Research in Social Sciences 1 (2017) 77-87

Contents lists available at https://www.jsa.social/archive/

The Journal for Social Advancement

Journal Homepage: https://www.jsa.social/

Nuclear Disaster Risk Reduction Management in India: Challenges and Prospects

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OPEN ACCESS

ARTICLE INFO

Article History:
Received *29 March 2017*
Revised *09 May 2017*
Accepted *29 November 2017*

Keywords:

Disaster risk reduction;
Nuclear disaster;
Disaster management;
Indian policy

A B S T R A C T

Mainstreaming of Disaster Risk Reduction has emerged as important policy intervention issue for sustainable development in India. There is a realization that investing in 'Disaster Risk Reduction' helps in reducing economic vulnerability and enhancing resilience. India is of the view that nuclear energy is cheap source of clean energy and its costs can be reduced to the level of energy through coal and it does not affect the Climate Change as it is considered as clean energy. India is expected to generate 60,000MWs of electricity through nuclear mode and it already has 22 nuclear reactors operational and around 60 new nuclear reactors are likely to be set up by year 2032 (www.npcil.gov.in, 2008).

In the aftermath of Fukushima accident, anti-nuclear peoples' movement at Kudankulam in Tamilnadu state and many other parts of India has increased, thus, raising serious concerns about the nuclear safety and need of having more nuclear power plants in India. Govt. of India has time and again allayed people's fear in the country about the safety of our nuclear power plants. For dealing with nuclear disasters in India there is National Disaster Management Guidelines: Management of Nuclear and Radiological Emergencies(NDMG-NRE) which is a bulky document along SOPs- 'Response actions and Standard Operating Procedures' that are to be followed is a classified document only. The paper looks into India's preparedness in light of her national and international obligations and capabilities regarding handling of a nuclear disaster in the country. It traces reasons for India's ever increasing dependence on nuclear energy that increases the possibility of nuclear disaster taking place in world's second largest populated country like India. It deals with post-disaster scenario in the light of necessary legislations, international obligations, preparations, creation of structures, fixing of responsibilities for managing climate change related nuclear disasters as the second largest populated country of the world. Finally, shortcomings in Indian system of managing the climate change related nuclear disasters and the need for re-strategizing nuclear disaster policy making in the country.

Recommended Citation:

Kuman, R. (2017). Nuclear Disaster Risk Reduction Management in India: Challenges and Prospects. *The Journal for Social Advancement. 1* (1), 77-87

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Introduction

Mainstreaming of Disaster Risk Reduction has emerged as important policy intervention issue for sustainable development in India. There is a realization that investing in 'Disaster Risk Reduction' helps in reducing economic vulnerability and enhancing resilience. India in recent years has embarked upon a massive nuclear power programme in the 21st century as part of its military and energy security policy. Given the energy security needs consistent with the demands of a growing economy, it has taken to nuclear path in a big manner for generating electricity, apart from generation through coal, gas, hydro, wind or other renewable sources of energy. India is of the view that nuclear energy is cheap source of clean energy and its costs can be reduced to the level of energy through coal and it does not affect the Climate Change as it is considered as clean energy. India is expected to generate 60,000MWs of electricity through nuclear mode and it already has 22 nuclear reactors operational and around 60 new nuclear reactors are likely to be set up by year 2032 (www.npcil.gov.in, 2008). The issue of setting up and operating of new nuclear power and reprocessing plants stands intertwined between development, environmental concerns, and areas under mega projects being struck with natural calamities' like floods, earthquakes, tsunamis, manmade accidents or breach of security etc., all might cause nuclear accidents/disasters. Dependence on nuclear power, storage and disposal of nuclear waste, areas surrounding reprocessing plants, transportations of nuclear warheads and their safety is a highly risky proposition in the country. The risk remains very high in India and raises serious questions over the capabilities and responsibilities of Central and State Governments in India which cannot match the state preparedness and disaster planning in Japan and other developed countries of the world.

