SPREADING OF RADIOACTIVITY FROM A POTENTIAL ACCIDENT AT THE PROPOSED NUCLEAR POWER STATION NEAR LUBIATOWO, POLAND

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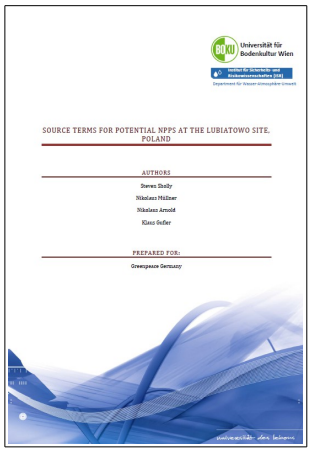
10 March 2014

YES, IT CAN HAPPEN

Source terms for potential nuclear power plants at the Lubiatowo site, Poland [1]



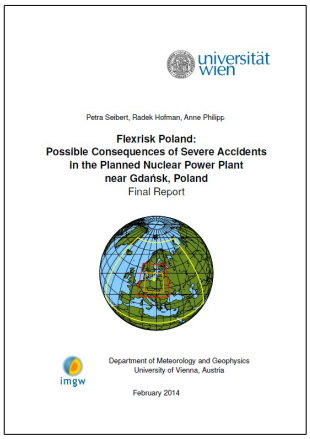
In the environmental impact assessment for the Polish Nuclear Energy Programme, which was accepted by the Council of Ministers on 28 January 2014, no accident was taken into account that could emit large amounts of radioactive substances into the atmosphere. Concerns about the possibility of such accidents were waived away with remarks that Poland does not know earthquakes and tsunamis like Japan, and that modern generation III reactor designs are completely safe. Greenpeace has asked the Institute for Safety and Risk Studies (ISRS) at the BOKU University in Vienna to assess whether an accident with a serious emission of radioactive substances is possible. The result is a resounding “yes”. The chance of such an accident is theoretically very low (in the order of magnitude of 10^{-9}/a to10^{-8}/a), but the consequential release of radioactive substances is very large. Accidents with a ten times higher chance are expected to lead to still substantial releases of radioactive substances.

The selected severe accidents include a failure of the containment. The release fractions for radioactive substances in these cases are dramatically high, in particular for radioactive noble gases (up to 100% of the in the reactor present gasses), Iodine (between 20 and 50%) and Cesium (between 20 and 60%). Even if such events may seem unlikely, they should be considered in the safety case of a nuclear reactor, because this type of calculations is subject to very large uncertainties.

The researchers investigated all three generation III and III+ reactors proposed for Poland. They base their conclusions on the documentation for the Japanese designed ABWR reactor (designed by Hitachi / GE) for the Lungmen power station in Taiwan; for the US designed AP1000 reactor (Westinghouse) for the Levy County 1 and 2 power station in Florida; and for the French designed EPR reactor (Areva / EDF) for the Hinkley Point C nuclear power station in Great Britain. These are the most recent publicly available sets of documentation for these designs.

AND IF IT HAPPENS, RADIOACTIVE SUBSTANCES CAN SPREAD WIDELY

Flexrisk Poland: Possible Consequences of Severe Accidents in the Planned Nuclear Power Plant near Gdansk, Poland [2]



The Department of Meteorology and Geophysics of the University of Vienna has calculated how the emissions from an accident as described above disperse in the atmosphere. The following examples describe what that means for Gdansk, Gdynia and Warsaw respectively.

1 Sholly, S, Müller, N, Arnold, N., and Gufler, K., 2014. *Source terms for potential NPPs at the Lubiatowo site, Poland*. Vienna, Bodenkultur Wien, Institut für Sicherheits- und Risikowissenschaften (ISRS)

2 Seiber, P., Hofman, R and Philipp, A. 2014. *Possible Consequences of Severe Accidents at the Proposed Nuclear Power Plant Site Lubiatowo near Gdańsk, Poland* Department of Meteorology and Geophysics - University of Vienna.

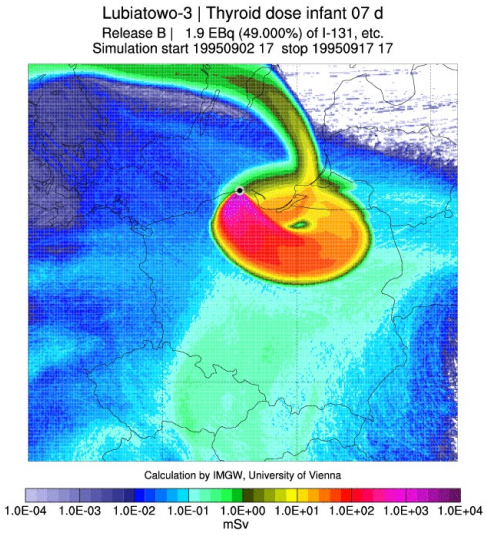
EXAMPLE: **Gdansk** with weather conditions as on 02 September 1995

