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ANALYSIS OF INDIAN LAWS TO CONTROL THE IMPACT OF RADIOACTIVE POLLUTION ON THE ENVIRONMENT

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Abstract: Advancement in science and technology especially in nuclear science has emerged as a boon for mankind in the form of Carbon free and clean source of energy. Also nuclear industry in the world is growing and is expected to form energy-mix of the world. But at the same time it has turned out to be bane in the form of radioactive accident and pollution endangering individual, property and environment; posing threat to Fundamental Right to live with dignity and to clean and healthy environment. The geographical scope of damage caused by nuclear accident may have national and trans-boundary effects. An unlikely event like nuclear accident may worsen up the situation. Numbers of legislations at National and Inter-National level have been enacted to prevent and control radioactive pollution, to provide liability for nuclear damage, compensation to victims of nuclear incident, but such laws are in their nascent stage and suffer from loopholes. Enormous benefits have been derived from the wise utilisation of the atom ever since radioactivity and, subsequently, the nuclear fission process were discovered. As experience amassed, so did wisdom on how to use atomic energy without attracting the most hazardous and long-lasting impact it could have on mankind if it is mismanaged. In spite of this awareness, the accidents at Chernobyl and Three Mile Island did occur. Nations across the globe have learned their lessons from these disasters. India is not an exception but is still lagging behind in providing a comprehensive legislation.
Keywords: Radioactive Pollution, Environmental Protection, Nuclear Law, Fundamental Right, Nuclear Accidents

INTRODUCTION

Indian Parliament having taken note of the developments in the field of atomic energy and with a view to implement the future programme of expansion in the field, thought it necessary to have a comprehensive legislation dealing with Atomic Energy, consequently, Act 29 of 1948 was repealed and the Atomic Energy Act, 1962 (33 of 1962) (in short the Act) was enacted which came into force on 29.01.1962. The Act has been enacted to provide for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes. The Central Government, in exercise of the powers conferred under Section 27 of the Act, constituted the Atomic Energy Regulatory Board (AERB) vide notification dated 15.11.1983 to carry out certain regulatory and safety functions envisaged under Sections 16, 17 and 23 of the Act. The AERB have powers to lay down safety standards and frame rules and regulations in regard to the regulatory and Safety requirements envisaged under the Act and have to report to AEC.

Atomic Energy Act provides for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful uses and for matters connected with. It provides the basic regulatory framework for all activities related to atomic energy programme and use of ionising radiation in India. Of the 32 sections of the Atomic Energy Act those related to safety are Sections 3 (e) (i), (ii) and (iii), 16, 17 and 23.

Pursuant to the Atomic Energy Act, the Atomic Energy Regulatory Board (AERB) designated by the Central Government, is the Competent Authority as the Regulatory Body for granting, renewal, withdrawal and revocation of consents for Nuclear and Radiation Facilities. The Regulatory Body also exercises control over nuclear installations and the use of radioactive substances and radiation generating plants outside such installations.

Section 16 and 17 of the Atomic Energy Act refers to control over radioactive substance and special provisions for safety. Section 23 empowers the Regulatory Body with administration of Factories Act 1948, including enforcement of its provisions, appointment of inspection staff and making of rules in the installations of Department of Atomic Energy (DAE). The Act underwent amendment vide amending Acts 59 and 29 in the years 1986 and 1987 respectively.

However, the major amendment was of the year 1987, vide Amending Act 29 of 1987, by which the Central Government was empowered to produce and supply electricity from atomic energy. For achieving the envisaged target of nuclear power generation, a nuclear power corporation or a Government company was also decided to be set up which would design, construct and operate nuclear power stations in India. Following that, a separate public sector company, namely, the Nuclear Power Corporation of India (NPCIL) with a view to design, build and operate nuclear reactors in the country was

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created in September 1987. NPCIL is a wholly owned by the Government of India undertaking which functions under the administrative control of DAE.

Radiation Protection Rules, 1971:

Radiation Protection Rules 1971 specifies the responsibilities of various parties, viz. the employers, licenses, Radiological Safety Officers and workers, with respect to radiation protection. The Rules also specify the powers of the competent authority (AERB) with respect to (i) specifying requirements in Respect of safety, health surveillance of workers, radiation surveillance and records to be maintained; (ii) issuing directives; (iii) inspections and (iv) enforcement actions. It prescribes conditions to be fulfilled for giving of license, for handling radioactive material equipment of etc. It prescribes duties of Radioactive Safety officer, Employer, Health surveillance of worker etc. It empowers duly authorized person to investigate, seize radioactive equipment. As per Radiation Protection Rules 2004, AERB has the responsibility for ensuring radiation protection by prescribing collective dose budgets, reviewing excess exposure cases, conducting regulatory inspections and reviewing radiological safety aspects of radiation facilities, mainly based on the prescribed reports submitted by the Radiological Safety Officers (RSO)of the facilities.

Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987:

The discharge of radioactive waste from NPPs is governed by the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 issued under the Atomic Energy Act. It is mandatory for an NPP to obtain authorization under the above rules from AERB for disposal of radioactive wastes. AERB prescribes the regulatory limits of radioactive effluents based on the apportionment of an effective dose limit of one mSv per year to the public, arising from nuclear facilities at a site, considering all the routes of discharges and significant radionuclides in each route of discharge**.**

According to Rule 3 of the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987,

No person should dispose of radioactive waste:

(a) unless he has obtained an authorisation from the competent authority under these rules;

(b) in any manner other than in accordance with the terms and conditions specified in the authorisation issued under these rules;

(c) in any location different from those specified in the authorisation;

(d) in quantities exceeding those specified in the authorisation.

While the systems and procedures for the disposal of disused sources in respect of NPP and other nuclear fuel facilities were in place, the same were not so in the case of other radiation facilities due to in adequate monitoring on account of shortfalls in RIs and in adequate strength of RSOs in these facilities. This was also evident in case of the radiation incident in Mayapuri mentioned earlier, which is described below:

Environment Protection Act, 1986:

This Act is umbrella legislation. The Act authorizes the central government to establish standards for the quality of the environment and for emission or discharge of environmental pollutants from any source. The Ministry of Environment and Forests has published Environment (Protection) Rules establishing general standards and industry based standards for certain types of effluent discharge. The Act also includes a citizen's initiative provision, section 19(b), and a provision authorizing the Central Government to issue direct orders to protect the environment.

This Act is also an enabling law 'laying down legislative policy on environmental protection giving scope to issue delegated legislation'. Under section 23 the Centre may delegate its powers and functions to any officer, state government or other authority. Section 24 says that provisions of this Act and rules or orders would override any other law. Under sections 6 and 25, broad rule making power is conferred on the Central Government. The Act imposes severe punishments namely a prison term upto five years or fine of Rs 100000/-(£1428) or both.

Delegated legislation under the Environment Act

The Government of India has made a large body of delegated legislation under the Environment Act (EPA). These may be broadly classified under following four groups:

Pollution Control:

Section 7 of the EPA prohibits the discharge of environmental pollutants in excess of the prescribed standards. The government has made the Environment (Protection) Rules 1986 to implement this mandate. Standards are appended in the schedule to the EPR. These are of three types namely source standard, product standards and ambient standards. Schedule I contains industry wise standards for effluent discharge. Pollution control boards are empowered to specify stricter standards than those published in respect of any industry, operation or process, where necessary. The Noise Pollution (Regulation and Control) Rules 2000 supplement the EPR.

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Hazardous Substance Regulation:

The Hazardous Wastes (Management and Handling) Rules 1989 were issued under the EPA. This introduced a permit system to regulate the handling and disposal of hazardous waste. The Manufacture, Storage and Import of Hazardous Chemical Rules 1989 spell out the responsibilities of those handling hazardous substances. In 1996, the Central Government made the Chemical Accidents (Emergency, Planning, Preparedness and Response) Rules. Under this, crisis management groups at Centre, State and District are to be set up.

Environment Impact Assessment:

The Ministry of Environment and Forests issued a comprehensive and statutory Environment Impact Assessment Notification in January 1994 (EIA) bringing 29 designated projects/industries under its domain. Before 1994, obtaining EIA was an administrative matter. The notification requires project authorities to submit an EIA report, an environment management plan, details of the public hearing, a project report to the impact assessment agency for clearance. There is also a provision of further Review by a committee of experts.

Coastal Regulations and Protection of Specified Areas:

In addition to the EIA, the Coastal Zone Regulations have also been issued in February 1991 to control development activity within a strip of 500 meters from the sea shore along the entire coast of India.

Indian Penal Code: Section 268 prohibited acts which tend to causes interference with health safety, comfort or convenience of public at large as public nuisance.

Criminal Procedure Code: Section 133 to 144 of Criminal Procedure Code 1973 can be invoked to prevent pollution. Section 133 says magistrate is empowered to pass conditional orders to remove the public nuisance within fixed period of times.

Civil Procedure Code: Section 91 provides right of action in case of nuisance.

Law of torts: Law of torts also prohibits public nuisance and provide remedies such as damages abatement, injunction etc. It also prohibits law of negligence and provides remedies such as compensation and damages.