The Fukushima disaster in March 2011 was the worst nuclear disaster since Chernobyl in 1986, but thus far it has not had a significant impact on the policy of the countries like India. Whereas, Germany, South Korea, and even Japan have openly stated that these countries are going to shut down some of their nuclear reactors and reduce dependence upon nuclear reactors for power generation in future. In the aftermath of Fukushima accident, anti-nuclear peoples' movement at Kudankulam in Tamilnadu and many other parts of India has increased, thus, raising serious concerns about the nuclear safety and need of having more nuclear power plants in India. For dealing with such nuclear and radiological emergencies in India, the NDMG-NRE Guidelines for dealing with nuclear disasters titled 'Response Actions and Standard Operating Procedures (SOPs)' are to be followed as per classified document with MHA. (NDMG-NRE, 2009, p. xxvii), that remains a secret document only. The natural disaster that took place in Uttrakhand in mid-2013 and Jammu Kashmir in September 2014 and the manner in which disaster relief operations were carried out in Uttrakhand and Jammu and Kashmir both, one is compelled to rethink about India's capabilities to handle nuclear disasters of Fukushima scale. The doubts become serious when one looks at the new government in India headed by Prime Minister Narendra Modi which is yet to make important appointments in the much hyped NDMA. Even the second highest post of Dy. Chairperson of NDMA has not been filled till the last week of October 2014. The new NDA government in aftermath of flood disaster of September 2014 in Jammu and Kashmir has been talking about thorough restructuring of NDMA and it has been of the view that all previous officials were appointed by the then UPA government and hence, now all officials need to be appointed by the incumbent NDA government only. It appears as if politics is too heavy even in cases of disaster related agencies like NDMA.

The paper is divided in three sections. First section, deals with imperatives for India's ever increasing dependence on nuclear energy that increases the possibility of nuclear disaster taking place in world's second largest populated country. Second section, deals with post-disaster scenario in the light of necessary legislations, international obligations, preparations, creation of structures, fixing of responsibilities for managing climate change related nuclear disasters as the second largest populated country of the world. The last section, deals with emerging issues and shortcomings in Indian system for managing nuclear disasters, specially in the aftermath of Fukushima nuclear accident in March 2011, Uttrakhand natural disaster in mid-2013 and the recent September 2014 disaster in Jammu and

Kashmir. The paper is based upon certain assumptions: 1. Govt. of India's plan of generating 60,000 mega watts of electricity by setting up of 60 new nuclear reactors by year 2032 is likely to raise the risk of nuclear accidents/disasters in India. 2. Jammu & Kashmir, Fukushima and Uttrakhand disasters have raised serious questions over the capabilities Union and State Governments in India, which in all probabilities, cannot match the state preparedness and disaster planning in Japan and other developed countries of the world. 3. Nuclear Disaster Risk Reduction Management in India would need a massive preparations, investments and paradigm shift in disaster policy making.

The methodology used for completing paper is content analysis of existing literature available in the public domain. Parliamentary debates/question hour have been used for completion of paper. Reports of various international agencies/think tanks, state as well as non-state agencies, like IAEA, NDMA, UN, CRS of USA and companies who sell reactors all over the world have been made. It also uses press coverage reviews and television programmes. Imperatives for India's Increased Dependence on Nuclear Energy and Likely Dangers

India in light of its energy security needs consistent with the demands of a growing economy, it has taken to nuclear path in a big manner for generating electricity, apart from generation through coal, gas, hydro, wind or other renewable sources of energy. India is of the view that nuclear energy is cheap source of clean energy and its costs can be reduced to the level of energy through coal and it does not affect the Climate Change as it is considered as clean energy. At present India has seven nuclear plants with 22 nuclear reactors (20 operational and 2 under completion) apart from research reactors at BARC, IGCAR and other production related establishments. They produce around 4700 Mwe of electricity only. Many new nuclear power plants are likely to come up like Jaitapur plant in Maharashtra, at Fatehabad in Haryana, Haripur in West Bengal and in Andhra Pradesh is in line with new policy of generating around 60,000 MWe of electricity through nuclear mode by 2032 after the 123 Agreement between India and USA. (www.npcil.gov.in, 2008). As per World Nuclear Association (WNA), India expects to have 20,000 MWe nuclear capacity on line by 2020 and 63,000 MWe by 2032. It aims to supply 25% of electricity from nuclear power by 2050. (http://www.world-nuclear.org/info/inf53.html &www.npcil.gov.in). As discussed, India's international obligations with regard to reducing the carbon emissions for preventing climate change, switching over to generation of electricity through nuclear mode suits her.

