Helmholtz Special

Helmholtz research focuses on the most pressing issues society faces. This is written down in our mission statement and is fully put to practice: On these special pages published at irregular intervals, we report on how through their research experts from the Helmholtz Association contribute to solving difficult problems and improve the quality of life of people in Germany and all around the world.

Impressions from Fukushima

Dr Walter Tromm is Spokesperson of the Programme Topic 6 - Nuclear Energy and Safety at the Karlsruhe Insititue of Technology. He collaborates on international expert committees on the safety of nuclear reactors. One year after the natural disaster at the Japanese coast, he visited the damaged reactors in Fukushima Daiichi. Antonia Röter spoke with him.

You travelled to Fukushima in your capacity as an expert on invitation by the Japanese government. How far have matters progressed?

Tromm: We took part in a conference and deliberated on the decontamination and decommissioning work on the affected reactors. We were also able to visit the facilities and approached the reactor building to a distance of 50 metres. At present, more than 1000 employees are deployed on site to maintain the cooling circuits, to support further safety measures and to start with the clearing-up operation. They have the task of renaturising the reactors to the state of green fields over a period of 40 years.

Yet for the almost one hundred thousand people who had to leave their houses after the catastrophe this still is a long time. What is planned in this respect?

Tromm: These people are to return soon. The prohibited area is in effect now still for a radius of 20 kilometres. Radiation levels are measured everywhere, in part, the top soil is removed and replaced. We had our own measuring devices with us and I think a return is possible. However, it is important for the people to be well informed and even for every household to be given a measuring device, for the contamination could be locally higher, for example, in the forest. In compliance with international guidelines, the Japanese government has determined the standard that measured levels of contamination must be less than one millisievert per year. At this level, no medical consequences are to be expected, not even over a period of decades. For comparison: In Germany, radiation contamination is at approximately 2.4 millisievert per year.

Walter Tromm

What can you and your colleagues from Germany contribute towards the process of clearing-up?

Thick lead glass panes protect the experimenters from the radiation of the radioactive samples. The KIT operates the currently largest German testing field for the decommissioning of nuclear installations. Foto: M. Breig/KIT

Tromm: In the past years, only little research took place in Japan on hazardous incident falling into the area of so-called beyond-design-basis events. These are hazardous incidents that were not part of the basis for approval at the time of building the facility, yet which cannot be fully ruled out. However, this is different here in Germany. At the KIT in particular we command very considerable expertise in the field of such beyond-design-basis hazardous incidents and can research what may happen in such events. In our test facility QUENCH we can observe what happens to nuclear fuel rods, if the cooling system fails, right up to the point of nuclear meltdown. At LIVE, we monitor how the molten mass subsequently behaves up to the stage where it forms a lake of molten mass in the lower part of the reactor pressure vessel. With the test facility DISCO we then examine what consequences the failure of the pressure vessel would have, for instance, where would the molten mass spread to, whether it would simply flow downwards or whether in the event of higher pressure it might spray up to the area of the containment. And ultimately we can use the test rig MOCKA to investigate how the molten mass might react with the surrounding concrete and where they extend to. This issue is of great importance with regard to decontamination at Fukushima, for at present it is not yet precisely known where the molten mass has spread to.

Right, because it still is not possible to investigate what actually happened inside the reactor cores.

Tromm: No, because the interior of the reactor is under water since cooling is necessary. It is possible to send in remote controlled cameras, but the quality of the pictures is bad because ▶

the water is dirty and the radioactive gamma radiation damages the photographic images. Therefore our test rigs will yield truly valuable insights into this matter.

What risks do you foresee for the next few years?

Tromm: Although the nuclear power plants at Fukushima are in a state of "cold shutdown", that is, the temperatures are stable and far below 100°C, their overall state continues to be fragile, of course, because parts of the core have shifted to the containment and hence require cooling there. However, the containment is not designed for such large quantities of water and in addition suffers from leaks, through which the water required for cooling seeps into the building. In the event of a stronger earthquake, for example, this could once again lead to problems.

