

# Nuclear is the ideal energy source, best for the environment and the world economy too

Only fear, ignorance and blind regulation stand in the way

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If our planet is to be home to ten billion or more people, how we treat the environment will have to change markedly. Unless education is improved to the point that at least some in the electorate engage with the underlying science, society will not be aware of what needs to be done or how to do it. This is not just a matter of spreading exciting science through the media – we need to build basic education with confidence and based on serious numbers, in the same way we examine our personal finances and the economy.

In particular, intense sources of energy must be found to replace the gas, coal and oil which pollute the environment. Wind and solar are not up to the job although they may contribute here and there – and gas is a polluting fossil fuel, whether it becomes more plentiful or not. Surprisingly, there is an almost ideal source – *nuclear*. The only difficulty is that world opinion is still mesmerised by mention of the words *nuclear* and *radiation*. There is absolutely no scientific justification for this. Many may think that nuclear is dangerous or that it is very difficult to understand, but this is quite wrong -- the truth is relatively simple and more people should take ownership of it [1].

Apprehension of technical change is not new, but even when there are genuine safety questions it usually brings vital benefits. For example, in 1865 the famous UK Red Flag Act reduced the pace of mechanised road traffic to a crawl. The “anti” lobby, who pressed for the legislation was concerned by accidents and did not want to frighten the horses! It is worth reflecting that modern prosperity would hardly have been possible if the Act had not been repealed in 1896, even though safety worries persist today.



*The final demonstration by the Anti-Fire Party, 25,000 BC*

An even more significant example occurred some 25,000 years ago when man first domesticated the use of fire. He must have found it dangerous -- the flames caught and destruction spread easily by a “chain reaction”. Animals panicked and ran away but early man overcame his natural fear and used his brain to study and learn. We may imagine some noisy demonstrations at the time by members of the Anti-Fire Party who had many powerful arguments, tales of death and destruction, but they lost the vote and unlike those in the Pro-fire Party they probably returned home to uncooked food and a miserable life of cold and damp. This was an important outcome because in spite of its dangers human civilisation needed fire to prosper.

The present debate over nuclear technology differs in one remarkable respect -- there is no danger, at least far less than those of road traffic or fire. Nuclear reactors may have been destroyed at Fukushima but there has been no death there and indeed no significant casualty from radiation. Neither is any cancer due to radiation likely in future. Although this was predicted within a couple of weeks [2], it took over two years for the official international consensus to reach a similar conclusion [3,4]. Meanwhile, unrestrained, the media continued to scare people with misinformation. The number of deaths due to fear in Japan was in excess of 1000 as a result of the forced evacuation of the elderly alone [5,6,7]. Worldwide an irrational loss of confidence in nuclear energy disrupted present and future energy supplies, damaged the world economy and increased the use of fossil fuel.

Much is known about the effect of nuclear radiation on life. High doses of radiation have been used for over a century to cure cancer with radiotherapy, and moderate doses are used in radiation scans. Members of the public receive treatment in hospitals worldwide using either external radiation from outside the body or a similar dose internally from a radioactive source by injection or implant. Having radioactivity inside your body may seem terrible, but every body is naturally radioactive – life has evolved in a world that has always been that way. Biology has many protection mechanisms that mend or replace cells damaged by radiation and learnt how to do that many millions of years ago. This all happens subconsciously at the cellular level for humans, as for animals and plants.

In 1987 a radiotherapy unit powered by caesium-137, the same radioactive material that caused concern at Fukushima, was stolen from a derelict hospital at Goiania, Brazil [8,9]. The robbers managed to break open the source, and their friends and neighbours were delighted at the blue glow it emitted. They painted themselves with it and spread it around their houses and workshops. Two weeks later the nature of the accident was discovered. In total 249 people were contaminated, of whom 28 suffered burns requiring surgery in some cases. As well as external radiation 50 patients received more than a million Bq of internal radiation. Within a few weeks four had died of radiation sickness, but in the past 25 years none has died of cancer from radiation [10]. Just zero -- no funny statistics here -- although many received a thousand of times more internal radioactivity than anyone at Fukushima [11].

Even at Chernobyl where the reactor was utterly destroyed there were less than 50 identifiable deaths directly caused by radiation – 28 fatal cases of radiation sickness

among the initial fire fighters and 15 deaths from thyroid cancer [12]. But there too fear of radiation was the major cause of suffering and loss of life, although it would seem that international reports of this were not read in Japan [13]. So, while the road traffic and fire “antis” of the past had strong safety arguments on their side, the nuclear “antis” of today do not.

Intense ionising radiation, for example ultraviolet in bright sunlight, can cause cancer, and skin cancer is responsible for 30 deaths per year per million population [14] -- less than road traffic (110 per million [15]) but more than fire (11 per million [16]), and far, far more than radiation from any nuclear incident. To be true to their concern, people worried about radiation should take their holidays by starlight or underground to protect their skin! Fortunately most people are more balanced and simply avoid over-exposure while enjoying their summer holidays with everybody else. The truth is that nuclear radiation is unique only because it still carries the stigma in the public mind that it received during the Cold War. But the propaganda picture of radiation from a nuclear holocaust is flawed. The actual blast and fire from the bombs at Hiroshima and Nagasaki were a hundred times more lethal than the later effects of radiation, as confirmed over the past 60 years by the health records of the survivors.