Disaster Threats because of Nuclear Power Plants

Scholars are of view that despite public concerns over least possibility of onsite accidents, waste disposal and uncertainties over economics, fuel switching to nuclear power currently remains the largest, proven, carbon-free generation option. One tonne of uranium produces the equivalent amount of electricity as 16, 000 tonnes of coal and 80 000 barrels of oil. The spent fuel from the reactor still contains 235U, so it can be recycled. Reprocessing the spent fuel produces uranium, plutonium and waste. Safe disposal/storage of waste from the nuclear fuel cycle presents a challenge. (Whittington, 2002, p. 1653-68). To some experts, the risk of major disaster is negligible, a nuclear power station is typically a system where dangerous and destructive processes can be set in motion because it is thought that all the safety backup systems in place will guarantee our safety. For skeptics, the main threat came from the nuclear power stations also. (Markku Wilenius, 1996. P.5-8). India's records so far have been fair barring few small accidents at certain nuclear power plants, specially, Madras Nuclear Power Plant at Kalpakkam when it was struck with Tsunami and the nuclear reactor could be stopped successfully averting any disasters.

Disaster Threats because of the Risks of Accidental Nuclear War

Nuclear disasters can also occur because of the outbreak of nuclear war between countries because of certain reasons like; Accident, error, or malfunction or system failure; The actions of a 'rogue general'; Miscalculations ; The continuing military buildups; A 'bolt-from-the-blue' preemptive first strike; Technologically advanced nuclear weapons ; Role of third parties; and Nuclear proliferation. (Petras and Morley, 1988, pp.151-53). As discussed, a hypothetical nuclear exchange between India and Pakistan, in which each country targeted major cities through dozen, 25-kiloton warheads, as per Natural Resources Defence Council (NRDC) study which calculated that 22.1 million people in India and Pakistan would be

exposed to lethal radiation doses of 600 rem or more and 8 million people would receive a radiation dose of 100 to 600 rem, causing severe radiation sickness and potentially death, especially for the very young, old or infirm and as many as 30 million people would be threatened by the nuclear attack. NRDC estimates that 8.1 million people live within this radius of destruction. (NRDC Report and Louis Ren Beres, 1998, pp.498-504). Similarly report of ICNND presented before the United Nations, says, a nuclear war between India and Pakistan could cause severe "climate cooling" and may have a devastating impact on agriculture worldwide. (The Times of India, 26 Jan 2010 & www.icnnd.com).

Social science research on efforts to maintain safe operations in many modern technological systems suggests that serious accidents are likely over time if the system in question has two structural characteristics: high interactive complexity and tight coupling. While the Indian and Pakistani nuclear arsenals are small and not complex, it is also clear, that the South Asian nuclear relationship is inherently tightly coupled because of geographical proximity. With inadequate warning systems in place and with weapons with short flight times emerging in the region, the time-lines for decision making are highly compressed and the danger that one accident could lead to another and then lead to a catastrophic accidental war is high and growing. (Sagan, 2004, pp.6-8). From an organizational perspective, it is not surprising to find evidence of serious accidents emerging in India's and Pakistan's nuclear and missile programs. On January 4, 2001, Indian Defense Secretary, Yogender Narain, led a special inspection of the Milan missile production facility in Hyderabad where a missile was accidentally launched, flying through the body of one official, catching on fire, and injuring five other workers. The false warning incident that occurred just prior to the Pakistani nuclear tests in May 1998 is a second case demonstrating the dangers of accidental war in South Asia. Such false warnings could be catastrophic in a crisis whether they are deliberate provocations by rogue intelligence officers, or genuinely believed but inaccurate, reports of imminent or actual attack. (Sagan, 2004, pp.6-8). The present stalemate in case of Iran's nuclear programme has allegedly led to beginning of nuclear programmes in Middle-east countries like Saudi Arabia, Qatar, Bahrain, Oman, the UAE and Jordan.(Guzansky, Asculai , and Lindenstrauss, 2012, pp.100-01).

