


Figure 3 : Terrestrial samplings performed by IRSN in the Lille area.

The results of the measurements performed on the various sampling conducted by IRSN during both field investigations are shown in Table 2.

¹ IRSN manages two monitoring networks dedicated to the radioactivity in the atmosphere: OPERA and TELERAY. The OPERA network is composed of about 40 air samplers to collect aerosols on filters followed by their measurement at the laboratory. The TELERAY network has more than 420 probes distributed on the whole territory for the measurement of the ambient gamma dose rate through a digital exchange data center. The almost instantaneous measurements (1 every 10 min) are available at <http://teleray.irsn.fr>

Table 2 : Measurement results by IRSN during the two in situ campaigns in the Lille area and in the north Cotentin

Area	District	In situ sampling / measurement	Sampling date	⁷⁵ Se activity concentration (Bq/kg)
Lille area	Villeneuve-d'Ascq	in situ gamma spectrometry	22/05/19	Not detected ²
		Soil	22/05/19	< 0,278 ³
		Grass	22/05/19	< 0,340 ³
	Tourcoing	in situ gamma spectrometry	22/05/19	Not detected ²
		Soil	22/05/19	< 0,144 ³
		Grass	22/05/19	< 0,127 ³
	Armentières	in situ gamma spectrometry	22/05/19	Not detected ²
		Soil	22/05/19	< 0,448 ³
		Grass	22/05/19	< 0,263 ³
	Sailly-lez-Lannoy	Rhubarb	22/05/19	< 0,358 ³
Sailly-lez-Lannoy	Salad	22/05/19	< 0,315 ³	
North Cotentin	Omonville-la-Petite	Grass	23/05/19	< 0,179 ³

² Qualitative measurement that does not exhibit the ⁷⁵Se presence.

³ Activity concentration below the decision threshold of the measuring devices.

All these data are below the detection limits of the measurement devices and do not reveal any ⁷⁵Se contamination of the terrestrial compartment (soil, plant, local foodstuff) under the plume trajectory.

These sampling analysis results are available on the « Réseau national de mesure de la radioactivité dans l'environnement » website (<https://www.mesure-radioactivite.fr/en/>).

Dosimetric impact

Based on these results, IRSN has performed a dose assessment for the population living in the Lille area exposed to the plume. The evaluation gives very low dose levels (much lower than 1 microsievert) without concern for public health and that do not justify to take specific protective actions on a radioprotection level.