Task 4.4.1: Harmonization of radon priority areas across borders : focus on some West European borders

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Task 4.4.1: Consistency across borders

- The definition of RPAs results from different Rn policies and different availability of data of predictor quantities. Therefore, **RPAs defined by countries individually will not be consistent across borders**, in general. This can lead to problems in communicating Rn issues and impair credibility.
- In this task, existing approaches have been compared to identify the reasons for consistency/inconsistency between resulting maps, with some examples of existing maps at different borders. This state of art and discussion provide an interesting base to propose further studies.





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- In this task, existing approaches have been compared to identify the reasons for consistency/inconsistency between resulting maps, with some examples of existing maps at different borders. This state of art and discussion provide an interesting base to propose further studies.
- For this study, it was decided to **focus on some borders** with France and Spain and for which data were available. The selected borders are:

- France-Belgium
- France-Switzerland
- Spain-France
- Spain-Portugal.





Methods : for the borders with France

The map of the country was compared to 3 different maps on the French border side:

- 1. <u>The geogenic radon potential map</u>: this mapping characterize the capacity of the underlying rocks to generate radon at the surface on the French territory. It is only based on the characteristics of the geological formations (indoor radon measurement results are not taken into account).
- <u>The classification of municipalities according to</u> <u>geogenic radon potential</u>: this classification is based on French geogenic radon potential map. This map is currently used in policies for radon risk management in France.
- 3. <u>The average indoor radon concentration by</u> <u>municipality</u>



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France-Belgium border

- In Belgium, radon risk management is based on the map of probability of exceeding the value of 300 Bq/m³ per municipality. This map was directly made with the indoor radon concentration measurements in homes.
- According to Belgian mapping, there is an area with a higher probability of exceeding the value of 300 Bq/m³ per municipality in the massif of the Ardennes.











France-Belgium border

No coherence between the two maps in the <u>Ardennes area</u>







- The Belgian priority zone corresponds more particularly to the **Devonian outcrops** (in brown). Only few outcrops of these formations are observed on the French side of the border.
- The available radon measurements in dwellings is very few on the French side compared to the number of data acquired in Belgium. These French results do not show higher values on these geological units particularly.



France-Switzerland border

- In Switzerland, the radon risk management is based on the map of probability of exceeding the value of 300 Bq/m³ in municipalities. This map was directly made with the indoor radon concentration measurements.
- According to Swiss mapping, there is an area with a high probability (>20%) of exceeding the reference value (300 Bq/m³) along the border, whereas the French mapping, based on geological data, shows a low geogenic potential.







No coherence between the two maps in the Jura mountains

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France-Switzerland border

No coherence between the two maps in the <u>Jura mountains</u>

- On the French side, quite high indoor values in the Jura mountains not taken into account by the geogenic Rn potential map
- Studies are currently being conducted to review the mapping of this sector (influence of karsts)

Probability [%] of exceeding the reference value (300 Bq/m³)

(Source: Federal Office of Public Health, 2018)





- **Jura mountains are a karst area.** Uranium content of karstic rocks (limestones) is low but karstic systems are very complex and their impact on radon potential is not very well known.
- IRSN performed a study to enhance knowledge on the influence of karstic structures. This study confirmed that karstic environments could be the source of locally high radon contents in soils.
- Average levels of radon activity in soils are essentially the result of radium-226 emanation from the soil. Indeed, on the study area, a relative enrichment of radium-226 was observed in soils due to the important dissolution of limestones in the past (karst formation) and the soil radium-226 contents was quite similar to those observed in some granitic regions.
- The study is still ongoing in other karstic regions in France before to be able to transpose these conclusions to the French geogenic radon potential map.



France-Spain border

- In Spain, the Spanish radon potential map provides the 90th percentile of exceeding the value of 300 Bq/m³ and is based on geological knowledge, on indoor radon measurements and on gamma exposure rate.
- According to Spanish mapping, there is an area with higher indoor radon concentrations along the border
- The French maps show a higher geogenic radon potential also in this area





Maps relatively consistent on both sides of this border.





Conclusion and perspectives for future studies

- This first comparison of some examples of borders in Europe shows different mapping methods and different mapping results. If we compare those results, in a qualitative and relative way, the RPAs are generally consistent. The main inconsistencies that were identified at the studied borders are linked to the lack of data in some areas, for indoor radon measurements.
- Further studies are still necessary in European Countries to provide the technical explanations of consistency or inconsistency between maps at borders and then communication elements for the Authorities and the public.