Constitutional perspective:

The Indian constitution is amongst the few in the world that contains specific provisions on environmental protection. Article 21 which guarantees right to life has been interpreted by the Supreme Court in Subash Kumar v/s State of Bihar[1] and Virender Gaur v/s State of Haryana[2] to include right to clean and healthy environment. Radioactive pollution certainly endangers clean environment. Article 38 which states State shall strive to promote public welfare also empowers it to take action against those industries who release radioactive wastes. Article 42 stresses that State must make provision to ensure just and human conditions to work. A workplace which exposes its workers to harmful radioactive rays denies human conditions of work. Article 48 and Article 51A- (g) strives to protect and improve environment and imposes duty upon citizens to protect and improve natural environment, respectively. Both Article 48 and Article 51-A (g) were held important and must be taken in to mind when issues pertaining environment are raised. [3]

The directive principles of state policy and the fundamental duties chapters explicitly enunciate the national commitment to protect and improve the environment. Judicial interpretation has strengthened this constitutional mandate. In the case of *Tarun Bharat Sangh Alwar v Union of India,* the Supreme Court had ruled that 'the issues of environment must and shall receive the highest attention from this court'. In the same case the Supreme Court said:

"This litigation concerns environment. A great American Judge emphasizing the imperative issue of environment said that he placed government above big business, individual liberty above government and environment above all".

The Supreme Court has adapted and developed some fundamental norms in the process of adjudicating environmental cases. These norms have come to stay in India as part of the environmental policy and law. These norms include right to a wholesome environment, polluter pays principle, precautionary principle, sustainable development principle, intergenerational equity etc.

The Supreme Court has held that the enforcement agencies are under a duty to enforce the environmental laws and they may not plead problems of funds. The Court further clarified that the natural resources are meant for the enjoyment of the general public and cannot be converted into private ownership.

India is a federation of states. Therefore, law-making power is shared between the union government and 29 states. Article 246 of the constitution divides the subject matter of laws made by parliament and by the legislatures of the states. "This provides three lists namely the union list, the concurrent list and the state list appended in the seventh schedule to the

[1] All India Reporter of the year 1991 Supreme Court cases 420 (1991)

[2] Supreme Court Cases (Law Reporter) of the year, 2, 577 (1995)

[3] Sadchidananda Pandey V. State of West Bengal All India Reporter Supreme Court, 1109 (1987)

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constitution." The concurrent list, among others, includes forests, the protection of wild life, mines and mineral development etc. Under this list, both parliament and the state legislatures have overlapping and shared jurisdiction. Parliament is also empowered to legislate in the national interest on matters enumerated in the state list under article 249. In addition, parliament may enact laws on state subjects, for states whose legislatures have consented to central legislation. The Water Act 1947 is an example under this.

Environmental protection and improvement were explicitly incorporated into the constitution by the Constitution (42 nd Amendment) Act of 1976. Article 48 A was added to the directive principle of state policy which are the commands of the constitution to the governments to run the affairs of the State. Article 48 A says 'the State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country.' Article 51 A (g) in a new chapter entitled 'Fundamental Duties', imposes a similar responsibility on every citizen to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures. Although non-enforceable by a court, the directive principles are increasingly being cited by judges as complementary to the fundamental rights. In several environmental cases, the courts have been guided by the language of the Article 48 A. An instance is the case *of M.C.Mehta v Union of India.* Article 253 of the constitution empowers Parliament to make laws implementing India's international obligations as well as any decision made at an international conference, association or other body. Entry 13 of the union list covers 'participation in international conferences, associations and other bodies and implementing of decisions made there at.' Parliament has used its power under article 253 read with entry 13 of the union list to enact the Air (Prevention and Control of Pollution) Act 1981 and the Environment (Protection) Act 1986. The preamble of both these Acts state that these acts were passed to implement the decisions reached at the UN Conference on Human Environment held at Stockholm in 1972.

Fundamental rights under the constitution have served a quick means of relief to people in cases of the environment. Right to life and personal liberty guaranteed under article 21 has been interpreted by the Supreme Court to also include right to a wholesome environment. The Supreme Court and the High Courts under articles 32 and 226 of the constitution have expanded the scope of providing relief in cases relating to environmental pollution and resource degradation. Article 21 which guarantees right to life has been interpreted by the Supreme Court in Subash Kumar v/s State of Bihar and Virender Gaur v/s State of Haryana to include right to clean and healthy environment.

Radioactive pollution certainly endangers clean environment. Article 38 which states State shall strive to promote public welfare also empowers it to take action against those industries who release radioactive wastes. Article 42 stresses that State must make provision to ensure just and human conditions to work. A workplace which exposes its workers to harmful radioactive rays denies human conditions of work. Article 48 and Article 51A- (g) strives to protect and improve environment and imposes duty upon citizens to protect and improve natural environment, respectively. Both Article 48 and Article 51-A (g) were held important and must be taken in to mind when issues pertaining environment are raised.

