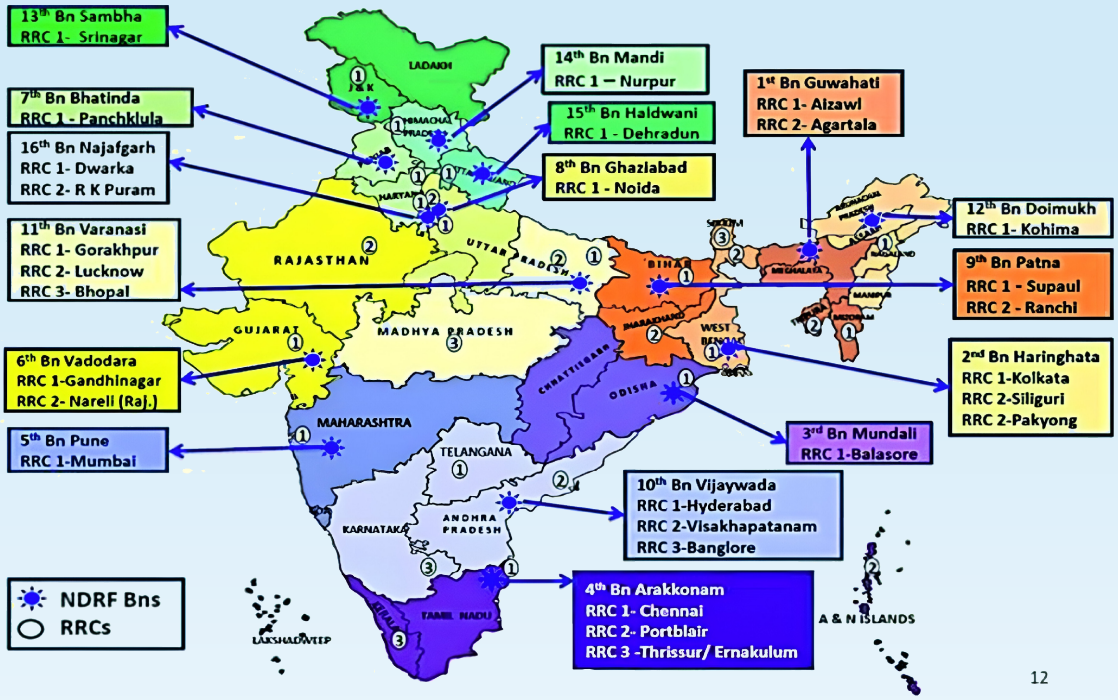
INDIAN NUCLEAR SOCIETY NEWS LETTER

NDRF Locations



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INS Executive Committee 2025-2027

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President's Message

Present EC (16th since inauguration of INS in 1988) assumed office on 22nd June, 2025. At the outset, I will like to thank wholeheartedly INS members for reposing faith in newly elected EC which got into action from the day one. Sub committees for Outreach / Seminar, Training, Newsletter, Website, FTGS, Nuclear Policy Studies were formed to focus on the INS activities as per the mandate of society. It is heartening to observe that these Committees have been functioning extremely well and getting support from many distinguished INS members who have been closely connected with the prestigious nuclear programs of the country for decades. It was a privilege for INS to start the activities of present EC with a seminar by Prof. V. Rangarajan on a path breaking medical feat of treating a 17-year-old boy suffering from relapsed neuroblastoma by administering 800 millicuries of I-131, making it the largest dosage ever used in India. It is desirable that INS outreach programs reach all sections of society as policy makers are amenable to the voice of a common man in the street. Beginning was made in this direction by organizing a program for defense veterans on 27th July,2025. There are several activities in the offing related to Outreach, Training, Certification Courses and preparation of document on national mission of 100GWe nuclear power by 2047 by various sub committees.