The New Challenge of Terrorism

The danger of terrorists gaining access to nuclear weapon is heightened during crises. Though, nuclear weapons cannot be manufactured directly from the key raw material found in nature, uranium. For this reason, *a terrorist organization can acquire a nuclear explosive only (1) by obtaining an intact nuclear weapon from a national stockpile or (2) by obtaining fissile material from stocks that were produced in highly advanced industrial facilities and then making the fissile material into a nuclear explosive.* The most important and effective steps for reducing the threat of nuclear terrorism are therefore to secure, consolidate, reduce, and, where possible, eliminate nuclear weapons and fissile material. Programs to implement such measures are under way in many countries but are far from reaching their goals. (Nuclear Posture Review, April 2010). There are an estimated 7,700 nuclear weapons deployed throughout the world as on today, plus more than 14,000 nuclear weapons which are inactive, in reserve status, or awaiting dismantlement. (Hans M. Kristensen, 2010). The international community urgently needs to expand its efforts to secure existing stockpiles of nuclear weapons and materials, particularly in Russia, Pakistan, and India. The elimination of nuclear weapons should be high on the global public health agenda deaths and billions of dollars in property damage if a cask of spent fuel rods were dispersed anywhere in the world. Additional measures by Govt. of India like raising of more Battalions of Para-Military forces, setting up of National Investigation Agency (NIA), National Intelligence Grid like institution or amendment of the Prevention of Unlawful Activities Act and making it more stringent, pointed in this direction that how serious such threats have become for India too.

Climate Change Catastrophe can't be replaced with Nuclear Disaster Catastrophe

The Report of Women in Europe for Common Future (WECF) says it is erroneous to consider nuclear energy as source of clean energy and this group is campaigning for a complete ban on production of nuclear energy in Europe. As per the report of IEA and IPCC, tripling the nuclear power

output by 2050 would save five billion tonnes of CO2 compared to a reduction of 25 to 40 billion tonnes by conventional methods by 2050. Since uranium is also a limited resource and, may last for about 70 more years, then switch to thorium for fuel, which is also finite, or to the Fast Breeder Technology together with fuel reprocessing – a polluting and dangerous production system that generates even more toxic nuclear waste. (www.wecf.com). A sense of prudence is needed on part of all countries, including India. Given the health hazards of nuclear material, nuclear power has repeatedly been shown to be toxic to human health at every step of production, right from uranium mining, to fuel production, from power generation to storage of nuclear wastes. Climate change itself can put the nuclear power energy supply at risk: nuclear power plants need great amounts of cooling water, which is why they are located along the coast or rivers. The group says, countries do not need nuclear power to avoid a climate catastrophe. (www.wecf.com). As discussed, nuclear disasters might occur because of manmade accidents taking place at nuclear power plants or climate change induced earthquake, tsunami, floods, storms or any other natural calamity taking place or any use of nuclear weapon in and around the nuclear plant.

