IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

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Fires in Ukraine in the exclusion zone around the Chernobyl power plant: First results of ^{137}Cs measurements in France

Since the release of the information notes on April 7, 15 and 17, 2020, the number of fires in Ukraine has decreased. As of April 24, 2020, however, a few outbursts remain in the exclusion zone around the Chernobyl power plant.
This note updates the previous situation points by setting out the state of the fires to date and by updating trajectories of the fire-contaminated air masses.
As promised, IRSN publishes the results of its first measurements, which notably concern the airborne ^{137}Cs activity in France of ^{137}Cs-labeled air masses from the fire area. These measurements show very tiny levels of radioactivity, consistent with its modeling results.

1 / Current situation (as of April 24, 2020)

The number of fires has decreased compared to the situation described in the previous note (April 17).

The closest fire groups to the Chernobyl power plant are about 16 km to the east and 20 km to the west. Other larger fires are also identified but at a larger distance from the plant: 37 km to the East and 110 km to the West.
Current winds (coming from West-North-West) may favor the fires coming closer to the power plant but significant rains are expected in this region Saturday April 25, 2020 afternoon which are likely to reduce the fire intensity and contribute to their extinction.

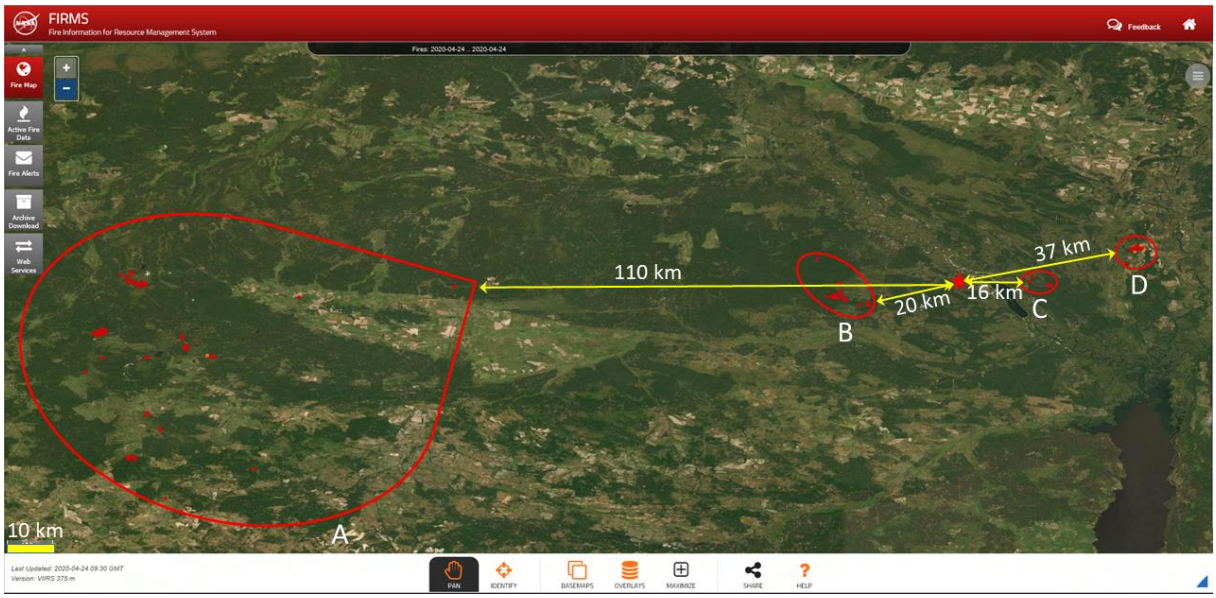

Figure 1: Map of fire spots on April 24, 2020 at 9:30 a.m. (UTC)
(source: NASA / FIRMS. The Chernobyl power plant is marked with a red star)

2 / IRSN measurements in France

The IRSN publishes the first results of airborne ^{137}Cs from its OPERA network aerosol samplers.

