



PAŃSTWOWA
AGENCJA ATOMISTYKI

Radiation Monitoring in Poland

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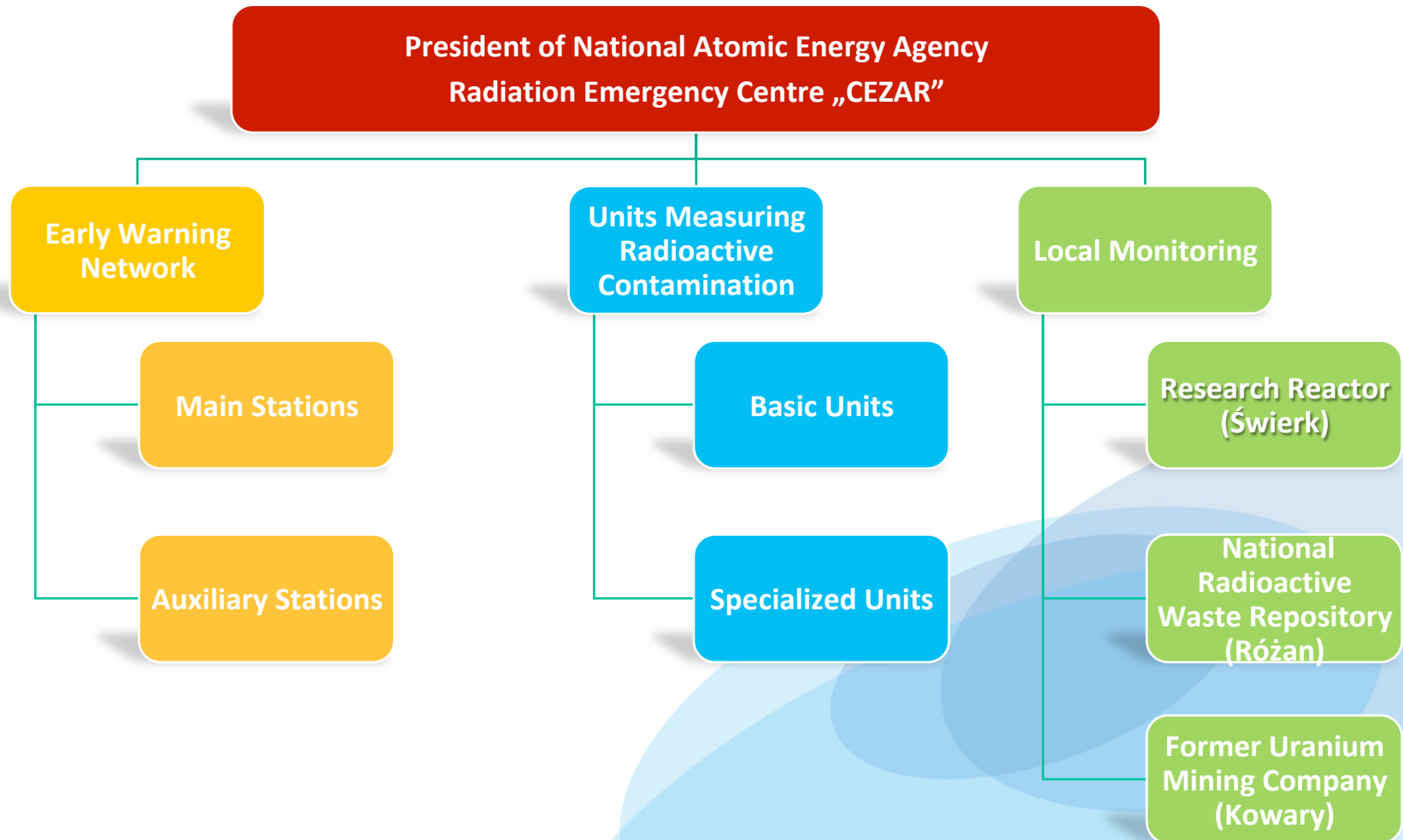
*Meeting of the Member States' experts under Articles 35 and 36 of the Euratom Treaty,
18-19 September 2018, Ispra*

Legal Basis

- Act of Parliament on *Atomic Law* of 29 November 2000 with further amendments
- Regulation of the Council of Ministers of 17 December 2002 on *stations for early detection of radioactive contamination and on the units that conduct measurements of radioactive contamination*