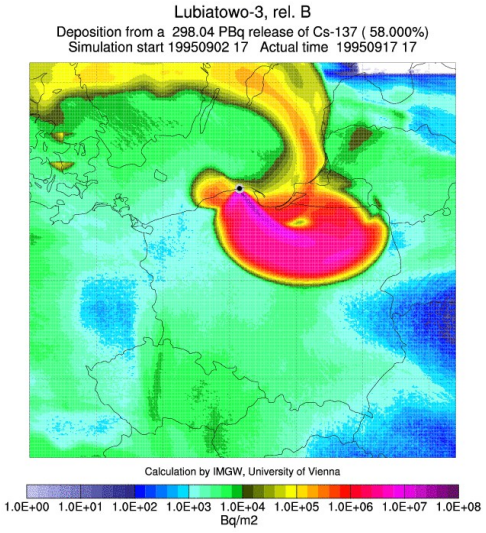
In this case, a Japanese Hitachi / GE ABWR design nuclear reactor is assumed to be situated in Lubiatowo.

A severe accident happens in which the cooling is lost during shut-down with the reactor vessel open. Without cooling, the reactor core heats up and melts. A large fraction of its radioactive fission products are released into the atmosphere (e.g. 49% of iodine-131 as well as 58% of the Cs-137).

An adult inhabitant in Gdansk, who does not evacuate within the first week could receive an effective dose close to 50 mSv (mainly due to radiation from the passing radioactive cloud and inhalation of radioactive isotopes from the cloud) . Next to that he would receive a dose of over 100 mSv because of iodine isotopes on his thyroid.
A small child would receive at the same time slightly higher doses. The IAEA recommends to take protective actions already at an expected thyroid dose of 50 mSv in the first week.

If they do not move out in the first year, they would receive an effective dose of 500 to 1000 mSv of radiation. Already at an expected dose of 100 mSv the IAEA would recommend actions like relocation, and decontamination. In case someone lives 50 years in the contaminated town of Gdansk the total dose would be well over 2 Sv. From the deposition maps it can be concluded that a region which could include Gdansk will be uninhabitable for a long time.



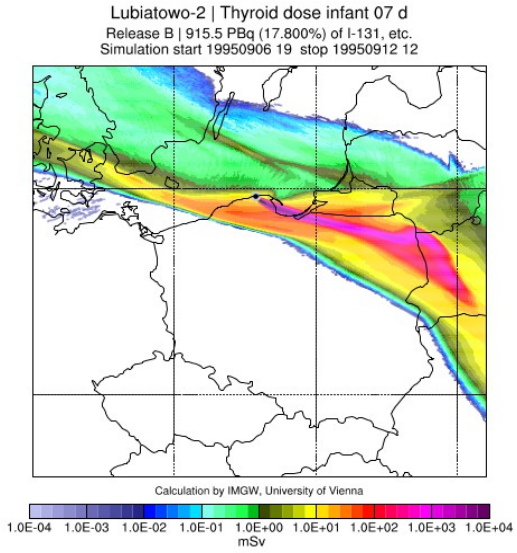


EXAMPLE: **Gdynia** with weather conditions as on 06 September 1995

We assume that the French Areva / EDF EPR design is build in Lubiatowo.

An interfacing system loss of coolant accident takes place at the NPP. The containment is bypassed, because an interfacing system, connecting the nuclear and conventional part, failed. The accident cannot be mitigated and develops into a severe accident, the core heats up and melts down, and over time a large fraction of the radioactive fission products in the core are released to the environment – 17.8% of the iodine-131 and of the Cs-137.

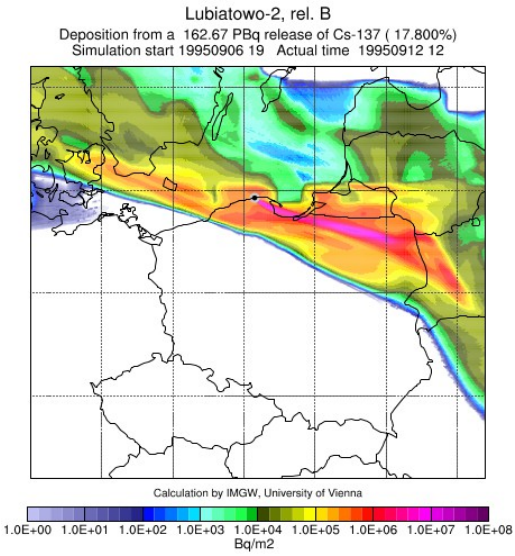
An adult inhabitant in Gdynia who does not evacuate within the first week could receive a thyroid dose of several Sievert because of the inhalation of iodine isotopes. He could furthermore receive an effective dose of 500 mSv from the passing radioactive cloud . A small child would receive slightly higher doses. With these extreme doses first symptoms of radiation sickness can be expected, as well as an increased risk for developing cancer later on.



