OpenRadiation: A collaborative project to measure radioactivity by and for citizens

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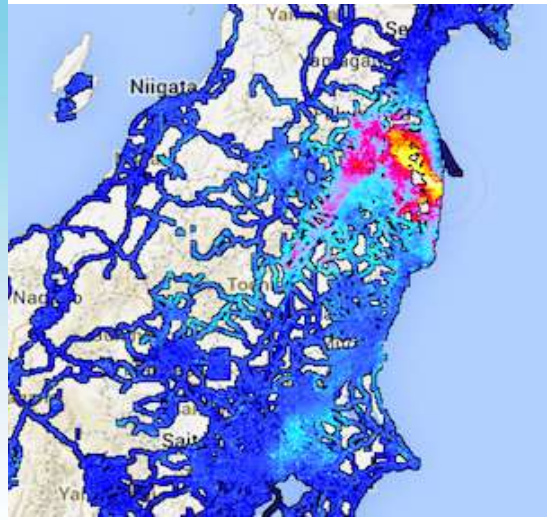
The origins of the OpenRadiation project

- Radioactitity measurements by citizens was tested for the first time in settlements close to the Chornobyl exclusion zone to promote a practical radiation protection culture. (report CEPN 286)
- Demonstrated that radioactivity measurement is an efficient mean to recover a certain level of confidence in daily living conditions (Lepicard et al, 2005).

© CEPN, 2005



Safecast 2012

- Following Fukushima accident, several citizen initiatives rise up due to a lack of confidence in the Japanese authorities.
- New tools emerged: interactive mapping, social media, which resulted in a large sharing of the results.
- Two main objectives:
  - Allowing everyone to evaluate by itself its own risks
  - Providing field data in real time.
- The inclusion of citizen consultation in post-accidental management is now part of ICRP's recommendations (ICRP 146, 2020).

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The beginnings of OpenRadiation

- Many nuclear plants in France
- Environmental monitoring is ensured by experts (ASNR), accredited labs from licensees and their partners and labs from NGOs.
- There is a public demand for measuring radioactivity around NPP and other nuclear installations. The system adopted should retain some characteristics:
  - A portable measurement tool, simple to use, robust and cheap
  - The possibility to make results publicly available
  - Transparency in the sharing and the publication of data
- A double challenge:
  - Operating such a system in a sustainable way in the absence of radiological issues
  - Being useful in case of nuclear or radiological emergency
- The solution : a collaborative approach with NGOs. Official public launching of the project: January 2017

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A partnership project:

in charge of public information about nuclear risks

Design and creation of connected tools

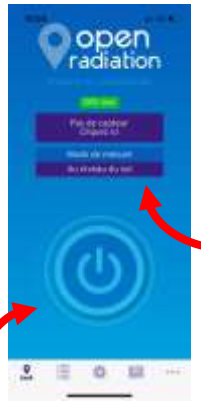
Education by and to science for children

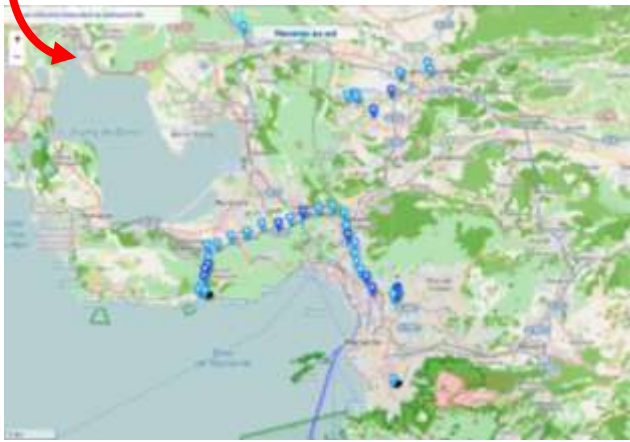
Continuous and public education about natural and technological risks

The organism bringing scientific, technical and financial support to the project

open radiation is made of three components:

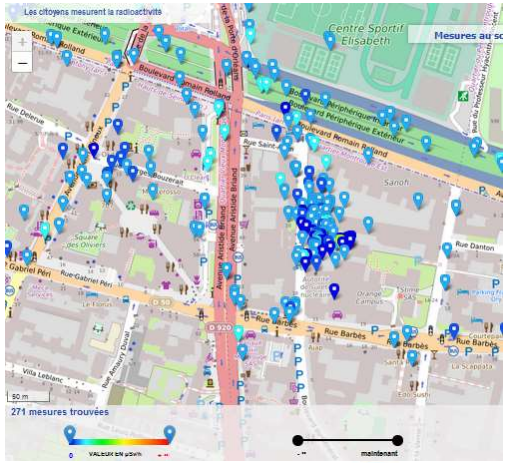
- A connectable (Bluetooth) radioactivity sensor
  - ➔ A Geiger-Müller tube
  - ➔ An integrated calibration function
- A smartphone apps
  - ➔ To drive the detector, to collect metadata and to publish the results
  - ➔ Compatible with several types of sensors
- A website: www.openradiation.org
  - ➔ To collect measurement results, whatever the type of measurement and the author
  - ➔ To visualize and share results
  - ➔ To facilitate users' exchanges, communication and project development.





An overview on May 1st, 2025

- Source codes from apps and website are in open source
- All data are freely available
- Associated publications are in open access (HAL)
- Lending of detectors is possible
- 850,000 measurement results on the interactive map, roughly 100,000 new results each year.
- 340 active contributors, more than 1000 followers.
- Roughly 430 active sensors in the world



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How reliable are the detectors ?

- The selected detection technology, a Geiger-Müller tube, is a well-proven technology and is not prone to deviation
- GM tubes are all tested before being included in detectors: response tolerance ±10%
- At least 50 counts detected before measurement validation : Maximum measurement uncertainty ± 15%.
- 7-year-old detector test: deviation of less than 2%

But…

- For citizen, no legal requirement for testing or calibrating its own detector.
- No scientific publication about intercomparison of citizen detector results with professional tools.

⇒ A persistent doubt among professionals …

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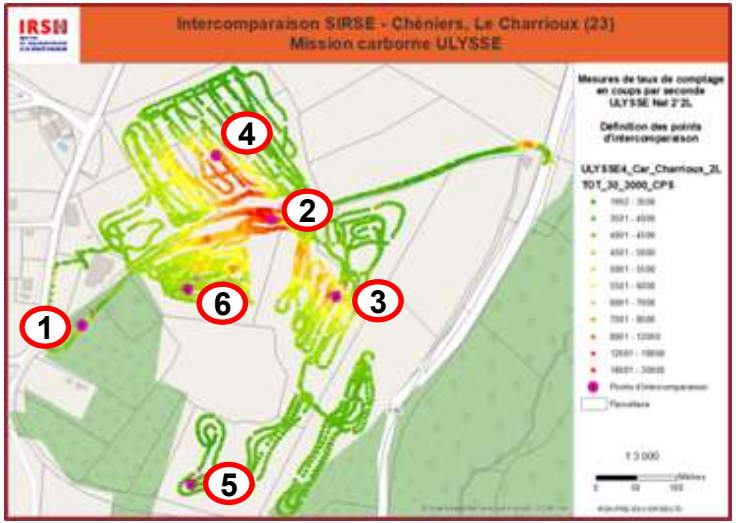
An intercomparison study

- Made in 2019 by the intervention department from IRSN
- Comparison of 9 citizen detectors with professional tools in an experimental area with locally elevated dose rates

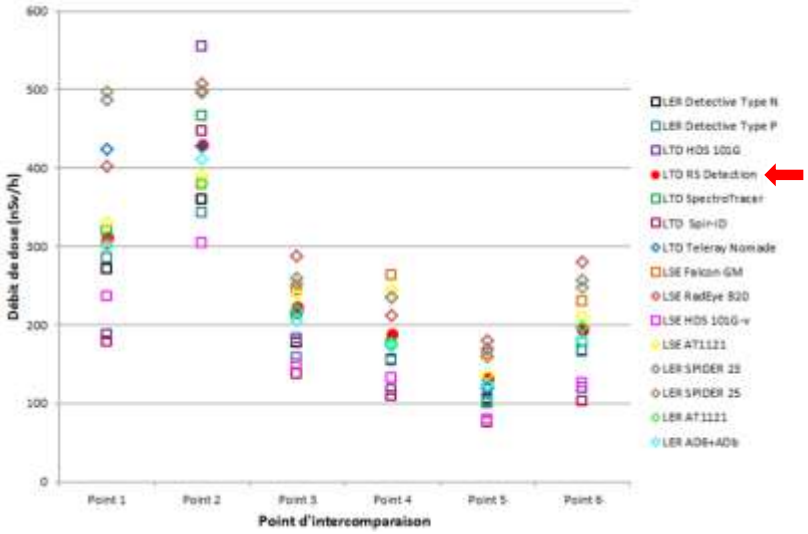
- The study zone was mapped out with an on-board measurement tool into an all-terrain vehicle dedicated to emergency situations
- 6 reference points for the intercomparison