Management of Nuclear Disasters in India: National and International Obligations

India in past one decade alone, has been struck with several natural disasters like Bhuj earthquake (January 26, 2001), the Tsunami (December 26, 2004), the Kosi flood disaster (2009), earthquake in Sikkim (2011) which resulted in total deaths of more than 50000 persons, displacement of 6.5 lac people on account of Tsunami and 2 million people got displaced during Kosi floods and the most recent Uttrakhand natural disaster in mid 2013. The idea of setting up of NDMA was first time reflected in country's *Tenth Five Year Plan (2002-07) under Chapter 'Disaster Management: The Development Perspective Document'* under the Ministry of Home Affairs and a statutory body known as 'National Disaster Management Authority of India (NDMA)' in 2005 came up and similar bodies have been created in all Indian States barring a few. As on today, disaster management departments are set up in more than 11 states and UTs. (www.ndma.gov.in, 2005).

For avoiding nuclear disasters and implementing safety regulations, India is party to the Convention on Nuclear Safety (CNS) 1994, and ratified it on March 31, 2005 , which is a legally-binding international convention to govern the safety of civilian nuclear power plants. In 2007, it signed ISSA with the IAEA and brought all civilian nuclear reactors under the safeguards. The Nuclear Safety Standards (NUSS) also apply to nuclear power plants in India. (Arun Shull, 2008, pp.5-6). A National Report was also prepared in accordance with the "Guidelines Regarding National Reports under the Convention on Nuclear Safety". (Govt. of India, 2008, p. ii). Thus, India's preparedness for handling nuclear disasters and the guidelines issued by NDMA is largely inspired by the IAEA and other international norms. In January 2003, the Indian Government had also established the Nuclear Command Authority (NCA) to manage its nuclear and missile arsenals and prevent its misuse. The complex system of control may be seen as a barrier against accidental or unauthorized use. (www.nca.gov.in & Hans Born). In order to prevent proliferation of nuclear technology, ensuring that it is not stolen or leaked in any manner to non-state actors, Govt. of India also got Nuclear Non-Proliferation Law enacted in 2007.

Safety Policies for Nuclear Power Plants (NPPs) Implemented By NPCIL

All NPPs are run by Nuclear Power Corporation of India Limited (NPCIL). Under October 1996 Headquarter Instruction HQI-7003, the NPCIL accords utmost importance to Nuclear, Radiological, Industrial and Environmental Safety, overriding the demands of production or project schedules. Its objectives and various steps under implementation are:

- To maintain high standards for safety within plant as well as in the surrounding areas.
- To ensure that health, safety and environmental factors are properly assessed for all NPPs.
- To ensure that all employees, contractors, transporters working for NPPs adhere to safety requirements while carrying out their responsibilities.
- To keep the public at large informed about the safety standards and regulatory practices that are being adopted at NPPs.
- Setting up of targets of safety performance parameters and their periodic monitoring.

• Carrying out of different levels of safety audits and reviews viz. Internal, corporate,

Regulatory and international like WANO Peer review.

• Assessment and enhancement of safety culture. (Govt. of India Report, 2008, p.82-83, accessed from www.npcil.gov.in)

For preventing nuclear related materials falling in the hands of the terrorists that can be used in the form of Radiological Dispersal Device (RDD), and development of crude form of "dirty bomb", Workshops on Nuclear Disaster Management are organized by National Disaster Management Authority with greater frequency for prevention, mitigation and preparedness and response at site and at hospital, rehabilitation, recovery and research. Input of specialists to delineate the threats, solutions, the technological procedures and to gain useful insights on counter terrorist operations, de-contamination, early detection, critical infrastructure protection, reconnaissance, protection, crisis management and emergency monitoring system is also there. (www.ndma.gov.in, 2005).