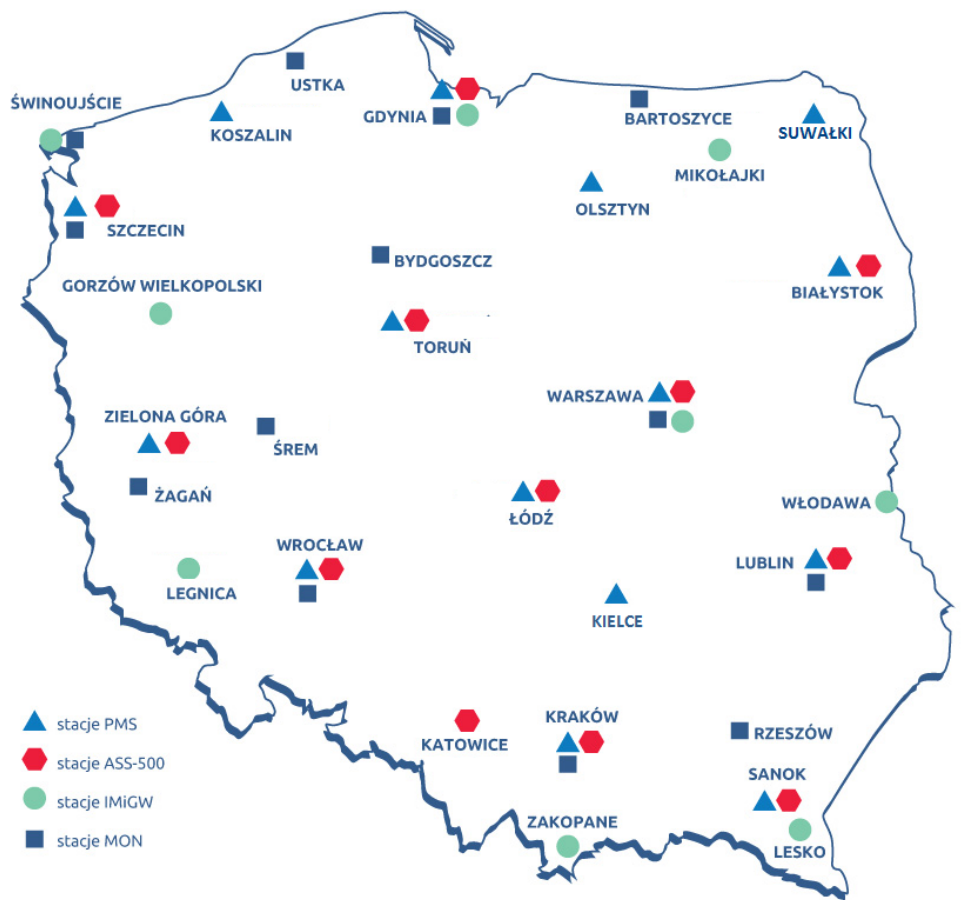


Structure



Early Warning Network

Early detection of radioactive contamination



Main Stations

- PMS - γ dose rate, γ spectrometry
- ASS-500 – aerosols (γ spectrometry – HPGe offline + NaI online)
- IMGW (Institute of Meteorology and Water Management) - γ dose rate, γ spectrometry, aerosols (total α , total β)

Auxiliary Stations

- MON (military) - γ dose rate

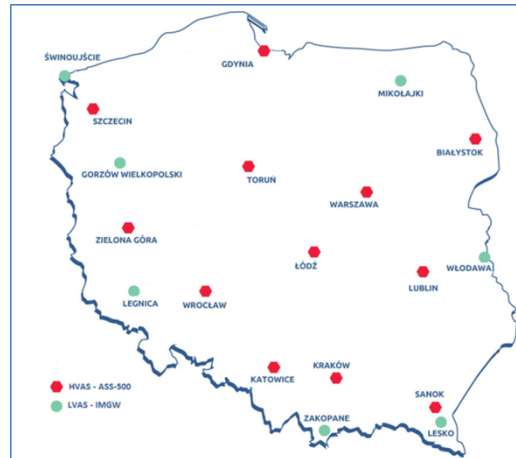
Ambient γ dose rate

Parameter	PMS	IMGW	MON
Detectors	2 GM tubes Range: 10 nSv/h – 2 Sv/h Type: TDLG and TDSG-3 512 channel spectrometer with 3x3'' NaI(Tl) Manufacturer: TD-Electronics	2 GM tubes Range: 10 nSv/h – 0.3 Sv/h Type: TDSG-2 512 channel spectrometer with 2x2'' NaI(Tl) Manufacturer: TD-Electronics	3 GM tubes Range: 10 nSv/h – 9 Sv/h Type: NEM RAMS PL HSH164 No spectrometer Manufacturer: Envinet
Data storage	Internal station disk Database in CEZAR	Internal station disk Database in IMGW Database in CEZAR	Internal station disk Database in Military CBRN Area Control Centre Database in CEZAR
Data transmission	Ethernet (internet) GPRS	Ethernet (separate IMGW network)	Ethernet (separate military network)
Transmission frequency	Every 10 minutes to CEZAR Hourly to EURDEP	Daily from the stations to IMGW Daily from IMGW to CEZAR Daily do EURDEP	Every 10 minutes to Military CBRN Area Control Centre Daily to CEZAR
Early warning	Frequent station polling	Frequent station polling	On alarm station calls server
Assuring continuous operation	Battery backup: up to 14 days Data buffer: 120 days Secondary transmission channel (GPRS)	Battery backup: up to 4 days Data buffer: 120 days	Battery backup: up to 7 hours Data buffer: 30 days

Airborne radioactivity

- **12 Aerosol Sampling Stations – ASS-500***

- high volume samplers
air-flow 500 m³/h
- Petrianov PVC filter
changed and measured
1/week in the laboratory
with HPGe detector
- **on-line preview of the γ spectrum**
spectrometer with 2x2''
NaI(Tl) probe above the
filter



- **9 Stations of Institute of Meteorology and Water Management – IMGW**

- low volume samplers
air-flow 25 m³/h
- glass fibre particles filter
- **α , β activities in atmospheric aerosols**
real time measurement with PIPS detectors (Passivated Implanted Planar Silicon detectors) – 30 min sampling time, 30 min measuring time;
- Data transmission frequency
1/day to CEZAR -> EURDEP