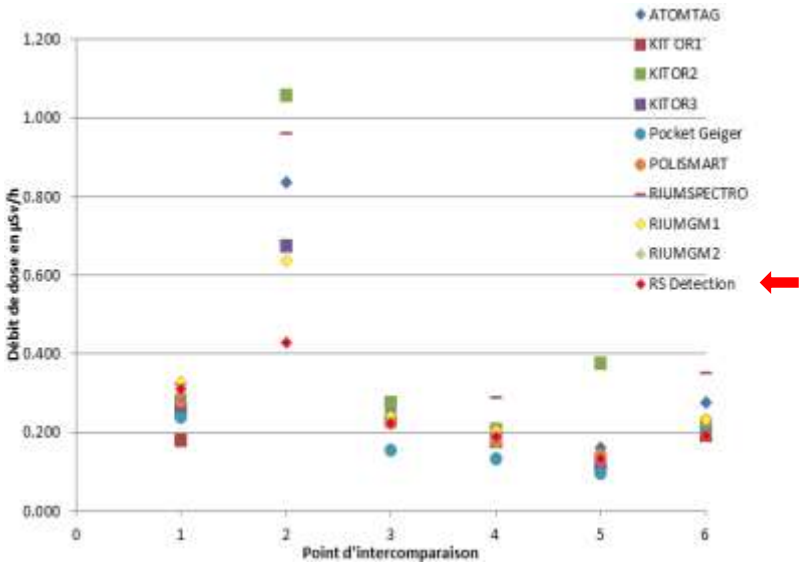


V. Bruno, ASNR, PSE-ENV/SIRSE

An intercomparison study: the results

- The citizen sensors have a similar response as compared to professional ones.
- A high sensitivity to external temperature (above 50°C)

