



UNIVERSITY OF TARTU

# Estonian nation-wide survey on indoor air radon in dwellings

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# Estonian legislation on indoor radon

- ❑ *Reference level in dwellings* **300 Bq/m<sup>3</sup>** - Regulation No. 19 of the Minister of Entrepreneurship and Information Technology
- ❑ *Reference level in workspaces* **300 Bq/m<sup>3</sup>** – Regulation no 28 of the Minister of Environment
- ❑ *Limit value in schools and kindergartens* **200 Bq/m<sup>3</sup>** – Regulations no 84 and 131 of the Government of the Republic
  - Reference level is annual average Rn-222 activity concentration.
  - Measurements must be performed during heating season (November to April).
  - Results of a continuous passive measurement performed during heating season can exceed reference value up to 20%.

# Estonian nation-wide survey on indoor radon in dwellings

**Goal:** to carry out a nationwide measuring campaign of indoor air radon content, which will allow to significantly improve today's knowledge on the distribution of indoor air radon concentrations in Estonian municipalities.

- Stage I: 2022 – 1000 detectors (technical assistance by IAEA)
- Stage II: 2024-2025 - 2000 detectors
- Funded by Estonian Ministry of Climate
- Executed by University of Tartu
- Detectors analysed by Climate and Radiation Department of the Estonian Environmental Board.

## Measurement method

- Solid-state nuclear track detectors (SSNTD).
- Two detectors per one dwelling.
- Two-month long measurements conducted during the heating season (from November to April)
- Laboratory analysis of detectors: accredited analysis procedure based on ISO 11665-4 (performed by the Climate and Radiation Department of the Estonian Environmental Board)



SSNTD by Radosys.

# Participant recruitment

- Even distribution of participants per municipality.
  - Comparable number of measurement locations in different municipalities -> comparable decision quality.
- Participants recruited on a volunteer basis.
- Online registration.

Two silver, crinkled detector bags are shown against a light green background. Each bag has a white label with a barcode and a number. The left bag's label shows the number '670609' and the right bag's label shows '662059'.

Detectors for participants.



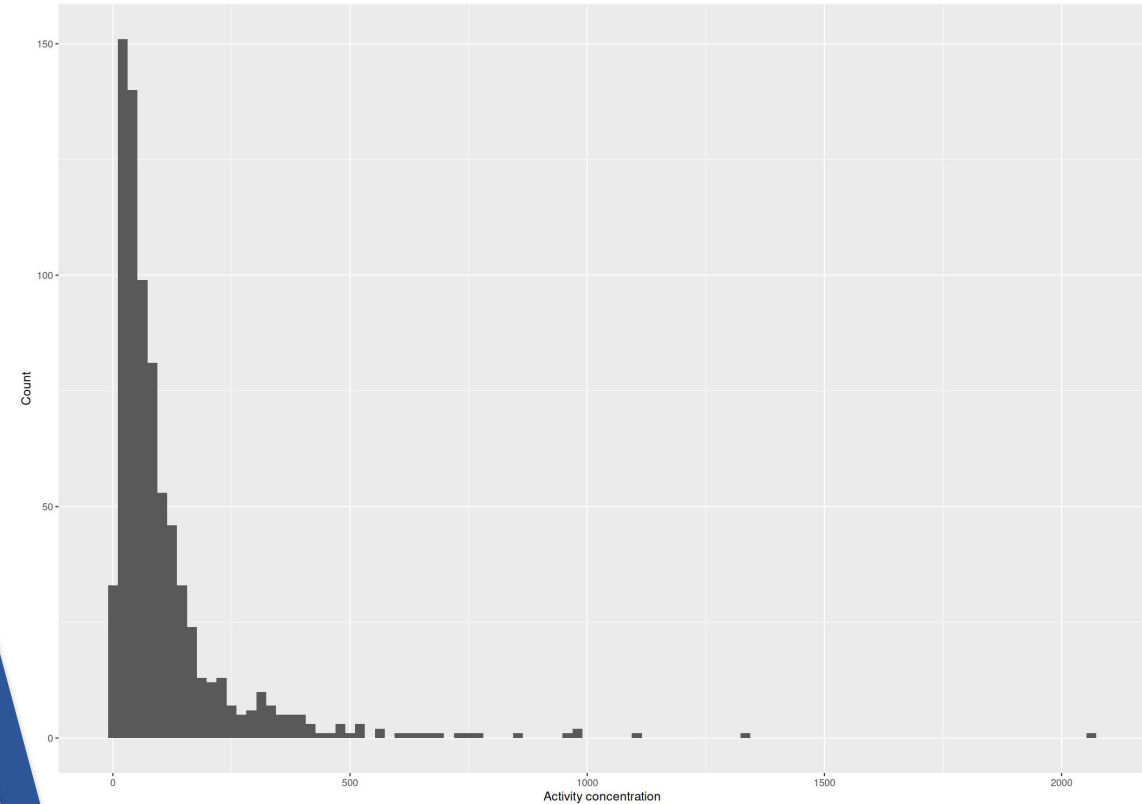
Return envelope for participants.