* 11 of ASS-500 stations are owned by Central Laboratory for Radiological Protection (CLOR),
1 – by National Atomic Energy Agency (PAA)

Dry and wet deposition - fallout

- **IMGW stations** collect fallout samples daily and monthly.
- Daily samples are measured for total **β activity** using TDSPI spectrometer with TD-SSU-BETA plastic scintillation probe.
- Monthly combined samples from all stations are analysed for:
 - Cs-137 content - gamma spectrometry (HPGe detector and gamma analysis software 'Genie2k')
 - Sr-90 content – radiochemistry and gas-flow counter (FHT 770T)
- Fallout data provided to CEZAR annually, not provided to REMdb.

Rok	Aktywność [Bq/m ²]		Aktywność beta [kBq/m ²]
	Cs-137	Sr-90	
2017	0,3	0,2	0,32
2016	0,5	0,1	0,31
2015	0,6	0,1	0,31
2014	0,5	0,1	0,32
2013	0,3	0,2	0,31
2012	0,3	0,1	0,32
2011	1,1	0,2	0,34
2010	0,4	0,1	0,33
2009	0,5	0,1	0,33
2008	0,5	0,1	0,30

Units Measuring Radioactive Contamination

Basic Units

Sanitary-Epidemiological Stations



- measure samples of:
 - drinking and surface water,
 - milk,
 - foodstuffs and feedstuffs,for ^{137}Cs and ^{90}Sr concentration;
the sampling programme has to be approved by the President of the PAA.
- take part in regular Inter-laboratory comparisons organized by PAA (coordinated by Radiation Emergency Centre (CEZAR)).

Units Measuring Radioactive Contamination

Specialized Units

- **Research institutes**
 - Central Laboratory for Radiological Protection (CLOR)
 - Institute of Nuclear Physics (IFJ)
 - National Centre for Nuclear Research (NCBJ)
 - National Institute of Hygiene (PZH)
 - Central Mining Institute (GIG)
 - AGH University of Science and Technology (AGH)
 - Institute of Meteorology and Water Management (IMGW),
 - Military Institute for Chemistry and Radiometry (WiChIR),
 - Military Institute of Hygiene and Epidemiology (WiHiE)
- identification of ^{239}Pu , ^{241}Am , ^{137}Cs and ^{90}Sr in samples
- special radiochemical/instrumental analyses with increased sensitivity
- take part in regular inter-laboratory comparisons and proficiency tests organized by PAA (coordinated by Radiation Emergency Centre (CEZAR)).

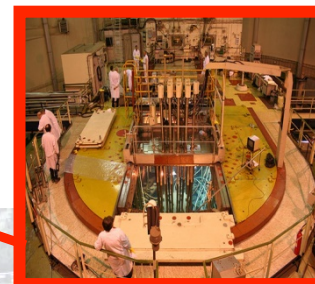


Local monitoring

National Radioactive Waste Repository in Różan



Planned NPP

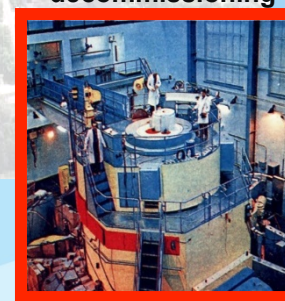


ŚWIERK

Storages for spent nuclear fuel

Research Reactor Maria in operation

Reactor EWA in decommissioning



Former Uranium Mining Facility in Kowary

Local monitoring (1)

National Centre for Nuclear Research in Świerk

- On-site & off-site
 - selected natural and artificial isotopes (^{137}Cs , ^{131}I) in atmospheric aerosols
 - β and γ isotopes in atmospheric fallout
 - β and γ isotopes in well water, water from water-supply system and Świder river
 - α , β and γ isotopes in drainage water
 - β and γ isotopes in sanitary sewage
 - selected natural and artificial isotopes in soil, grass, cereal crops and milk from the nearby farm
 - γ dose rate in 5 selected locations

Local monitoring (2)

National Radioactive Waste Repository in Różan

- On-site and off-site
 - γ isotopes in atmospheric aerosols
 - β isotopes (including ^3H) in water from the water supply systems and groundwater
 - β and γ isotopes in grass and soil
 - γ dose rate in selected locations (14 on-site and 4 off-site)
 - ^{137}Cs , ^{134}Cs and ^3H in spring water

Former uranium mining facility

- total α and β activity concentration in drinking and surface water
- radon concentration activity in drinking and surface water
- radon concentration in the air

Mobile monitoring

Mobile Spectrometric Laboratory

- γ spectrometer
- Portable NaI(Tl) scintillation detector (0.35 liter)
- 4-liter NaI(Tl) scintillation detector placed on the roof of the car
- On-board computer for data collection, on-line visualization and storage
- GPRS data communication system.



