PAŃSTWOWA AGENCJA ATOMISTYKI

Radiation monitoring of contaminated foodstuffs in Poland after the Chernobyl accident

Dawid Frencel
Maciej Krawczyk

Emergancy Preparedness and Response Division
Radiation Emergency Centre (CEZAR)
National Atomic Energy Agency (PAA)

Technical Workshop on Remediation of Radioactive Contamination in Agriculture
IAEA Headquarters - 17 - 18 October 2016

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1. The accident

The nuclear accident which occurred on 26th April 1986 in Chernobyl Nuclear Power Plant, resulted in serious release of radioactive material into the atmosphere. As the result many countries all over Europe were contaminated, including Poland. According to UNSCEAR 2000 these radionuclides were released by the Chernobyl accident in the following amounts: ^{137}Cs – about 85 PBq, ^{90}Sr – 10 PBq, ^{239}Pu – 0,013 PBq, ^{240}Pu – 0,018 PBq. It is estimated that total ^{137}Cs deposition from Chernobyl accident in PBq for various European countries amounted from 0.053 PBq for Belgium to 29 PBq for European part of Russia. For comparison for Poland it was 1,2 PBq, for Ukraine – 13 PBq and Belarus – 15 PBq . Deposition of ^{90}Sr, ^{239}Pu and ^{240}Pu, which are less volatile than isotopes of cesium, was confined to areas closer to the damaged reactor than the deposition of ^{137}Cs.

Chernobyl NPP after the accident

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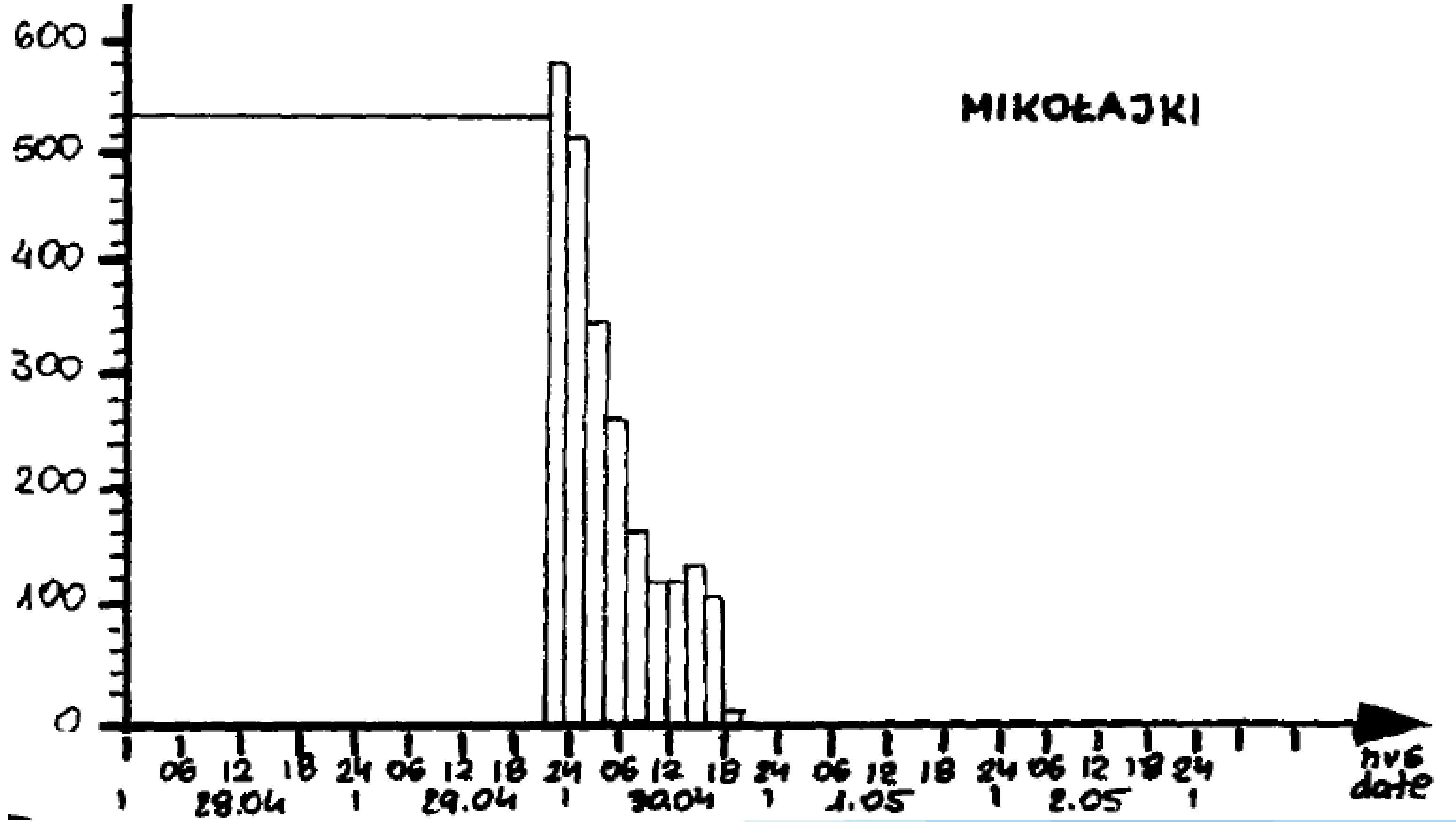
1. The accident



VARIATIONS OF TOTAL BETA ACTIVITY IN AIR MEASURED AT IMiGW STATION AS FUNCTIONS OF TIME

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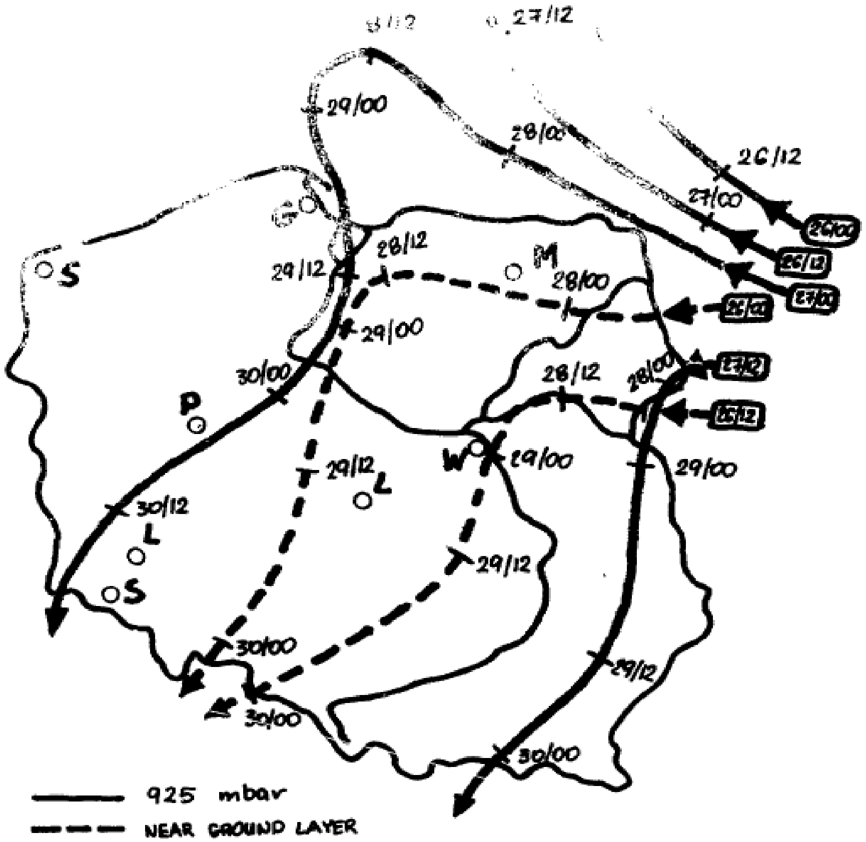
2. Detection of radioactive plume



TRAJECTORIES OF THE AIR CONTANIMATlOMS RELEASED FROM THE CHERNOBYL REACTOR AT 0.00 AND 12 GMT ON 26 and 27 APRIL 1986

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2. Detection of radioactive plume

LOCALISATION OF THE RAINFALLS IN POLAND
IN THE LAST DAYS OF APRIL

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3.Intervention measures taken in Poland

Stable iodine was administered to potentially affected populations in Poland to mitigate the effects of the inhalation of radioactive iodine from the dispersing radioactive cloud.

