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Nuclear Power and the Probability of Severe Accidents

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Introduction

In December 2008, the Department of Energy and Climate Change (DECC) reported that the probability of a 'severe' accident, (ie one that would kill at least one hundred people), was one chance in 10 million per year for a modern nuclear reactor.

In this short briefing, the comparable figure for a severe accident at the Sellafield nuclear site is set out - and compared with actual incidence of critical malfunction at the Sellafield site.

What Sellafield Does

The main process carried out at the Sellafield nuclear site is the separation of plutonium from used nuclear fuel rods. This procedure is carried out using a liquid based chemical technique known as 'solvent extraction'. Following the plutonium separation, the bulk of the radioactive wastes are to be found in a hot nitric acid mixture known as 'Liquid High Level Wastes.

The Importance of Constant Cooling

This High Level Waste stream at Sellafield is fiercely radioactive - so much so that it is self-heating and needs to be constantly cooled. This is achieved by a system of pipework inside the tanks which carrying cold water.

It is important that the cooling system in the high level waste tanks is kept running constantly - otherwise the high level wastes in the tank could get so hot that they boiled. If the cooling problem was still not sorted out, the tank would eventually boil dry.

It is very important to prevent this happening - because if the wastes were allowed to start boiling then radioactivity would escape and contaminate the surroundings.

Precise estimates of how much radioactivity would escape - and how many people would be affected - have not been carried out. However the Nuclear Installations Inspectorate (NII) have stated that the consequences of prolonged cooling failure could be 'very severe'.

The timings involved are very short. BNFL analysis has indicated that cooling failure would lead to boiling after 12 hours, and to the tank drying out after three days.

Estimated Probabilities of Cooling Failure

Although the time it would take for radioactivity to start escaping is short, it has been argued that the probability of a failure in the cooling system is extremely low. For example the NII have argued that the probability of a failure continuing for 24 hours is less than one in one million years - and the possibility of 3 day failure (that would lead to the tanks drying out) is less than one in a 100 million years.

However on Thursday 9th April, Cumbrians Opposed to a Radioactive Environment (CORE) revealed that at the beginning of April (2009) a cooling failure had in fact taken place. The incident was on Wednesday 1st April and

the Sellafield Site Newsletter 'Sellafield News' indicates that that the problem was so serious that the Site Emergency Control Centre arrangements had to be called on.

Comparison with Chernobyl

This happened just a week after the Norwegian Radiation Protection Authority published a report comparing the effects of an accidental release of radioactivity from the Sellafield high level waste tanks to the effects of the Chernobyl accident.

This clearly indicates that the probabilities of cooling failure that are used by the NII to regulate the Sellafield site are extremely unrealistic. It is important to realise that although the Norwegian report refers to the implications of an accident at Sellafield being up to 50 times worse than Chernobyl (see page 5) - obviously, because Sellafield is in Cumbria, the effects on Cumbria and the UK would be much worse.

Conclusion

Today an announcement has been made about where the Government would like nuclear power stations to be built in the UK. Nuclear power stations are potentially extremely dangerous. The policy of the present Government to build new nuclear power stations is built on the assumption that the chance of a severe accident is once in 10 million per year.

However, at the beginning of this month, there was an accident at the Sellafield nuclear facility that was only supposed to happen of the order of once in one million years. Due to the fact that radioactivity could have escaped from the site, emergency arrangement needed to be brought into play.

The reality of the Sellafield incident - as compared to the abstract calculation of the probability of future accidents - clearly indicates that there is no place for nuclear reactors in a world that we want to be safe for our children

Dr Rachel Western, 15th April 2009