Water monitoring – surface water(1)

- **Sanitary-Epidemiological Stations (basic units)**
 - water samples collected twice a year from Vistula (Wisla), Bug, Narew, Odra and Warta rivers
- **Measurements contracted by the Chief Inspectorate of Environmental Protection, GIOŚ in frame of the National Environmental Monitoring**
 - water samples collected twice a year from Vistula (Wisla), Bug, Narew, Odra and Warta rivers and six lakes located in various regions
- samples analysed for:
 - Cs-137 with radiochemical or spectrometric methods
 - Sr-90 with radiochemical method
- results sent to:
 - Chief Sanitary Inspectorate
 - CEZAR

Average isotopes concentration in surface water in 2017 [mBq/l], GIOŚ

	Wisła, Bug i Narew	Odra i Warta	Jeziora	
Cs-137	Zakres	0,4 - 4,98	1,90 - 4,31	1,23 - 3,01
	Średnio	2,37	3,20	1,88
Sr-90	Zakres	1,38 - 5,59	2,45 - 3,94	1,32 - 9,01
	Średnio	3,06	3,24	3,10

Water monitoring – surface water (2)

Measurements contracted by the Chief Inspectorate of Environmental Protection, GIOŚ

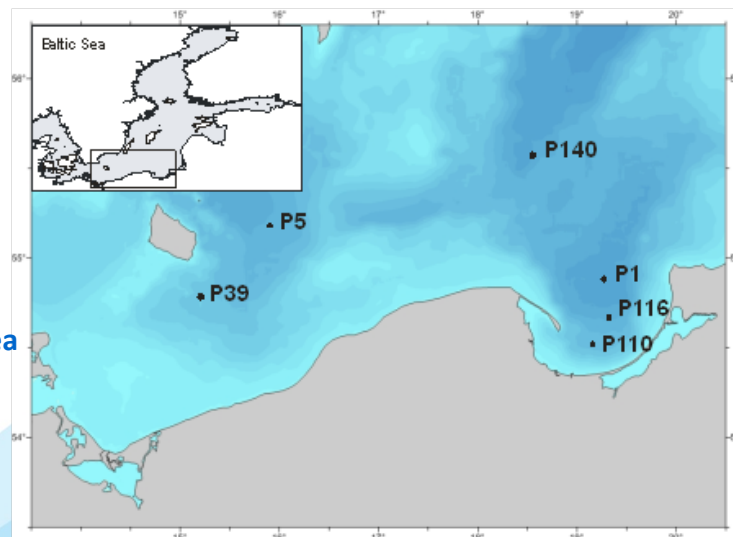
- water samples measured in frame of the Directive 2008/56/EC of the European Parliament and of the Council and in accordance with Helsinki Commission Recommendations (HELCOM 26/3) from the Baltic Sea
- samples analysed for:
 - Cs-137, Sr-90

Average isotopes concentration in sea water in 2017 [mBq/l]

- Cs-137 - 28,3 mBq/l
- Ra-226 - 3,85 mBq/l
- K-40 - 4257 mBq/l

Measurements contracted by PAA

- water samples collected and measured from the Baltic Sea in accordance with Helsinki Commission Recommendations (HELCOM 26/3)
- samples analysed for:
 - Cs-137, K-40, Ra-226 and H-3



Water monitoring – drinking water (1)

- **Sanitary-Epidemiological Stations (basic units)**

- water samples collected once per quarter

- samples analysed for:

- Cs-137 with radiochemical or spectrometric methods

- results sent to:

- Chief Sanitary Inspectorate

- CEZAR

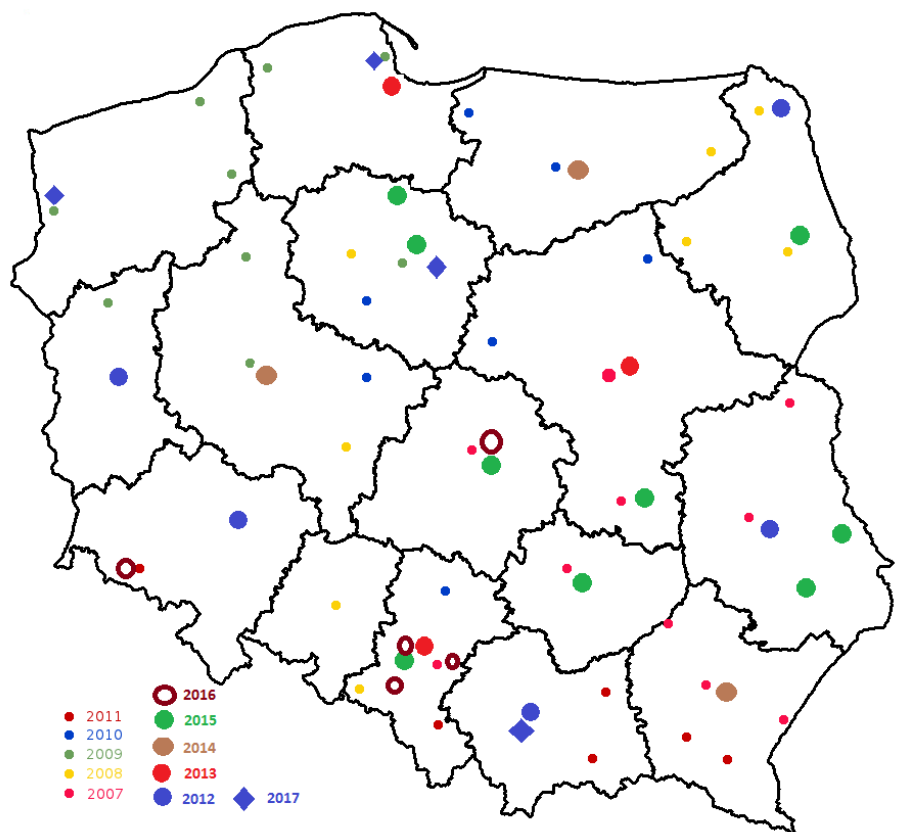
Range of measured values in 2017:

< 0,01 – <2 Bq/l

- **Measurements according to the Council Directive 2013/51/EURATOM performed by water suppliers**



Water monitoring – drinking water (2)



Measurements contracted by PAA

- water samples collected once per quarter in selected cities
- samples analysed for:
 - Cs-137
 - Sr-90,
 - H-3
 - total α , β activities

Range of measurement values in 2017:

- Cs-137 – $< 0,05$ Bq/l
- Sr-90 – $< 0,002$ to $0,005$ Bq/l
- H-3 – $< 3,5$ Bq/l
- total α - $< 0,01$ – $0,08$ Bq/l
- total β - $< 0,5$ Bq/l

Water monitoring – ground water

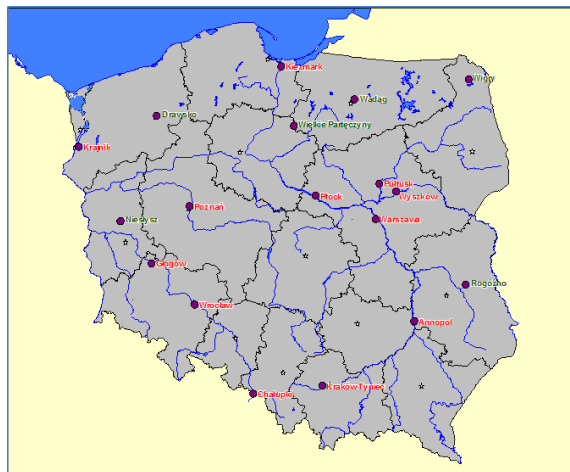
Local monitoring

- **National Radioactive Waste Repository in Różan**
 - Samples analysed for **H-3** and total **β** activity
- **National Centre for Nuclear Research in Świerk**
 - Samples analysed for **H-3**
 - Samples analysed for **H-3**, **Cs-134**, **Cs-137** and **Sr-90**

Sediments (1)

Measurements contracted by Chief Inspectorate of Environmental Protection, GIOŚ

- sediments samples collected from rivers and lakes every 2-3 years
- samples analysed for:
 - Cs-137, Pu-238, 239, Pu-240



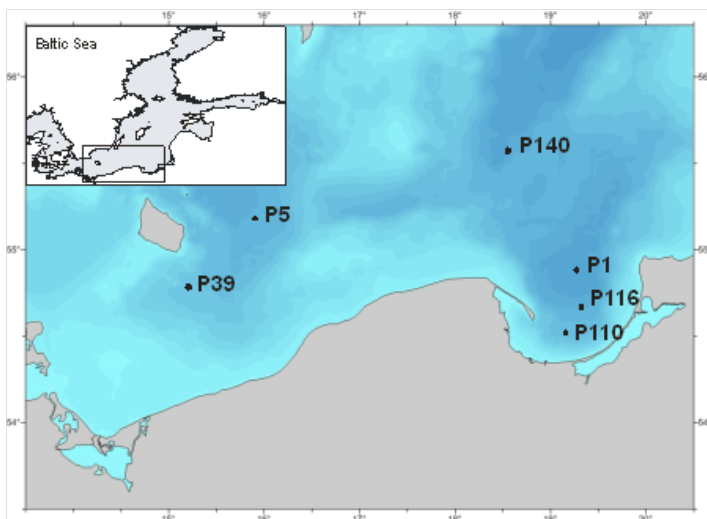
Average isotopes concentration in sediments in 2017 [mBq/l], GIOŚ

	Wisła, Bug i Narew	Odra i Warta	Jeziora	
Cs-137	Zakres	0,26 - 6,00	0,49 - 6,88	1,37 - 14,94
	Średnio	2,76	2,09	5,09
Pu-239,240	Zakres	0,003-0,0344	0,006-0,0487	0,004-0,0551
	Średnio	0,019	0,017	0,018

Sediments (2)

Measurements contracted by PAA

- sediments samples collected from the Baltic Sea in accordance with Helsinki Commission Recommendations (HELCOM 26/3)
- samples analysed for:
 - Cs-137, Sr-90, K-40, Pu-238, Pu-239, Pu-240



Average isotopes concentration in sediments in 2017 [mBq/l], CLOR for PAA

		Grubość warstwy 0-19 cm
Cs-137	kBqm ²	2,52
Pu-238	Bqm ²	1,82
Pu-239,240	Bqm ²	81,9
K-40	kBqm ²	41,5
Sr-90	Bqm ²	141,8

Food and feedstuff (1)

Sanitary-Epidemiological Stations (basic units)

