



Lessons from Nuclear Imbroglios and Indian Diaspora

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ABSTRACT

Nuclear pollution is a form of physical pollution damaging to all major life-supporting systems such as air, water and soil. Nuclear safety covers the actions taken to prevent nuclear accidents and minimise its devastation. There are organisations in developed countries like USA and UK who regulate and control the ethos of nuclear safety. As the nature and effect of the radioactive wastes are diverse, the lawmakers need to have a specific approach towards it. The disasters like Fukushima and Chernobyl in developed countries have pointed out that nuclear safety shall not be taken lightly. On the road of being an atomic superpower in Asia, India should not undermine the legislative necessities of a matter of such paramount importance.

KEYWORDS : Nuclear Safety, Nuclear Accidents, Radiation, Radioactivity.

Introduction:

Nuclear power is the use of sustained nuclear fission to generate electricity. Nuclear power plants provided about 5.7% of the world's energy and 13% of the world's electricity in 2012.¹ In global debate regarding the use of nuclear energy, proponents such as World Nuclear Association, International Atomic Energy Agency (IAEA) and Environmentalists for Nuclear Energy contended that nuclear power is a sustainable energy source that reduces carbon emissions.² Opponents such as Greenpeace International and Nuclear Information and Resource Service (NIRS), believe that nuclear power poses many threats to people and the environment.³ Nuclear pollution, also called as radioactive pollution is a special form of physical pollution related to all major life-supporting systems such as air, water and soil. Radioactivity is the phenomenon of emission of energy from radioactive isotopes⁴. The emission of energy from radioactive substances in the environment resulting in the pollution of the environment is often called as 'Radioactive Pollution' or 'Nuclear Pollution'.

Nuclear Safety:

Nuclear safety covers the actions taken to prevent nuclear and radiation accidents or to limit their consequences. Mistakes do occur and the designers of reactors at Fukushima in Japan did not anticipate that a tsunami generated by an earthquake would disable the backup systems that were supposed to stabilize the reactor after the earthquake.⁵ According to UBS AG, the Fukushima I nuclear accidents have cast doubt on whether even an advanced economy like Japan can master nuclear safety. Catastrophic scenarios involving terrorist attacks are also conceivable. The Atomic Energy Act, 1962 governs the law relating to development and control of atomic energy in India. However, as the government has allegedly diminished the liability of the foreign suppliers in possible nuclear accidents, there is a huge uproar about the pending 'The Civil Liability for Nuclear Damage Act, 2010' and lessons from Bhopal Gas Leak Disaster.

Agencies Responsible for Nuclear Safety:

Internationally the IAEA works with its Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies.⁷ Many nations utilizing nuclear power have special institutions overseeing and regulating nuclear safety. Civilian nuclear safety in the U.S. is regulated by the Nuclear Regulatory Commission (NRC). The safety of nuclear plants and materials controlled by the U.S. government for research, weapons production, and those powering naval vessels is not governed by the NRC. In the UK nuclear safety is regulated by the Office for Nuclear Regulation and the Defence Nuclear Safety Regulator. The Australian Radiation Protection and Nuclear Safety Agency is the Federal Government body that monitors and identifies solar radiation and nuclear radiation risks in Australia.⁸

Hazards of Radioactive Materials and their Management:

The most important waste stream from nuclear power plants is spent nuclear fuel which is mainly composed of uranium, plutonium and curium. In addition, about 3% of it is fission products from nuclear reactions. These elements are responsible for the bulk of the long-term

radioactivity, whereas the fission products are responsible for the bulk of the short-term radioactivity.⁹

High Level and Low Level Radioactive Waste:

The world's nuclear fleet creates about 10,000 metric tons of high-level spent nuclear fuel each year. High-level radioactive waste management concerns management and disposal of highly radioactive materials created during production of nuclear power. These materials remain deadly to living organisms for extremely long periods. Consequently, high-level radioactive waste requires sophisticated treatment and management to successfully isolate it from the biosphere. The timeframes in question while dealing with such radioactive materials range from 10,000 to millions of years.¹⁰ However some proposed nuclear reactor designs such as the American Integral Fast Reactor and the Molten Salt Reactor can use the nuclear waste from light water reactors as a fuel, decreasing the processing time to hundreds of years instead of tens of thousands of years. This offers a potentially more attractive alternative to deep geological disposal.¹¹ The nuclear industry also produces a large volume of low-level radioactive waste in the form of contaminated items like clothing, hand tools, water purifier resins, and (upon decommissioning) the materials of which the reactor itself is built. In the United States, the NRC repeatedly attempted to allow low-level materials to be handled as normal waste.

Waste Disposal:

Disposal of nuclear waste is often said to be the Achilles' heel of the industry. Presently, waste is mainly stored at individual reactor sites and there are over 430 locations around the world where radioactive material continues to accumulate. There is an "international consensus on the advisability of storing nuclear waste in deep geological repositories"¹², with the lack of movement of nuclear waste in the 2 billion year old natural nuclear fission reactors in Oklo, Gabon being cited as "a source of essential information today"¹³ As of 2009 there were no commercial scale purpose built underground repositories in operation.¹⁴ The Waste Isolation Pilot Plant in New Mexico has been taking nuclear waste since 1999 from production reactors, but as the name suggests is a research and development facility.

