CITISTRA - “Citizen measurements as complementary radiation monitoring strategy in threats due to armed conflict or natural disasters”

Fojtíková Ivana, Hůlka Jiří, Davídková Marie, Helebrant Jan
National Radiation Protection Institute (SÚRO), Prague, Czechia

Kierepko Renata, Pawel Olko
Institute of Nuclear Physics Polish Academy of Science (IFJ PAN), Krakow, Poland

Gomola Igor, Ragan Pavol
Slovak Medical University in Bratislava, Faculty of Public Health, Bratislava, Slovakia

on behalf of the research team

PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH
CITISTRA

NERIS, 29. 9. 2025, London, UK

Co-funded by the European Union

CzechRad detectors

- CzechRad is a portable detector inspired by SAFECAST bGeigie Nano
- rechargeable battery, GPS and automatic data saving to SD card
- pancake GM tube, rugged weatherproof case

PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

CITISTRA

Co-funded by the European Union

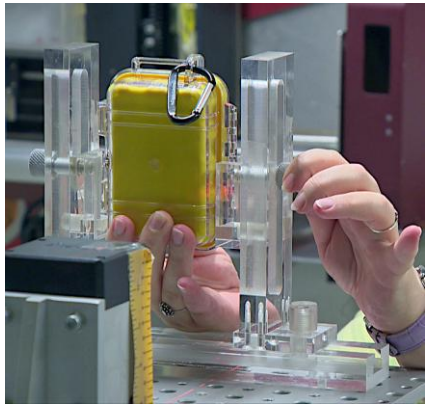
CITISTRA - detector production

- **300 devices successfully produced,**

  now distributed (CZ and PL fire brigades, SK – paramedical teams)

- each device tested with Cs-137 source
- detailed laboratory tests of several pieces in SÚRO