Friends, present EC is indeed fortunate to be in office at a time when the nuclear industry globally as well as at home is responding fast to the challenges of increasing demand of uninterrupted, high-density energy with low greenhouse gas emissions. Blanket of dark clouds gathered over nuclear industry in the aftermath of Fukushima is withering away gradually and the world is gearing up to accelerate the contribution of nuclear power to meet the global target of net zero carbon emissions in 2050. It is gratifying to learn that about 400 reactors are either under construction (70) or are planned (100) and proposed (~300) across the world. Incidentally, this number is similar to the currently operating reactors worldwide. Even with conservative estimate of the success of planned projects, it has the potential to alter the global landscape wrt nuclear power in the next 2-3 decades. However, unlike the present geographic scenario of operating reactors, most of the upcoming reactors are in Asian countries characterized by fast-growing economies and rapidly-rising electricity demand of these countries.

There has been particular interest to develop GEN IV technologies to address to nuclear safety, waste, proliferation and public perception concerns apart from the capital investment . The six conceptual designs viz., the gas-cooled fast reactor (GFR), the lead-cooled fast reactor (LFR), the molten salt reactor (MSR), the sodium-cooled fast reactor (SFR), the supercritical-water-cooled reactor (SCWR) and the very high-temperature reactor (VHTR) have received attention from the nuclear technology researchers of Gen IV international forum. China was the first country to operate a demonstration generation-IV reactor, the HTR-PM in Shiadown, Shandong, which is a pebble-bed type high-temperature gas-cooled reactor. It was connected to the grid in December 2023, making it the world's first Gen IV reactor to enter commercial operation in 2024.

There has also been resurgence in the concept of Small Modular reactors driven by the advantages such as enhanced safety features, modular design, lower upfront costs through factory pre-fabrication, greater siting flexibility for remote or brownfield locations, and scalability to meet evolving energy demands, notwithstanding higher per unit cost and nuclear waste production. This concept has gained traction from advocates of captive plants to meet the specific requirements of AI and data centres as well as industries located in remote areas like mining, cement, desalination and hydrogen production. It is interesting to note that Russia is currently the only country with SMRs operational since 2020. Russia's Akademik Lomonosov, a floating nuclear power plant with two KLT-40S reactor units (each 35 MWe) has been operational since May 2020 providing power and heat in Pevek, Chukotka. In addition, Russia has several SMRs under design and construction. On the other hand, NUWARD in France and NuSCALE / HOLTEC / TERRA Power / X-Energy in USA are also engaged in developing designs of a variety of SMRs.

India too is vigorously positioning nuclear energy as a major pillar in its energy mix aiming to emerge as a global leader in advanced nuclear technology. The provisions for nuclear power in the Union Budget 2025-26 mark a transformative shift in India's energy landscape. The government has set an ambitious target of 100 GW nuclear power capacity by 2047. This development is in sync with the broader objectives of ensuring energy reliability and reducing dependency on fossil fuels. By promoting nuclear energy as a sustainable, scalable, and secure power source, the government aims to bolster energy security and meet the nation's long-term economic and environmental goals. A key highlight of the Union Budget 2025-26 is the launch of a Nuclear Energy Mission, which is focused on research and development (R&D) of Bharat Small Reactors as well as Small Modular Reactors (SMRs). The government has allocated ₹20,000 crore for this initiative, aiming to develop at least five indigenously designed and operational SMRs by 2033.

INS is gearing up to meet the expectations of INS members and society at large to play its role as a catalyst to meet the challenges encountered in the national mission of 100GWe nuclear power. It is working on the possible roadmap to achieve this formidable target. Human resource development and aligning public perception with this mission through outreach programs are the key areas of focus.

Friends, INS is proud of its large pool of members, who have decades of experience in various facets of nuclear science and technology. This is perhaps our unique strength. INS EC is committed to meet the aspirations of members by dedicating itself to the tasks to meet the challenges presented by ambitious national nuclear mission. At the end, I would like to congratulate the Editor and members of the Editorial Board of INS Newsletter for this inaugural issue and wish them best in their efforts to make it as an instrument of communication with INS members on the contemporary issues related to nuclear science and technology.

Vijay Manchanda

From Editor`s desk

Greeting to fellow members of INS

The new executive committee took charge of INS management during end June 2025. EC immediately constituted a committee of three EC members and suggested to co-opt INS members with domain expertise in nuclear science and engineering for compiling contemporary articles/news/reviews/interviews/reports/views for the newsletter. I am happy to mention here that the committee earnestly took to the task of soliciting interesting articles and reports from the potential contributors. I am glad to present to you the first newsletter of the present EC. Now-a-days with ease of access to updated information, it is a challenge to select and compile relevant articles. I earnestly hope that the contents of this News Letter will be of interest to members. I also urge members to visit the INS website any time to access archived News Letters.