The Lacunas and Critical Analysis of the present laws-

The Atomic Energy Act 1962 (33 of 1962) is supposed to serve a few specific purposes: enhancing the safety of the "ordinary citizens" of India; safeguarding India's natural resources and talents for the country's development; and controlling and using atomic energy for the welfare of Indians and for other peaceful uses.

In reality, this law has failed miserably on all counts. Instead, it is used for a few other anti-people purposes: to threaten the critics who disagree with the authoritarian Department of Atomic Energy (DAE), to undermine the democratic fabric of the Indian society and to help private profiteers reap rich dividends at the cost of public safety and costs.[4]

Enhancing Safety:

Providing the basic regulatory framework for all activities related to atomic energy program and the use of ionizing radiation in India, Sections 3 (e) (i), (ii) and (iii), 16, 17 and 23 of the Atomic Energy Act, 1962 address the safety concerns. The regulatory body designated by the Central Government is the competent authority for granting, renewing, withdrawing and revoking consents for nuclear facilities. This body also exercises control over nuclear installations and the use of radioactive substances and radiation generating plants outside such installations. Section 16 and 17 of the Act refers to control over radioactive substance and special provisions for safety. Section 23 empowers the regulatory body with administration of Factories Act 1948, including enforcement of its provisions, appointment of inspection staff and making of rules in the nuclear installations.

The Central Government had appointed Chairman, Atomic Energy Regulatory Board (AERB) as the 'Competent Authority' to exercise the powers conferred on it in the various Rules such as the Radiation Protection Rules, 1971; Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules, 1984; Atomic Energy (Safe Disposal of

[4] The Hazardous Mix: A Peculiar Act and the Perilous Energy by S. P. Udayakumar (October 22, 2004)

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Radioactive Wastes) Rules, 1987; Atomic Energy (Factories) Rules, 1996; and Atomic Energy (Control of Irradiation of Food) Rules, 1996. As far as radioactive substances are concerned, AERB is empowered to enter any installation and take samples under the Environmental Protection Act, 1986 and to receive information on excess discharge of pollutants under the Environmental Protection (Amendment) Rules, 1987.

Similarly, when it comes to radioactive air pollution and radioactive wastes, the provisions of Atomic Energy Act, 1962 and rules made there under cover these issues rather than the relevant rules and AERB becomes the authority to enforce directions and procedures as per the Atomic Energy Act, 1962 with respect to radioactive substances under Rules 2(b) and 3 of Manufacture, Storage and Import of Hazardous Chemical Rules (1989) under the Environmental Protection Act, 1986.

This all-powerful AERB with a wide range of functions to lays down safety standards and frame rules and regulations to carry out its mandate was set up in November 1983. When A. Gopalakrishnan, the AERB Chairman from 1993 to 1996, submitted the Safety Issues Report that ordered several procedures and corrective actions in Indian nuclear installations, "the BARC management refused outright to comply with [them]" (Frontline, June 24, 2000). In fact, in April 2000, Dr. R.Chidambaram, the then secretary of DAE, simply took away the authority of the AERB to oversee the safety of a large number of critical nuclear installations meant for the weapons program in the Bhabha Atomic Research Centre (BARC). An Internal Safety Committee set up by the BARC director became responsible for ensuring the safety of the public and the workers from dangers that could emanate from these facilities. Thus the safety norms and provisions of the Atomic Energy Act 1962 stood seriously compromised.

Safeguarding Natural Resources:

The Atomic Energy Bill 1948 which Pandit Jawaharlal Nehru moved in the Constituent Assembly of India (Legislative) on April 6, 1948 ensured the state control of atomic minerals. The Parliament repealed the Atomic Energy Act 1948 when it passed the Atomic Energy Act 1962 and the new Act was quite comprehensive about the discovery of uranium or thorium (section 4), control over mining or concentration of substances containing uranium (section 5), disposal of uranium (section 6), power to obtain information regarding materials, plant or processes (section 7), power of entry and inspection (section 8), power to do work for discovering minerals (section 9), compulsory acquisition of rights to work minerals (section 10), compulsory acquisition of prescribed substances, minerals and plants (section 11), compulsory acquisition not sale (section 11-A), compensation in case of compulsory acquisition of a mine (section 12), and novation of certain contracts (section 13). Despite this painstaking coverage of all aspects of uranium and thorium discovery inside India, several

Private operators are mining the coastal sand in southern Kerala and southern Tamil Nadu indiscriminately. They extract thousands of metric tons of ilmenite, sillimanite, zircon, garnet, and most importantly, monosite that contain thorium, uranium and certium. The people of Kanyakumari and Tirunelveli districts in Tamil Nadu have been agitating against these sand barons whose unscrupulous activities have triggered massive sea-erosion, increased the amount of natural radiation, undermined fishing, and caused havoc in the overall environment. The enormity of the operation and the severity of the situation are so huge that the Member of Parliament of Nagercoil constituency has recently asked the DAE officials not to let private operators handle the rare earths that contain atomic minerals and insisted that the Central Government institutions alone process the atomic minerals (Dinamalar, Nov 2, 2004). But the Atomic Energy Act 1962 has simply been a paper tiger crouching in front of the big-money business and big-time corruption.

