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Rebuilding Public Confidence in Nuclear Power in order to Achieve a 50% Reduction in GHG Emissions by 2050

Gerry Thomas*

The latest science on climate change makes sobering reading. There is a suggestion that our oceans may absorb less CO_2 than had been originally predicted. This coupled with the physical fact that progressively less CO_2 will be absorbed by the oceans as the sea temperature rises, suggests that the targets set for reducing carbon emissions may be too low. In addition, the drive for westernisation in the less developed world means that the demand for energy will continue to rise. Politicians are more likely to respond to the demands for a better life from their voters, rather than taking the long-term view of preserving an inhabitable planet for all for the future. There is a drive in the developed countries of the world to move towards electric vehicles, but the electricity required to charge these when the population wish to charge them, i.e. at night, will need to be found. Solar and wind power cannot be relied upon to provide the base-load required for this when the population wants it, which means that there will be pressure to return to quick and dirty energy production by burning fossil fuels.

So how do we manage to square this circle? The only reasonable answer is to build more nuclear power plants, and quickly, before it is too late to put the brakes on global warming. Solar and wind can play their part, but the simple fact is that both of these methods of power production are much less energy dense than nuclear and depend on the vagaries of the climate. Even the majority of the “green” environmental think tanks now admit that the best way forward would be with a mix of nuclear, wind and solar technologies. Environmental progress (1) report that globally, the world is likely to suffer a net loss of 72 GW of nuclear power by 2030, and that there was a 6.6 per cent drop in electricity generated from nuclear power in 2017 compared with its peak in 2006. The proportion of energy from clean sources in 2016 was 32.3%, still below the peak level for clean electricity of 36.4% in 1995. Despite the recent huge increase in deployment, solar and wind only contributed 5.2% of global energy sources in 2016, compared with 10.5% from nuclear, down by 7% from nuclear’s peak in 1994. These figures clearly show that energy production from nuclear is falling, yet the facts and figures suggest that it is the only possible solution for reducing our reliance on carbon-based fuels for energy.

Why then have we seen large increases in solar and wind, but a significant decrease in the use of nuclear? A large part of this has been due to public acceptance/rejection of the differing technologies, although we are now starting to see some resistance to the siting of yet more on shore

* Professor of Molecular Pathology, Imperial College London / Director, Chernobyl Tissue Bank

wind farms. If we accept that the only way to stand a reasonable chance to meet the GHG reduction targets that we have agreed upon is to increase nuclear energy production, how can we achieve this?

Firstly, we have to address some of the unconscious biases around nuclear power. These stem from a confusion between nuclear weapons and nuclear power – it is possible to have one without the other – and from a misunderstanding of the real health effects of exposure low doses of radiation from a nuclear power plant accident. One consequence of the Fukushima accident in 2011 is that there was significant engagement between scientists that had studied the effects of low dose radiation exposure with environmentalists and the media. It was already known that the health risks of exposure to radiation were related to dose to the individual, with high dose resulting in deterministic risks, whereas low doses result in stochastic risks. Deterministic health effects can be observed within a short time after exposure and can be seen in a small population size, whereas determination of stochastic risks require a large population to be exposed and a long period to have elapsed post exposure – and the lower the dose of radiation, the longer the time period is likely to be before a final determination of risk can be obtained. At the time of the Chernobyl accident, data from the Life Span studies carried out in Japan on the residents of Hiroshima and Nagasaki were available, but lacked the long term data for those survivors that received low doses at exposure that became available in this millennium.