Inhabitants who stay in Gdynia will receive an effective dose of roughly 500 mSv of radiation in the first year after the accident – the IAEA recommends relocation already at an expected dose of 100 mSv. In case someone lives 50 years in the then contaminated town of Gdynia the total dose would be well over 1000 mSv.

The radioactive cloud hits the town already four hours after the first releases from the NPP at 23:00 and continues for around 2 hours. The cloud returns, be it a lot thinner, three days later and continues to cover the town for a week.

That means that the entire city of Gdynia should be evacuated within 3 hours after the first releases to prevent its inhabitants receiving dangerous doses.
From the deposition maps it can be concluded that Gdynia will be uninhabitable for a long time.



EXAMPLE: **Warsaw** with weather conditions as on 14 September 1995

We assume that the nuclear power station at Lubiatowo has reactors of the US Westinghouse AP1000 design.

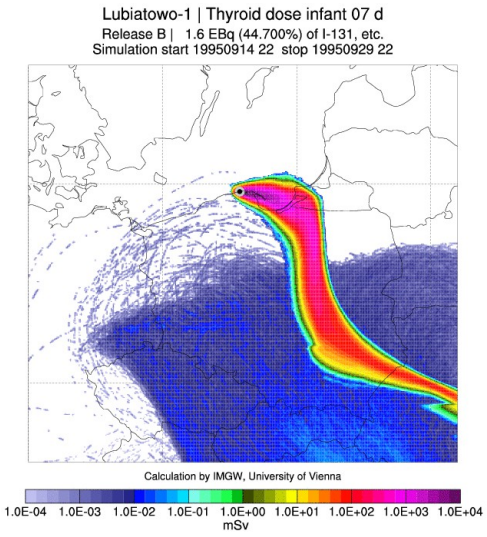
Multiple steam generator tubes fail, which means that, firstly, a connection between the primary and secondary system is created that bypasses the containment, and secondly, that coolant keeps leaking from the reactor cooling system. Multiple consequential failures inhibit safety systems to operate, and severe core damage can not be prevented, nor its consequences mitigated. Over time 44.7% of the iodine-131 accumulated in the reactor core is released into the atmosphere, as well as 27.2% of the Cs-137.

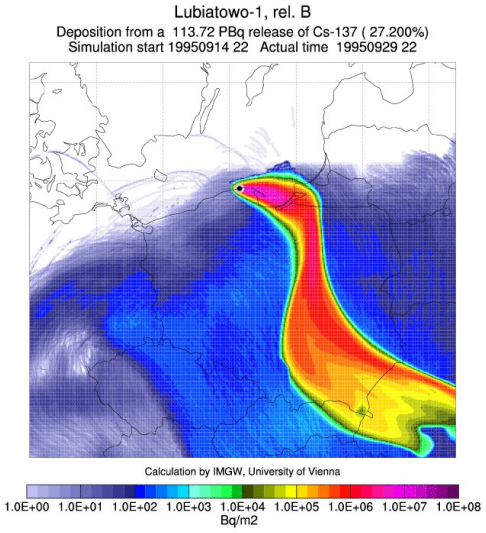
An adult inhabitant in Warsaw who does not evacuate within the first week can receive a dose of over 150 mSv because of iodine isotopes on his thyroid (IAEA recommends response actions if more than 50 mSv dose on thyroid is to be expected) .

If inhabitants stay in the city, they could receive an effective dose of between 25 and 50 mSv in the first year. In case someone lives 50 years in the contaminated town of Warsaw the total dose would be well over 100 mSv.

The radioactive cloud hits the town after around 22 hours from the first releases from plant and continues for around 4 hours.

That means that the entire city of Warszawa should have been provided with iodine prophylaxis within less than 24 hours .





AND THE CONSEQUENCES...

If an accident like described above happens, the consequences for Polish and European citizens will be enormous. The French nuclear research institute IRSN, which is linked to the nuclear regulator ASN, recently calculated that a large nuclear accident in France would cause over 400 Billion Euro of damages.[3] In the case of the above described accidents, damage could be even larger.
Polish law does not foresee coverage of such accidents. The maximum coverage foreseen is 700 Million Euro.

In Fukushima, where there was no limitation of liability, we see what the reality of such a catastrophe means to people. Over 150.000 people had to be evacuated and the vast majority is, three years after the accident, still not able to return, lives in makeshift emergency houses, and has to live on small compensation payments which do not come near to meeting the actual costs, let alone enable people to rebuild their lives.

You can find more about what the impacts from the Fukushima catastrophe are for people on:
http://www.greenpeace.org/international/en/campaigns/nuclear/safety/accidents/Fukushima-nuclear-disaster/fukushima-dont-forget/

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3 Pascucci-Cahen, L. & Patrick, M., 2013. *Les rejets radiologiques massifs diffèrent profondément des rejets contrôlés*. IRSN, Fontenay-aux-Roses. www.irsn.fr/FR/Actualites_presse/Actualites/Documents/FR_Eurosafe-2012_Rejets-radioactifs-massifs-vsrejets-controles_Cout_IRSN-Momal.pdf