  X-ray and gamma ray laboratory



PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH
CITISTRA

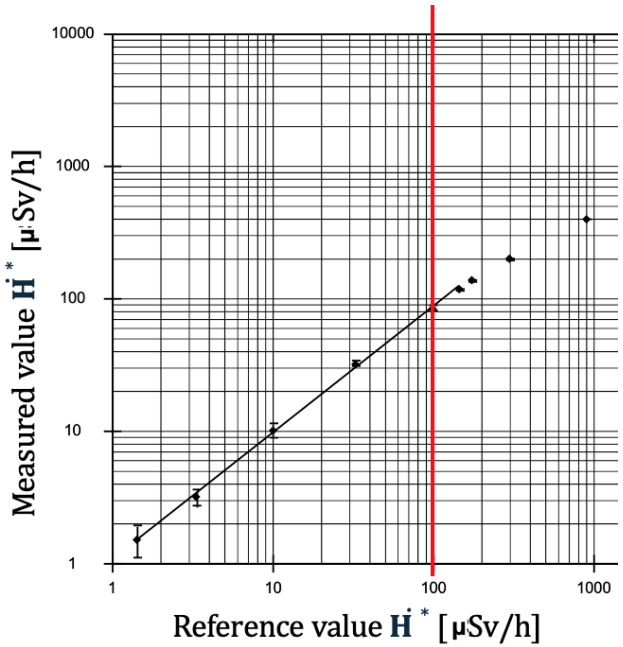
Co-funded by the European Union

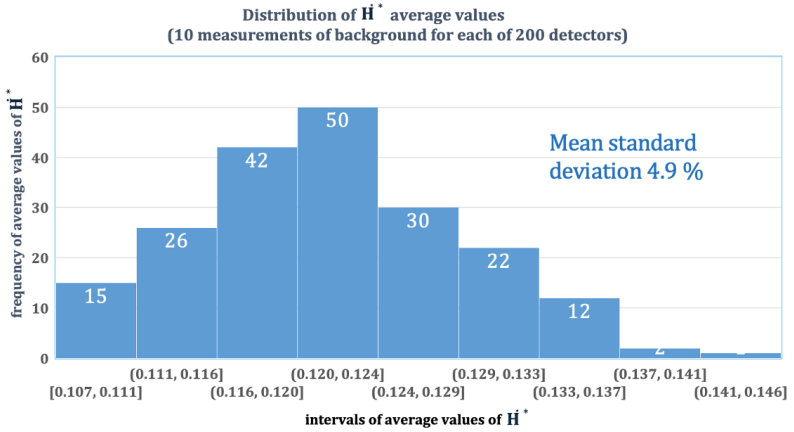
CITISTRA - detector distribution

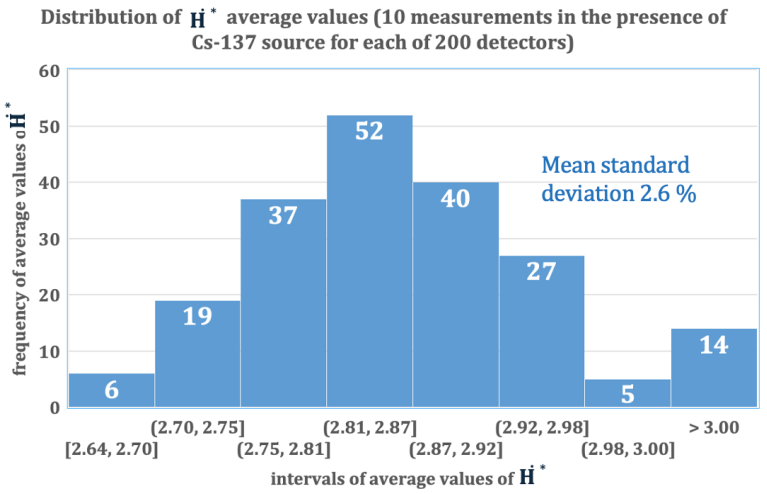
Photo: IFJ PAN

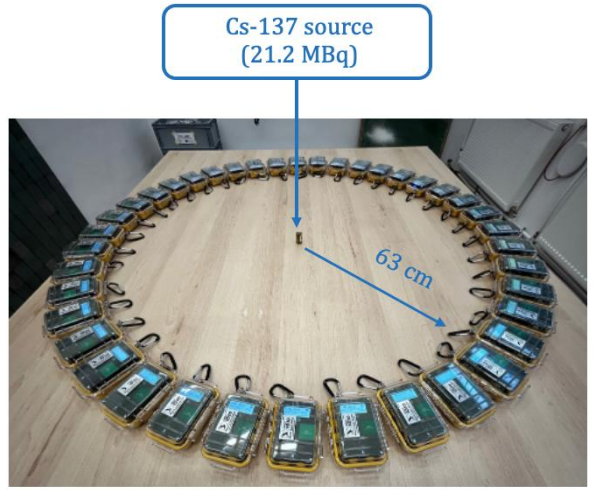
Detailed calibrations in Krakow

Linear range of detection

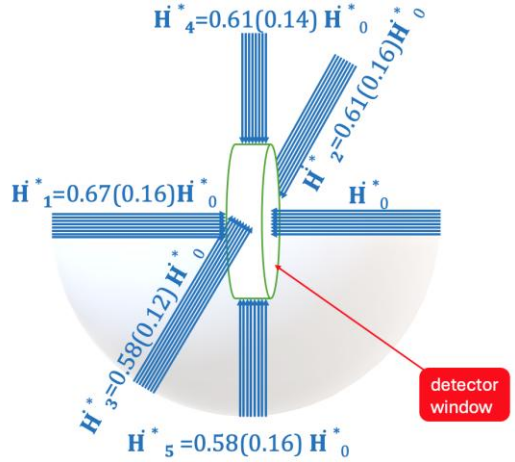








Systematic errors – continuous source of ionizing radiation



PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

CITISTRA