On April 28 governmental commission was called upon to assess damage potential and to recommend protective measures. Due to lack of reliable information, decisions was based on the worst case scenario. The following intervention levels were recommended by the commission on the morning of April 29:

- whole body committed dose should not exceed 5 mSv/a,
- thyroid committed dose should not exceed 50 mSv/a for children and 500 mSv/a for adults.
- thyroid content in children sixteen years or under should not exceed 5700 Bq at any moment.

3.Intervention measures taken in Poland

On April 29 at noon, the Polish Minister of Health ordered the centralized pharmacy to prepare KI solutions for distribution in 11 most affected provinces. The KI doses were prepared according to the following protocol:

a) 15 mg for newborns,

b) 50 mg for children five years or under,

c) 70 mg for all others,

d) Because the cancer risk for adults was believed to be low, and some side effects might be anticipated, iodine prophylaxis was not recommended to adults.

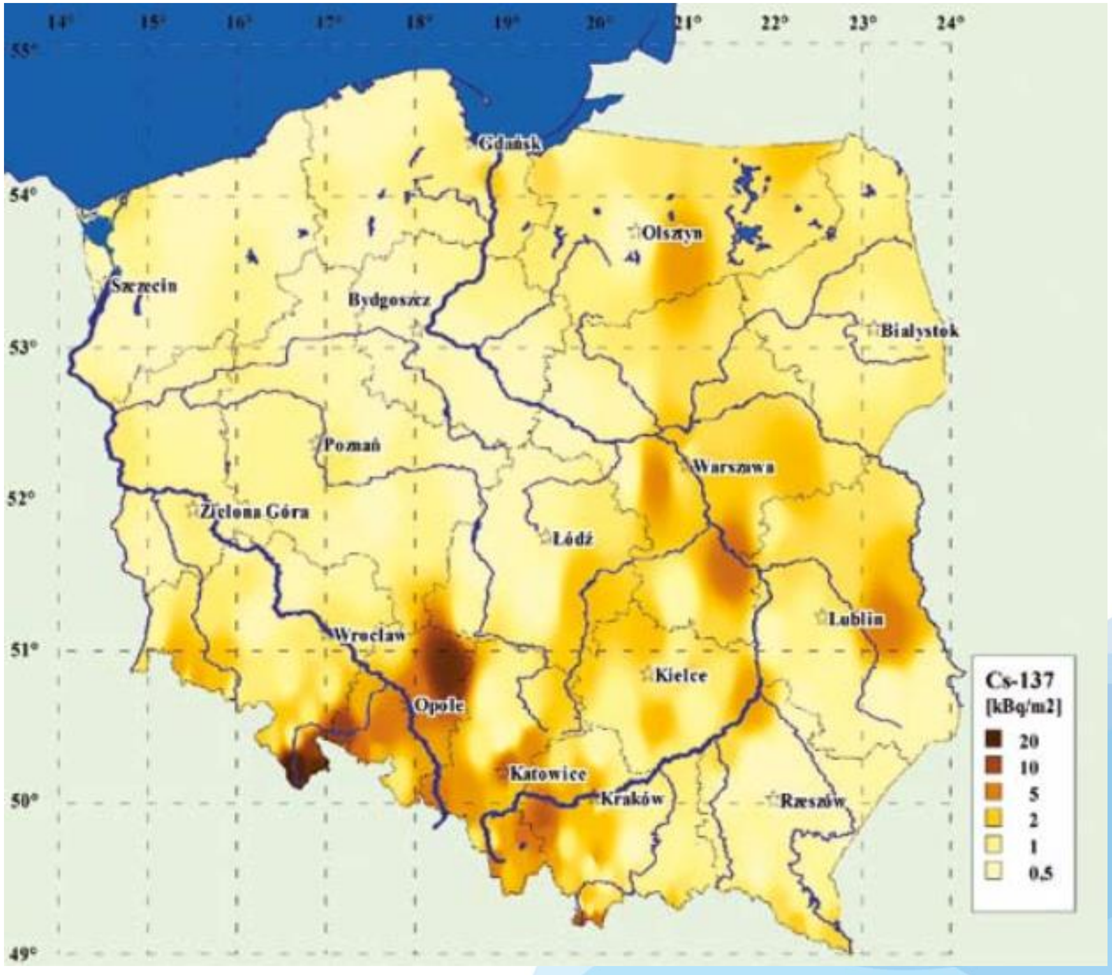
e) Iodine prophylaxis was recommended to lactating women, but was not mandatory.

3.Intervention measures taken in Poland

4. Radiation monitoring of foodstuff over the years

It has been well known that the unit of soil contamination for particular radionuclide results in a defined value of the doss commitment from external irradiation to an inhabitant of the contaminated area as well as a dose commitment from internal contaminations because of consumption foods from this contaminated region and meter. It is also known that the soil contamination can be caused by dust which is deposited on a ground surface. Dust after a nuclear explosion and air contaminations following a reactor accident can transfer different ways and deposit with different velocity. In various conditions, seasons, climate and physical and chemical forms of contaminations the same amounts of the same radionuclides may result in different doses. Such calculation gives yet approximated values of doses from ingestion of contaminated food and internal radiation from inhalation.

4. Radiation monitoring of foodstuff over the years



The distribution of ^{137}Cs activity concentration in surface-layer soil in Poland in 2011.

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4. Radiation monitoring of foodstuff over the years

On 29 April 1986, the Central Laboratory of Radiological Protection activated the whole Service of Measurements of Radioactive Contamination to carry out the measurements in accordance with the alarm programmes. Sixteen Veterinary Hygiene stations also began systematic monitoring of the contamination of milk, meat, fish, grass and other products applying the method of total beta activity. Some laboratories also began measuring the activity of selected radionuclides.

4. Radiation monitoring of foodstuff over the years

The highest dose rates of gamma radiation measured 1 m over the ground were observed from 29 April to 3 May 1986. The maximum dose rate amounted to 0.6 mR/h. The dose rate subsequently decreased, reaching a mean value of about 0.025 mR/h on 10 May and continuing to decrease thereafter. The contamination of grass was recorded as of 29 April, with a maximum value of 105,000 Bq/kg on 30 April. A decrease followed with some rise again on 14 May.

4. Radiation monitoring of foodstuff over the years

The contamination of milk was already detected on 29 April, and the maximum was observed the same day in the region of Lublin. It amounted to 2,000 Bq/l After a decrease, a new peak was noted on 4 May amounting to 1,640 Bq/l. Then there was a decrease of contamination, with the level dropping to 200 Bq/l on 20 May 1986. Radioactive contamination of meat in most cases did not exceed 400 Bq/kg. Relatively low levels of radioactive contamination (mostly below 100 Bq/kg) were found in samples of meat products, fish and eggs. The contamination was much higher in the case of meat of wild animals, especially roe-deer.

4. Radiation monitoring of foodstuff over the years

In the meat of these animals obtained in northwestern Poland, the region of highest contamination, the values reached about 1,500 Bq/kg during the period of May-June 1986. Since then, a systematic decrease in the level of contamination of venison has been observed.

On 29 April 1986, the Ministry of Agriculture, Forestry and Food Economy delivered an injunction against the pasturing of cattle and the use of green forages for feed in thirteen provinces. On 5 May this was revoked for all animals except dairy cows and cows prior to calving. On 13 May the ban was lifted for dairy cows.