For dealing with nuclear disasters in India there exists *National Disaster Management Guidelines: Management of Nuclear and Radiological Emergencies(NDMG-NRE)* which is a bulky document having ten chapters, having lengthy preface and 134 pages covering all technical and operational aspects of nuclear disaster. The Guidelines observe 'nuclear disaster' as that dimension of emergency situation leading to mass casualties and destruction of large areas and property, unlike a nuclear emergency, the impact of a nuclear disaster is beyond the coping capability of local authorities and such a scenario calls for handling at the national level, with assistance from international agencies, if required. (NDMG-NRE, Feb 2009, p. xxiv). Highlights of NDMG-NRE involve the elements of rescue, medical care, transportation, evacuation, providing food and shelter, etc. The National Crisis Management Committee (NCMC) assisted by the National Executive Committee (NEC), Department of Atomic Energy (DAE), MHA and National Technical Research Organisation (NTRO) shall handle such emergencies. Specially trained NDRF, fire service personnel, civil defence, medical, transport, civil supplies, civil engineering departments, etc., are to have the radiation emergency response component as part of their response system to ensure large scale national capability in this regard. Response actions and Standard Operating Procedures (SOPs) are to be followed as per classified document with MHA. (NDMG-NRE, 2009, p.xxvii). The details of NDMG-NRE can be accessed from (www.ndma.gov.in, 2005).

Emerging Issues: Post Fukushima and Lessons For India

According to the Reconstruction Agency, the combined disaster of the earthquake, tsunami, and the nuclear accident caused nearly 16,000 deaths, over 1.2 million destroyed or damaged buildings, temporary evacuation of over 380,000 people from their home, most of whom were residents of Iwate, Miyagi, and Fukushima prefectures on the northeast coast of the Pacific Ocean. It also disrupted water supply, power distribution, and train, highway and air transport systems in a wide area of eastern Japan. Reconstruction of infrastructures has been partly hindered by radioactive contamination around the nuclear power plant, and as of spring 2013, some key infrastructures, such as a major train line and a major highway (Joban Line and Joban Expressway), have not been recovered yet. After the nuclear accident, no deaths from radiation exposure have been reported, and long-term radioactivity-related health risks for the Fukushima residents are considered to be low (WHO, 2013). Still, radioactivity added a special dimension to the problem. To reduce radiation exposure, all residents approximately within a 20 km radius of the Fukushima Dai-ichi power plant were forced to leave their home. (http://www.reconstruction.go.jp/topics/000046.html, accessed on April 5, 2013).

A study was carried out by a group of scholars following a major earthquake off the Pacific coast of Japan, involving panel data for 5,979 individuals interviewed in Japan before and after the accident to analyze the effect of the accident on people's subjective well-being. The main hypotheses was that this effect declines with distance to the place of the event but also with distance to other nuclear power plants. To test these hypotheses, scholars used Geographical Information Systems to merge the well-being data with information on respondents' distance to the Fukushima nuclear plant and on their proximity to nuclear power stations in general. The empirical results suggested the existence of

significant well-being effects of the combined event of the earthquake, tsunami and nuclear accident that are proportional to proximity to the Fukushima site being equivalent to up to 72 percent of annual household income. The study found no evidence for increased nation-wide worry about the presence of nuclear power plants near people's place of residence. (Katrin Rehdanz, Heinz Welsch, Daiju Narita, and Toshihiro Okubo, July2013).

Nations are learning from Japan's experience of the nuclear alternative through the Fukushima Daiichi disaster. Germany, Switzerland, Italy, Israel and other critical players have joined Japan in announcing they will build no more reactors is being considered--- a major blow to any prospect of curbing global carbon emissions. Some will start shutting the ones they have. Switzerland's cabinet has voted to phase out atomic energy by 2034, and Germany has declared to close all its nuclear power plants by 2022. Germany is planning alternatives for generating electricity through natural sources including sun, wind and water. In May 2011 G-8 leaders also took lessons from the Fukushima reactor to seek more stringent international rules on nuclear safety. Japan's nuclear disaster registered as a wakeup call by indicating the importance of a national regulatory body's independence from both government and the corporate sector. (Jain,2011). Scholars are also of view that disruptive disasters in major food-producing regions could have dire global consequences. Corn, wheat, and rice crop failures would lead to price hikes and shortages in far-flung locations. The worldwide collapse of one of these major staples—for example, from a new fungal infestation in one region and a drought in another—could lead to famines, export cutoffs, stockpiling and hoarding, or cartelized supply arrangements. Such developments could create new zones of instability, hostility, and populist pretexts for aggressive steps to secure new supplies or assure future access. (Frederick S. Tipson, Feb.2013).

