INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

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INFORMATION NOTICE

Detection in France of traces of iodine-131 in the air coming from radioactive releases in a foreign country

Unofficially informed via the scientific networks of which it is a member, the IRSN was made aware last week of the detection by several Central European countries of traces of iodine-131 in the air, an event which was the subject of an IAEA press release published on November 11th. As soon as it was informed, the IRSN rapidly undertook the analysis of samples of aerosols and gaseous iodine taken in France using gamma spectrometry in order to look for the possible presence of this radionuclide.

Since the expected levels were extremely low, in the order of a few microbecquerels per m^3 of air ($\mu Bq/m^3$), the institute first deployed its most efficient metrology resources located at the Orsay environmental radioactivity measurement laboratory, and selected samples taken from very high aspiration rate filtering stations (between 300 and 700m^3/hour) from its OPERA-Air monitoring network (figure 1). The combination of these resources is the only way of measuring traces of radionuclides in the air, especially when from artificial sources. The sampling period on these stations is at least four days.

The IRSN is also carrying out ongoing sampling of aerosols in Le Vésinet in a medium flow rate collection station (60m^3/hour) and has air sampling equipment on the same site using activated carbon to trap the iodine in gaseous form. In its Le Vésinet laboratories, the IRSN measured the most recent samples using this equipment.

Figure 1 - IRSN OPERA-Air network equipment: very high flow rate aerosol collection station (TGD) on the right, intermediate flow rate aerosol collection station (Le Vésinet) in the centre, and shielded gamma spectroscopy room in the Orsay IRSN Laboratory.

Usually the sample filters are kept for five or six days before measurement to allow the short lived natural radionuclides to reduce, in order to be able to quantify the artificial radionuclide traces which would otherwise be impossible. They are then subjected to gamma spectrometry over a period of two to five days in order to reach very low threshold detection limits.

In the current situation, the most recent sample filters were measured on reception and then recounted several days later in order to reach the lowest detection limits.

The results currently available (Monday November 14th) are shown in the table below. Considering the short half-life of iodine 131 and the sampling period (from five to more than ten days), the activity measured in the laboratory was corrected to take into account radioactive decay, in order to arrive at the average concentration levels in the air half way through the sampling period.

Table 1 - Concentrations in air particle iodine-131 activity measured by gamma spectroscopy on sampling filters from the IRSN OPERA-Air network stations. The significant values are in red, with the associated measurement uncertainty. Measurements preceded by a "<" symbol are lower than the indicated detection limit.

Sampling location	**Sampling period**		**Iodine-131 volumetric activity in the air (in µBq/m³) reported at mid-sampling period**
	Start date	*End date*	
ALENCON	30/09/2011	10/10/2011	<3.9
ALENCON	10/10/2011	20/10/2011	<1.7
ALENCON	20/10/2011	31/10/2011	<0.8
ALENCON	31/10/2011	05/11/2011	1st measurement <3.5
ALENCON	31/10/2011	05/11/2011	2nd measurement in progress
BORDEAUX-MERIGNAC	10/10/2011	20/10/2011	<1.1
BORDEAUX-MERIGNAC	20/10/2011	31/10/2011	<0.4
BURE	30/09/2011	10/10/2011	<2.9
BURE	10/10/2011	20/10/2011	<1.4
BURE	21/10/2011	02/11/2011	<0.6
BURE	02/11/2011	07/11/2011	**0.79 +/-0.22**
BURE	07/11/2011	10/11/2011	Measurement in progress
CHARLEVILLE-MEZIERES	30/09/2011	10/10/2011	<2.9
CHARLEVILLE-MEZIERES	10/10/2011	20/10/2011	<0.8
CHARLEVILLE-MEZIERES	20/10/2011	31/10/2011	<1.4
CHARLEVILLE-MEZIERES	31/10/2011	05/11/2011	<1.0
CHARLEVILLE-MEZIERES	05/11/2011	10/11/2011	**5.7 +/- 1.9**
GOLFECH	24/10/2011	31/10/2011	<0.7
GOLFECH	31/10/2011	07/11/2011	<1.6
ORSAY	30/09/2011	10/10/2011	<3.2
ORSAY	20/10/2011	28/10/2011	<1.4
ORSAY	28/10/2011	04/11/2011	<2.7
ORSAY	04/11/2011	10/11/2011	**4.9 +/- 1.4**
SEYNE S/MER	30/09/2011	11/10/2011	<2.6
SEYNE S/MER	11/10/2011	20/10/2011	<1.5
SEYNE S/MER	20/10/2011	02/11/2011	<0.5
LE VESINET	01/11/2011	06/11/2011	<4.9
LE VESINET	06/11/2011	09/11/2011	**12 +/- 6**

These initial results reveal the presence of iodine-131 particles in the air in France at concentrations not in excess of a few µBq/m³ and very close to the detection limits of the measurement instruments.