Year 2024-25 has been a year of great opportunity for nuclear industry like never before. Thanks to the climate change followed by global push for nuclear energy. When INS organised international conference INSIC-2023, it was clear from the participation of industry leaders that nuclear is being looked as key player in the energy mix to power growth without emission. India responded with equal rigour by declaring targets to achieve net-zero carbon emission. Today, it is amply clear that nuclear has a central role if hard to abate industries have to accelerate growth and boost country`s economy. While NPCIL is rightly focusing on adding 700 MW PHWR plants and accelerating construction of PWRs through international cooperation, PSUs and eventually private players will have to chip-in with investment and commitment to add nuclear capacity to the grid. In all a win-win game for nuclear. However, who-so-ever enters the nuclear business, will have to stand by the responsibility of safely operating the plants all the time and assure safety for general public. It is to be borne in mind that robust nuclear technology and public acceptance are the two pillars for the success of nuclear program.

In this NL issue, we have one interesting article on “Can we afford to be afraid of nuclear power?” It is trying to show that nations with low-energy consumption and high-income exist. In those countries prosperity and energy are separable. Yet carbon emission has reached dangerous levels in general warranting early replacement of fossil fuels with something that’s always on, potent and emissions-free. Nuclear reactors meet these ideals. They are dispatchable, industry parlance for reliable. France built 56 nuclear reactors between 1973 and 1999 cutting the fossil fuel share of electricity in its grid from 65% to less than 10%. GDP per capita rose by 58% over the same period. By going nuclear the contradiction of growth without emission was effectively addressed.

Radiological emergencies occur due to natural or factors beyond human control. Such emergencies will have to be so managed that it minimise risks to health, life and the environment through well-established pre-planned structural and non-structural measures by all the stakeholders. Though India has enviable and impeccable record of safety and virtually fail-safe arrangements in all our nuclear & radiological establishments, the possibility, however, remote it may be, of human error, systems failure, sabotage, earthquake and terrorist attacks leading to the release of radioactive matter in the public domain, cannot be entirely ruled out. The article on radiological

challenges and the all-important role of National Disaster Management Authority (NDMA) in mitigating the consequences in public sphere is brought out by domain expert.

The newsletter has summary reports on one INS lecture and one outreach program. Both the programs were well attended by scientific community and appreciated the content and relevance. The outreach program was specially designed for defence veterans for the first time. The scientific information shared with them on three topics; benefits of nuclear science, nuclear technology and safety were liked by one and all.

As a regular practice, Independence Day was celebrated in the INS premises by hoisting the national flag and rendering national anthem. INS / AERWA members and the members of the Executive Committee of the INS as well as of the Managing Committee of AERWA participated with great enthusiasm.