Atomic Energy for Indians' Welfare:

The Atomic Energy Act 1962 is expected "to provide for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith." The atomic adventurism of May 1998 and the subsequent weaponization hoopla that resulted in the 2002 Kargil war and the near nuclear annihilation in the subcontinent speak amply about the contribution of atomic energy "for the welfare of the people of India." The use of atomic energy "for other peaceful purposes" would become clear if one were to look into the track record of the DAE and the humongous amount of money, time, energies and natural resources it has swallowed over the past fifty years to spit out a meagre two percent electricity of India's total power generation.

One of the chief dangers of Jim Crow legislations is that they can be implemented in a manner that was violative of the Constitution and international treaty obligations of the concerned country. The Atomic Energy Act 1962 has indeed become a potent weapon for the DAE officials to threaten and silence the opponents and critics and shun any public dissension to their plans and projects. As a matter of fact, Dr. R. Chidambaram did warn openly and blatantly the anti-nuclear power activists in and around Koodankulam in southern India that the Atomic Energy Act 1962 would be used against those who spread "canards" against the upcoming nuclear power project there. All local Tamil dailies reported this public warning to the advantage of the DAE and there was no opposition to this highhandedness from any quarter.

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Section 3 of the Atomic Energy Act 1962 enables the Central Government "to declare as 'restricted information' any information not so far published or otherwise made public" and "to declare as 'prohibited area' any area or premises" where "production, treatment, use, application or disposal of atomic energy or of any prescribed substance" is carried out. Leaping much further, section 18
(Restriction on disclosure of information) restrains nuclear information sharing even more stringently. To make matters worse, the Supreme Court ruled in January 2004 that the Central Government had every right to maintain secrecy about nuclear installations and deny public information about these in the interest of national security, which was paramount. Although our Constitution guarantees us the right to information vide Article 19(1)(A), these are, according to the court, subject to reasonable restrictions in the interest of national security. Rejecting a petition by the People's Union of Civil Liberties (PUCL) and the Bombay Sarvodaya Mandal for making
public a government report on safety of nuclear installations, submitted by the Atomic Energy Regulatory Board (AERB) to the Delhi government in November 1995, the Court ruled that the petitioners were "not entitled" to get the document declared as "secret" by the Union Government under Section 18 of the Atomic Energy Act 1962.
It is important to note that the petitioners did not ask for any information about India's nuclear arsenal or its storage site or anything like that but expressed a genuine concern that there was not enough safety precautions in nuclear power stations in the country and any accident could have a disastrous affect on human beings, animals, environment and ecology. The petitioners had moved the Supreme Court after the Bombay High Court had rejected their petition in January 1997. The petitioners had also raised doubt about the safety aspect with regard to disposal of nuclear waste.
The Atomic Energy Act 1962 allows arbitrary suppression of all information --patently unconstitutional, according to V.R. Krishna Iyer, a widely respected legal luminary in India. The DAE is easily one of our most secretive departments and has much to hide: uranium mining hazards in Jadugoda, excessive irradiation of power-plant workers, waste mismanagement, and numbers regarding explosive yields. When a former Captain B.K. Subba Rao questioned the DAE's nuclear sub
(Advanced Technology Vessel) project, a spectacular Rs. 2,000 crore failure, he was charged in 1988 with spying with the ludicrous evidence of his IIT-Bombay Ph.D. thesis for "espionage" and jailed for 20 months--until fully exonerated by three different courts. Without any transparency, accountability, parliamentary oversight or popular scrutiny and with unlimited funding, 'sacred cow' status, innocuous 'science and technology' label, and the 'national security' jingoism, the DAE is an undemocratic and anti-people department. By making it possible for the DAE parivar (family) to keep several 'incidents' and 'accidents' under wraps and to persist with the authoritarian tendencies and practices, the Atomic Energy Act 1962 clearly undermines India's democratic heritage too.
There is an added danger now that the DAE is looking into ways of making amendments in the Atomic Energy Act 1962 in order to have private participation in the future nuclear power programs. Talking to reporters after inaugurating the Reverse Osmosis Plant and participating in the 'Bhoomipooja' for the construction of turbine building and other civil structure at Koodankulam on August 1, 2002, the chairman and managing director (CMD) of Nuclear Power Corporation of India Ltd (NPCIL) V. K. Chathurvedi said that NPCIL's proposal in this regard was under the consideration of the Central Government. The latest word is that amendment to the act is under consideration at various levels. Once the amendment is passed in the Parliament, rich power barons could invest in the nuclear power program and reap high dividends while the Indian state would subsidize nuclear research, enrichment of fuels, disposal of nuclear wastes, decommissioning of plants etc. with public funds. Thus the Atomic Energy Act 1962 would facilitate the fusion of secretive state, careerist DAE and greedy capitalists for private profit and the fission of Indian citizens' safety, health and futures for several generations to come. All this shouldn't be surprising to us after all. As is the department, so is the law. Instead of getting its act together, it all together gets into wrong acts.
Laws generally come from religion with clear notions of right and wrong, traditional customs and practices, and from the lawmakers. In the globalized world, laws also sneak in from corporate boardrooms, technocratic conclaves and other such caucuses of capitalist coolies. Knowing how to read and reinterpret these laws and to recover the human agency is a very crucial aspect of being a citizen of a democracy today. In that spirit, every Indian should be aware of the Atomic Energy Act 1962.
The Indian nuclear industry is able to hide behind an oppressive ‘Official Secrets Act‘ and is not directly accountable to the people for its actions. All nuclear research including health physics and health test of affected populations are hidden by this Act.
- In the absence of any official initiative to find out the health status of the people living around the mine, in 1993, Bindrai Institute for Research Study and Action conducted a survey in seven villages within a kilometre of the mining site, specifically the tailings dams. It took two years to complete the survey.