- monitoring programme approved by PAA



Measurements contracted by PAA

- mixed diet samples

Veterinary Hygiene Stations

- animal food samples measured for Cs-137



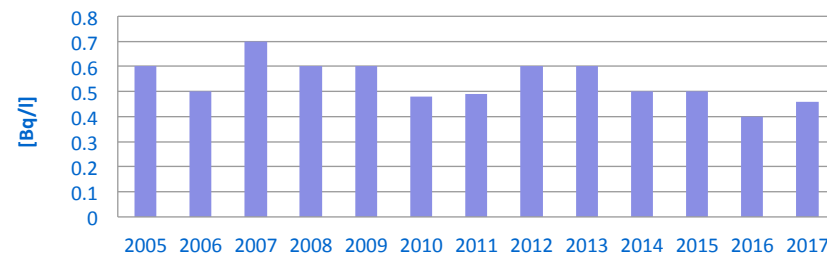
Food and feedstuff (2)

Food products

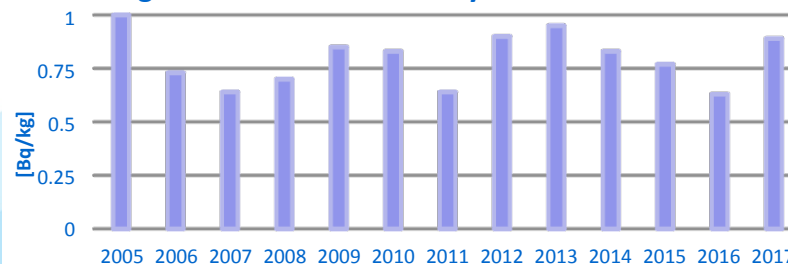
Sanitary-Epidemiological Stations (basic units)

- samples collected according to monitoring programme approved by the PAA:
 - milk, local producers or local shops quarterly
 - fish, eggs, cereals – once per year,
 - fruit, vegetables – once per year during harvest period
 - meat (different kinds) – once per quarter
 - samples analysed for Cs-137 and Sr-90 activity concentration
- results sent to:
 - Chief Sanitary Inspectorate
 - CEZAR
- data provided to REMdb

Average annual Cs-137 activity concentration in milk

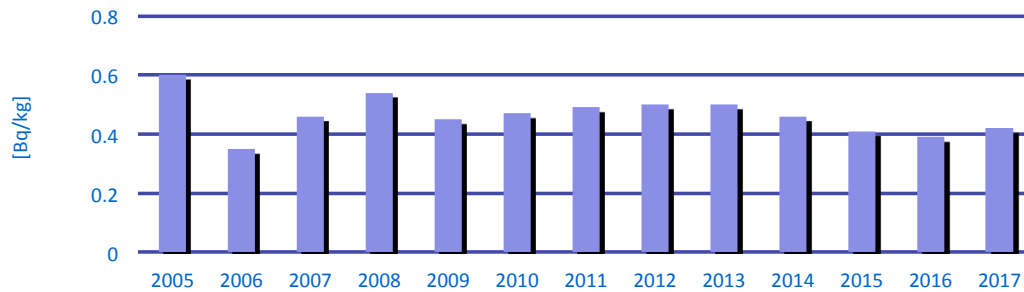


Average annual Cs-137 activity concentration in meat

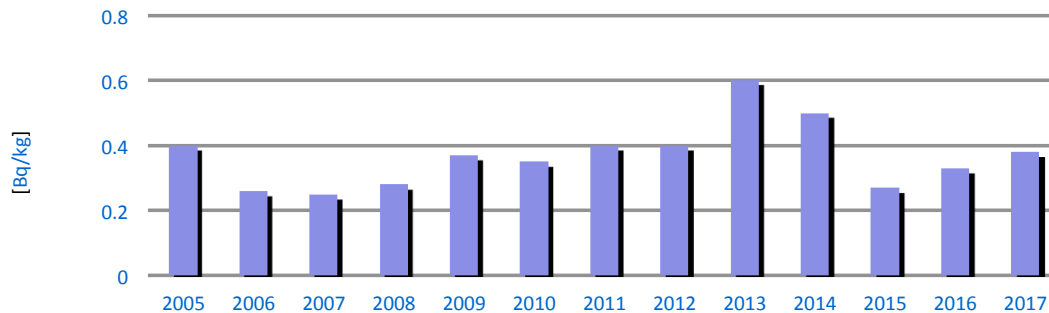


Food and feedstuff (3)

Average annual Cs-137 activity concentration in vegetables



Average annual Cs-137 activity concentration in fruit



Food and feedstuff (4)

Feed products

Sanitary-Epidemiological Stations (basic units)

- samples collected once per year from local vendors:

- wheat bran
- rye bran
- maize
- fodder mixtures
- grass



- results sent to:

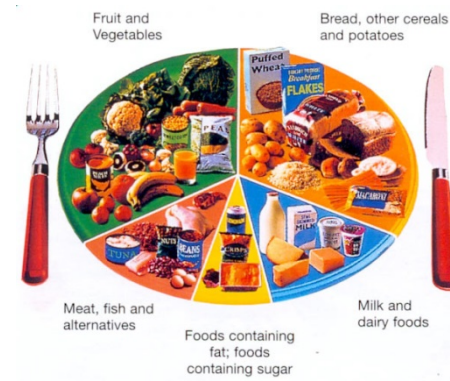
- Chief Sanitary Inspectorate
- CEZAR

Food and feed stuff (5)