ERPW2025, London, UK

Co-funded by the European Union

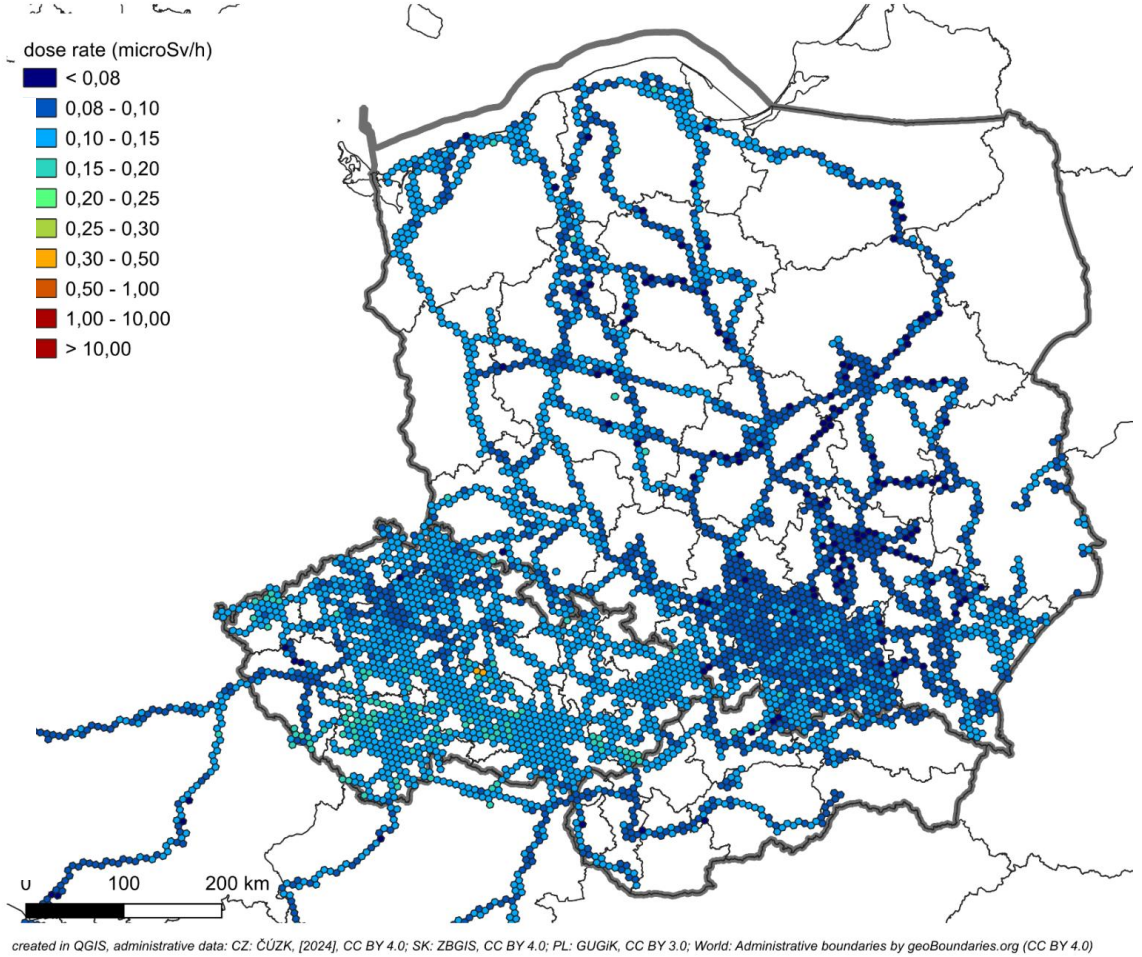
CzechRad - detector firmware

software / firmware development

- USB mode for CzechRad (no card reader needed for downloading the data)
- thyroid measurement feature (rough sorting of people in field conditions)

Citizen radiation map of Central Europe

- as of September 11, 2025,
  2,993,330 data points processed
- various user groups involved
  - ordinary citizens
  - volunteer firefighters
  - professional firefighters
  - border guards, etc.
- emergency data processing tools have been tested