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- The report revealed that 47 per cent of women suffered from disruptions in their menstrual cycle, 18 per cent said they had suffered miscarriages or given birth to still born babies in the last 5 years. 30 per cent suffered fertility problem. Nearly all women complained of fatigue, weakness and depression. Further, the survey found a high incidence of chronic skin diseases, cancer, TB, bone, brain and kidney damages, nervous system disorders, congenital deformities, nausea, blood disorders and other chronic diseases. Children were the most affected. Many were born with skeletal distortions, partially formed skulls, blood disorders and a broad variety of physical deformities. Most common is missing eyes or toes, fused fingers or limbs incapable of supporting them. In addition, the researchers found that 30,000 people living within 5 kilometres of the mining area were exposed to abnormally high levels of radiation.

The IAEA Safety Standards stress the importance of establishing a national policy for safety by means of different instruments, statutes and laws. They specify that the regulatory body, as designated by the Government, has to be assigned with the implementation of the safety policy by means of a regulatory program and a strategy set forth in its regulations or in the national standards.As per the Constitution Order1983, AERB was specifically entrusted with the function of developing safety policies in both radiation and industrial safety areas. It was expected to develop a radiation safety policy under this responsibility, along with next level safety documents in the form of codes, standards, guides and manuals.While the radiation protection rules had been put in place, AERB had not prepared a radiation safety policy, even after nearly three decades of its existence.

AERB failed to prepare a nuclear and radiation safety policy for the country in spite of a specific mandate in its Constitution Order of 1983. The absence of such a policy at a macro-level can hamper micro-level planning of radiation safety in the country.

Non-development of radiation safety codes, guides and standards-

It is observed that AERB, after 18years of its existence, had brought out a Safety Guide in 2001, specifying a provisional list of safety documents which comprised codes, standards and guides to be prepared by it. AERB identified 148 codes, standards and guides for development under various thematic areas. On a subsequent re-assessment, it deleted 25 safety documents and added another 45 safety documents in the provisional list, for development. We observed that out of 168 safety documents, 51 were issued before release of the Safety Guide in 2001 and 90 were issued during the period 2001 to 2012.

AERB had developed 141 of the 168 safety documents that it was expected to develop. It is observed that the Meckoni Committee in 1987and the Raja Ramanna Committee in 1997 had stressed upon the need for hastening the process of development of codes and guides.

Safety in Nuclear Plants-

When it comes to safety, the existing compilation of safety-related unusual occurrences indicates a high degree of human errors and equipment failures. Installation-wise, the overall safety status can be gauged from the following:[5]

Tarapur power station (TAPS-1 and 2)-

The two boiling-water reactors at Tarapur are of 1969-vintage U.S. design. All similar reactors around the world have been shut down for reasons of safety. The two reactors at the Tarapur Power Station (TAPS) share the same subsystems, including the emergency core cooling system, in violation of all safety standards of today. The inerting of the TAPS containment with nitrogen was long discontinued by the DAE, and operation in the present mode could lead to a containment explosion in case a loss-of-coolant accident (LOCA) happens. Many parts of TAPS reactors are not inspectable, nor do Indian scientists have the tools or the technology for doing this. After 1974, no spare parts or assistance have been coming from the United States The two steam generators in each unit are totally disabled owing to extensive tube failures and because of this TAPS has been de-rated from 200 MWe to 160 MWe. It is evident that TAPS-1 and 2 should have been shut down long ago in the interest of public safety.