Measurements contracted by PAA

Mixed diet

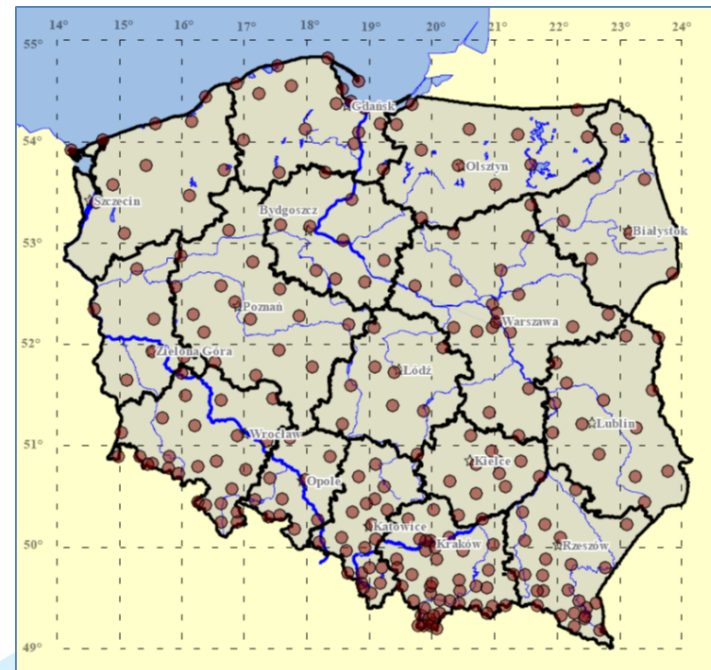
- samples collected:
 - once or twice a year
 - from canteens with all-day meals
 - for 5 consecutive days
- samples analysed for Cs-137 and Sr-90 activity concentration
- data provided to REMdb
- before 2016 samples collected from two or three cities with population over 100 thousand inhabitants, now according to verification mission recommendation one permanent location - Warsaw



Soil (1)

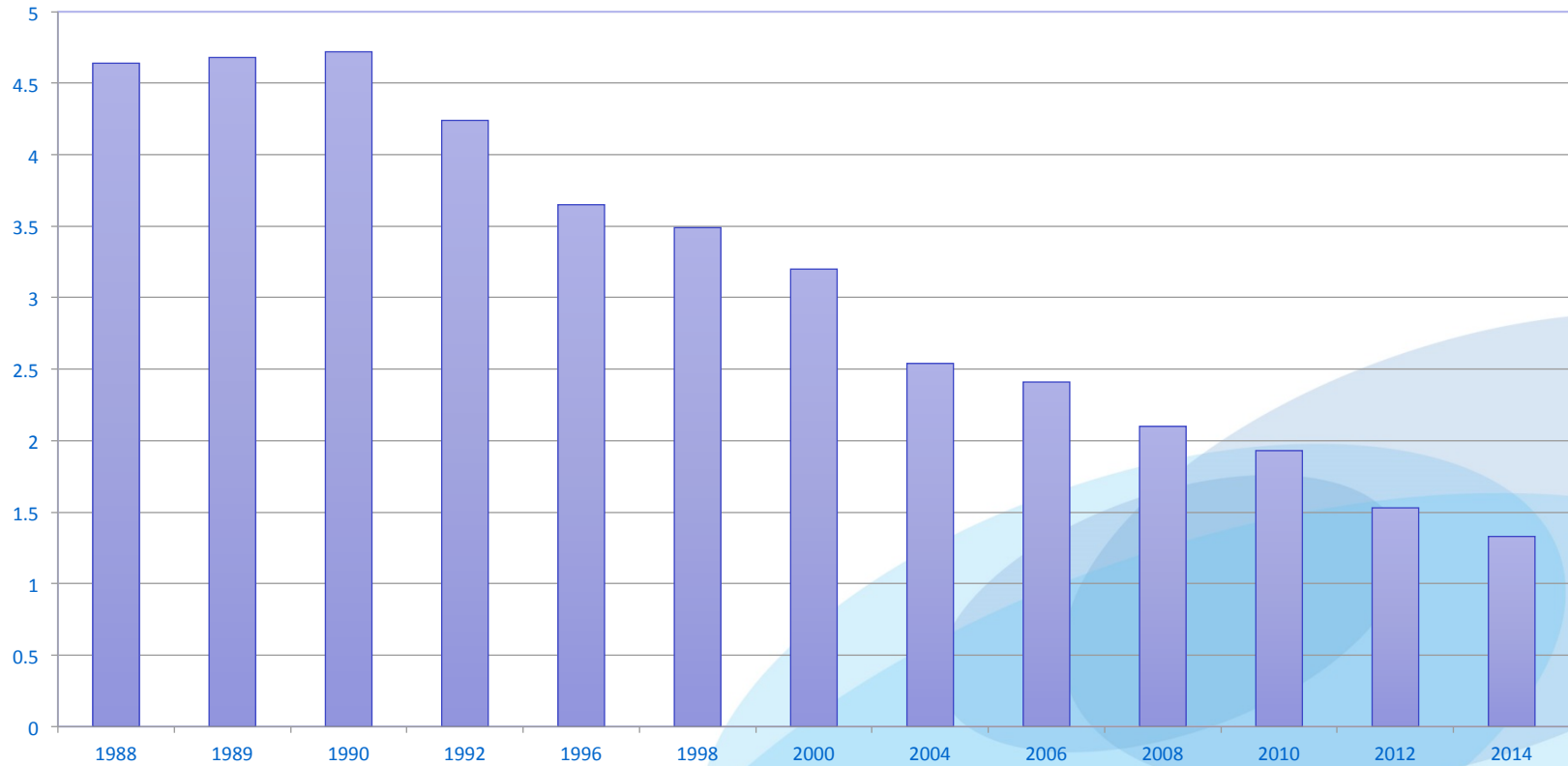
Measurements contracted by Chief Inspectorate of Environmental Protection, GIOŚ