What about radioactive waste and terrorist nuclear threats? These are only dangerous to the extent that radiation is dangerous. If the dangers of radiation have been overestimated, then waste is less of a problem. A terrorist dirty bomb incident becomes mostly a matter of handling public panic and less of a radiation hazard as such. Nuclear waste, though nasty stuff, does not spread or infect like fire or the disease that follows biological waste. Because nuclear energy is so concentrated, little fuel is used and little waste is created – about a millionth as much as fossil fuel. High level waste needs to be cooled, reprocessed (to recover the valuable unused fuel) and then buried after a few years -- not too big a task.

But returning to the central question: why is the gap -- the gulf -- between public fear and real danger from radiation so large? Official public information relates to national safety regulations, based in turn on international advice. This ineptly recommends that nuclear radiation be kept *as low as reasonably achievable* (ALARA). Reports of recent work in toxicology have emphasised just how mistaken this principle could be [17]. It is a simple attempt to appease public fear without reference to any risk. Unfortunately, regulations based on it have also set the scale of reaction to any accident (evacuation, food restrictions) and public perceptions (personal and social stress, economic confidence). Appeasement has not worked, there has been great suffering without benefit, the extra fossil waste emissions caused by closing nuclear power plants have added to the damage and the added safety costs of nuclear programmes have been a blind response to public phobia. Personal testimony by senior safety professionals tells how dangerous industrial safety hazards are routinely accepted rather than incur miniscule radiation risks [18,19]. Such are the consequences of the current dogmatic use of ALARA as recommended by international safety standards.

So what should be our attitude to nuclear technology? We should think and apply

knowledge, as our stone age forbears did when they adopted fire. Though they were faced with a finely balanced dilemma, they did a better job at decision making than we seem to be doing with nuclear today. Authority is no substitute for science-based confidence and it is time that the UN accepted through the various international committees (UNSCEAR, ICRP, WHO, IAEA and others [20]) that radiation safety based on ALARA is fundamentally flawed and dangerous. (Also you might well ask why there are so many of these committees.) Some countries may decide to set aside current advice and embrace cheaper nuclear technology with more realistic safety regulations. That would bring them economic advantage at the expense of others who moved too slowly to embrace such an initiative. It would be better to move together towards safety standards that relate to actual risks as in other spheres – there is no reason to treat radiation as special.

As well as electric power, nuclear technology can provide unlimited fresh water by desalination and cheap food preservation by irradiation. The world needs these opportunities to expand economically, but the philosophy of ALARA stands in the way. This excessive safety is responsible for the apparent cost of nuclear technology. Indeed an investment in the necessary scientific education and a relaxation of safety regulations by a factor up to a thousand [1] would provide a significant economic boost. The great 18<sup>th</sup> Century economist, Adam Smith, said “Science is the great antidote to the poison of enthusiasm and superstition”. Nuclear fear is such a superstition and it needs to be exposed. Establishing public trust through education rather than appeasement should achieve this.

## Notes and references

- [1] Further discussion is given in *Radiation and Reason: the Impact of Science on a Culture of Fear* and other articles posted on [www.radiationandreason.com](http://www.radiationandreason.com) See also Amazon websites
- [2] [www.bbc.co.uk/news/world-12860842](http://www.bbc.co.uk/news/world-12860842)
- [3] [www.who.int/mediacentre/news/releases/2013/fukushima\\_report\\_20130228/en/index.html](http://www.who.int/mediacentre/news/releases/2013/fukushima_report_20130228/en/index.html)
- [4] [www.unis.unvienna.org/unis/en/pressrels/2013/unisinf475.html](http://www.unis.unvienna.org/unis/en/pressrels/2013/unisinf475.html)
- [5] <http://nextbigfuture.com/2012/08/fear-of-radiation-has-killed-761-and.html>
- [6] Ichiseki, H. *Lancet* 381, 204, (2013)
- [7] Yasumura, S. et al. *Public Health* 127, 186-188, (2013)
- [8] [http://www-pub.iaea.org/mtcd/publications/pdf/pub815\\_web.pdf](http://www-pub.iaea.org/mtcd/publications/pdf/pub815_web.pdf)
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- [14] in USA (2009) [www.cancer.gov/cancertopics/types/melanoma](http://www.cancer.gov/cancertopics/types/melanoma)
- [15] in USA (2009) [http://en.wikipedia.org/wiki/List\\_of\\_motor\\_vehicle\\_deaths\\_in\\_U.S.\\_by\\_year](http://en.wikipedia.org/wiki/List_of_motor_vehicle_deaths_in_U.S._by_year)
- [16] in USA (2009) [www.usfa.fema.gov/statistics/](http://www.usfa.fema.gov/statistics/)
- [17] [www.sciencedaily.com/releases/2013/08/130813201434.htm#UgtmL4TW\\_-k.email](http://www.sciencedaily.com/releases/2013/08/130813201434.htm#UgtmL4TW_-k.email)
- [18] Chaplin, K Senior inspector in the nuclear industry “*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*” Extract from an email of Dec 2012, quoted with permission <http://goo.gl/zm82t>

[19] Iskayn, H. Design Engineer “*For the nuclear regulatory death by hot gas was satisfactory so long as the body could be buried without radiation restrictions. Accordingly, the design stressed radiation ALARA and had almost no concern about the hazard of hot gas.*” Extract from a post on LinkedIn Nuclear Safety Group, 20 May 2013, quoted with permission

[20] United Nations Scientific Committee on the Effects of Atomic Radiation, International Commission for Radiological Protection, World Health Organisation, International Atomic Energy Agency. There are others, as well as many influential national committees.