international campaign to abolish nuclear weapons

Our goal: a treaty banning nuclear weapons

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Supplementary information re question from Senator Fawcett regarding nuclear accidents in India, taken on notice

Joint Standing Committee on Treaties

Public Hearing regarding proposed Australia –India nuclear co-operation agreement

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I attach a number of documents authored by Prof MV Ramana and colleagues regarding this topic:

Chapter 7, Safety, in Ramana MV. The power of promise: Examining nuclear energy in India. New Delhi; Viking, Penguin Books India, 2012: 193-222.

2013a - Ramana MV, Kumar A. 'One in infinity': failing to learn from accidents and implications for nuclear safety in India. Journal of Risk Research, 2013;1-20.

2013b - Ramana MV, Kumar A. Nuclear safety in India: Theoretical perspectives and empirical evidence. Journal of International Studies, 2013; 1 (1):49-72.

Ramana MV, Seshadri AK. Negligence, capture, and dependence: safety regulation of the design of India's Prototype fast breeder reactor. Journal of Risk Research. 2015:1-21.

The first is the chapter on safety from Ramana's landmark book " The power of promise", published in 2012, the most authoritative comprehensive volume to date regarding nuclear power in India. This outlines a number of problematic aspects in relation to nuclear power generation and its regulation in India, including organisational deficiencies and reactor design issues, and documents repeated accidents in India's nuclear plants, briefly summarised below.

Narora 1993

The most serious accident to date occurred on 31 March 1993 accident at the Narora nuclear plant when two blades of the main turbine of the first unit broke off, sliced through other blades and destabilised the turbine, making it vibrate excessively. These vibrations cause the pipes carrying hydrogen gas to cool the turbine to break, releasing hydrogen which caught fire. Lubricant oil also leaked at the same time; the fire then spread to the oil and throughout the entire turbine building. As a result of fire damage to cables, there was a general electrical blackout in the plant, involving the power to the secondary cooling systems, which were rendered inoperable. To make matters worse, the control room was filled with smoke and operators were forced to leave within 10 minutes of the blade failure. Smoke sensors were inadequate – the fire was only noticed when flames were directly observed by plant personnel.

Even though the operators manually activated primary shutdown of the reactor, given continued heat generation from the nuclear fuel, it was necessary to start diesel-driven fire pumps to circulate water meant for fire control, to cool the reactor. Some operators had to climb physically on top of the reactor building with the aid of battery-powered torches, and manually open valves to release liquid boron into the reactor core. Had these multiple makeshift emergency measures undertaken by workers not been possible in a timely fashion, it is virtually certain that a core melt and explosive fuel–coolant interaction would have resulted in a much more serious accident. It took 17 hours from the time the fire started for the power to be restored to the reactor and its safety systems, and 13 hours before the control room could be re-entered. This accident came close to a catastrophic one rather similar to the Fukushima disaster, and there were no primary or redundant systems in place to prevent and mitigate such a serious multifaceted accident.

The 2013b paper (p 60) documents numerous oil leaks and associated fires at reactors, and at least one hydrogen gas leak, and repeated turbine blade failures (2013a, p 11) prior to the Narora fire accident.

Kakrapar 1994

An accident at the Kakrapar Atomic Power Station (KAPS) on 15-6 June 1994 was associated with heavy rains and flooding of the turbine building. Because neither cable trenches nor valve pits were sealed, water was also able to enter the reactor building. Workers on the morning shift of 16 June 1994 reportedly had to swim in chest-high water, and the control room was inaccessible for some time. Subsequently, a site emergency was declared and workers were evacuated. Fortunately, local villagers, worried about the security of their own homes, made a breach in the embankment of nearby Moticher Lake, which allowed lake water to drain.