- samples measured every 2 years
- samples analysed for
 - Cs-137
 - Cs-134
 - K-40
 - Ra-226
 - Ac-228
 - Pb-210

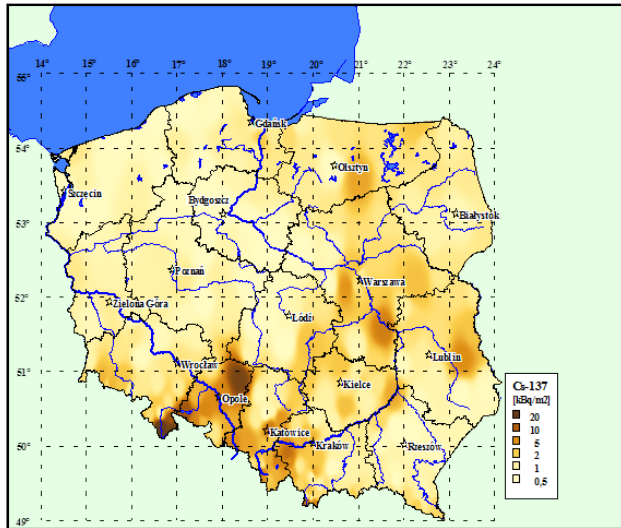


Soil (2)

Average Cs-137 activity concentration in soil 1988-2014, GIOŚ, 2015 [kBq/m²]



Soil (2)



Results publishing

Daily map of γ dose rate in Poland

- interpolated results from PMS stations



PAA President's Annual Report

- detailed monitoring results



RAPORT ROCZNY

Dotyczy: Działalność Prezesa Państwowej Agencji Atomistyki oraz ocena stanu bezpieczeństwa jądrowego i ochrony radiologicznej w Polsce w 2017 roku



2017

PAA President's quarterly report on radiation situation in Poland

- γ dose rate (PMS and IMGW)
- ^{137}Cs concentration in air (ASS-500)
- ^{137}Cs concentration in milk (Basic Units)

www.paa.gov.pl

Ru-106 and Ru-103 in aerosols in October 2017

ASS-500 – aerosol samples

Location	Ru-106 [mBq/m ³]		Ru-103 [μBq/m ³]	
	Week 39 (25.09 – 02.10)	Week 40 (02.10-09.10)	Week 39 (25.09 – 02.10)	Week 40 (02.10-09.10)
WARSZAWA	4.09 ± 0.05	2.46 ± 0.06	0.85 ± 0.19	
BIAŁYSTOK	0.23 ± 0.01	1.75 ± 0.04		
GDYNIA	3.62 ± 0.07	2.54 ± 0.05		
KATOWICE	0.60 ± 0.03	4.65 ± 0.12		
KRAKÓW	1.67 ± 0.12	3.11 ± 0.22		0.85 ± 0.27
LUBLIN	7.16 ± 0.17	3.36 ± 0.05	2.30 ± 0.40	
ŁÓDŹ	7.63 ± 0.22	12.19 ± 0.34		
SANOK	6.52 ± 0.37	4.83 ± 0.28		
SZCZECIN	0.36 ± 0.01	0.09 ± 0.01		
TORUŃ	9.93 ± 0.30	2.93 ± 0.07	3.46 ± 0.47	0.84 ± 0.22
WROCŁAW	3.03 ± 0.06	2.97 ± 0.04		
ZIELONA GÓRA	3.99 ± 0.12	1.54 ± 0.04		

Ru-106 and other isotopes in fallout in October 2017

IMGW – fallout samples

Activity concentration [Bq/m ²]	Poznań 1.10.2017	Warszawa 2.10.2017	Mikołajki 2.10.2017	Warszawa 3.10.2017	Włodawa 3.10.2017
Ru-106	12,072 ± 0,985 (0,506)	14,482 ± 1,156 (0,451)	5,710 ± 0,535 (0,375)	2,993 ± 0,354 (0,382)	19,686 ± 1,528 (0,516)
Cs-137	< 0, 53	<0,046	< 0,053	< 0,047	< 0,070
K-40	1,584 ± 1,040 (1,260)	< 1,190	1,874 ± 1,020 (1,150)	<1,150	1,996 ± 1,054 (1,260)
Ra-226	1,283 ± 0,625 (0,879)	< 0,926	1,165 ± 0,610 (0,753)	1,020 ± 0,604 (0,744)	<0,959
Ac-228	< 0,266	< 0,272	< 0,237	< 0,236	< 0,289
Be-7	8,150 ± 0,791 (0,695)	8,224 ± 0,812 (0,642)	6,818 ± 0,719 (0,694)	7,746 ± 0,794 (0,750)	10,669 ± 0,950 (0,700)

Thank you for your attention!

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