Reprocessing:

Reprocessing, that is putting radioactive waste into new mixed oxide fuel, produces a reduction in long term radioactivity. Reprocessing of civilian fuel from power reactors is currently done in Britain, France and Russia, soon will be done in China and perhaps India, and is being done on an expanding scale in Japan. The full potential of reprocessing has not been achieved because it requires breeder reactors, which are not commercially available. France is generally cited as the most successful reprocessor, but it presently only recycles 28% (by mass) of the yearly fuel use 7% within France and another 21% in Russia.¹⁵

Treatment by Nuclear transmutation: 'Nuclear transmutation' is the conversion of one chemical element or isotope into another. In other words, atoms of one element can be changed into atoms of other element by 'transmutation'. This occurs either through nuclear reactions or through radioactive decay.

Environmental Impact and Climate change:

Climate change causing weather extremes such as heat waves, reduced precipitation levels and droughts can have a significant impact on nuclear energy infrastructure. Seawater is corrosive and so nuclear energy supply is likely to be negatively affected by the fresh water shortage. This can force nuclear reactors to be shut down, as happened in France during the 2003 and 2006 heat waves. Nuclear power supply was severely diminished by low river flow rates and droughts, which meant rivers, had reached the maximum temperatures for cooling reactors. During the heat waves, seventeen reactors had to limit output or shut down. 77% of French electricity is produced by nuclear power and in 2009 a similar situation created a huge shortage and forced the French government to import electricity. Some other cases have been reported from Germany, where extreme temperatures have reduced nuclear power production nine times due to high temperatures between 1979 and 2007.¹⁶

Environmental Impact of Nuclear Accidents:

During the *Fukushima Disaster* in March 2011, an earthquake and tsunami caused damage that led to explosions and partial meltdowns at the Fukushima I Nuclear Power Plant in Japan. Radiation levels rose to such an extent that it was sufficient to cause radiation sickness at a later time following a one hour exposure.¹⁷ Significant release in emissions of radioactive particles took place following hydrogen explosions at three reactors, as technicians tried to pump in seawater to keep the uranium fuel rods cool, and bled radioactive gas from the reactors in order to make room for the seawater. Later, the UK, France and some other countries told their nationals to consider leaving Tokyo, in response to fears of spreading nuclear contamination.

However, the *Chernobyl Disaster* in Ukraine was the world's worst nuclear power plant accident. Estimates of its death toll are controversial and range from 62 to 25,000, with even higher projections by experts. An estimate of 16,000 excess cancer deaths predicted to occur because of Chernobyl out to the year 2065.¹⁸ Large amounts of radioactive contamination, which were spread across Europe, contaminated many agricultural products, livestock and soil. It necessitated the evacuation of 300,000 people from Kiev, rendering the city uninhabitable for humans. Thousands of people who drank milk contaminated with radioactive iodine developed thyroid cancer.¹⁹ In 2007 The Ukrainian government declared much of the Chernobyl exclusion zone, almost 50,000 hectares, a zoological animal reserve, with many species of animals experiencing a population increase since human influence has largely left the region, including an increase in moose, bison and wolf numbers. .

Precautionary Measures:

To prevent nuclear pollution of a large scale, the Government of India has to take into consideration some important suggestions before formulating any regulations, such as:

- Nuclear devices should be exploded under ground.
- Extreme care should be exercised in the disposal of industrial wastes containing radioactivity
- Appropriate steps should be taken against occupational exposure and hazards
- Use of high chimney and ventilations at the working place where radioactive contamination is high along with safe coolants
- Implementing safe drilling and drainage systems during mining

- Nuclear medicines and radiation therapy should be applied when absolutely necessary
- Carefully construct future nuclear power plants in safer areas, such as in non-seismically active zones and away from coastal areas.
- Create effective governmental organizations specifically to monitor running nuclear power plants and to make sure they are implementing the Nuclear Safety Norms.
- Further develop research and studies to consider a range of nuclear waste management options which can tackle natural disasters

Conclusion:

With the increasing defence budget of India and with our new government keen towards atomic energy, our country has plans for supersonic nuclear cruise missiles and nuclear power plants like "Kudankulam" on a larger scale in near future. The increase in atomic appetite shall not hinder the fair rule of law to govern such area of national interest. Our country is incredibly polluted, and it is only getting worse with global warming and over-population. To meet the energy crisis and global warming at the same time, we have to be concerned about the possible threats of clean atomic energy. Nuclear power plants seem to provide an answer to the increasing energy demands of the world as they don't emit greenhouse gases and hence don't contribute to global warming and air pollution. We need to take all adequate steps to prevent catastrophes like Chernobyl and Fukushima from ever happening again. The advancement of nuclear power and technology must be balanced with adequate safeguards and restrictions and the entire process should be regulated by proper legal framework. Fukushima Daiichi nuclear disaster prompted a rethink of nuclear energy policy in many countries. Germany decided to close all its reactors by 2022, and Italy has banned nuclear power. India, on the other hand, lacks such regulative laws which can monitor and master safe nuclear energy. The administration must realise that, with great power, comes great responsibilities.

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