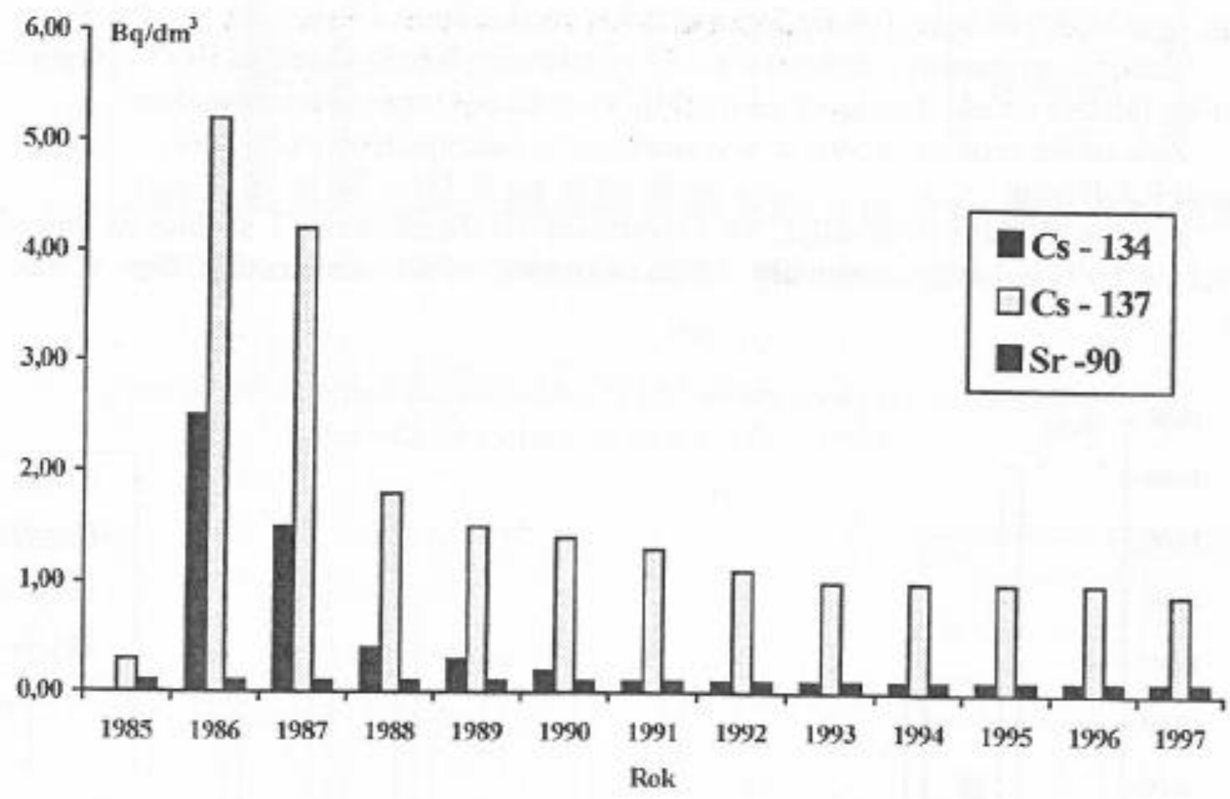
4. Radiation monitoring of foodstuff over the years

After receiving the opinion of experts in different fields, the governmental Committee accepted the following limits of radioactive contamination for food products of animal origin:

- milk: 1,000 Bq/l
- meat, poultry and fish: 1,000 Bq/kg.

At the same time it was recommended that milk showing higher activity than the accepted limits should be processed into stable dairy products. For young children as well as for pregnant and nursing women, it was recommended to use only milk powder from government reserves or import. A regulation providing milk powder for children up to three years of age was also introduced. In order to examine the radioactivity of Polish goods for the export market, control measuring stations were organised at seven border crossings.

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-134,Cs-137 and Sr-90 in milk in the years 1985-1997.

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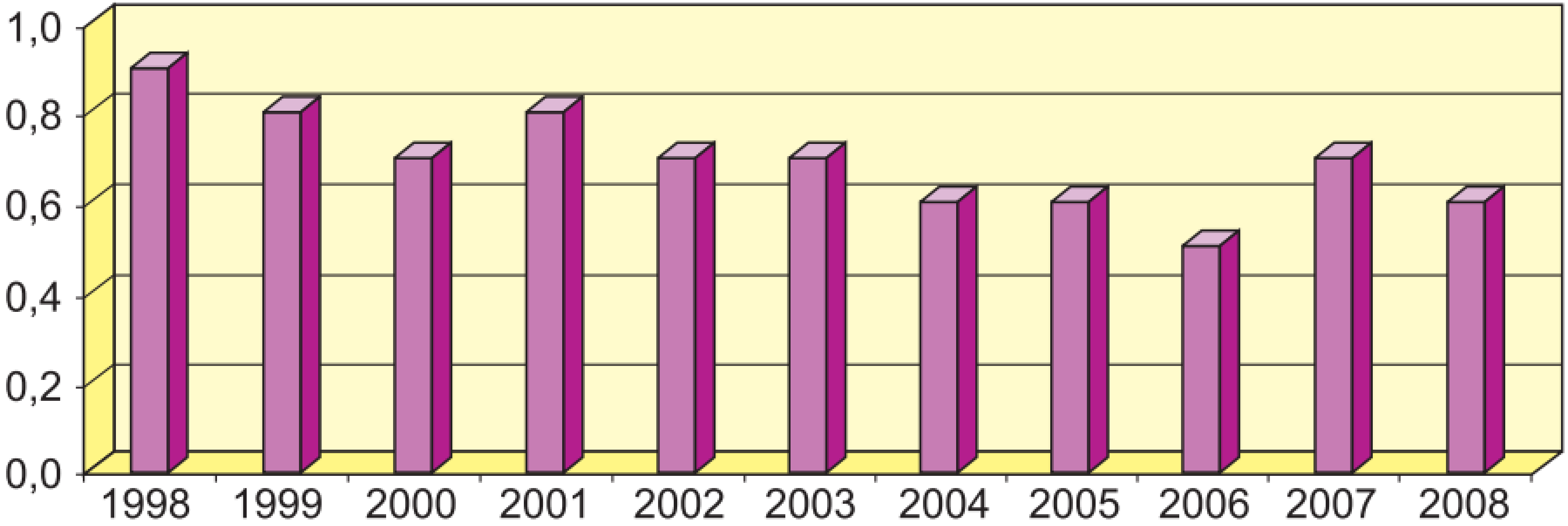
4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in milk in Poland in the years 1998-2008 (PAA, based on measurements conducted by sanitary and epidemiological stations).

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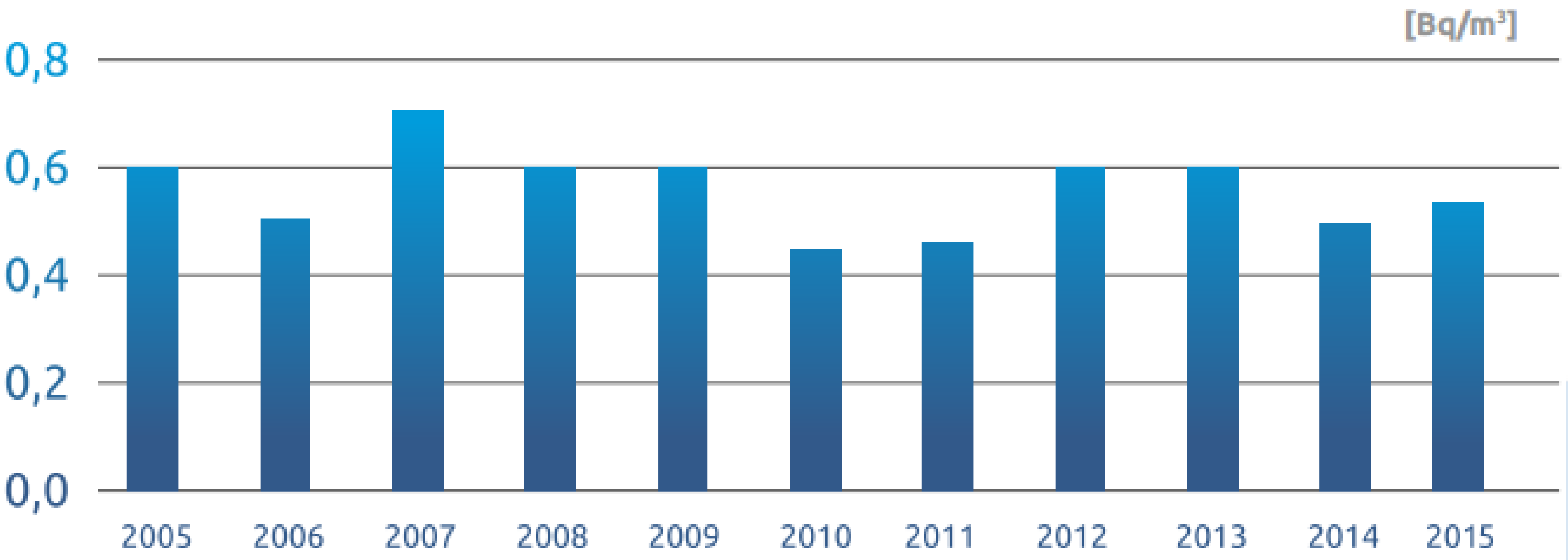
4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in milk in Poland in the years 2005-2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