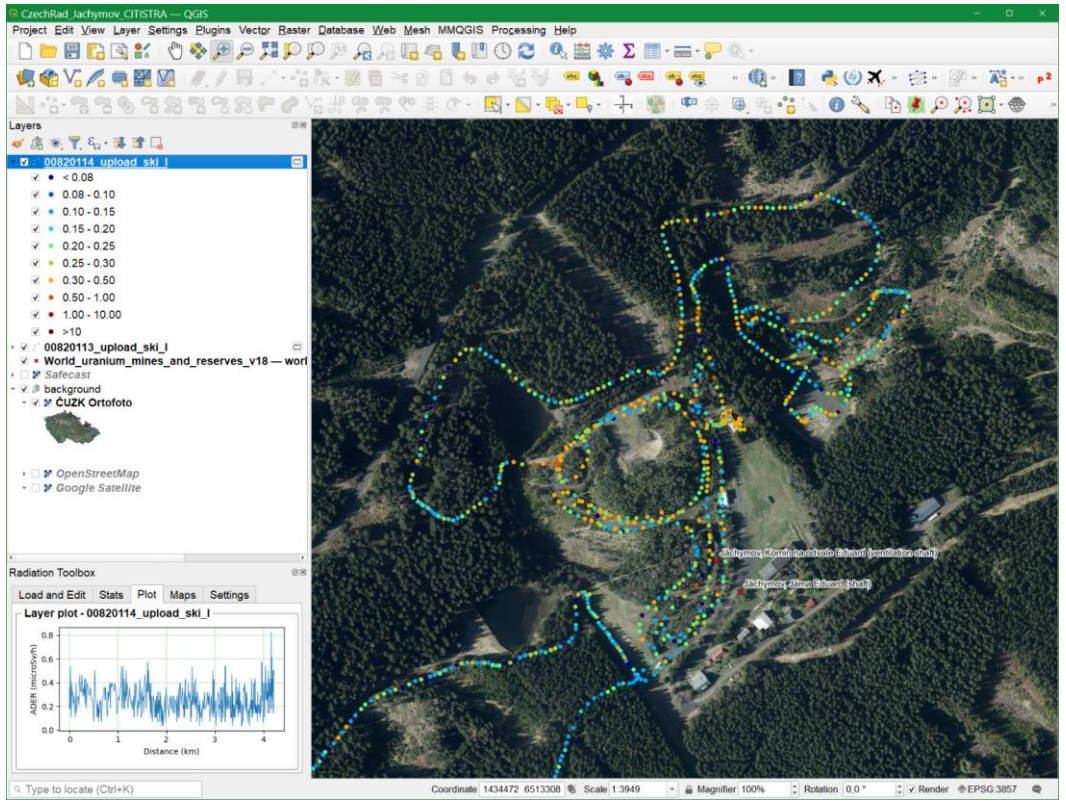
PIANFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

CITISTRA

Co-funded by the European Union

User support

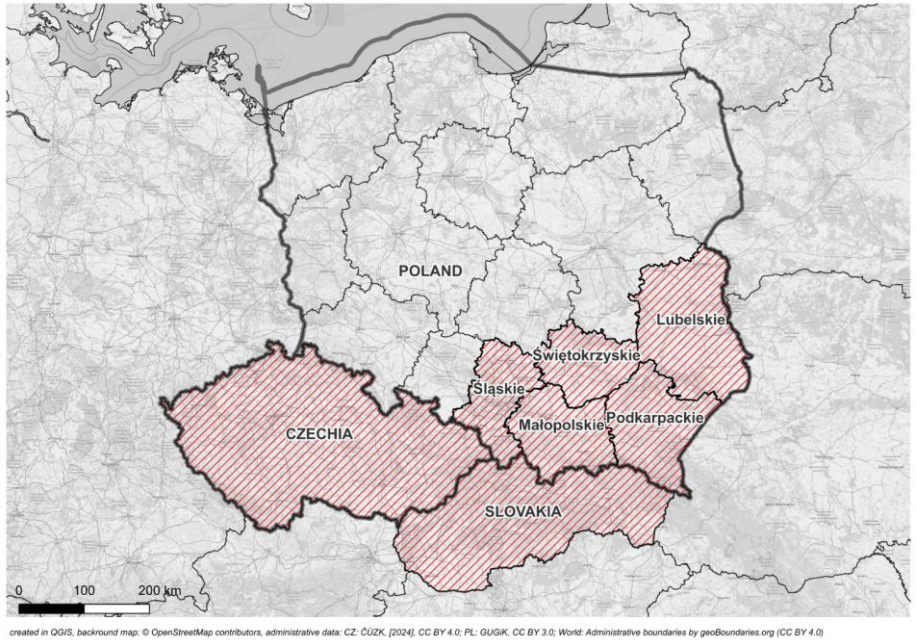
- technical support for device users (email, social networks, Discord etc.)
- data processing
- consultations in the field of (not only natural) radioactivity (is this normal?, will these values cause me any problems?)
- sharing dataset with positions of sites related to the exploration and extraction of radioactive raw materials - sites with potentially higher radioactivity values
- providing data processing tools (QGIS + Radiation Toolbox plugin) and other free tools
- publishing measured data (after quality control) for public use



PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH
CITISTRA

Co-funded by the European Union

Credible public groups for citizen radiation monitoring - Sociology survey



Objective: understand perception of citizen measurements and their potential for measurement of radiation by members of the public in extraordinary radiation situations in different regulatory systems with past and present radiation emergency experience