## Return rate

- No of detector sets sent out  
**992**
- No of detector sets returned  
**914 (92,1%)**
- No of detector sets for which the measurments protocol was followed  
**777 (78,3%)**

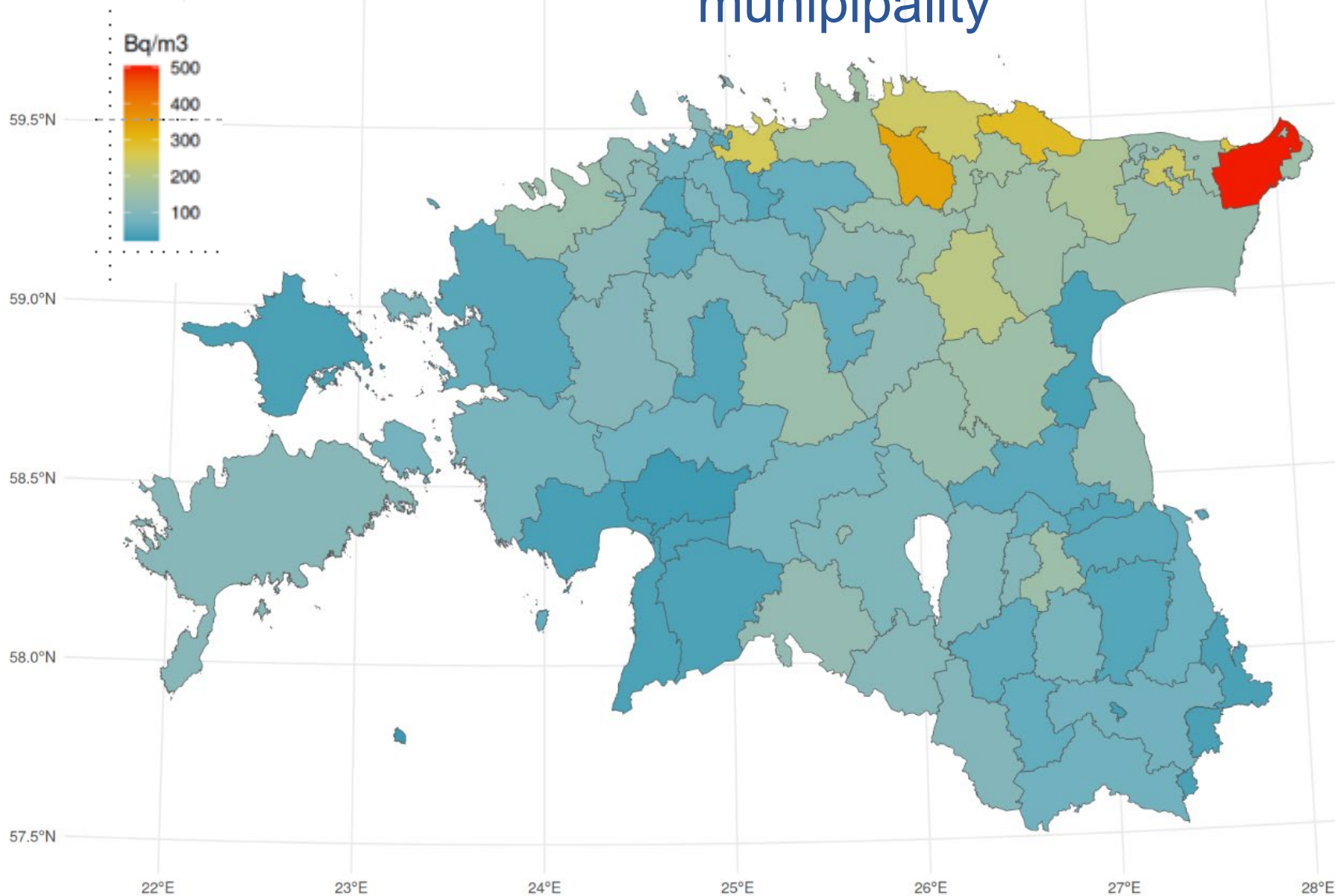
# Results

	Results per measurement locations
No of measurement locations that followed the protocol	777
Min	< 7 Bq/m <sup>3</sup>
Max	2070 Bq/m <sup>3</sup>
Median	65 Bq/m <sup>3</sup>