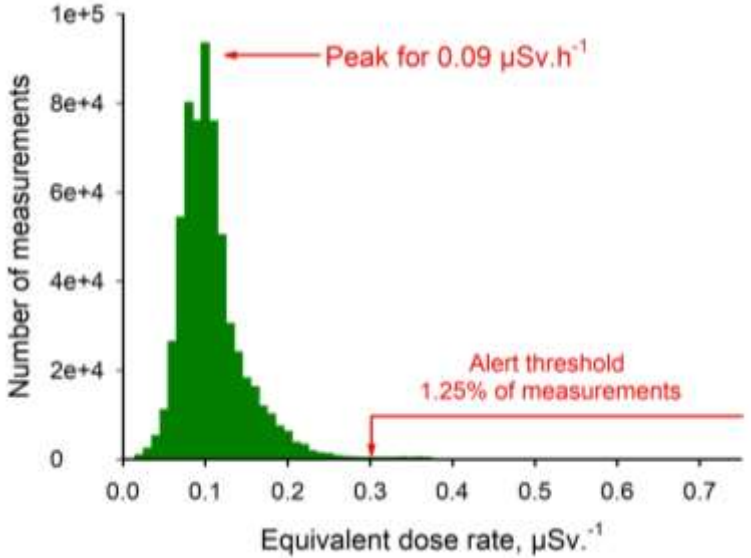




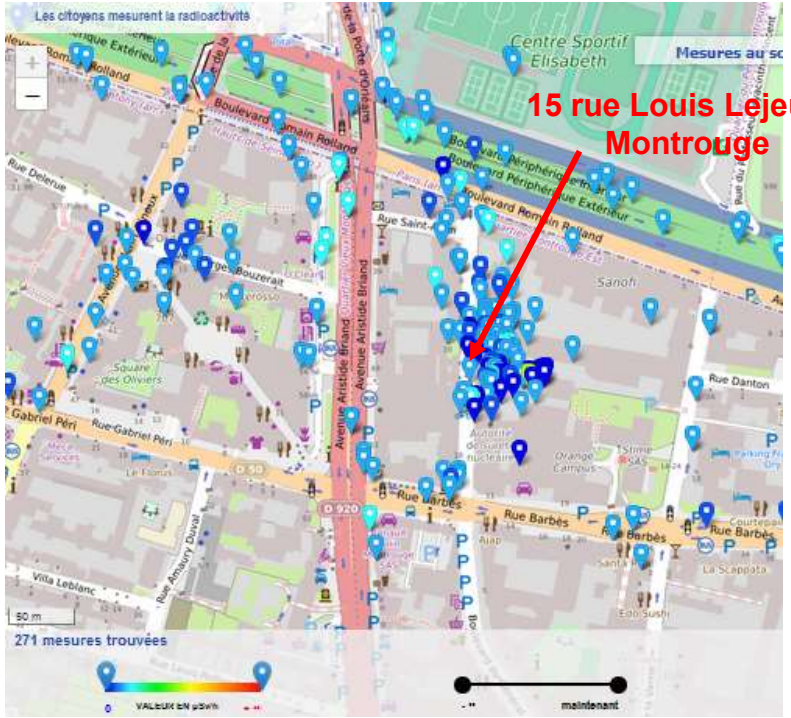
Which moderation on the map?

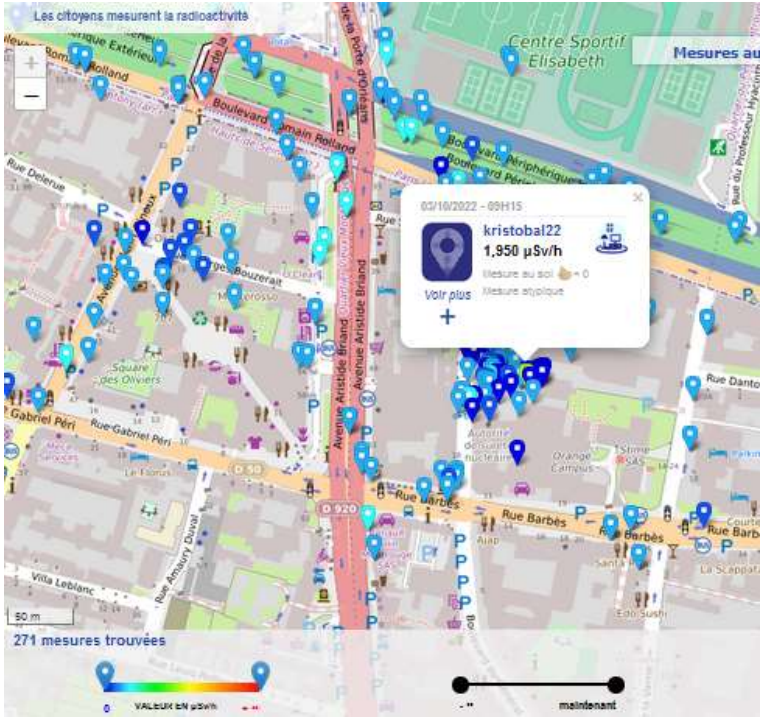
None!

- All the results are published by the author without any censoring.
- None of the results are retrieved from the map. Essential for contributor's confidence.
- A spontaneous « auto-moderation ».
- An alert for all measurements with a dose rate <0,3 $\mu Sv.h^{-1}$ (1,25% of published results).
- All alerts are treated with a search for an explanation, and a comment is shared.
- Less than 0,02% of the measurement results remain unexplained.



Some few examples of « auto-moderation » (1)





A single abnormally elevated measurement result among a high number of measurements, all in a very narrow range: who is right?