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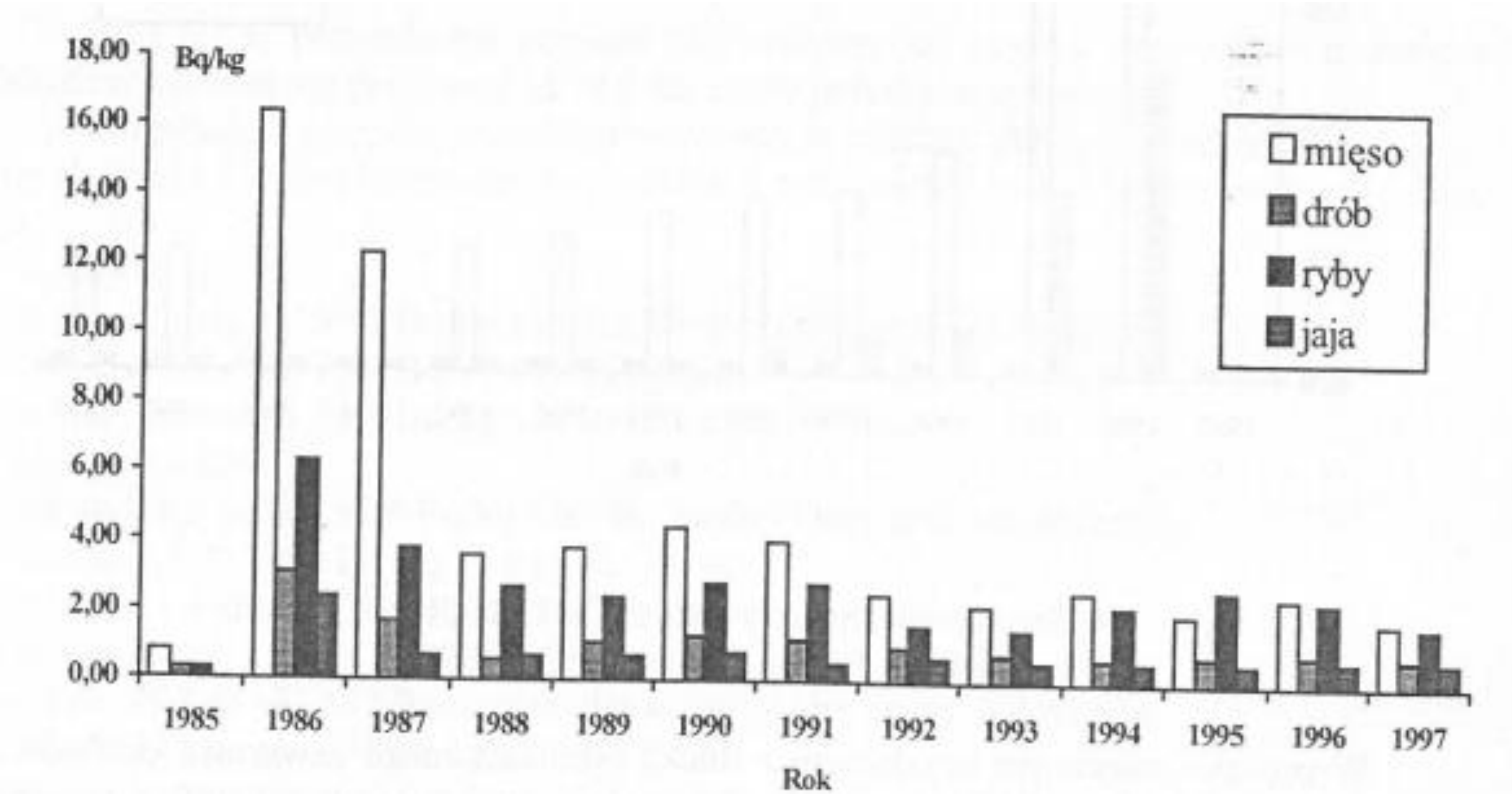
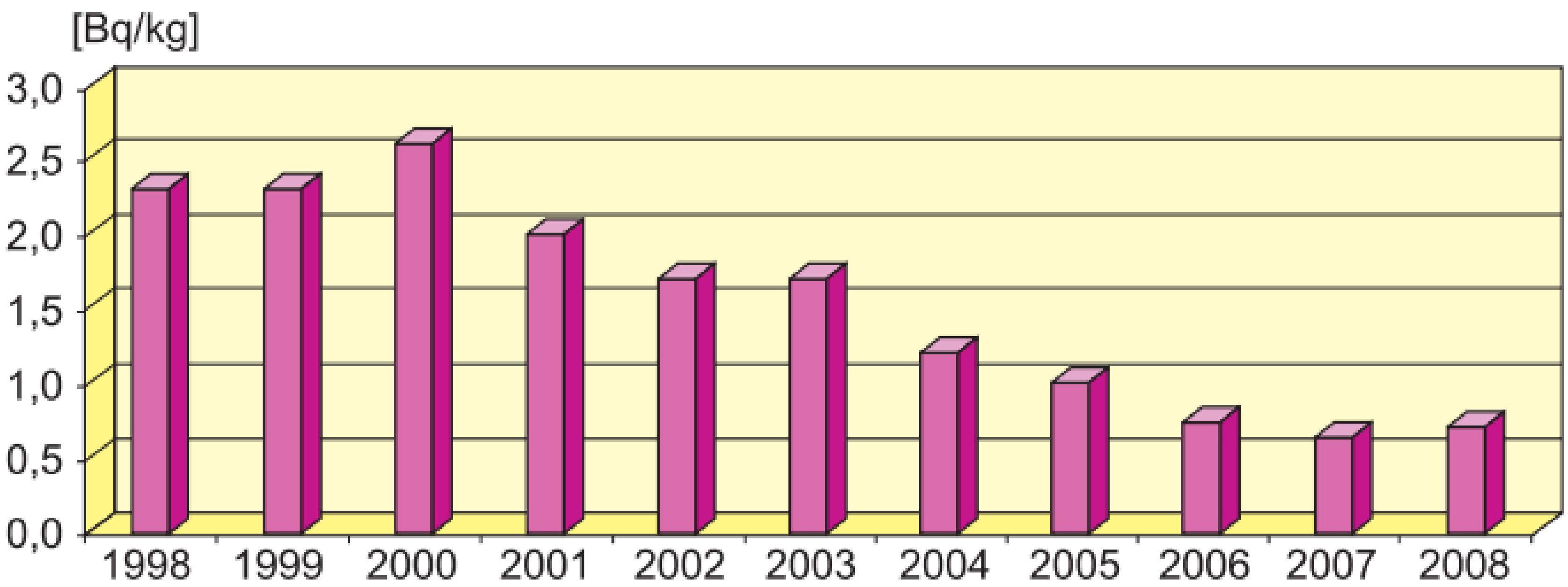
4. Radiation monitoring of foodstuff over the years



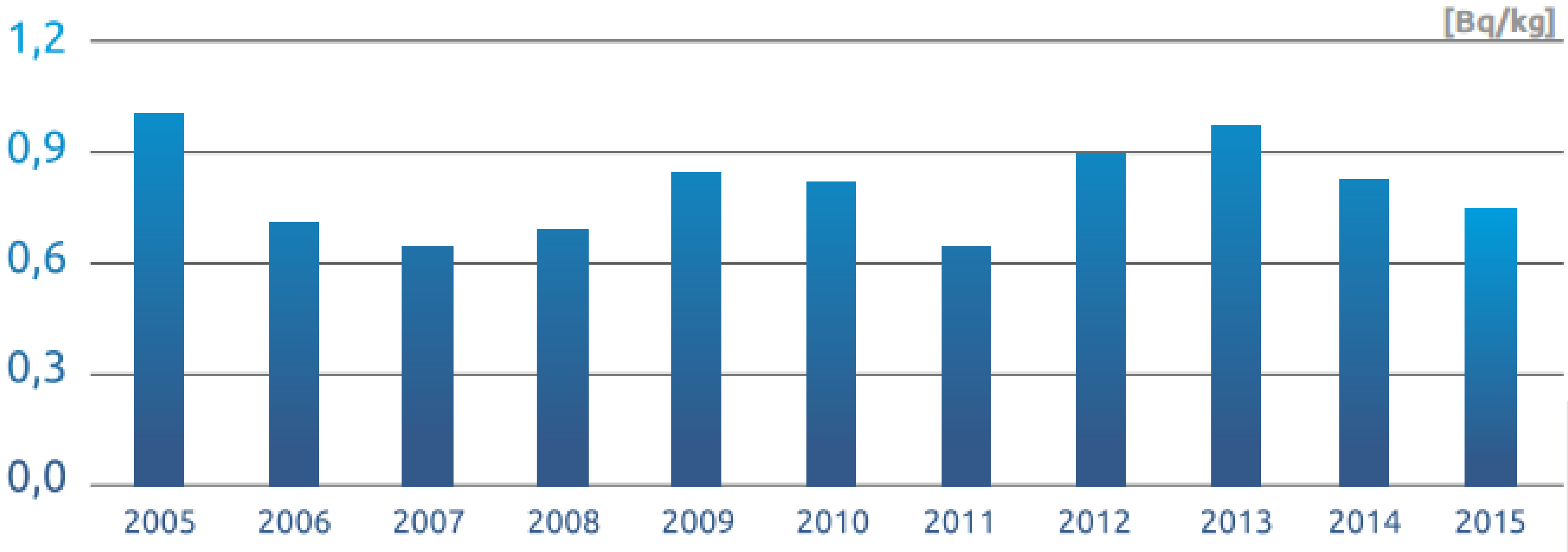
Annual average concentration of Cs-137 in meat, poultry, fish and eggs in Poland in the years 1985-1997

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in meat breeding in Poland in the years 1998-2008.