- MEDIAN company selected in a public tender (www.median.eu/en/)
- performed in the Czech and Slovak Republic and Poland (selected voivodeships)
- 1,000 respondents interviewed in each country

Parts:

1. Socio-demography - basics, education, employment, financial situation, place of residence
2. Respondent's anxiousness and threat perception
3. Respondent's knowledge of radioactivity
4. Perception of radiation risk and ability to respond to it
5. Confidence in institutions, professionals and NGOs

PIANFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

CITISTRA

Co-funded by the European Union

Respondent's anxiousness and threat perception

Anxiousness: Mean value of responses to the question T2_1 How often in your daily life do you experience the following feelings? Rotate answers.
Answer on the scale 0 (never) – 10 (constantly)

	Czechia	Poland	Slovakia
Feeling nervous, anxious or on edge.	2.47	5.46	4.27
You can't stop worrying or get the worry under control.	3.19	5.22	3.71
You feel excessive worry about different things.	3.32	5.31	3.96
You have difficulty relaxing.	3.08	5.23	4.00
You feel so restless that you can hardly sit still.	2.12	4.77	3.01
You get angry or irritable easily.	3.37	5.80	4.65
You feel scared, as if something terrible is about to happen.	2.27	4.72	3.46

The nuclear attack and nuclear accident are perceived as less threatening than other situations or actions. In contrary, manipulation of information in media is perceived as the activity most threatening for the population in all three countries.

General threat perception: Mean value of the responses to the Question T4_1: In your opinion, how big a threat do the following facts pose in the Czech Republic, Slovakia, Poland at the moment? Rotate the options. Answers marked on a scale of 1 (no risk) - 6 (very high risk)

	Czechia	Poland	Slovakia
Manipulation of information in the media	4.48	4.37	4.76
Inflation	4.25	4.29	4.60
Migration	4.25	4.17	3.91
Increase in poverty	4.07	4.11	4.52
Long-term weather fluctuations, e.g. long-term drought, long-term extremely high or low temperatures, etc.	3.90	4.16	4.13
War conflict	3.83	4.12	4.04
Participation of extremist political parties in government	3.92	3.81	4.29
Epidemics	3.58	3.68	3.59
Lack of energy power (electricity)	3.54	3.89	3.36
Nuclear attack	3.29	3.59	3.39
Nuclear accident	3.22	3.45	3.33
Long-term failure of the internet, mobile networks or telephone	3.07	3.70	3.16

Respondent's knowledge of radioactivity

Mean value of the responses to the Question T5_1: Which of the following modalities do you consider to be radioactive source? Rotate the items. For selected sources, choose how much radioactive they are, marked on a scale: none (1), low (2), medium (3), high (4)

	Czechia	Poland	Slovakia
People	1.50	1.90	1.57
Foods	1.55	2.00	1.64
Rocks and ground	1.70	2.03	1.91
Computer screen	1.75	2.32	2.00
People after X-ray imaging	1.81	2.27	2.10
Building materials	1.83	2.01	1.84
Microwave	1.85	2.42	2.22
Cell phones	1.87	2.39	2.24
Magnetic resonance examination	2.07	2.50	2.35
Radiation of sun	2.17	2.24	2.28
Working NPP	2.22	2.72	2.45
Cosmic rays	2.38	2.50	2.52
Roentgen diagnostics	2.47	2.78	2.73
Radon gas	2.76	2.75	2.67

Percentage of positive answers to the Question T5_3: Which of these effects on human health can be, in your opinion, attributed to radioactive (ionising) radiation? Rotate the items.

	Czechia	Poland	Slovakia
Cancer	86.4	60.2	87.8
Headache	47.2	58.9	59.5
Infertility	67.4	43.8	70
Vomiting	39.9	41.2	44.5
Insomnia	24.8	29.4	31.8
Depression	20.2	17.5	20.9
Atopic exanthema	9.7	24.4	15.2
Broken bones	6.9	12.2	8.3
Cataract	6.8	13.4	9.2

The knowledge is quite good, cancer is reported as a consequence of radiation exposure most often. On the next places, headache and infertility are named. The public apparently derives its ideas about the effects of ionising radiation from the description of radiation sickness (see relatively high “vomiting” option). The high scores in the case of insomnia and depression are surprising.