Geometric mean	64 Bq/m <sup>3</sup>
Average (arithmetic mean)	111 Bq/m <sup>3</sup>
Standard deviation	157 Bq/m <sup>3</sup>
No of measurement locations where 300 Bq/m <sup>3</sup> was exceeded	63 (8.1%)
No of measurement locations where 360 Bq/m <sup>3</sup> was exceeded	40 (5.1%)



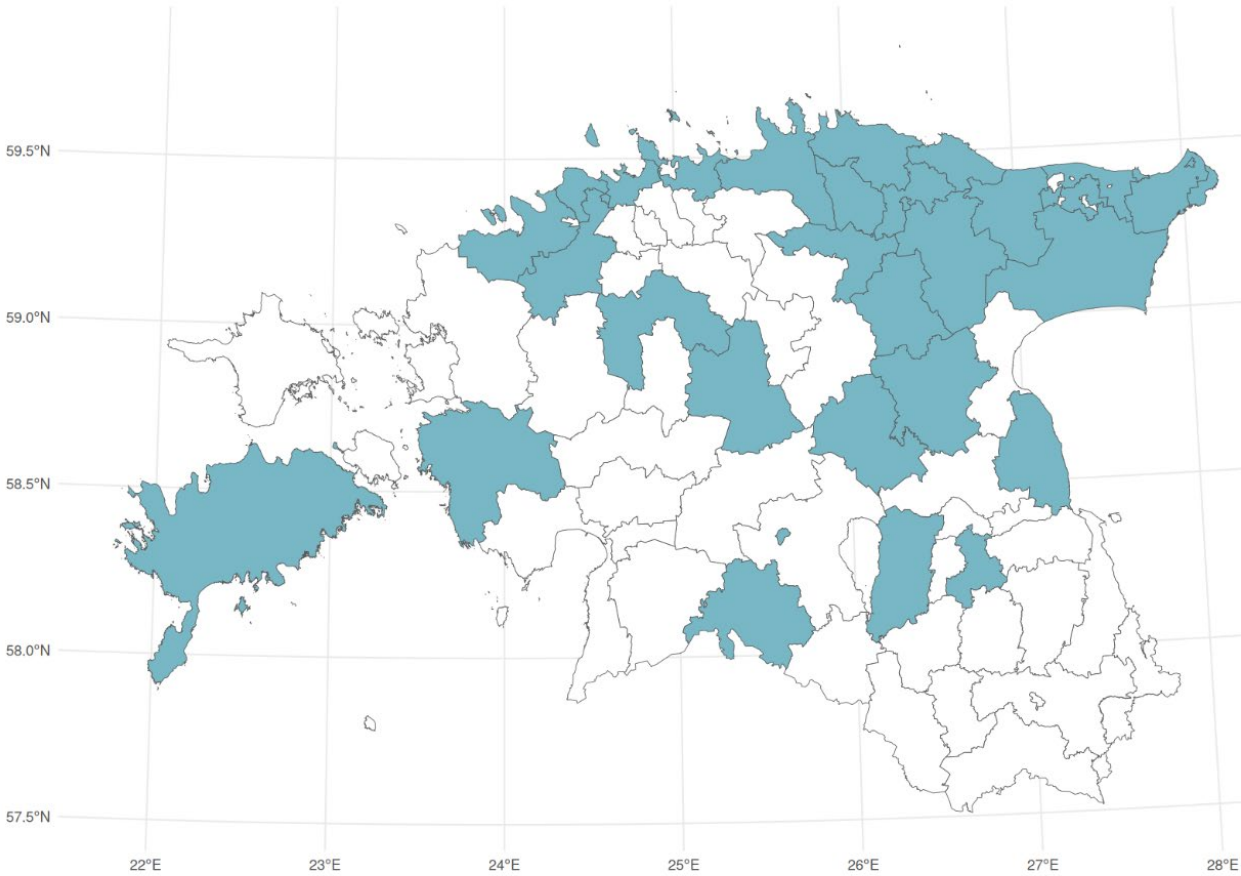
Distribution of measurement location results follows log-normal distribution.