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in meat from Polish animal farms in the years 2005-2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

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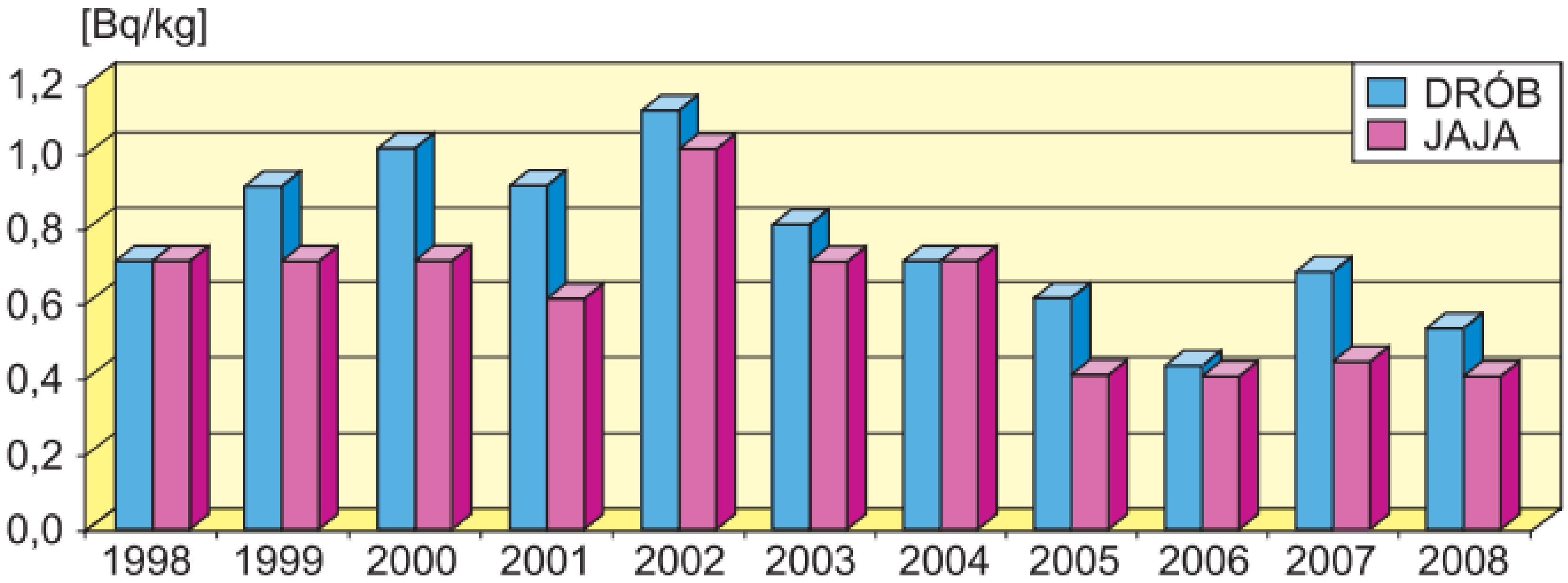
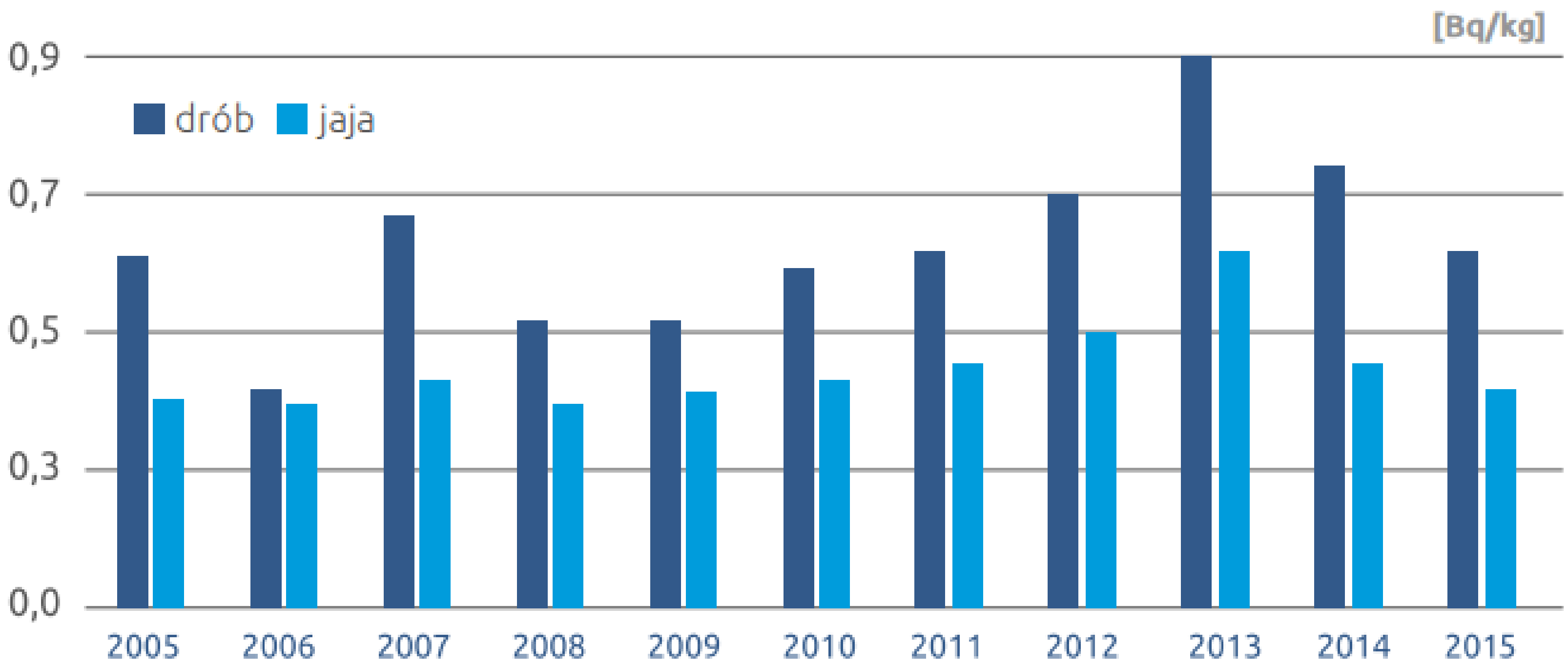
4. Radiation monitoring of foodstuff over the years



