

## **Public Confidence in Nuclear Technology and Access to Future Prosperity<sup>1</sup>**

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If the public has become less engaged with action on climate change, perhaps it is because they are tired of waiting for clear leadership. The need to replace fossil fuels is urgent but proposals to achieve this, beyond using new known technologies to improve efficiency, have been unrealistic and tended to play to the unscientific gallery. The unreliability of wind energy is well known, and a new analysis based on large scale practical experience shows that investment in wind has an economic life of only 10-15 years, not 20-25 years as assumed by industrial and government projections<sup>2</sup>. Like solar, wind power is expensive and in need of artificial support from either the consumer or the taxpayer. Many of the alternatives are no better; the use of bio-fuels, another popular idea, simply frustrates natural carbon capture and drives up the price of food. The public are understandably reluctant to respond to climate change when they see large but unconvincing increased costs with no clear direction.

There has been a similar lack of leadership to convince the public that nuclear technology is not a threat. Environmentally, nuclear energy is a nearly ideal solution to the need for energy – negligible atmospheric discharge, compact plant, steady base load supply, treatable waste, well understood technology, excellent safety record, secure fuel supply and economic return on long term investment. Unfortunately the public have no such confidence, and even some scientists whose knowledge does not span the wide range of disciplines involved express extreme caution. In addition nuclear safety guidelines drawn up by international committees attempt to appease concerns about radiation by running away from the science and piling up expensive and unnecessary precautions. In the process these have created a whole safety industry which has raised the costs of the nuclear option absurdly<sup>3</sup>. But the public are always interested in what they will have to pay, and it is not difficult to explain in simple terms how reliable and safe nuclear energy really is and where the policy is going wrong<sup>4 5 6</sup>.

In May 2011 I described in these pages the mistakes and misunderstandings that distorted the public perception of what happened at Fukushima and at Chernobyl<sup>7</sup>. But since then, dramatic press

1 This article was originally published in Oxford Magazine, No 332 (Jan 2013).

2 The Performance of Wind Farms in UK and Denmark, Gordon Hughes, Renewable Energy Foundation (19 Dec 2012) [www.ref.org.uk](http://www.ref.org.uk)

3 This article concentrates on the present situation and what needs to be done for the future. Other recent work has addressed the history of how these safety regulations with the scientifically untenable LNT hypothesis came to be made [https://lawreview.uchicago.edu/sites/lawreview.uchicago.edu/files/uploads/Dialogue/Calabrese Online.pdf](https://lawreview.uchicago.edu/sites/lawreview.uchicago.edu/files/uploads/Dialogue/Calabrese%20Online.pdf)

4 “Radiation and Reason”, Wade Allison (2009) ISBN 9780956275615 [www.radiationandreason.com](http://www.radiationandreason.com)

5 “Public Trust in Nuclear Energy” Wade Allison, [World Nuclear Association](http://WorldNuclearAssociation.org) (2012)

6 [Evidence submitted](#) to UK House of Commons Select Committee on Science and Technology (2012)

7 Oxford Magazine “Life and Nuclear Radiation: Chernobyl and Fukushima in Perspective” (May 2011), also publ.

reports of radioactive leakage from the Fukushima Daichi Nuclear Plant in Japan have continued to carry an apparently dire safety message; and industry, governments and the public worldwide have been concerned to ensure that, at whatever cost, such an accident should never happen again. But, this is a mistake. Another accident like Fukushima, somewhere, sometime, should be avoided but would represent no global disaster.

As forecast<sup>8</sup> and belatedly confirmed<sup>9</sup>, there have been no significant health consequences of the radiation at Fukushima and none should be expected in the future. However, the deep aversion to nuclear technology implanted in the public mind by World War II and the Cold War was re-excited by media pictures and accounts of reactor destruction at Fukushima. The distinction between the fate of the plant and the effect on humans, that is radiation safety, was not explained to the public and, indeed, it seems not understood by those in authority either. Fear of radiation continues to have a serious effect on the workers, the general population and the economy of Japan. The number of psychological casualties is hard to quantify although 761 such deaths have been recorded<sup>10</sup>. The panic reactions of the authorities to evacuate the population and restrict the sale of radioactive food brought no benefit and simply reinforced the fear. But simple comparisons are easy to calculate; the personal consumption of 5 tonnes of radioactive food in 3 months would give the same radiation dose as a single whole body CT scan in the same period<sup>11</sup>. This pandemic of fear has spread worldwide leading to cancelled nuclear power provision in many countries with large increases in CO2 emissions, present and future.

