Possible consequences of severe accidents at the Lubiatowo site, Poland

Petr Seibert\(^1\), Anne Philipp\(^1\), Radek Hofman\(^1\), Klaus Gufter\(^2\), Steven Sholly\(^2\)

\(^1\) Department of Meteorology and Geophysics (IMGW), University of Vienna, Austria
\(^2\) Institute of Safety and Risk Sciences, University of Natural Resources and Life Sciences, Vienna, Austria

**Introduction**

The construction of a nuclear power plant is under consideration in Poland. One of the open issues discussed is the Lubiatowo, located on the coast of the Baltic Sea southeast of Gdansk. An assessment of possible environmental consequences was carried out for 86 real meteorological cases with the Lagrangian particle dispersion model FLEXPART. Based on literature research, three reactor designs (ABWR, EPR, AP, 1000) were identified as being under discussion in Poland. For each of the designs, a set of accident scenarios was evaluated and two source terms per reactor design were selected for analysis. One of the selected source terms was a relatively large release while the second one was a severe accident with an intact containment.

**Results**

The possibility of very large releases, even if their frequencies are estimated to be extremely small, leads to correspondingly serious potential consequences.

**Conclusions**

- Contamination and dose calculations were carried out for hypothetical severe accidents at the potential Polish NPP site Lubiatowo, covering Poland and surrounding countries.
- The results indicate very low probability of exceeding advice levels for the agricultural sector in a larger environment is possible.
- The possibility of very large releases, even if their frequencies are estimated to be extremely small, leads to correspondingly serious potential consequences.

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**Methodologies and Discussion**

The methodology applied here is the same as in a larger, similar project called flexRISK (http://flexrisk.boku.ac.at). However, the wet deposition parameterisation used is new.

**Results – Overview – Severe source terms “B”**

Below the ground contamination with Cs-137 is shown for ca. 50% of all cases (15 km grid). There is a wide range of patterns. Some are very complicated, with plumes returning one or even multiple times.

- Release of 114 PBq Cs-137, 1.6 E9 Bq 137I
- Radioactive cloud would cross Poland from NW to SE, hitting Warsaw
- Cs-137 ground contamination >500 Bq Cs-137 m\(^{-2}\) reaching Ukrainian border
- Thyroid doses for infants exceed 50 mSv (typical intervention level for iodine prophylaxis) across the whole country
- Maxima of infant thyroid dose >10 μSv; still >0.5 μSv near Kaliingrad

**Results as function of distance – Severe source terms “B”**

- These results are for accident scenario 1B, the smallest of the three severe ones.
- Higher percentiles of contamination and dose roughly follow a linear relationship in the double-log diagramme, with a reduction by a factor of 10 when the distance to the NPP is increased by a factor of 10.
- 1480 Bq Cs-137 m\(^{-2}\) (Chernobyl mandatory relocation) can be reached at distances over 100 km (99th percentile) and in extreme cases (99.9th percentile) even ca. 400 km.
- Infant thyroid dose exceeding 50 mSv (iodine prophylaxis) in extreme cases (99.9th percentile) all over the domain (>800 km), with 1% probability at ca. 450 km.

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**References & Acknowledgements**


**Results – Sample case Warsaw – Severe source term “B”**

- This scenario is based on the largest source term, with almost 300 PBq Cs-137 and 2 E9 Bq 131I

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**Results – Sample case Gdańsk – Severe source term “B”**

- This scenario is based on the largest source term, with almost 300 PBq Cs-137 and 2 E9 Bq 131I

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