What weight does the voice of German experts actually carry within the international expert committees, especially after Germany's decision to give up nuclear energy

Tromm: In spite of this decision we continue to carry a lot of weight internationally, because we are free of invested interests, so to speak: German companies no longer sell nuclear power plants, therefore we no longer have the reputation of having to act in a supporting capacity. In the international committees, I represent the demand for best state-of-the-art safety engineering also towards smaller countries now thinking of building their own nuclear power plants. Nuclear energy with a low level of safety requirements is simply not acceptable.

Thank you very much for the interview!

One Year after Fukushima

The disaster of Fukushima is one year ago, but the consequences are far from overcome. Immediately after the nuclear accident became known on 11 March 2011, the KIT established working groups for the Helmholtz Association, which continue to edit scientific insights for general publication even today.

In the first three months, the approximately 30 involved researchers worked in part around the clock. In cooperation with the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS - Society for Plant and Reactor Safety) and experts from the USA and Japan, the scientists collected all available data, on the basis of which they then attempted to assess the respective current status and forecast the further development. „Our calculations, for example, regarding the contamination of the ground with caesium, proved to be correct without exception", explains Wolfgang Raskob, who with his team at the KIT compiled daily forecasts.

Great Demand for Verified Information

The working groups published their results on the KIT's website under *www.helmholtz.de/kit-fukushima*. In the period between March 2011 and January 2012, these pages registered about 54,000 access hits. „The graphs regarding the calculations of the spreading were accessed even in Japan as independent information", reports Dr Joachim Knebel, Chief Science Officer at the KIT and Programme Spokesperson Nuclear Safety Research for the Helmholtz Association. At the same time more than 270 articles in online media, more than 150 articles in printed media, over 50 television broadcasts and more than 80 radio broadcasts reported on the work of the Helmholtz researchers at the KIT in the wake of Fukushima.

Current Situation in Fukushima

At the end of the past year, a delegation from the Japan Atomic Energy Agency visited the KIT to gather information regarding reactor safety research on site and enter into an agreement on increased cooperation. In the region around the nuclear power plant site Fukushima, the Japanese currently attempt to prepare the decontamination of several hundreds square kilometres of ground. „By excavating an approximately five-centimetre thick layer of top soil, the radiactive contamination is to be reduced to below the threshold value of five millisievert", explains Wolfgang Raskob. However, as yet there is no long-term solution in sight for the storage of the excavated soil. At the plant itself, protective covers consisting of steel framework and polyester sheets are currently erected to create a gas tight enclosure around the reactors. Steel sheet pile wall rammed into the ground about 23 metres deep are to prevent the leakage of radioactively contaminated water from the reactors into the ocean or the ground water. „By now, there is a fully operational cooling circuits in place again", says Raskob. Debris and scrap metal are to be removed from the plant bit by bit in order to finally dismantle it and/or encase the areas with the highest degree of radioactivity in a sarcophagus.

From today's point of view, nuclear technology experts from the IAEA, who met at the HZDR in March 2012, evaluate the situation as follows: In the high-technology country Japan nuclear power plants were not sufficiently fit to survive major natural catastrophes without presenting a danger to the environment and population. Modern passive safety systems are very likely to have reduced the discharge of radioactivity, yet were not featured in the plants at Fukushima. By contrast, the German nuclear power plants continue to be amongst the safest worldwide and the German know-how as regards reactor safety enjoys international high esteem.

To the Helmholtz Fukushima website:
www.helmholtz.de/japan

After the events in Japan, many people want to know more about the future consequences of the hazardous incidents. **Experts from the Helmholtz Zentrum München** have compiled some answers:
www.helmholtz.de/faq-zu-fukushima

To the KIT Fukushima website:
www.helmholtz.de/kit-fukushima