# Average Rn-222 activity concentration (Bq/m<sup>3</sup>) in indoor air per municipality



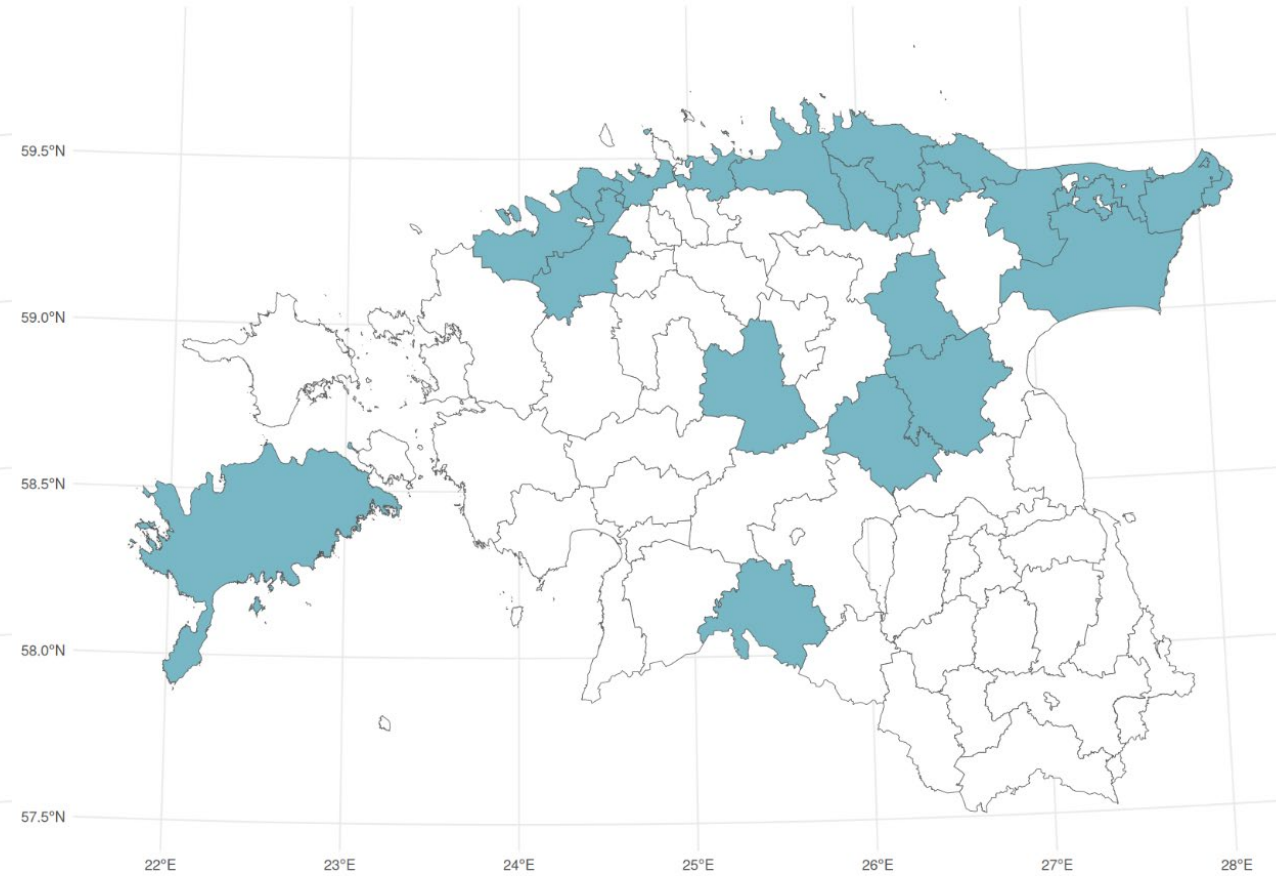
Average activity conc. $A_C$ (Bq/m <sup>3</sup> )	No of municipalities (total 79)	
$A_C < 50$	15	19%
$50 \leq A_C < 100$	29	37%
$100 \leq A_C < 200$	26	33%
$200 \leq A_C < 300$	6	8%
$300 \leq A_C < 400$	1	1.3%
$400 \leq A_C < 500$	0	0.0%
$A_C > 500$	1	1.3%