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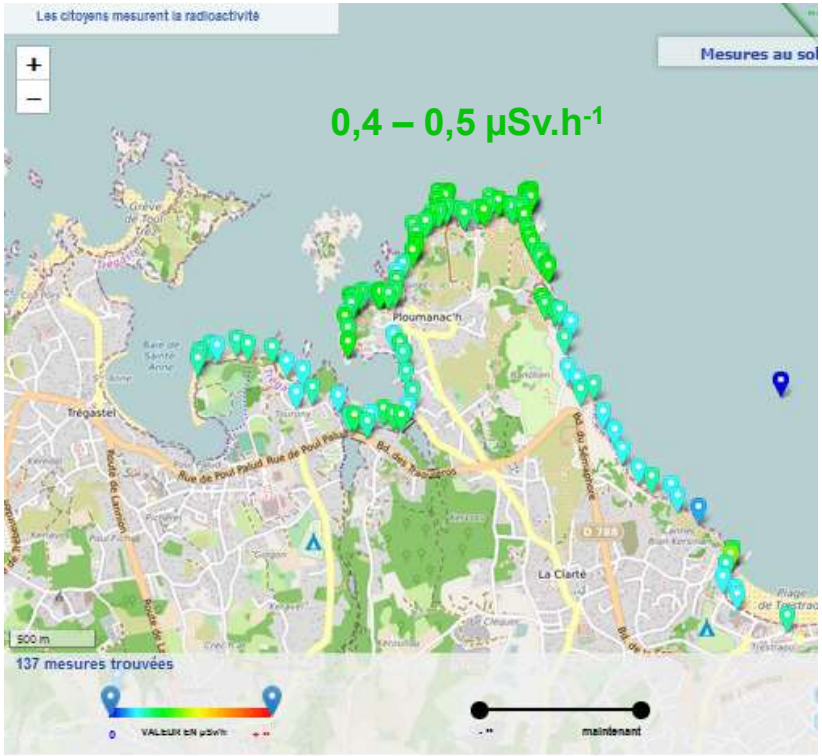
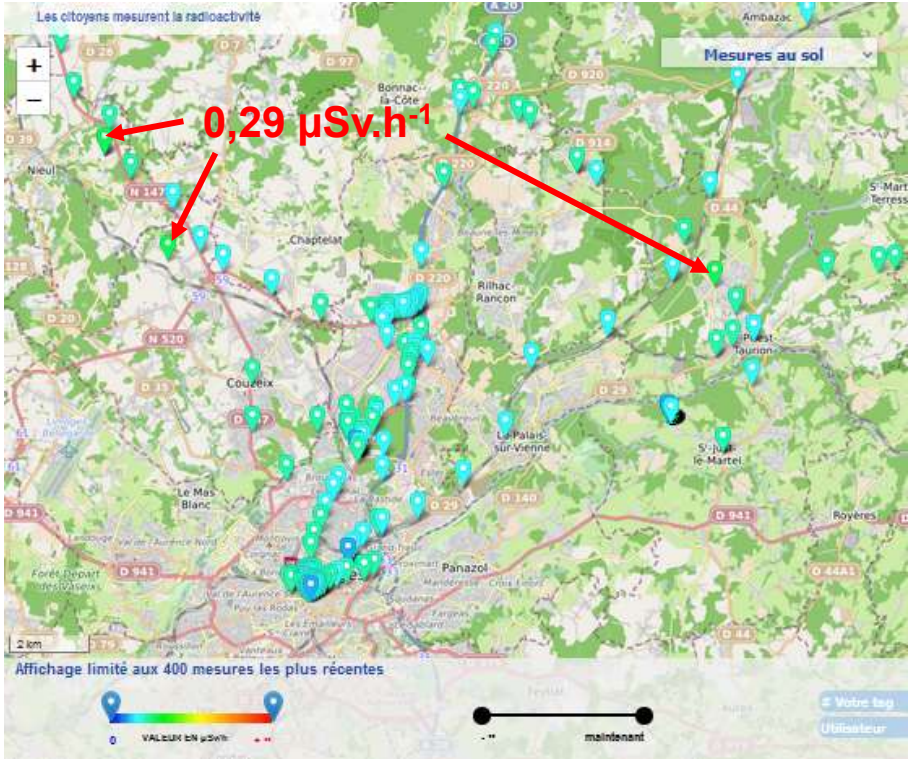
Some few examples of « auto-moderation » (2)





