

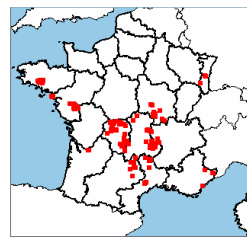
# BESSINES-SUR-GARTEMPE: A HOUSE BUILT ON RADIUM RESIDUES

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## Context



- | In 2009, French public authorities launched an action plan aimed at identifying the areas of reuse of waste rocks from uranium mining from 1945 to 1995 within 210 sites
- | in 2010, a helicopter radiation measurement campaign was carried out by AREVA (=ORANO) over such potential areas
- | 1 348 areas were identified and categorized according to their radiological impact in terms of “added annual dose” to the inhabitants:
  - < 0.3 mSv/y ( 1 093 areas): no action needed
  - 0.3 – 0.6 mSv/y (194 areas): further investigations needed to decide whether remedial actions should be undertaken
  - > 0.6 mSv/y (61 areas): systematic remedial actions based on a cost/benefit balance + radon screening in buildings
- | 10-13 March 2014: As part of this action plan, high radon concentrations were detected in one house in Bessines-sur-Gartempe (> 30 000 Bq/m<sup>3</sup> in the basement, ≈ 10 - 20 000 Bq/m<sup>3</sup> in living rooms).

# Main milestones

10 – 13 March: Detection of high radon concentration in the house

The Prefect informs the owners and asks them to stop childcare

It is decided to carry out further radon measurements in the house

17 – 20 March: New campaign of radon measurements

High radon concentration are confirmed

The Prefect asks ORANO to offer another accommodation to the family

21 March: Action plan of the national authorities + IRSN

The family is temporarily relocated to a campsite.

The Ministry of env. requests the IRSN to carry out an expertise

The children in daycare in this house from 1999 to 2014 are looked for

26 – 27 March: IRSN's expertise

Prefecture's press release

Radon screening is proposed to the house's neighbours

Whole body countings + urine samplings performed to the owners, the children in daycare and their relatives

15 - 30 April

Risk assessment and medical recommendations

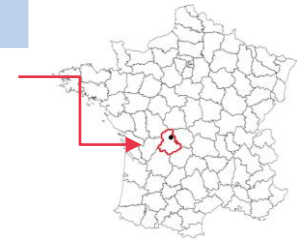


From 19 to 22 May, face-to-face meetings with exposed people (or parents of the kids) were held to provide them with their individual risk assessment and medical recommendations

## Annual radon concentration in the house

Room	Radon concentration - Day (Bq/m <sup>3</sup> )	Radon concentration - Night (Bq/m <sup>3</sup> )
Sleeping room 1	9 000	9 000
Sleeping room 2	14 300	16 000
Sleeping room 3	9 300	9 300
Living room	14 700	18 700
Kitchen	8 500	10 000

For comparison, the average radon concentration in houses in the department is 200 Bq/m<sup>3</sup>



## Risk assesement

Rather than using the effective dose for communicating to the people exposed it was decided to calculate their individual risk using a risk model

	Home occupant	Age at the end of exposure	Duration of exposure	Probability of death from lung cancer (%) – general population	Probability of death from lung cancer (%) – home occupant <sup>a</sup>	Lifetime relative risk <sup>a</sup>
Family	Adult working at home	50 years	20 years	0.32 <sup>b</sup>	4.08	13.02
	Adult working outside	50 years	20 years	0.32 <sup>b</sup>	3.13	10.00
	Young adult <sup>c</sup>	20 years	20 years	0.36	0.51 (4.49)	1.41 (12.40)
	Schooled child	7 years	7 years	0.36	0.37 (1.84)	< 1.01 (5.10)
Children babysitted	Child babysitted afterschool	7 years	4 years	0.36	0.37 (0.43)	< 1.01 (1.17)
	Child babysitted at home	3 years	3 years	0.36	0.37 (0.58)	< 1.01 (1.58)

<sup>a</sup> Figure into brackets corresponds to the conservative hypothesis that the relative excess risk for children is not cancelled 30 years after the end of the exposure