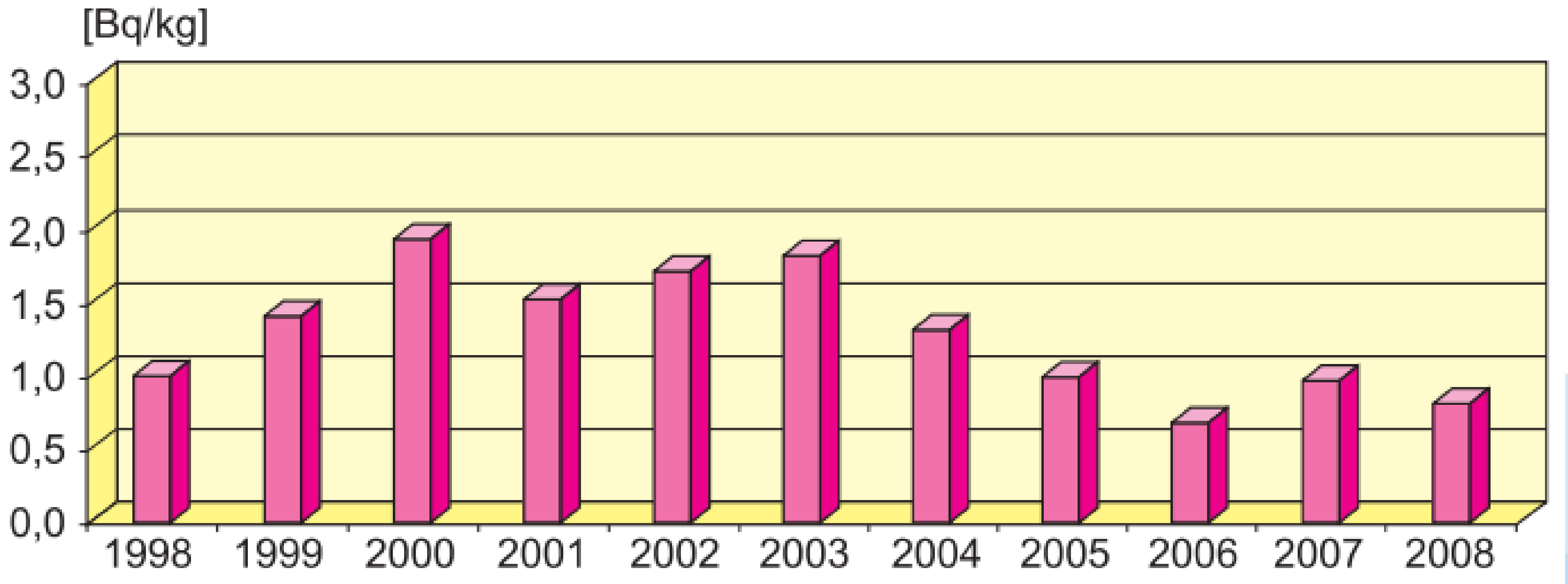
Annual average concentration of Cs-137 in poultry and eggs in Poland in the years 1998-2008.

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in poultry and eggs in Poland in the years 2005-2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in fish in Poland in the years 1998-2008.

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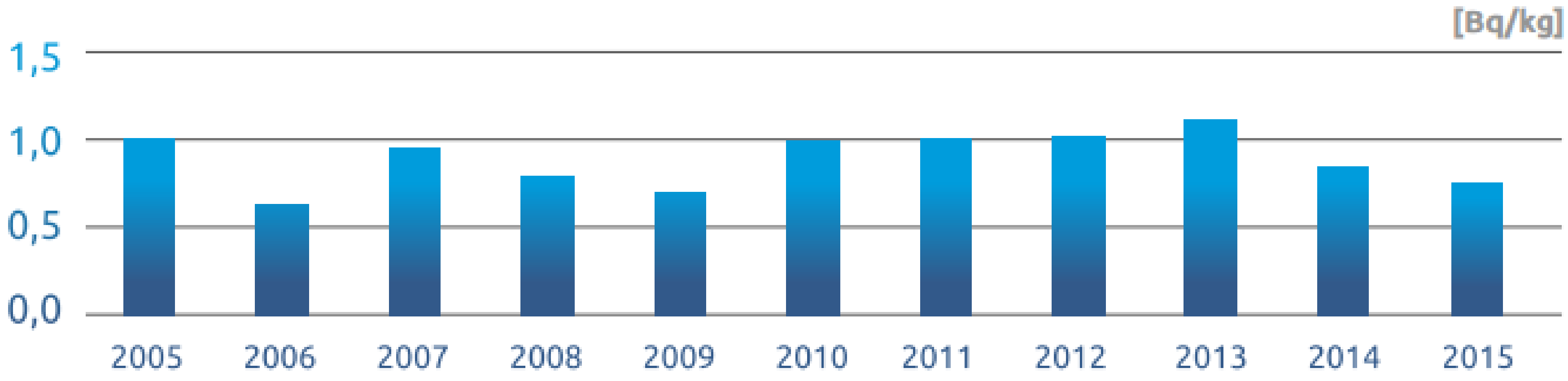
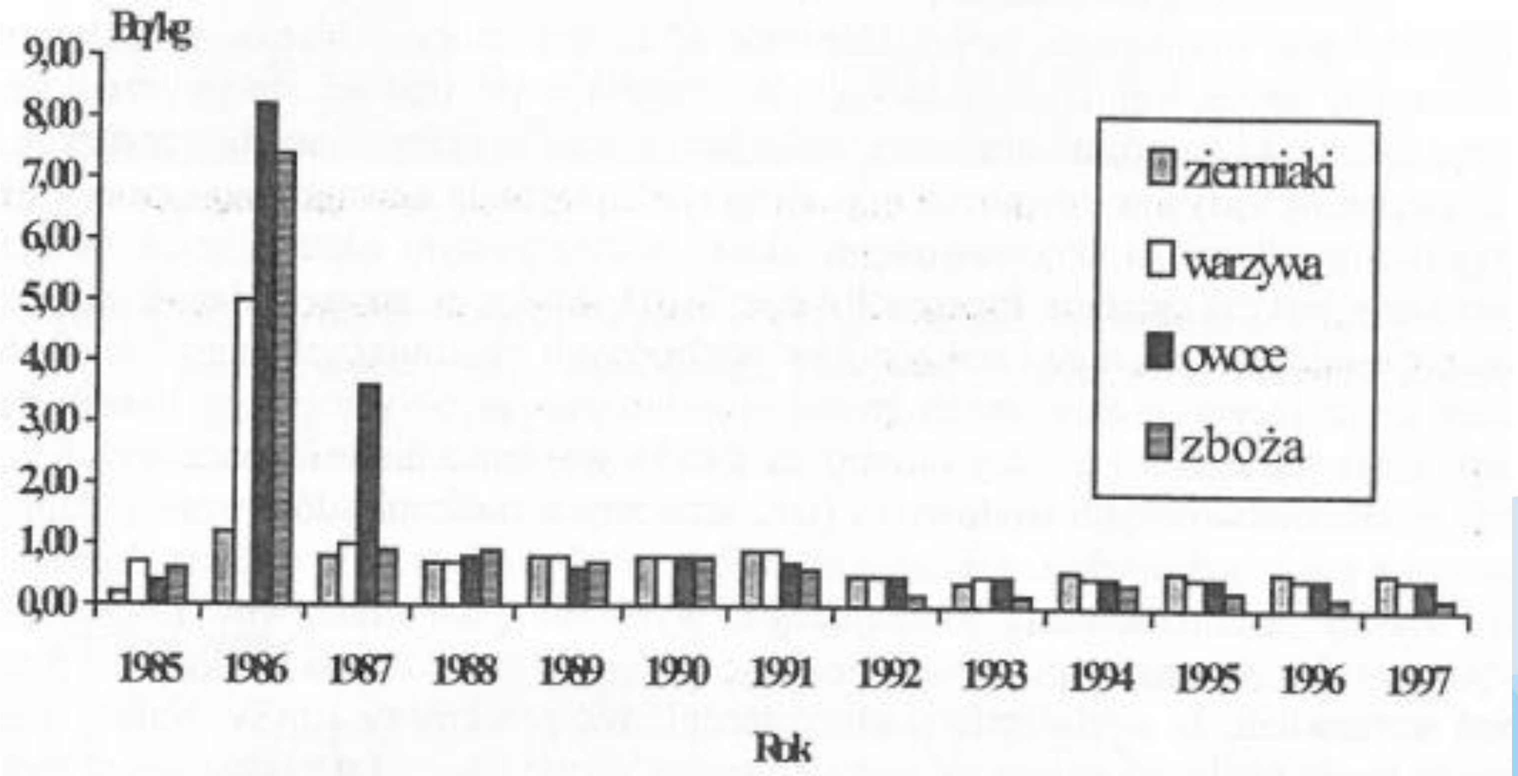
4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in fish in Poland in the years 2005-2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in potatoes, vegetables, fruits and crops in Poland in the years 1985–1997