Rajasthan Atomic Power Station (RAPS-1 & 2)

RAPS-1 and 2 are the two oldest Pressurised Heavy Water Reactor (PHWR) nuclear power units, built with Canadian assistance. RAPS-1, which was originally rated at 200 MWe, had to be de-rated to the 100 MWe level, after an end-shield showed cracks and consequent leakages. In RAPS-1 and 2 and the Madras Atomic Power Station-1 (MAPS-1), 3.5 per cent nickel stainless steel was used to make these shields, which led to radiation embrittlement and cracking.

The nuclear fuel in the PHWRs is housed within a pressure tube (P.T.) which passes through a calandria tube (C.T.) with a gas-filled gap between them. In the first seven Indian PHWRs, P.Ts were made of zircalloy-2, which was later found to be prone to creep deformation under irradiation. Canadian PHWRs have all been fully changed over to P.Ts fabricated out of

[5] Issues of nuclear safety, Frontline, Vol. 16 :: No. 06

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a zirconium-niobium alloy. The reactors at RAPS-1, MAPS-1 and 2, the Narora Atomic Power Station-1 and 2 (NAPS-1 and 2) and the Kakrapar Atomic Power Station-1 (KAPS-1) will have to be re-tubed en masse between six and eight full-power years. Otherwise it could lead to a serious LOCA, as happened in Canada in 1984. RAPS-2 has recently been retubed, but the degree of quality control and reliability are questionable. Another very serious safety deficiency in the four reactors at RAPS and MAPS is the absence of an adequate high-pressure emergency core cooling system (ECCS), which is crucial for avoiding core-meltdown in the case of a LOCA. In a LOCA that occurs as a result of a medium-sized pipe break, which is more likely, the coolant in the fuel channels could vaporise and cause voids, leading to a partial core meltdown. No PHWR anywhere in the world currently operates with such an obsolete and unsafe ECCS as the ones at RAPS and MAPS.

Madras Atomic Power Station (MAPS-1 and 2)

In the early 1980s, the discovery of some pieces of zircalloy in a moderator pump in MAPS Unit-1 was traced to the problem of substantial cracking of the reactor inlet manifold. An identical problem surfaced in MAPS-2 almost during the same period. Instead of fabricating the manifolds as an integral unit as per Canadian advice, at MAPS the DAE fabricated each manifold in three sections and then joined them within the calandria. The poor quality control in such work, done within a confined space, has led to the cracking. The MAPS reactors were de-rated from 235 MWe to 175 MWe because of this and their continued operation in this mode is not considered safe, even at this power level. The P.T.-C.T. contact problem and the inadequate ECCS system, as in RAPS, also exist in MAPS-1 and 2. Thus, the synergy of different kinds of serious safety issues in MAPS-1 and 2 puts this station at a higher risk than will be acceptable anywhere else in the world. And Chennai city is within 30 kms of MAPS.

Narora Atomic Power Station (NAPS-1 and 2)

One major modification at NAPS-1 and 2 was the inclusion of a fourth level of safety protection through the gravity addition of boron solution (GRAB) into the reactor core, as a last-level protection in the event of a prolonged station power blackout. Just that eventuality occurred on March 31, 1993 in Narora Unit-1 when a devastating fire brought the reactor core very close to partial fuel meltdown. The timely use of the GRAB system saved the day. In 1985, an overheated cable joint at RAPS-2 caused a fire, which spread through the cable trays and disabled four out of eight PHT pumps. In 1991, a fire in the KAPS-1 switchgear room led to a complete loss of emergency diesel power and a partial loss of D.C. power supply. Then came the NAPS-1 fire in March 1993.The DAE does not seem to have learnt from its experiences.

The 1993 fire was initiated by two steam turbine blades which broke at their roots and caused the turbine's destruction. Faults in the blade of the design in similar turbines were detected by the turbine designer, GEC of the United Kingdom, a few years prior to the Narora fire. In 1989, GEC promptly provided a revised blade design to the Indian manufacturer and it, in turn, prepared detailed drawings for fabricating and supplying new blades for NAPS, KAPS and Kaiga. But the DAE did not take any action on the warning from the GEC, until months after the Narora fire.

Kakrapar Atomic Power Station (KAPS-1 and 2)-

In June 1994, flood waters entered the condenser pit and the turbine building basements in the KAPS reactors because sealing arrangements were not provided to prevent water ingress through cable trenches and valve pits. Similar flooding had occurred twice at RAPS in 1976 and 1982, owing to the very same construction errors as at KAPS. The first-generation microprocessor-based indigenous control system of the Bhabha Atomic Research Centre (BARC) has been introduced at KAPS. There have been instances of dangerous and erratic behaviour, such as a shutdown rod coming out when signalled to go into the reactor. The new systems introduced from BAPC are not tested thoroughly for their reliability; no appropriate facility for such testing exists with the DAE.

