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IRSN
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

INFORMATION REPORT

Detection of an increase in airborne radioactivity levels in Northern Europe

Date : 30/06/2020

The safety and radiation protection authorities of the Scandinavian countries have reported an increase in atmospheric radioactivity detected by their monitoring stations during June. The levels recorded in these countries are very low and do not pose any risk to the public or to the environment.

To date, available measurements from the IRSN's OPERA monitoring network show no abnormal increase in the level of atmospheric radioactivity in France.

The origin of the release is not identified at this stage. Based on the available measurements, IRSN is conducting investigations, including simulations, to better understand the source location and possible causes of this increase.

1. AVAILABLE INFORMATION

The competent authorities in Sweden[1] (SSM), Norway[2] (DSA) and Finland[3] (STUK) have reported an increase in atmospheric radioactivity levels based on measurements performed on aerosol filters sampled at stations belonging to their national monitoring networks. In addition, the Comprehensive Nuclear-Test-Ban Treaty[4] Organization (CTBTO) reported that a station of its international monitoring system (IMS) located in Sweden had detected this increase.

During June, various artificial radionuclides were indeed detected. First, the Norwegian authorities reported having measured traces of iodine 131 over their territory during the first week of June. Then, the Swedish and Finnish authorities reported that the following radionuclides had been detected by their stations from June 8, 2020: cobalt 60, cesium 134, cesium 137, and ruthenium 103.

[1] https://www.stralsakerhetsmyndigheten.se/press/nyheter/2020/mycket-laga-nivaer-av-radioaktiva-amnen-uppmatta-i-sverige/

[2] https://www.dsa.no/nyheter/95196/svaert-lave-nivaa-av-radioaktivt-jod-maalt-i-finnmark-og-paa-svalbard

[3] https://www.stuk.fi/-/helsingin-ilmassa-pienia-maaria-keinotekoisia-radioaktiivisia-aineita-viime-viikolla

[4] https://twitter.com/SinaZerbo/status/1276559857731153921

This information was also relayed by the RIVM[5], the Dutch institute responsible for monitoring environmental radioactivity in the Netherlands, which indicates that these radionuclides could originate from damage to fuel elements in a nuclear power plant. The RIVM indicates that the location of the release point cannot be specified at this stage but that the calculations they carried out show that the radionuclides could have been transported on a trajectory going from western Russia to Scandinavia.

Questioned by the media, the Russian operator of nuclear electricity Rosenergoatom indicates that "*no anomaly was recorded in the nuclear power plants of Leningradskaya and Kolskaya*" and that "*the discharges did not exceed the control values for the period indicated"*.

Furthermore, the Scandinavian countries declared that they were not aware of an incident at their nuclear facilities which would explain the levels of activity measured.

2. MEASURES IN FRANCE AND ABROAD

Measurements by IRSN's OPERA[6] monitoring network stations in northern France do not report any abnormal increase in airborne radioactivity over the period from the beginning of June. Cesium 137 measured at trace levels (< 0,1 µBq/m^3) comes from the remainders of the Chernobyl accident fallout and from global fallout from atmospheric nuclear tests.

Table 1: IRSN measurements of the airborne cesium 137, cesium 134, cobalt 60 and ruthenium 103 concentrations

Sampling location (department)	Collection period from	to	Activity in ^{137}Cs in air (µBq/m^3)	Activity in ^{134}Cs in air (µBq/m^3)	Activity in ^{60}Co in air (µBq/m^3)	Activity in ^{103}Ru in air (µBq/m^3)
* Bure (55)	08/06/20	15/06/20	0,020 ± 0,012	< 0,016	< 0,014	< 0,015
* Dijon (21)	10/06/20	18/06/20	0,025 ± 0,018	< 0,024	< 0, 030	< 0,021
* Orsay (91)	10/06/20	17/06/20	0,034 ± 0,020	< 0,024	< 0,030	< 0,028
* Revin (08)	09/06/20	16/06/20	0,044 ± 0,026	< 0,028	< 0,027	< 0,027

The results indicated after the < symbol correspond to values below the decision threshold.
The activities are returned on the date of mid-collection (by agreement).
*The localities whose names are preceded by an * are equipped with a station with very high sampling rate (400 to 700 m³ / h).*

These results confirm that the slightly contaminated air masses measured in the Scandinavian countries did not reach France during the aforementioned period. This is in line with the first numerical simulations concerning the transport of these air masses, carried out by the IRSN.

[5] RIVM : National Institute for Public Health and the Environment – Pays-Bas https://www.rivm.nl/nieuws/radioactieve-stoffen-gedetecteerd-in-lucht-boven-noord-europa

[6] See appendix presenting the IRSN OPERA network.

The analysis of filters from OPERA network stations for the second half of June is underway in IRSN laboratories and the results will be published soon. The aforementioned simulations show that air masses from the Scandinavian countries were able to reach northern France in the last week of June.