Naturally elevated measurement results: a vision of its own environment

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Study of alerts, April-December 2024

75,506 published results

DdD > 0,3 µSv/h? → Yes: 30,613 results → Users' Tags →

No: 44,893 results

Yes: 9

No: 1,211 results ← Altitude > 3 000 m? ← 1,220 results

Yes: 738 ← 0,3 <DdD<0,8 µSv/h? → No: 473

Possible origins:
1- geology, including radon
2- Urban objects
3- Unknown origin
4- Travel in Japan
5- Tests with sources
6- Technical defects

Contacts with contributor

Comment on the map site

Possible origins:
1- Tests with sources
2- Travel in Japan
3- geology, including radon
4- Urban objects
5- Unknown origin
6- Technical defects
7- Manual reporting

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Study of alerts, April-December 2024 (2)

Analysis of the remaining 1,211 results:

	0,3<DdD<0,8	DdD>0,8
N measures	738	473
Manual reporting	0	2
N contrib.	24	14
	Geology?	Source?

- 2 manual reporting with a hand-made calibration function: incorrect results
- 4 calibration studies by 4 different contributors. 979 results >0.3 µSv.h^{-1}
- 63 measurements made in Japan, especially in the Fukushima NPP and ISF area
- 128 results with a geological origin (coherence with environment as observed on the map)
- 22 hot spots with either a geological or an anthropic origin.
- 0 case of technological defaults
- 17 results >0.3 µSv.h^{-1} of undefined origin

- For that series, <0.002% not explained, elevated results
- A part (11/17) is due to anonymous measurements: no way to have a contact with the contributor

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Current activities are mainly of pedagogic nature


Comment créer son compte ?

La création d'un compte Openradiation se fait depuis le site :
www.openradiation.org

L'inscription sur le site permet d'identifier et de récupérer facilement toutes vos propres mesures. De plus, être inscrit permet de créer ou de participer à des missions. Une mission rassemble les participants autour d'un objectif commun, à réaliser dans une durée définie. La mission est gérée par un chef de mission. Si vous souhaitez créer une mission, merci de contacter le webmaster en utilisant le lien de contact. Si vous souhaitez participer à une mission existante, veuillez contacter directement le chef de mission. Les missions peuvent être soit publiques (toutes les données sont accessibles au public), soit privées (accessibles uniquement aux participants)

Sur la page d'accueil du site Openradiation :

Cliquez sur « s'inscrire »

Remplissez votre adresse email et renseignez un nom d'utilisateur

Cliquez sur « créer un nouveau compte »

Un message de bienvenue contenant des instructions supplémentaires est envoyé à votre adresse email :

Cliquez sur le lien pour créer votre mot de passe sur le site.

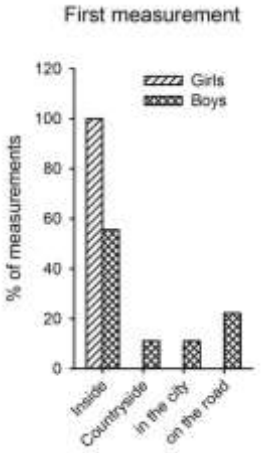
Le lien n'est actif que pendant 24 heures et uniquement pour un usage

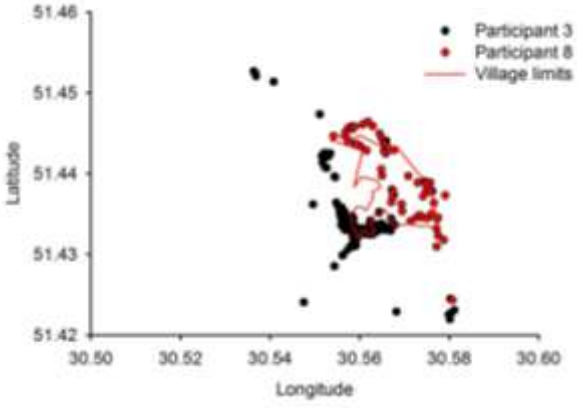
- Mainly towards scholarship publics and population living in the vicinity of NPP
- A tool allowing to speak about radioactivity and to educate about nuclear risk:
  - Science day, national resilience day, « let's know » festival, …
  - Interventions in public meetings
  - Provisioning education tools: tutorials, assembly notice, user's guide, advices for making measurements, guide about radioactivity measurements.
  - Community management: newsletter, contributors' day, special events, …