These detections cover four samples taken in November by the very high flow rate stations located in the Northern half of France (Orsay (91), Charleville-Mézières (08), Bure (55) and the medium flow rate station in Le Vésinet (78)). **Although the presence of iodine-131 in the air is highly unusual in France, and indicates the presence of abnormal radioactive releases into the atmosphere, the concentrations**

observed present no risk to the health of the population[1]. The most recent samples from the other OPERA-Air network TGD stations located in the Southern half of France are still being analysed, whereas the samples taken in October have not yet revealed any traces of iodine-131 higher than the detection limits of the measurement techniques. Long measurements are in progress in order to lower the detection limits on all the samples.

Amongst the four aerosol samples showing significant iodine-131 activity, the three most recent samples (end of sampling on November 9th and 10th) have the highest concentrations (5.7µBq/m^3 in Charleville-Mézières, 4.9µBq/m^3 in Orsay and 12µBq/m^3 in Le Vésinet). The sample taken in Bure, taken in a previous period (from November 2nd to 7th), reveals a much lower activity (0.79µBq/m^3). This is probably a very widespread low concentration of pollution in the North of France, and these results lead to the conclusion that the iodine-131 air pollution entered the territory towards the end of the sampling period, i.e. between the 7th and 10th of November. Furthermore, the highest value obtained was for the sample which was taken the most recently (November 6th) in Le Vésinet, whereas the measurement of the sample for the preceding period (from November 1st to 6th) gave a result which was lower than the detection limits. It is possible that this pollution may continue beyond November 10th which future measurements will make it possible to confirm.

The origin and the dates of the radioactive releases which caused this iodine-131 pollution are currently unknown. The detection in France by the IRSN probably has the same origin as what was detected previously in various central European countries. These releases, the scale of which cannot be estimated at this time and the local impact of which may be significant, can be the result either of an iodine-131 production activity for medical use, or a nuclear reactor (producing electricity or used for research). In the latter case, this radionuclide would be accompanied by other nuclear fission products which were not detected by the first analyses carried out by the IRSN. However, considering the very low concentrations of iodine 131 measured in the air, it is possible that the other radioactive elements, if present in the air, have concentrations currently too low to detect.

Special attention has been taken to examine the hypothesis of a new release from the Fukushima power plant. Several considerations make it possible to reject this hypothesis:

- the iodine 131 released in March during the Fukushima accident has almost completely disappeared, including from the reactors, due to its very short half-life; furthermore, the stricken reactors are no longer producing iodine 131 because the nuclear fission reaction was stopped on March 11th;
- even if the concentrations measured in France are approximately 100 times lower than those observed after the Fukushima accident, it would have taken a major release of iodine 131 in Japan to reach such a level, this would have caused much earlier detection and higher levels in Japan, as was the case in March 2011.

The IRSN is currently conducting retro-trajectory calculations in an attempt to locate the origin of the air masses that carried the detected iodine 131.

Given these initial results, the IRSN is continuing to specifically and actively monitor iodine 131 levels in the air. Besides the sampling of aerosols, the IRSN has implemented air sampling using activated carbon cartridges in order to detect the possible presence of iodine 131 in its gaseous form. However the detection limit that this technique can reach is of the order of 300µBq/m^3, which will make the quantification of iodine 131 in this form difficult. To illustrate this, the first result obtained by the IRSN on a sample made from November 9th to 10th in Le Vésinet (78) shows a concentration lower than the detection limit (280µBq/m^3).

[1] For information, the iodine 131 levels measured in France after the Fukushima accident reached a few milliBecquerels per m^3 of air (see the June 10th bulletin), which is over 100 times greater than the values currently being detected.