This resilience of life to nuclear radiation is a surprise because radiation is a powerful agent and the forces that hold life together are feeble. A surprise that is, until you realise that in over 400 million years life has had time to evolve many ingenious defences that enable it to survive powerful attacks and in recent biological research many of these have been studied. Indeed the whole design of cellular biology with its dispersed DNA copies, its cycle of cellular replacement, overlaid by the life-and-death cycle of individuals, is optimised to ward off attacks by physical and chemical agents -- and, with less certainty, by other biological systems too. So humans and other life forms survive low and moderate radiation levels without lasting effect<sup>12</sup>, and adaptive mechanisms bolster natural radiation protection mechanisms based on previous radiation exposures<sup>13</sup>.

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Europ J Risk Regulation Volume 3 (2011) 373

8 [www.bbc.co.uk/news/world-12860842](http://www.bbc.co.uk/news/world-12860842) also publ. Philosophy & Technology: Volume 24, Issue 2 (2011) 193

9 [www.world-nuclear-news.org/RS\\_UN\\_approves\\_radiation\\_advice\\_1012121.html](http://www.world-nuclear-news.org/RS_UN_approves_radiation_advice_1012121.html)

10 <http://nextbigfuture.com/2012/08/fear-of-radiation-has-killed-761-and.html>

11 that such consumption is absurd simply reinforces the conclusion that the regulation is inept

12 [www.radiationandreason.com](http://www.radiationandreason.com)

13 This was discussed by biological and medical experts from around the world at the Special Session on Low Dose Radiation, June 2012 American Nuclear Society Meeting, Chicago. The papers are available at <http://ansnuclearcafe.org/2012/07/11/Int-examined-at-chicago-ans-meeting/>

At the highest intensity the defences fail and living cells are unable to repair the damage that radiation causes – such rates kill cancer cells in radiotherapy. The use of such therapy cures hundreds of thousands of cancers every week and offers palliative respite to others. The public should be reminded that this nuclear radiation, a thousand times the dose of a CT scan, can be beneficial to health.

Exceptionally, high acute doses of radiation may also cause a new cancer, as, for example too much ultraviolet radiation from the sun. Although moderate exposure to the sun is healthy, skin cancer is particularly serious, and in the USA more than 9000 people a year die from it<sup>14</sup>. Yet the public generally enjoy the sun wisely by following the common sense advice passed to families by doctors and pharmacists. The dangers of skin cancer do not frighten people to death or put any major economy at risk and there is no ponderous international committee setting regulations. Strangely, those most concerned about radiation inconsistently seek sunny holidays rather than staying in the dark!

Although ultraviolet sunshine and nuclear radiation are closely related, only nuclear carries the stigma, yet there is no scientific reason for this sharp distinction. Threatened by protesters and activists in the Cold War period governments came to rely on international advice, in particular from the ICRP<sup>15</sup> who still recommend today that nuclear radiation safety levels be kept to small increases over natural levels – the acronym is ALARA, as low as reasonably achievable<sup>16</sup>. This is not a scientific safety level but a policy of appeasement. The ALARA principle ignores recent advances in biological understanding and the competing effects of other more dangerous risks in its dogmatic pursuit of caution. Yet this does not succeed in providing reassurance and has itself proved dangerous. It has been acknowledged by the UN, WHO and others<sup>17 18</sup> that the evacuation and food restrictions at Chernobyl caused social stress, economic damage and premature loss of life that were more harmful than the radiation itself. These published reports were not read in Japan, it seems, and the same errors of judgement were repeated at Fukushima, made worse by closing down the power stations vital to the Japanese economy and beneficial to the environment. At the same time a visceral pursuit of nuclear safety was joined by authorities around the world, resulting in increased stress for workers and future costs to tax payers and consumers, without benefit or reason. An illustrative example comes from an unsolicited email received in December 2012 from Ken Chaplin, a senior long-time inspector in the nuclear industry, who writes

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14 US National Cancer Institute [www.cancer.gov/cancertopics/types/melanoma](http://www.cancer.gov/cancertopics/types/melanoma)

15 International Committee for Radiological Protection.

16 Sometimes expressed as ALARP, as low as reasonably practicable

17 Health effects of the Chernobyl accident and Special Health Care Programmes. Report of the UN Chernobyl Forum, World Health Organization. [http://whqlibdoc.who.int/publications/2006/9241594179\\_eng.pdf](http://whqlibdoc.who.int/publications/2006/9241594179_eng.pdf)

18 Dagens Nyheter (2002). Article published in the major Stockholm morning paper on 24 April by Swedish Radiation Protection Authority. English translation, [http://www.radiationandreason.com/uploads/dagens\\_nyheter\\_C3D.pdf](http://www.radiationandreason.com/uploads/dagens_nyheter_C3D.pdf)