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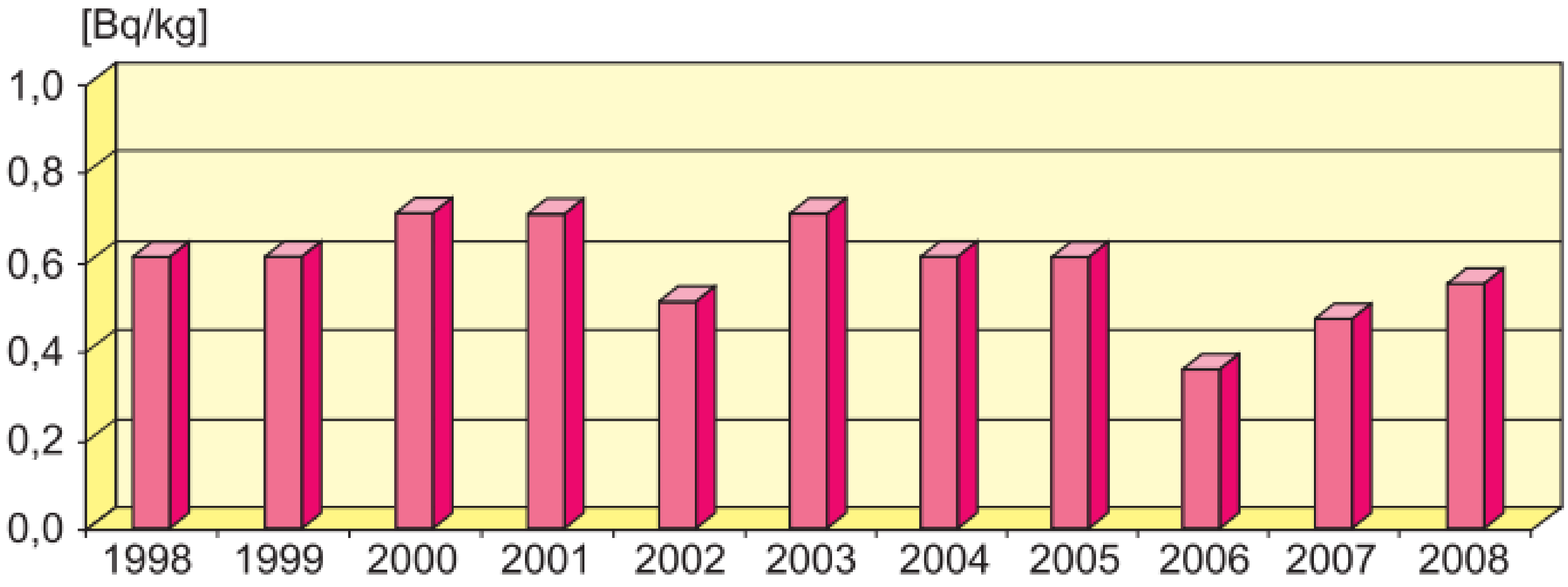
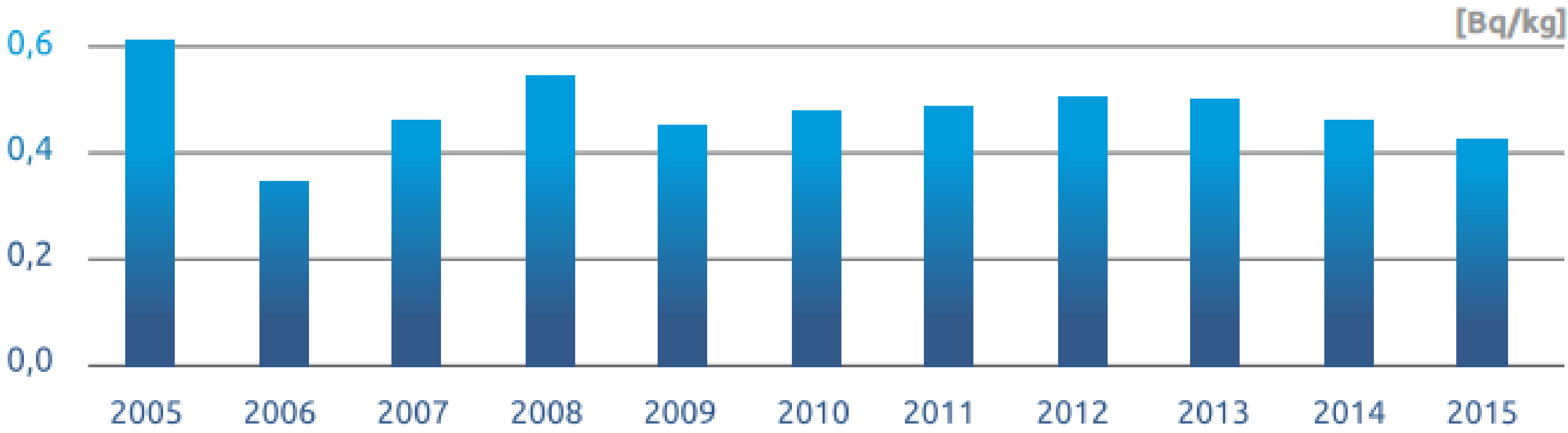
4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in vegetables in Poland in the years 1998–2008

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in vegetables in Poland in the years 2005–2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

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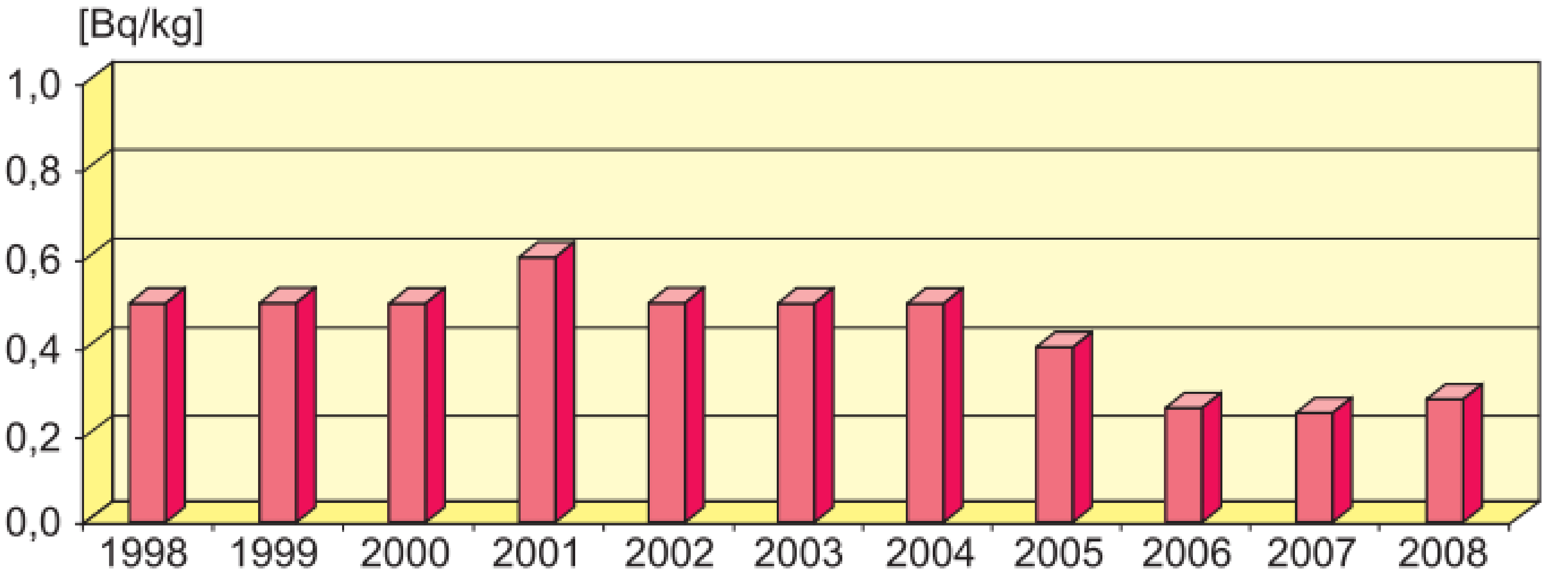
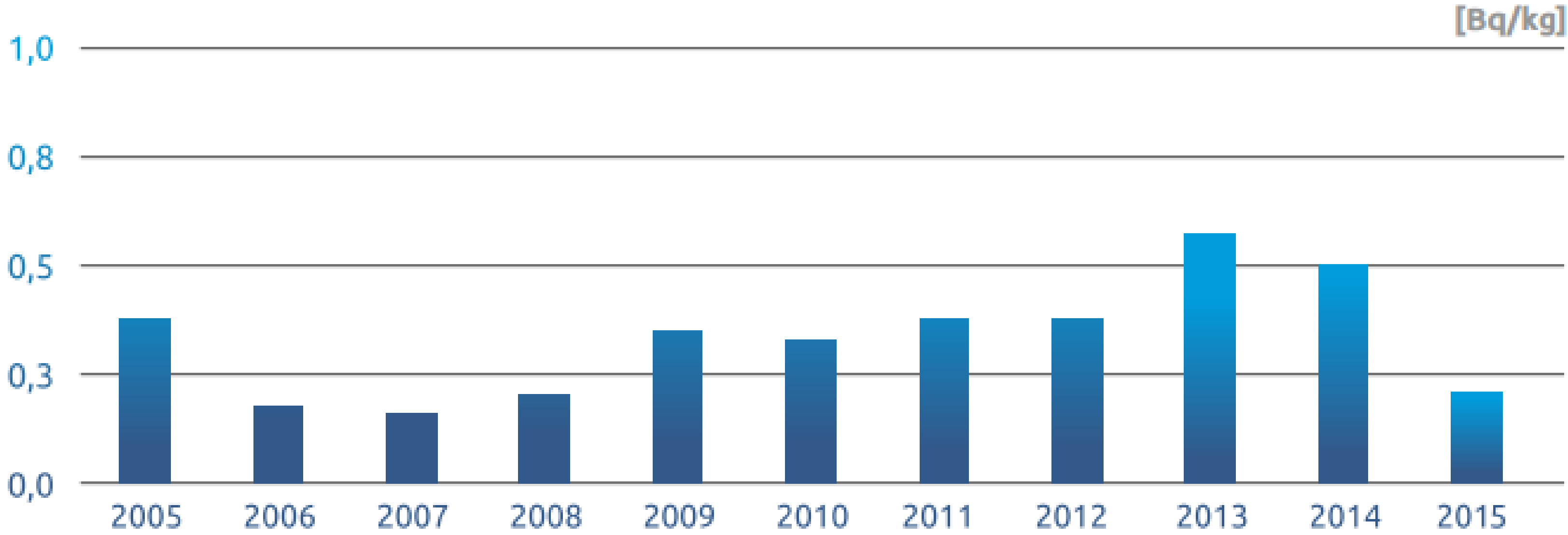
4. Radiation monitoring of foodstuff over the years