The measurements performed by the STUK (Finnish authority), published on their website, report levels of radioactivity in the air, at the Helsinki station, from June 16 to 17, 2020, of the order of ten microbecquerels/m^3: Cs-137 = 16,4 µBq/m^3 ; Cs-134 = 21,5 µBq/m^3 ; Co-60 : 7,6 µBq/m^3 ; Ru-103 : 4,8 µBq/m^3.

3. POSSIBLE ORIGIN OF THIS ELEVATION AND MODELING

The IRSN made simulations using available measurements centralized in particular by the IAEA. At this stage, these simulations do not make it possible to pinpoint the origin of the release. At first glance, however, it seems that the geographic area mentioned by the RIVM (from western Russia to Scandinavia) is plausible.

The radionuclides measured, and their relative ratios, provide information on the source which released them. Thus, the ratios of the fission products measured (Cs-134, Cs-137 and Ru-103), are characteristic of nuclear fuel irradiated in a power plant; irradiation which ended several months ago. As a reminder, in power plants, the fuels after irradiation are placed in a so-called deactivation pool, connected to the nuclear reactor. In addition, cobalt 60, which is a neutron activation product formed from metallic materials present in the nuclear reactor core, has been measured. This element can migrate in the water of the primary cooling circuit.

It should be noted that in a scenario involving nuclear fuel, other fission products can also be expected, notably gas (krypton 85, iodine 131, strontium 90, etc.). The absence of such radionuclides in the available measurements can be due to the difficulties to detect them at very low levels or by the measurement techniques implemented, but also to the fact that the event concerns a piece of equipment from a power plant where certain elements preferentially accumulates (for example in the water treatment system).

It should also be noticed that such mix of radionuclides has already been detected in the past, especially in the Scandinavian countries. This may support the hypothesis that the origin of the release is linked to a regular industrial operation carried out on purification equipment of the primary circuit or of the deactivation pool (for example the treatment by incineration of used resins and filters).

For the IRSN, the iodine 131 measurement performed in Norway during the first Week of June does not likely result from the same origin. This measure of iodine could correspond to the release of radioactive elements from radiopharmaceutical production units, whose detections have already taken place in Europe in the past[7]. In addition, iodine 131 from an irradiated fuel several months old, would have disappeared due to the radioactive decay and its period of about 8 days.

4. RADIOLOGICAL CONSEQUENCES

The levels of radioactivity in the air measured in the Scandinavian countries are low and pose no risk to the public or the environment.

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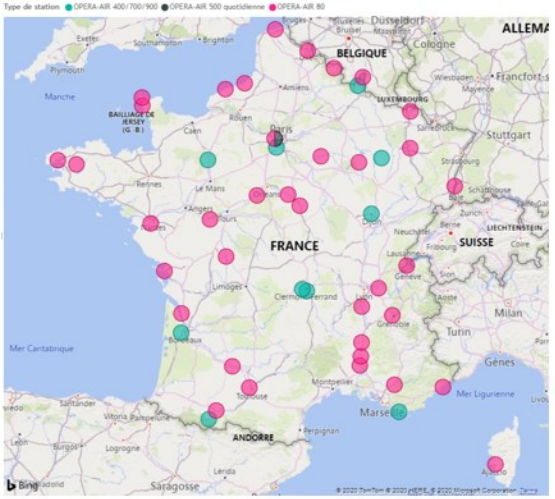
[7] O. Masson & al : "Potential Source Apportionment and Meteorological conditions involved in airborne ^{131}I detection in January/February 2017 in Europe", Environmental science and technology, 2018 ,52, 8488-8500.

APPENDIX: THE IRSN OPERA NETWORK

Map of the IRSN OPERA-AIR network

Monitoring radioactivity in air by measuring aerosols taken from filters.
37 medium flow stations (80 m³ / h)
11 very high flow stations (400 to 800 m³ / h)
spread over the whole territory



Sampling (1 week)

In normal situation:
- 37 medium flow stations (80 m³/h)
- 11 very high flow stations (400 et 800 m³/h)

Filter collecting

- Recording of information about the sample (volume, ...)
- Filter change
- Sending to IRSN

LA POSTE

Expedition (a few days)

- Sending by postal services to IRSN laboratories in Orsay and Le Vésinet

Reception at IRSN (one day)

- Recording
- Compaction to improve measurement performance

Measurement (2 days)

- Gamma spectrometry measurement on "anti-cosmic" detector, allowing very low level measurement (<1 µBq / m³, up to 0.05 µBq / m³)
- Counting for 24 or 48 hours depending on the station

Metrological analysis and validation of the result

In case of an event

In normal situation

Publication of information reports

on www.irsn.fr

Publication of results

on the national network for environmental radioactivity measurements RNM
www.mesure-radioactivite.fr