Therefore, initial predictions of the longer term effects of exposure from the Chernobyl accident were cautious. This can be seen in the difference in expected outcomes reported in the UNSCEAR report of 2000 (2) compared with that of 2008 (3). The 2008 report stated categorically that although there was a significant increase in thyroid cancer in those that were youngest at exposure and ingested significant amounts of radioiodine, the major health detriment to the population at large was psychological as a result of fear of exposure to radiation rather than the physical consequences of low dose radiation exposure. Despite the predictions of 16,000 cases of thyroid cancer by 2050, death from thyroid cancer would be expected to be in the order of 1% i.e. 160. Exposure to radioiodine is not the only factor that causes thyroid cancer and, as with all cancers, it is important to take into account the natural incidence of the disease in order to access the proportion of the increase that can be attributed to one particular cause. The latest figures from UNSCEAR (4) suggest that the fraction of thyroid cancers from exposure to radiation from the Chernobyl accident is between 0.07 and 50%, with a mean of 25%. This would suggest that the number of thyroid cancer cases actually caused by the radiation would be between 1,250 and 8000, but most likely 4000. If this is the case than the number of deaths from thyroid cancer that would be attributable to exposure from Chernobyl could be as low as 40 in 64 years. The real attributable risks therefore appear to be decreasing as we have more data to go on.

The increased understanding obtained from the Japanese Life Span studies and the numerous studies carried out after Chernobyl helped contribute to the likely assessment of risks for health

from the Fukushima accident. The latest White Paper from UNSCEAR (5) states that “A discernible increase in cancer incidence in the adult population of Fukushima Prefecture that could be attributed to radiation exposure from the accident was not expected” … and although a theoretical increase in thyroid cancer in children could be inferred, this “could be discounted because absorbed doses to the thyroid after the accident at Fukushima were substantially lower” (than Chernobyl). Furthermore, UNSCEAR also concluded that “no discernible changes in birth defects and hereditary diseases were expected and that any increased incidence of cancer among workers due to their exposure was expected to be indiscernible because of the difficulty of confirming a small increase against the normal statistical fluctuations in cancer incidence. The effects on terrestrial and marine ecosystems were expected to have been transient and localized.”

There have been significant impacts on the everyday life of those who were evacuated from their homes in both Fukushima and Chernobyl, and the need for evacuation in the event of a nuclear power plant accident is now being questioned, when the doses of radiation that are likely to be received by the population at large are so low as to result in a negligible health risk. Sheltering in place is now being suggested as a better response, together with better engagement of the population resident in the area surrounding a nuclear power plant. However, changes in policy are only likely to be brought into place once ICRP guidelines are better interpreted and those advising the Ministers address their own unconscious biases around nuclear power. A restatement has recently been issued by the Oxford Martin School to summarize what is now known about health effects of low dose radiation exposure (6) for a non-expert audience.

Why then after all of this effort and data provided by the scientific community are the general public still fearful of nuclear power? The issue is simply one of communication. Following Fukushima, the scientific community has become more engaged with groups that they would previously have never engaged with – namely “green” groups that were in the past associated with pseudoscience and belief rather than facts generated from evidence based, rigorous scientific studies. Perhaps we should be seeking to provide evidence in a digestible form to help the general public address their unconscious biases around non-carbon based energy generation as a whole, not just nuclear. We should also admit scientists may not be the best people to do this, but support others who are able to communicate better. In general, scientists do not make good communicators to the general public – we tend to lack charisma and empathy as we are trained to be dispassionate and always aware of uncertainty in our data. The messages around climate change and appropriate energy choices are so much more important than the messenger who delivers them.

〈References〉

1. http://environmentalprogress.org/global-crisis/
2. http://www.unscear.org/docs/reports/2000/Volume%20II_Effects/AnnexJ_pages%20451-566.pdf
3. http://www.unscear.org/docs/reports/2008/11-80076_Report_2008_Annex_D.pdf
4. http://www.unscear.org/docs/publications/2017/Chernobyl_WP_2017.pdf
5. http://www.unscear.org/unscear/en/publications/Fukushima_WP2017.html
6. https://www.oxfordmartin.ox.ac.uk/publications/view/2583

Writer's Profile

Gerry Thomas

Gerry Thomas is Professor of Molecular Pathology at Imperial College London and the Director of the Chernobyl Tissue Bank (CTB). The CTB was established in 1998 to facilitate research, in cooperation with Belarussian, Ukrainian and Russian scientists, into the biological mechanism that are involved in development of thyroid cancer following a nuclear power plant accident. Since the Fukushima accident in 2011, she has been engaged in public communication of the real health risks of energy production, including exposure to low doses of radiation from nuclear accidents.