Next event: a detector assembly workshop, June 26th, Lab ASNR, Fontenay aux roses (France)

The Territories project example

- Dose rate measurements by a group of 17 pupils in a settlement close to the Chernobyl exclusion zone, in Belarus
- Principle: Measure what you want, when you want, as you want
- Advices:
  - If possible, measure 1 meter above the ground
  - Don't put yourself at risk
- Measurement results collection, co-analysis and co-interpretation
- Allowed to understand some behaviours
- Allowed to detect three hot spots in the village and to explain these hot spots



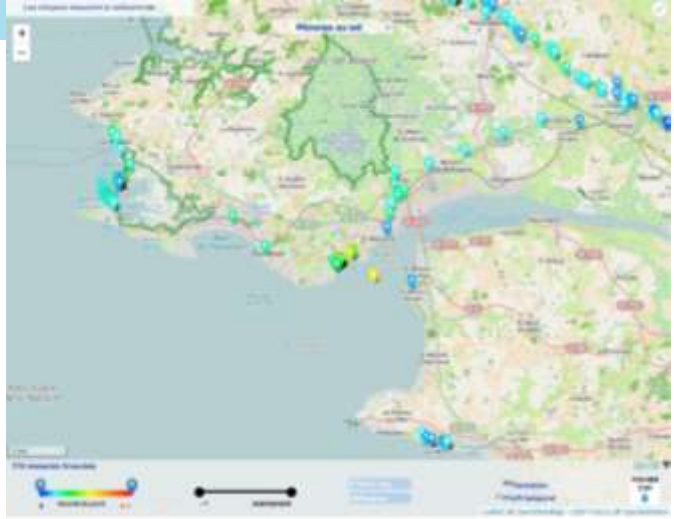


A project in between participatory science and collective intelligence

The example of Saint-Nazaire

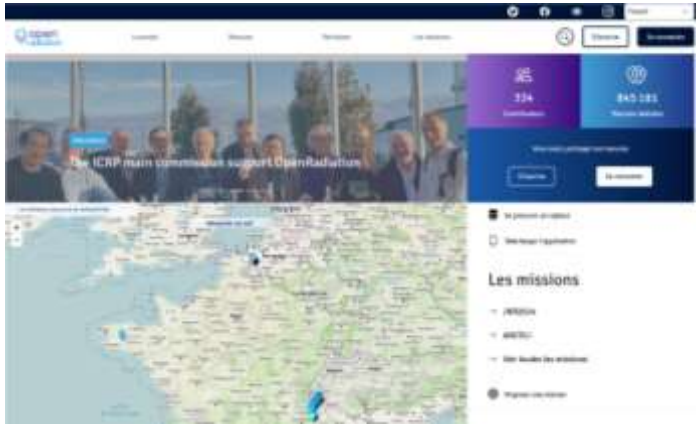
- Elevated dose rates measured along the right riverbank of the Loire river, more elevated as compared to what was measured in the region, in May 2023.
- The highest dose rates were on the sand beach of Trébézy , in the city of Saint-Nazaire.
- Confirmation of these elevated dose rates by an NGO, CRIIRAD, in September 2023, with a hot spot at 78,5 µSv.h^{-1}
- (former…) IRSN characterized the origin of this anomaly: this is due to the presence of monazite, a mineral enriched in thorium and uranium.
- The dosimetric evaluation concluded to an absence of risks for the population.

The discovery of a true hot spot



The future ?

- Increasing OpenRadiation awareness
- Continue to develop awareness-raising actions: Assembly workshops, scientific mediation events, nuclear risk awareness actions, public meetings, etc… especially towards scholarship public.
- Continue and expand the support to the contributors: video, tutorials, newsletter, contributors' day …
- Evolution of the website
- Launching new actions: Survey and interview study (in course), participation to European projects (Pianoforte, Eurados)
- Development of an automated database analysis
- Support citizen initiatives: intercomparisons, local environmental monitoring, …



Thanks a lot for your attention!

Wish to get a detector?

contact@openradiation.org
openradiation@gmail.com

www.openradiation.org