The political and social dimensions of massive shifts in environment and population are difficult to predict, but the likelihood is that over time large groups of people will become ecologically displaced persons or "environmental refugees," forced from their historic homelands and needing relocation to more hospitable places within or beyond national boundaries. Such transitions will present large political and economic challenges, both for long-term humanitarian support and for immigration laws and enforcement. If these movements involve millions of desperate people, geographic and political boundaries will become increasingly problematic (Elizabeth Ferris, 2013). A country like which has so much of pressure on land because of high density of population need to put into place a very effective mechanism for dealing with such eventualities.

Safety Concerns regarding Spent Fuel Storage

Safely securing the spent fuel that is currently in crowded pools at reactors should be a public safety priority of the highest degree. As in Japan, U.S. spent-fuel pools are not required to have defense-in-depth nuclear safety features. They are not covered by the types of heavy containment structures that cover reactor vessels. Reactor operators are not required have backup power supplies to circulate water in the pools and keep them cool in the event of onsite power failures. Reactor control rooms rarely have instrumentation keeping track of the pools' water levels and chemistry. (In one incident at a U.S. reactor, water levels dropped to a potentially dangerous level after operators simply failed to look into the pool area.) Some reactors may not have the necessary capabilities to restore water to pools when needed. Quite simply, spent-fuel pools at nuclear reactors are not required to have the same level of nuclear safety protection as required for reactors, because the assumption was that they would be used only for short-term storage before the rods were removed for reprocessing or permanent storage. (Robert Alvarez, 2012).

The NRC of U.S. ordered reactor operators to:

- ". . . provide sufficient safety-related instrumentation, able to withstand design-basis natural phenomena, to monitor key spent fuel pool parameters (i.e., water level, temperature, and area radiation levels) from the control room."
- ". . . revise their technical specifications to address requirements to have one train of onsite emergency electrical power operable for spent fuel pool makeup and spent fuel pool instrumentation when there is irradiated fuel in the spent fuel pool, regardless of the operational mode of the reactor."
- ". . . have an installed seismically qualified means to spray water into

> the spent fuel pools, including an easily accessible connection to supply the water (e.g., using a portable
> pump or pumper truck) at grade outside the building." Improving pool safety is certainly important. For decades, nuclear safety research has consistently pointed out that severe accidents could occur at spent-fuel pools that would result in catastrophic consequences. A severe pool fire could render about 188 square miles around the nuclear reactor uninhabitable, cause as many as 28,000 cancer fatalities, and cause $59 billion in damage, according to a 1997 report for the NRC by Brookhaven National Laboratory. (**Robert Alvarez**, 2012).

Measures Undertaken by then UPA Govt. headed by Prime Minister Man Mohan Singh

Immediately after the accident at Fukuskima in Japan, NPCIL Chairman assured to Indians that there would not be any slowdown in the country's nuclear energy program and assured that the DAE and NPCIL are undertaking an immediate technical review of all safety systems of our nuclear power plants in case of large natural disasters such as tsunamis and earthquakes. (The Hindu, March 22, 2011). Scholars in India had serious doubts about the secrecy in DAE, public health systems, their skills, skill development process, and needs urgent attention. The response expected from state governments in case of nuclear disasters of the magnitude of Fukushima disaster has been very doubtful. The NDMG-NRE, 2009 guidelines would remain on paper if proper evacuation plans in a densely populated country are not worked out and practiced. (M.M.K. Sardana, 2011, pp. 1-4). Japan in its 750 page report on the Fukushima accident prepared by its Nuclear Emergency task force to the IAEA, has given following findings like, Japan was ill prepared, reactor design were old, lack of facilities and equipments on sharing basis, poor information and decision-making and lack of protection facilities were reasons for the disaster. (ibid., p.9).