It was only two days later on 18 June that a large pump was brought to the plant and the work of removing the water from the turbine building began. Because of the floodwater entry, much of the equipment in the turbine building was submerged, including the water pumps used to cool the reactor core. As electrical power from the grid failed, diesel generators had to be used. It is indeed fortunate than the reactor had been shut down for over 4 months at the time of the flooding, otherwise a high risk of a disaster would have been likely. In addition, floodwater breached the solid waste management facility, lifting canisters containing radioactive waste and carried them out into the open. It was not known exactly how many canisters were swept away, nor if they were ever recovered, or if any of them released their contents into the floodwaters.

All of this information only came to light because of information made available by and well-placed senior whistleblower. The Atomic Energy Regulatory Board former head subsequently stated that similar flooding had occurred twice before at other plants. The same construction errors of too low elevation in a flood-prone area and inadequate sealing arrangements which could not prevent water ingress into cable trenches and valve pits were replicated at the Kakrapar plant.

Kaiga 1994

On 13 May 1994 inner containment dome of one of the units of the Kaiga nuclear power plant collapsed during its construction, after the dome itself had been completed but cabling and other works were being carried out. This collapse is reported by Professor Ramana to be unprecedented in the annals of nuclear energy history. It would have been potentially catastrophic had it occurred during operation of the nuclear reactor.

Kalpakkam Reprocessing Plant Accident 2003

Here workers were tasked with collecting a sample of low level waste from the waste tanks on 21 January 2003. Unknown to them, a valve had failed, resulting in the release of highly radioactive waste into the area where they were working. There were no radiation monitors in the area, and no mechanisms to detect failure of valves. Therefore the workers had no way of knowing that they were in a highly radioactive area, and their exposure was only recognised after the sample they collected was processed in a different part of the facility. This accident resulted in six workers being exposed to high-levels of radioactivity, measured between 280 and 420 milliSievert (the recommended maximum occupational exposure limit for nuclear industry workers is an average of 20 mSv over a full year).

The employees union made a number of safety-related demands, and recounted two previous incidents in the previous two years when workers had been exposed to high levels of radiation. This incident was subsequently admitted to have been ” the worst accident in radiation exposure in history of nuclear India” (Chapter p211).

Heavy water leaks

The chapter and 2013b paper describe a number of substantial, frequent and ongoing leaks of heavy water at Indian nuclear power stations, involving leaks of up to 7 tons of heavy water.

The chapter and papers attached review various aspects of these and other incidents in further detail and characterise: multiple organisational and systemic failures in the nuclear industry in India, including an extremely weak safety culture, denial of the possibility of accidents, and intimidation of workers and those raising safety concerns. Poor reactor and plant design, cutting corners to save costs, the lack of the culture of review and learning from nuclear accidents both in India and elsewhere, are all prevalent.

As the Nuclear Threat Initiative draws attention to in its Nuclear Materials Security Index findings for India mentioned in my testimony, there is a lack of independence of the regulatory agency (the Atomic Energy Regulatory Board), which reports to the Atomic Energy Commission and thus is inherently conflicted and lacking independence. Such “regulatory capture” has been recognised as a major problem in the Japanese context and a major cause of the Fukushima nuclear disaster, and seismic and other safety risks at multiple other Japanese nuclear power reactors. This problem is extensively discussed in the 2015 paper attached, which draws on the Indian Comptroller and Auditor General audit which makes very plain the lack of separation of regulatory and non-regulatory nuclear functions.

These documents provide an authoritative and concerning record of repeated accidents in nuclear facilities, some of them extremely serious. As a number of these events only came to light through whistleblowers and plant employee unions, it is quite likely that other accidents and incidents have occurred which are not publicly documented.

These documents also reveal a wide range of deficiencies in the design, implementation of safety recommendations, vulnerability flood damage and other natural hazards, inadequate knowledge of seismic risks, unfounded overconfidence, lack of organisational learning from accidents, deficient implementation of safety measures; and other ongoing gaps in design, regulation and performance which make it clear that the record of repeated and serious nuclear accidents in India is likely to continue.

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