Table 1: Airborne ^{137}Cs activity (µBq/m^3)

Sampling location (department)	Sampling period from	to	Airborne ^{137}Cs (µBq/m^3)
* Orsay (91)	01/04/2020	08/04/2020	0,139 ± 0,031
* Orsay (91)	08/04/2020	15/04/2020	0,267 ± 0,064
* Dijon (21)	30/03/2020	06/04/2020	0,184 ± 0,046
* Romagnat (63)	03/04/2020	09/04/2020	0,269 ± 0,079
* Revin (08)	01/04/2020	16/04/2020	0,183 ± 0,038
*** Bouc Bel Air (13)**	**04/04/2020**	**10/04/2020**	**1,161 ± 0,212**
** Bugey (01)	30/03/2020	06/04/2020	< 2,7
** Nancy (54)	31/03/2020	07/04/2020	< 2,5
** Fessenheim (68)	30/03/2020	06/04/2020	< 0,7
** Grenoble (38)	30/03/2020	06/04/2020	< 0,44

The results indicated after the symbol < correspond to values below the decision threshold[1]
The activities are returned to the date of mid-collection (by agreement)
Localities whose names are preceded by an * are equipped with a high sampling rate station (400 to 700 m^3/h) for trace detections
Localities whose names are preceded by ** are equipped with a lower sampling rate station (80 m^3/h)

The highest airborne ^{137}Cs activity has been measured at the Bouc-bel-Air station (13) southeastern France (ca. 400 m^3/h) with 1.161 ± 0.212 µBq/m^3 for a collection period from April 04-10, 2020.
This measurement reflects a weak ^{137}Cs labeling linked to air masses coming from Ukraine and is consistent with IRSN's modeling expectations. The background level[2] near the station is estimated to about 0.15 µBq/m^3 at that season. Without the exact date being able to be deduced from this measurement, it tends to confirm that the air masses did arrive in France from April 7, 2020.[3]

The measurements performed on the aerosol filters from high-flow rate samplers in Orsay, Dijon, Romagnat and Revin are above decision thresholds but correspond to tiny ^{137}Cs concentration within the

[1] equivalent to the detection limit

[2] due to Chernobyl fallout in 1986 and global fallout from atmospheric nuclear weapon tests

[3] Each measurement result represents an average value over a usual 7-day sampling period which does not necessarily corresponds to the period during where the 137Cs-labeled air mass resulting from fires in Ukraine was present at the sampling station. Therefore it can lead to a lower value compared with what would have been measured if the sampling had started exactly at the time of the air mass arrival. In order to take this into account, the IRSN, based on its weekly routine airborne ^{137}Cs measurements at the closest OPERA station to Bouc Bel Air (i.e. the one located at La Seyne sur Mer in the Var department) estimated the usual average background value measured in the same period (March to May) over the past 5 years, in the region. This average ^{137}Cs background level is 0.15 µBq/m^3. By subtracting this background level and most precise estimated dates of the ^{137}Cs-labeled air mass resulting from fires (data from modeling performed by IRSN), IRSN estimated that the average ^{137}Cs level added by fires in Ukraine during the presence of the air mass is at most 2 µBq/m^3.

usual background variability concentrations at those locations. During the sampling periods, they do not show any radiological labelling of the air masses coming from Ukraine.

The measurements performed on the medium-flow station filters (80 m^3/h) from Bugey, Nancy, Fessenheim, and Grenoble are below the detection limits for the considered sampling periods.

To detect radionuclide trace levels above the usual background level, the IRSN implements very efficient sampling and measurement equipment (as for those used by the French Atomic Energy Commission) with large volumes of air and long counting periods (several days)on low-level gamma spectrometers. Results obtained thanks to these protocols require delays on about one to two weeks under normal conditions. A diagram describing the main stages in obtaining these measurements is presented in the appendix.

3 / Modelling

Since its note of April 17, 2020, IRSN has completed its simulation of air mass transport which now covers the period from April 3 to 27, 2020 [4] assuming that the fires will continue until April 25, 2020 (midnight).

The video[5] of the air mass dispersion simulation between April 3 and April 27 is available on the IRSN website.
This video shows the arrival of a first plume in France from April 7, 2020 by the South-East with very low concentrations levels which lasted until April 14, 2020.
It also indicates that a second plume was able to enter France from April 23, 2020 through the Southeast with concentration levels again extremely low, close to detection limits.

To confirm its modeling assessments, IRSN will continue to measure aerosol filters from its OPERA network. These measurement results will be made publicly available.

[4] based on a total remobilized activity of around 700 GBq in ^{137}Cs between 3 and 25 April 2020 (midnight) estimated thanks to the measurements transmitted by our European partners among them Ukrainians.

[5] https://www.irsn.fr/EN/newsroom/News/Pages/20200424_Fires-in-Ukraine-in-the-Exclusion-Zone-around-chernobyl-cesium-137-results-in-france.aspx

Appendix

Diagram of the different stages of sampling to the measurement of a filter from an IRSN OPERA station