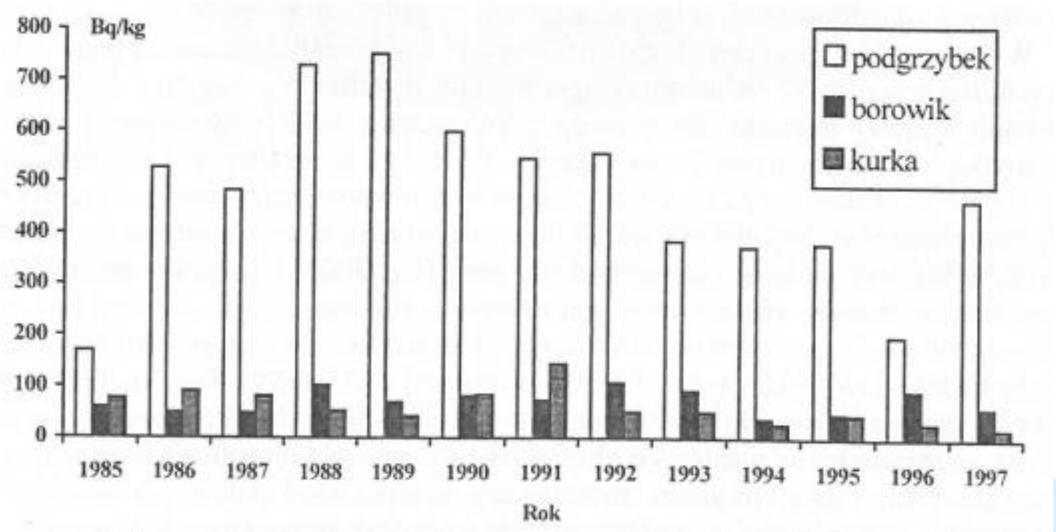
Annual average concentration of Cs-137 in fruits in Poland in the years 1998–2008 (PAA, based on measurements conducted by sanitary and epidemiological stations).

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in fruits in Poland in the years 2005–2015 (PAA, based on measurements conducted by sanitary and epidemiological stations).

4. Radiation monitoring of foodstuff over the years



Annual average concentration of Cs-137 in mushrooms in Poland in the years 1985–1997.

In 2015, no radiochemical measurements of Cs-137 in fresh mushrooms were conducted. In 2014, the average activity of caesium in basic specimens of fresh mushrooms came to ca. 22 Bq/kg. It should be stressed that in 1985, i.e. before the Chernobyl disaster, the activity of Cs-137 in mushrooms was also much higher than in other foodstuffs. At that time, this radionuclide was produced in the course of tests of nuclear weapons (which is confirmed by an analysis of the proportion of the Cs-134 and Cs-137 isotopes in 1986)

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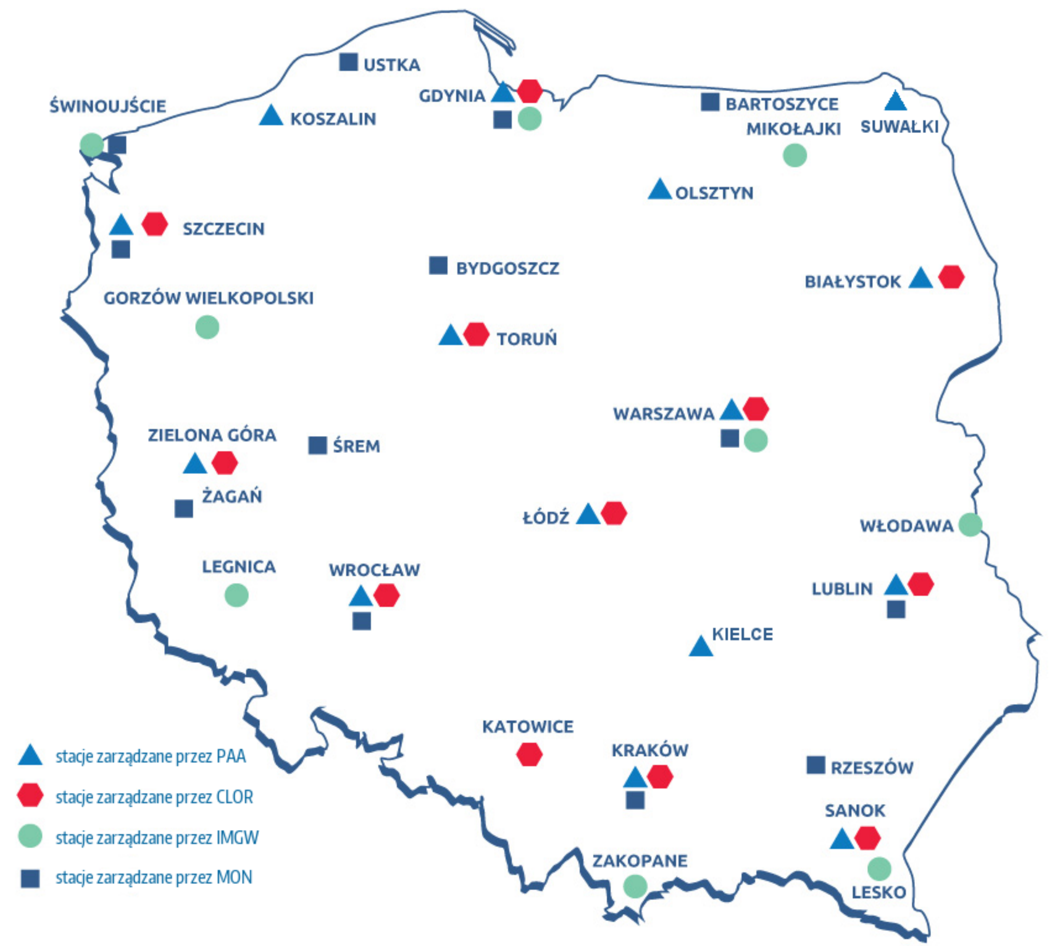
Nowadays



Locations of early warning stations for radioactive contamination.

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Nowadays

Areosol sampling station.

Permanent monitoring station.

Nowadays

Locations of basic units monitoring radioactive contamination in Poland.

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THANK YOU FOR YOUR ATTENTION ! ☺

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