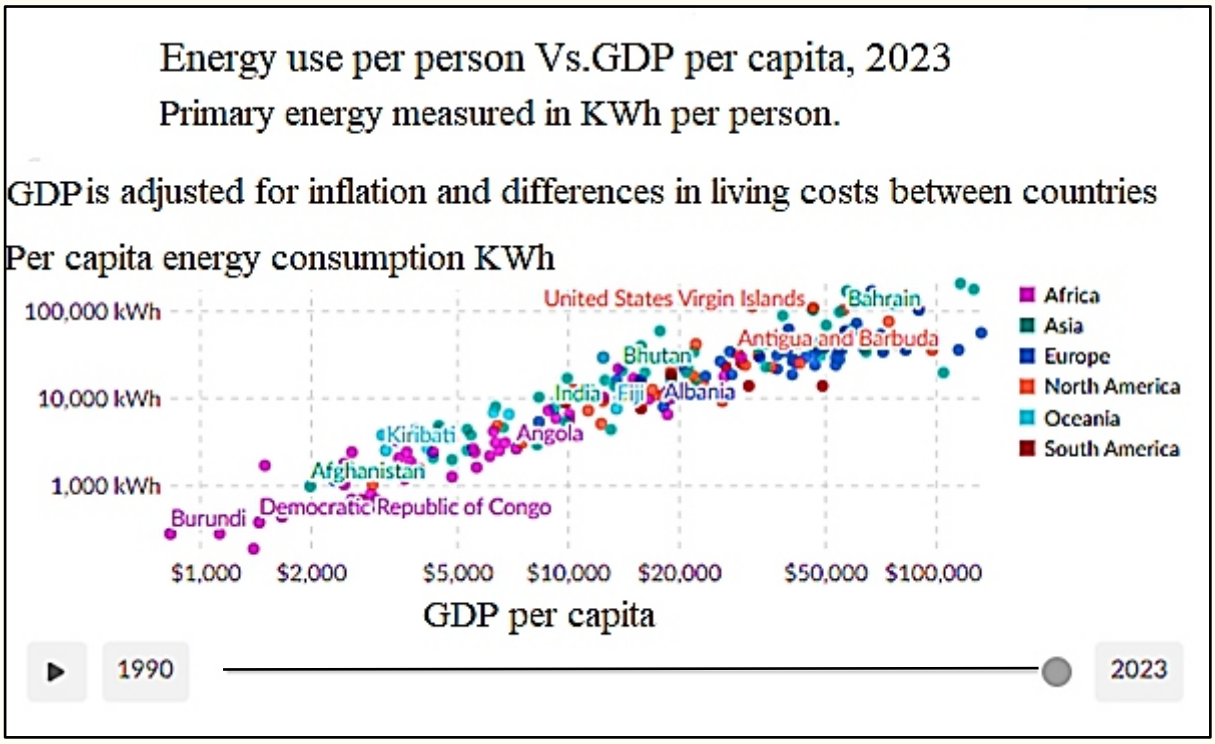
A. Rama Rao

Can we afford to be afraid of nuclear power?

Tim Gregory Sun 6 Jul 2025 14.00 BST
The Guardian

Money can buy comfort, but energy makes comfort possible in the first place. Energy is the great enabler of the modern world. It connects the globe by moving people and hauling goods. It loosens the grip of the weather by warming our homes in winter and cooling them in summer. It connects the globe by moving people and hauling goods. It loosens the grip of the weather by warming our homes in winter and cooling them in summer. It forges the steel that raises our cities and synthesises the fertilisers that keep half the world's population from starvation. It increasingly empowers us by electrifying the technologies we rely on daily.

It is also the great enabler of socioeconomic development. Monetary wealth and energy abundance move in lockstep: plot a graph of GDP per capita against energy consumption per capita, and you'll draw a straight line. Low-energy, high-income nations do not exist. Prosperity and energy are inseparable; you cannot have one without the other.



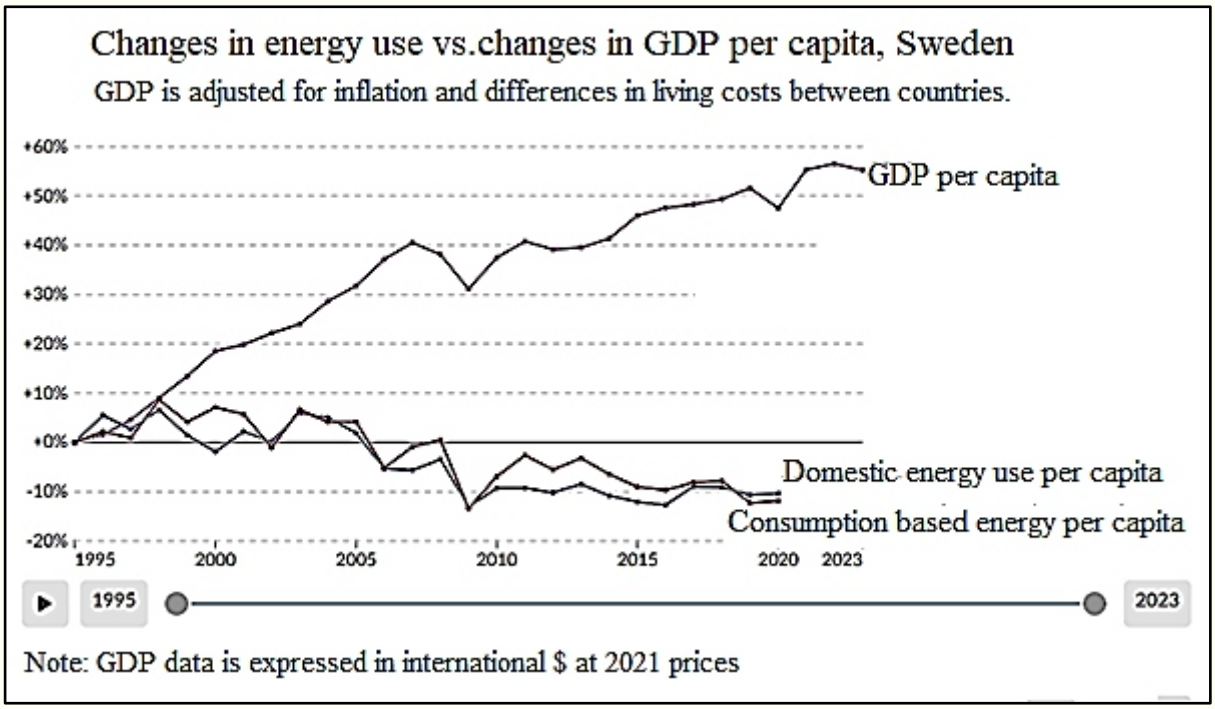
Sure, GDP per capita isn't a perfect measure of socioeconomic development. It says nothing about how evenly that wealth is distributed, for instance. But it remains an excellent barometer, and one that all nations actively strive to raise, particularly less wealthy ones.