Kaiga Nuclear Power Project (Kaiga)

The Kaiga project was substantially delayed because the pre-stressed concrete containment dome in Unit-1 collapsed on May 13, 1994 during the final stages of construction. The AERB Investigation Committee's findings, which were later accepted in toto by the Atomic Energy Commission (AEC), showed that the failure occurred owing to design deficiencies and the absence of quality control. In the Kaiga-1 and 2 and RAPS-3 and 4 projects, the AERB had directed that integrated ECCS testings be carried out in each reactor before start-up, proof and leakage tests be conducted on the reactor containments, and a full-scope simulator installed for operator training. None of these stipulations have been met by the DAE.

Other DAE installations

Safety standards at the research reactors at BARC leave a lot to be desired. The 100 MWth Dhruva reactor and the 60 MWth CIRUS reactor are in BARC's Trombay complex. The safety culture in BARC is generally poor, even in comparison to the nuclear power stations. There have been instances of a reactor being started up with an operator inadvertently locked inside a room below. There was also an incident of operating the Dhruva reactor for almost one month

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with an emergency coolant system valve closed tight. The bursting of underground pipelines carrying radioactive fluids within the BARC campus, which has contaminated hundreds of tonnes of subsoil, and leaky tanks holding lakhs of litres of highly radioactive fluids not being replaced or repaired are some of the other instances.

The situation in the DAE's fuel reprocessing and fuel fabrication units is no different. High levels of air-borne radioactive dust and minor explosions in active chemical reactors are not rare. Workers at uranium mines and the extraction plant in Jaduguda and the Nuclear Fuel Complex in Hyderabad are not adequately protected from radiation intake and external exposure.A PROBLEM with assessing safety is that all radiation measurements and exposure evaluations are done by health physics personnel employed by the DAE. The AERB has no facilities or personnel to do this. Even in the nuclear power stations, the DAE personnel stationed there carry out the measurements and the DAE then provides the data to the AERB. These DAE physicists, however, receive a monthly bonus from the Nuclear Power Corporation (NPC), which is in proportion to the quantum of energy produced. If a reactor is shut down on the recommendation of a station health physicist, he loses his bonus. The reader can guess how honestly the data will get reported to the AERB in this situation.

Safety issues in DAE installations

It is evident from the above that the safety status in the DAE's facilities is far below international standards. In July 1995 the AEC asked me, in my capacity as Chairman of the AERB, to make a brief presentation on the DAE's safety status. The discussion at this meeting was an eye-opener to the non-DAE members of the Commission. The Prime Minister's Secretary and the Cabinet Secretary thereafter informally directed that the AERB must prepare a more comprehensive document on safety. After four months of serious effort by the AERB staff and after referring to more than 700 of the DAE's own documents, the AERB prepared a report titled "Safety Issues in DAE Installations". It covered about 130 safety issues, of which 95 are of top priority. This document was discussed and approved by the AERB at its 46th meeting on November 7, 1995 and then submitted to the AEC.The document generated heated discussions at the next meeting of the AEC held in February 1996, after which the AEC gave the AERB the clearance to proceed as it felt proper. This decision was taken at the insistence of the Prime Minister's Office and the Cabinet Secretary and the Finance Secretary, and was not that of the DAE members in the AEC or the DAE Secretary. To date, however, it is not known whether any concrete action has been taken on this report, even though the present Chairman of the AERB, asserts to the press that "every issue is being seriously looked into". Top-priority deficiencies still exist, and the AERB is far from being proactive as it used to be in the 1993-96 period.

In June 1994, the IAEA organised a Diplomatic Conference to adopt the final text of the Convention on Nuclear Safety. I was the head of the Indian delegation to this conference and was unanimously elected Chairman of the 16-nation Drafting Committee for the Convention. The Convention, based on the text submitted by this committee, was adopted on June 17, 1994. India was one of the first countries to join the Convention in September 1994.Article 8-2 of this Convention reads: "Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organisation concerned with the promotion or utilisation of nuclear energy."With the present arrangement, under which the AERB reports to the AEC and, in effect, to the Secretary, DAE, it is evident that India is in deliberate violation of this international Convention, to which it is a party.

CONCLUSION

The Indian Environmental Law on the question of radioactive pollution needs to be updated as per the needs and requirement of the global development so as to prevent both macro as well as micro level radioactive pollution. Indian Environmental Law is mostly concerned with macro level radioactive pollution. The safety status of nuclear energy installations in India is not compatible with international standards, and that it is due to the absence of an independent regulatory body which has serious implications for public safety. AERB is not an independent authority and is under the control of Central Government.