Governments need to take note of the need for an informed debate on nuclear energy as brought out in the above report. The exclusiveness of the Nuclear Energy establishments should give way to exchange of dialogues among communities, community leaders, scientists, sociologists, environmentalists, economists, health scientists, political leaderships and nuclear scientists with a view to recommend strategies to harness this source of energy balancing with safety, health and environmental concerns. (The Times of India, July 14, 2011). The NPCIL in post-Fukushima also got done the safety evaluation of 20 operating power plants and nuclear power plants under construction. The report titled *Safety Evaluation of Indian Nuclear Power Plants Post Fukushima Incident* suggested a series of safety measures which pertained to strengthening technical and power systems, automatic reactor shutdown on sensing seismic activity, enhancement of tsunami bunds at all coastal stations, etc. (NPCIL Report, 2011).

Indian Response to Fukushima

The then Prime Minister Manmohan Singh assured the country that all nuclear programmes are safe shall not be slowed down and in his speech emphasised, "there would be no looking back on nuclear energy", while on a visit to West Bengal on 21 August 2011. He added, "we are in the process of expanding our civil nuclear energy programme. Even as we do so, we have to ensure that the use of nuclear energy meets the highest safety standards. This is a matter on which there can be no compromise". (The Hindu, 22 Aug 2011). It is expected that the new government of Prime Minister Modi would continue to follow the policies of previous government and avoid politicization of disaster management issues. Even the officials of AEC had the responsibility to assure the country men by stating that "Our record of nuclear safety has so far been impeccable and we have taken steps after Fukushima to ensure that it remains so," Dr Srikumar Banerjee, Chairman, Atomic Energy Commission (AEC), said in interview given to the Tribune Newspaper. (The Tribune, 19 June 2011). But the NDMA Chief was pessimist about India's abilities to handle such post nuclear disasters when he said, "India is not prepared to deal with nuke disaster". (NDMA Chief , Wednesday, Jun 1, 2011, PTI). Indeed, the message from India's political as well as nuclear bureaucracy is clear: despite the disaster, India's nuclear power projects will proceed unimpeded. (Gaurav Kampani, 2011).

Conclusion

There have been several occasions when serious doubts about the functioning of DAE and its sister agencies have been raised in India, specially, that their functioning is not transparent not much information is shared with public. In case of enquiries, officials would not point out safety and design lapses due to fear of action being taken against their brother officials only. GOI on September 7, 2011 had tabled in the Lok Sabha the much awaited independent Nuclear Safety Regulatory Authority Bill (NSRA), 2011 for bringing about much-needed independence and transparency in administering the safety oversight of nuclear operations in India. However, with the end of 15th Lok Sabha's term (Lower House of the Indian Parliament), the bill got killed as it could not be passed by both the houses of the Parliament. Today there is a new government in India headed by Prime Minister Narendra Modi which is yet to make important appointments in the much hyped NDMA. Even the second highest post of Dy. Chairperson of NDMA has not been filled till the last week of October 2014. The new NDA government in aftermath of flood disaster in Jammu and Kashmir has been talking about thorough restructuring of NDMA and it has been of the view that all previous officials were appointed by the then UPA government and now all officials need to be appointed by the present government only. It appears as if politics is too heavy even in cases of disaster related agencies like NDMA. Overall it can be said that India need to take a cautious path for implementation of its ambitious nuclear power programme in light of its need as well as its realistic capabilities of managing nuclear disasters if at all they were to become a reality. A lot of education and training of citizens at massive scale need to be undertaken. There is an urgent need for developing a new culture of resilience towards such disasters on part of average citizens of the country. Union government need to encourage the state governments for preparing themselves in the light of current realities. Schools, Colleges and Universities of the country need to introduce a course on Disaster Management at every level of education. Youth of the country need to be attracted towards creation of exclusive wing of volunteers who would ever remain ready to offer their services in the hours of crisis on the patterns of N.S.S. The private sector of the country will also have to assume responsibility for such causes in a very big manner. A 'disaster cess' on patterns of education or petrol cess can be imposed for creating a financial reserve for training of youth and human resource exclusively for disaster related needs.

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