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English text:

"Germany should rethink its policy on nuclear energy"

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Germany resolved to close its nuclear power stations following the Fukushima accident but most other countries have not followed. Why not? What happened at Fukushima? Has Germany misunderstood its significance?

When the earthquake struck there were 500,000 people in the region subsequently inundated by the tsunami, and within 26 to 45 minutes, all except 18,880 managed to escape, a truly remarkable achievement. The Japanese people have learnt about tsunamis and earthquakes, and they know what to do. Communication, mutual trust and understanding within the society dramatically reduced the impact of a natural disaster. However, nobody knew what to do in the face of the radiation release. Even those in authority had built their expectations on assurances that such a release should not happen, and rather than study its consequences, allowed themselves to shelter behind the expertise of others.

The nuclear accident destroyed several reactors but the release of radiation killed nobody, and it is unlikely that anybody will die from the released radiation even in the next 50 years. This is clear from the records of Hiroshima and Nagasaki survivors and the Chernobyl accident, seen in the light of modern biology and a century of experience of using moderate and high doses of radiation to diagnose and cure cancers on a world wide scale.

That leaves two important questions. Why is life so unexpectedly resilient to nuclear radiation? Why has there been such widespread misunderstanding of this situation at a social and political level?

Indeed nuclear radiation has a very damaging effect on the delicate molecules of life, in particular DNA. This damage is similar to that caused by powerful chemical agents that regularly break and disrupt critical molecules. Unsurprisingly, dedicated to the survival of life, biology has evolved many repair and servicing mechanisms whose function is to stabilise life against these attacks. The simpler of these are now understood by biologists, others are being slowly unravelled, including the action of the immune system. The double strands of the DNA helix, the existence of many independent cells with their own DNA records, the cell cycle and the regular replacement of all cells are just a few examples of features that stabilise life against attack. Any feedback or repair mechanism has a response time and is vulnerable to any overwhelming attack accumulated within that time. However, at longer times effects are not generally cumulative. Such stabilising mechanisms are intrinsically non-linear, that is non-additive. However, in biology such ideas were undeveloped when nuclear radiation hit the public headlines after Hiroshima and Nagasaki.

At that time the destructive power of nuclear weapons persuaded many in society to avoid all things nuclear at any cost. Such a reaction to fear is natural and protective, but man has established superiority on Earth by studying and understanding threats. Nonetheless at the time of the Cold War fear of radiation was an important and effective weapon in world politics. In democracies many marched, demonstrated and voted for a radiation-free life. And radiation protection today is still a response to this pressure; the acronym is ALARA, As Low As Reasonably Achievable. The aim is to appease fear through extreme caution independent of any actual risk. It recommends that any additional exposure rate (1 mSv per year) be kept at, or below, average natural background levels from space and radioactivity already in the body and surroundings (average 2.4 mSv per year and

up to 70 mSv per year in some places). Modern data and understanding confirm that dose rates up to 1000 times higher would present no danger to life, either at the time or in subsequent years. Precise numbers are arguable but the qualitative conclusion is clear. Safety based on ALARA is unnecessary -- and also very expensive. The need to control a reactor and its heat output are important but many other worries about nuclear technology, including waste and decommissioning, are exaggerated and the basis of unwarranted costs.

At Fukushima the unseen and unexplained threat from radioactivity lead to serious social harm -- widespread voluntary evacuation, failed businesses and losses of confidence in society and nuclear power. The destructive effect at an individual and family level included suicides, alcoholism, hopelessness, depression and bed-wetting. The Japanese authorities have reported 573 deaths as 'disaster-related', none of them involving radiation. Earlier, the experience of Chernobyl had shown that the psychological and social trauma of a major radiation accident can far outweigh any physical effect of radiation. Further away, there were 2000 additional abortions in Greece and food restrictions caused major hardship in Scandinavia. Unfortunately the international reports that chronicled these social consequences of fear were ignored in Japan where the trauma has been repeated with the media competing for dramatic headlines.

The need to reduce the use of fossil fuel is generally accepted but national perceptions of nuclear as part of a safe solution differ for historical reasons. But safety is an objective question, to be determined by science, not history, and to be followed by engaging wider society with honest and open explanations. Significantly, biology handles radiation protection with responsibility devolved to the local cellular level -- indeed the brain does not even feel the radiation. Individual responsibility was essential to the reaction to the tsunami too. Currently, radiation protection in society is organised top-down starting with advice from international committees. This is slow and paternalistic; public ignorance is a source of instability and danger. Real safety comes from education and discussion -- as it already does for protection against ultraviolet, the ionising radiation component of sunshine.

Radiation has no place on the list of global dangers -- socio-economic instability, climate change, population growth, food and fresh water. In popular perception nuclear technology should be seen as essential and beneficial to the world, deserving of study and engagement, and not a matter to be "spooked" by. Germany in particular should feel encouraged boldly to change its policy on nuclear energy for the good of all.