<sup>b</sup> The lifetime probability of death from cancer for adult is lower than for young adult because it is taken into account that the individual is unharmed at the end of his (her) exposure

<sup>c</sup> For the calculation, it is considered that the child is first an infant and then a schooled child

(Cléro et al. *Assessment of radon-induced health risk for occupants of a house built on uranium ore residue*. Revue d'Épidémiologie et de Santé Publique. Vol 64. Issue 4, Sept 2016, pp 237-246)

# The event was reported in the media

LE POPULAIRE  
du Centre

Publié le 28/03/2014

Their house is too much radioactive: « what we fear is cancer »



Un taux anormalement élevé de radon présent au quotidien durant dix-sept ans. Des enfants gardés dans une maison que l'on vient de lui faire évacuer d'urgence. Aujourd'hui, la famille Jusiak s'interroge et s'alarme.

la Nouvelle  
République.fr

The house of a babysitter is exposed to abnormally high radon level



Vingt-deux enfants ont été gardés dans cette maison de Bessines-sur-Gartempe, dans la Haute-Vienne, où une "quantité anormale" de radon, un gaz naturel radioactif, a été détectée.

The family is rehoused temporarily at the camping site



3 nouvelle  
aquitaine

Radon pollution: the radioactive house in Bessines-sur-Gartempe will be destroyed



Maison radioactive de Bessines - évacuée le 26 mars 2014, elle sera finalement détruite pour cause de pollution au radon.

francetvinfo

8 novembre 2015

The destruction of the house has started



21 July 2017



The house has been razed and the U-residues have been removed

# A huge psychological impact on the family



2.5 years later...

« It was the house of (their) dream but (their) dream turned into nightmare »  
(the father)

New house



« I can't get used to it. I think about the previous house all the time. It is as if we had torn a blanket from a child. Here, I don't feel at home. »  
(the mother)

« They took away my childhood, my memories. It can't be about the money, it's priceless »  
(the eldest daughter)

## Was it tolerable to let the family longer in the house? (1/2)

- The house was built in 1963 and transformed in 1994, It was originally a gas station
- Such high radon concentration in a house was unprecedented in France
- The family lived in the house for  $\approx$  17 years
- The house has been used as a home-care facility for 20 children from families in the area
- The level of exposure and associated risk for those most exposed can be qualified as high (equivalent to the risk of lung cancer for a smoker)
- The source of radon was artificial: it appears very likely that backfillings under the house were at least partly carried out with sand from the residues of the uranium ore processing plant which was operated by the SIMO company in Bessines from 1958 to 1993
- Alternatives to evacuation could have been explored (involving possibly stakeholders) but it would have take more time



## Was it tolerable to let the family longer in the house? (2/2)

However

- It was not known at that time if the radon concentration measured was fully representative of the situation to which the family have been exposed for  $\approx 17$  years
- The occupants didn't have a say
- They were attached to their home and they have to leave it in a hurry
- Being exposed for a few more months would not have drastically change the level of risk
- The decision to evacuate not only impacted the family living in the house but also the children who were babysitted (and their parents)

## What could be the other lessons of this story?

- About the use of uranium ore tailings for building backfilling:
  - It is a legacy of the past
  - Until now, it was admitted that these residues had not been subject to reuse in a public place
  - It seems that there was no awareness of the potential danger of these sands, even though the rules in force in the early 1960s could have been warnings
  - Awareness of radon accumulation in indoor atmospheres was also limited at that time
- About the management of other situations
  - The house in Bessines was revealed following controls realized as part of the action plan aimed at identifying areas where reuse of material from U-mines was highly suspected: such campaigns are useful
  - A ministerial direction has been published afterwards to deal with buildings where radon concentration related to U-mine tailing is  $> 2\,500 \text{ Bq/m}^3$
  - It could be logical to manage in the same way situations where radon is from natural origin
  - It seems however difficult to determine a threshold above which the exposure situation should be considered not-tolerable. It is probably to be defined on a case by case basis

**THANK YOU  
FOR YOUR ATTENTION!**