Co-funded by the European Union

Perception of radiation risk and ability to respond to it

Average rating of personal perception of risk associated with various events in Ukraine related to the threat of nuclear use. Questions T6_1 – T6_4: To what extent do you think that ionising radiation can affect your health in case of.... Scale 1 (not at all) – 6 (very seriously)

	Czechia	Poland	Slovakia
... an armed attack on a nuclear power plant or the nuclear power plant accident in Ukraine	4.11	4.02	4.62
... an armed attack on a nuclear power plant or the nuclear power plant accident on the territory of the Czech Republic/Slovakia	4.88	*	5.02
... a nuclear bomb attack on Ukrainian territory	3.97	4.15	4.64
... a nuclear attack on territory of the Czech Republic/ Slovakia/Poland	5.14	4.49	5.41

The answers suggest that the Czechs and Slovaks are aware that a nuclear event has much worse consequences on their territory, i.e. that distance is a protective factor.

The average value of respondent´s self-evaluation of their ability to protect themselves and their family in the case of nuclear emergency situation.

Question T7_1: How confident are you in your ability to effectively respond to radiation emergency situation? Answer on the scale 1- Very confident, 2 – Slightly confident, 3 - Not very confident, 4 - Not at all confident

Czechia	Poland	Slovakia
2.94	2.64	2.94

Question T7_2: Do you know what to do generally in case of a possible radioactive contamination near your stay?

Choose one option on the scale

1- I know what to do, 2 – I have partial knowledge, 3 – I know nothing

Czechia	Poland	Slovakia
2.36	2.39	2.38

Average rating of realised actions in response to the risk associated with various events in Ukraine related to the threat of nuclear use (percentage of respondents who chose the item. Question T7_5: Did you take any action after learning that Nuclear Power plants in Ukraine were under attack? (multiple choice)

	Czechia	Poland	Slovakia
I looked for the detector to measure radiation	1.8	11.3	*
I tried to buy the iodine tablets	6.9	21.5	*
Other	1.2	0.6	*

PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

CITISTRA

Confidence in institutions, professionals and NGOs

The average value of credibility derived from answers to question T3_1: How much do you trust these stakeholders? Rotate the items. Scale 1 (very high trust) - 6 (absolute distrust)

	Czechia	Poland	Slovakia
Fire Brigades	1.63	2.59	3.18
Emergency Medical Service	1.71	3.09	3.21
Scientific institutions, Universities	2.50	3.34	2.48
Civil defence	*	*	3.16
Office of Public Health	2.59	3.62	3.20
The Police	2.68	3.69	3.24
The Army	2.84	3.22	3.18
Ministry or institution dealing with radiation protection	3.15	3.69	3.19
Your regional government	3.34	3.91	3.24
Ministry of health	3.40	3.98	3.21
The president	3.44	4.05	3.23
The parliament	4.24	4.37	3.19
Your municipality government	4.10	3.80	3.12
The government	4.37	4.43	3.27

The average value of credibility derived from answers to question T3_3: How much do you trust these (professional) groups? Rotate the items.
Scale 1 (very high trust) - 6 (absolute distrust)

	Czechia	Poland	Slovakia
Fire brigades	1.55	2.50	1.80
Rescue service	1.62	2.79	1.95
Physicians, doctors	2.08	3.27	2.43
Experts, scientists	2.20	3.23	2.28
Ordinary people, neighbours, friends	2.58	3.36	2.82
Teachers	2.66	3.39	2.71
Priests	3.92	4.21	3.46

Summary

- The analysis allows for a sufficiently reliable identification of institutions, professional groups and other organisations that are perceived by respondents as suitable for contact with the public in the conditions of a radiation event, in particular because of their credibility, ability to carry out effective interventions and reliable measurements.
- The **most trusted professional groups in all three countries are firefighters and the rescue services**. These groups are not only perceived as trustworthy in general, but also in emergency situations and as a source of up-to-date radiation data.
- These professional organisations should be considered as users, providers and promoters of simple dose rate monitors.

ERPW
EuropeanRadiationProtectionWeek
London 2025

Get the presentation from bit.ly/citistra

Thank you for your attention

PIANFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH
CITISTRA

NERIS, 29. 9. 2025, London, UK

Co-funded by the European Union