*“There are two negative impacts of Radiation Protection on my workers. First, concerns for radiological protection outweigh concerns for industrial safety. One example, four of us were working in a relatively high temperature environment in lead jackets and plastic lined tyvek suits. The radiological hazards were insignificant, but two of us almost passed out from the heat in a very difficult to access location. A second example, I had staff climbing ladders attached to walls, with very little space to get their feet on the ladder rungs. They were required to wear steel toed shoes, inside rubber "one size fits all" boots, inside paper booties. The extra layers were in the name of contamination control; however, I am far more concerned about people falling 8 metres onto piping.*

*A second issue is increased psychological stress. I have had my inspection staff worried and declaring tasks too dangerous to perform. Upon discussion with radiation protection staff, I convinced the inspection staff that the work was possible. The work resulted in only 4% of the allowable dose. A second example, staff are increasingly worried about low levels of contamination in spite of ever increasing efforts to eliminate contamination. In my opinion, this results in much lower productivity and higher stress levels caused, and experienced, by the entire organization pursuing ALARA, without accompanying health benefits.*

*I am watching as radiological protection dogma, in particular ALARA, stops the nuclear industry dead in its tracks. It is hard to prevent this, but I am trying.”*

This testimony shows how safety restrictions based on ALARA and intended to allay fears, achieve exactly the opposite. Radiation regulation and personal stress to workers combine to drive up costs and kill professional motivation; these bring no benefit and are economically damaging.

A major re-orientation of safety culture and attitude to the use of nuclear technology is needed, based on scientific explanation that can be assimilated by the public who are often more scientifically aware and more ready to listen with a fair attention span than the media. Major alterations to regulations should follow, with corresponding changes to principles previously endorsed by international committees and the UN. Nuclear has no downside as a source of energy. Significantly, freed from the shackles of misapprehension and regulation induced by ALARA, it would be inexpensive and its waste would not be a major problem. Unlike biological or fossil fuel waste, nuclear waste is not volatile or released into the environment. By its nature nuclear activity does not “spread like wildfire” or propagate like the disease that follows biological waste. Nuclear waste does not even persist indefinitely like toxic chemical waste. For the same energy production nuclear waste is about a millionth of that of fossil fuel and can be safely disposed of, once cooled and separated, by simple burial for a few hundred years. Human beings show great personal

concern about their own biological waste and should do the same for their fossil fuel waste. However their concern about their share of nuclear waste is simply misplaced. Indeed a debate to discontinue the use of fire on safety and scientific grounds would be rather finely balanced compared to the case to discontinue nuclear. Those of our cautious cave-living forbears who voted against fire and returned to their uncooked food and wretched existence of cold and damp had undeniably strong points to make, although those who actually chose that way made a big mistake and probably perished as a result. In today's debate those who argue against nuclear have no strong points that are scientifically defensible.

Much is now known of the biological impact of radiation on life and the scientific consensus is clear. Like sunshine, low levels of radiation might even be beneficial and only very high levels in acute exposures can cause death or cancer<sup>6 7</sup>. Only the extremely conservative advice from ICRP continues to support ALARA as a basis for nuclear safety. Yet this influence, however discredited, still entrenches the bureaucratic structure of radiation protection today. If the money spent on implementing absurd regulations was redeployed towards proper explanatory public education, the public safety limit could be relaxed from 1 mSv per year to about 100 mSv per month with complete safety<sup>3</sup> -- and society could have the benefits of nuclear energy, cheaply without fear and without carbon.

But no government has yet had the confidence to do the obvious; instead, they are either phasing out nuclear power completely, or planning to make it absurdly expensive with quite unnecessary extra "safety" appeasement, or relying on natural gas that is only fractionally less destructive to the atmosphere than coal. This is mad. In all probability climate change is upon us and the chances that civilisation will survive it are falling. We should have a better chance to survive by using our scientific judgement. Unfortunately serious untruths are difficult to expose, especially when internationally entrenched and spread across several fields of expertise.

Generally, those in authority have no understanding of science. But new prosperity depends on science, as it has in the past, and the country that first sets aside the legacy of ALARA and embraces cheap nuclear technology with proper safety<sup>3</sup> will reap great rewards. As well as electric power, this technology can provide unlimited fresh water by desalination and cheap food preservation, harmlessly by irradiation without refrigeration. The world needs these opportunities but the philosophy of ALARA stands in the way. Adam Smith said "Science is the great antidote to the poison of enthusiasm and superstition", and fear of nuclear is such a superstition, now ripe for exorcism.