We Were Once Terrified of Fire, Too

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The discovery of fire 790,000 years ago must have been terrifying to cave men and women. [1] Since that time, many people have died and much property has been destroyed as a result of chemical energy released through fire. Nevertheless, that chemical energy found its place in the world, providing great benefits, and most people take it for granted.

In stark contrast, humankind began to develop and use nuclear energy less than a hundred years ago. According to a 2008 report from the International Energy Agency, nuclear energy provides 13.5 percent of worldwide electricity. [2]

On March 11, 2011, just before we went to press, several of the Fukushima, Japan, nuclear power plants were damaged from a 9.0 magnitude earthquake and a 10 meter tsunami. The event dominated headlines and, with help from the mass media, re-sparked the public's fears of nuclear energy. Some people may look back at Fukushima and consider it a nuclear disaster; others may consider it a nuclear engineering success story, considering the parts of the reactors that did stand up to natural disasters beyond those for which they were designed.

Some members of the public have the misinformed view that radiation has no place in a safe and healthy world. Yet radiation has always been around us. It comes from a variety of natural sources, and it is widely used in medicine.

The difference between radiation levels that pose a significant health risk and radiation levels that pose negligible or no risks has everything to do with emission rate, concentration, dispersion, distance from, and duration of exposure. Other key factors include the unique properties of each isotope, such as how it affects the body and how long it remains radioactive.

In light of the public’s fear, examining how nuclear energy has fared in terms of safety and environment is useful. Remembering that a perfect energy solution for electricity production and transportation does not exist is also useful. Chemical energy and hydroelectric energy have not been without accidents and deaths. Solar and other renewables may have fewer health and environmental risks, but excluding hydroelectric, they provide only 2.8 percent of electrical power worldwide; they have not demonstrated greater capacity for baseload electrical production.

The public's fear of nuclear energy is an undercurrent that affects all actions related to this industry. This fear must be addressed. Doing that requires exploring the risks and consequences of nuclear energy and other energy

technologies. The perceived relationship between nuclear energy and nuclear weapons also contributes to the public's fear.

The 1986 Chernobyl nuclear accident - by far the worst - is most instructive. In 2006, the Chernobyl Forum, an organization comprising the International Atomic Energy Agency, the World Health Organization, the World Bank and five United Nations organizations working in the areas of food, agriculture, environment, humanitarian affairs and radiation effects, published an authoritative analysis of the health, environmental and socio-economic impacts of Chernobyl. [3]

The report concluded that 31 emergency workers died as a direct consequence of their response to the Chernobyl accident. The Forum was unable to reliably assess the precise numbers of fatalities by radiation exposure. The best they were able to do was speculate and make conjecture based on the experience of other populations exposed to radiation. They also wrote that small differences in their assumptions could lead to large differences in their predictions. By 2002, 15 deaths were reported from among 4,000 people exposed to radiation and diagnosed with thyroid cancer. These data are in stark contrast to a number of other poorly referenced sources which have speculated on large numbers of radiation-related deaths.

Concerning environmental impact, the report said that the majority of the contaminated territories are now safe for settlement and economic activity and that the Chernobyl Exclusion Zone and a few limited areas will have restrictions for many decades.

In August 1975, the Banqiao hydroelectric dam in western Henan province, China, failed as a result of Typhoon Nina, which produced floods greater than the dam was designed to withstand. According to *Encyclopedia Britannica*, 180,000 people died. [4]

On April 20, 2010, the Deepwater Horizon offshore oil drilling rig failed and caused 200 million gallons of crude oil to leak into the Gulf of Mexico, according to “PBS News Hour.” The leak was out of control for three months. Eleven men died.

One billion gallons of oil from 21 disasters have been spilled in the oceans since 1967, according to Infoplease. [5]

In the United States alone, 260 workers have lost their lives in 21 coal mining accidents since 1970, according to the United States Mine Rescue Association.[6]

In Nigeria, on Oct. 18, 1998, a natural gas pipeline explosion took the lives of 1,082 people, according to Agence-France Presse.[7]

Members of the public would benefit from scrutinizing the comparative safety and track record of clean, emission-free nuclear energy. They would also benefit from learning the basic concepts and principles of nuclear energy production.

The nuclear industry would know that the public is never going to believe - nor should it - that nuclear accidents can't happen. However, it would do well to hear the public's fears and help people understand that nuclear energy has some risks and hazards. Governments would also do well to show how they are prepared to protect their citizens with effective regulation to minimize radiological emergencies as well as effective response strategies when they occur.

In the absence of the public's understanding of the facts, fear mongers and sensationalist media will surely fill in.

Nuclear energy is certainly not perfect, but the efforts of researchers and industry are significant and crucial. The innovative scientific research and engineering designs shown in this book reflect decades of technological developments in a variety of nuclear applications that are ready to be put to use.

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