Municipalities where Rn-222 activity concentration in indoor air exceeded **300 Bq/m<sup>3</sup>** in at least one measurement location



33 municipalities

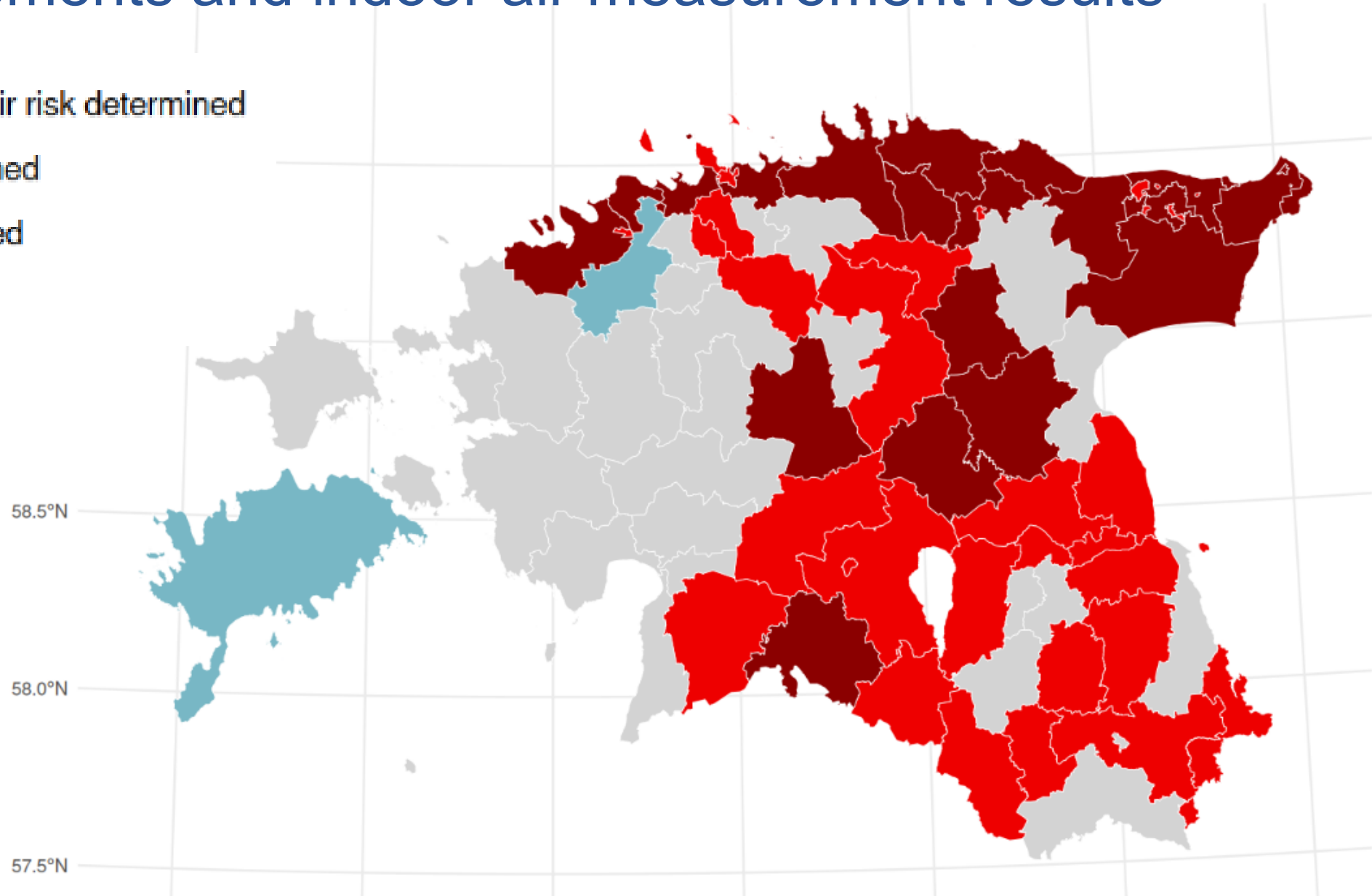
Municipalities where Rn-222 activity concentration in indoor air exceeded **360 Bq/m<sup>3</sup>** in at least one measurement location



23 municipalities

# Comparison of radon risk areas determined by soil air measurements and indoor air measurement results

- Geological and indoor air risk determined
- Geological risk determined
- Indoor air risk determined
- No risk determined



Thank you!

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