AGH
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Radioactivity in the gas pipeline network in Poland

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NORM in gas industry

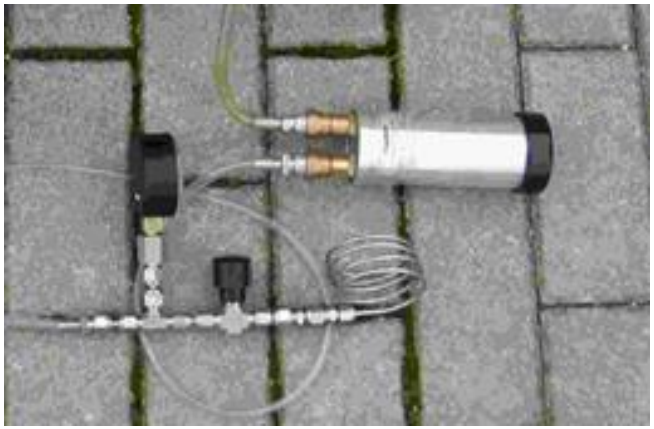
The main sources of radiation in gas industry:

- Rn-222 in transported gas
- short-lived Rn-222 progeny (Po-218 - Pb-214) accumulated:
  - on inner pipe surface (thin film -> scales)
  - on filters („black powder”)
- Po-218 - Pb-214 decay after a few hours
- Finally, the long-lived Pb-210 is produced from Rn-222 progeny

Radiological risk

- External exposure
- Radioactive contamination (external/internal)

Methods of measurement



Measurements of Rn-222 in NG

- Lucas ZnS(Ag) scintillation cells 270 ccm
  + PYLON AB5

Measurements of Pb-210 in black powder

- gamma-ray spectrometry
- HPGe detector (efficiency 40%),
- Pb shield

Results - Rn-222

Content of Rn-222 - weekly average

- Imported gas (mainly from Russia) long transport time - 5 sites — 52 – 80 Bq/m^3
- gas from local gas mine (measurement soon after extraction) — 1370 Bq/m^3
- a blend of the national gas (ca 30%) with imported one — 370 Bq/m^3
- *the air of dwellings in Poland* — *ca 100* *Bq/m^3*
  (for comparative purposes)

Rn-222 variability

Temporal variability of Rn-222 concentration was measured on daily and weekly time scales.

No significant temporal variability of 222Rn on those time scales could be detected.

Results – black powder from gas filters

- The Pb-210 activity concentration
  for the black powder sample (5 sites) 500 – 17 000 Bq/kg

- The highest Pb-210 activity concentration for the sample from metering station, where content of Rn-222 in gas is the highest (370 Bq/m^3)

- At the moment of stopping the gas flow through the filter, the dust contains significant amount of short-lived Rn-222 daughters, but their activities decrease rapidly (100 times over 3,5 hours)

Conclusion

- The source of radiological hazard in Polish natural gas network is Rn-222 and its daughters.

- Rn-222 concentration depends on the gas origin (imported – local).
- Daily and weekly variability of the Rn-222 concentration in gas has not been found.

- Pb-210 concentration in black powder from filters reaches significant values.

- Potential risk comes from internal exposure as a result of inhalation of powder from filters containing Pb-210.

References

J. Nowak, **P. Jodłowski**, J. Macuda, Radioactivity of the gas pipeline network in Poland, J. Environmental Radioactivity, **213 (2020) 106143**