Today, 700 million people live in extreme poverty (defined as living on less than $2.15 per day). They won't climb out of it without access to more energy. Making as much energy as possible available to as many people as

possible ought to be a defining goal of the 21st century.

But there is an elephant in the room: the climate emergency. Our energy supply is responsible for three-quarters of our global greenhouse gas emissions. Plot a second graph, this time of carbon emissions per capita against energy consumption per capita: you'll draw another straight line. So, how do we promote energy abundance and the prosperity it enables without sacrificing the natural environment?

The answer is not to use less energy. Only a handful of countries; the UK, Sweden, Switzerland, Denmark and the USA, for example have managed to decouple GDP from energy. They've grown richer over the past few decades, even though their energy consumption per capita has flat lined or even declined. But these countries are outliers: rich, highly developed economies with infrastructure already in place. For the vast majority, the link between energy and prosperity remains unbroken. Denying the developing world access to abundant energy would be a profound moral failure, not to mention an act of breath taking hypocrisy. The answer is not less energy, but cleaner energy, and more of it.



Wind and solar power are often offered as the solutions. But their power is intermittent, energy industry jargon for "unreliable". They're fundamentally constrained by meteorology and celestial mechanics: wind turbines falter on still days, and solar panels don't work on the side of the Earth facing away from the sun (colloquially called "night-time"). I would love to live in a world where wind and solar alone could replace fossil fuels, but there's no beating the laws of physics.

To replace fossil fuels and support renewables, we need something that's always on, potent and, crucially, emissions-free

Nuclear reactors meet these ideals. They're dispatchable, industry parlance for reliable. A single one generates enough electricity to power the lives of 2 million average Europeans, even after accounting for downtime and maintenance. And they don't emit carbon dioxide.

"But doesn't nuclear take too long to build?!" Not necessarily. Between 1973 and 1999 France built 56 nuclear reactors with a median construction time of just six years, cutting the fossil fuel share of electricity in its grid from 65% to less than 10%. (Incidentally, France's GDP per capita rose by 58% over the same period.)

It's true that sluggish build times torment the west today. Flamanville 3, France's first and only reactor of the 21st century so far, was supposed to take five years to build but ended up taking 17. Hinkley Point C – the UK's first since 1995 – is still a construction site seven years after breaking ground; the British government recently announced another power station – Sizewell C – will be online by the mid-2030s, but many fear the actual completion date will recede quickly into the future. Across Europe, the median build time since the year 2000 has dragged out to almost a decade. But it's not a problem with nuclear power per se; it's a symptom of the west's chronic inability to deliver large pieces of infrastructure, an ailment that affects everything from laying high-speed railway lines, to building new housing estates, to filling in potholes.

By contrast, rapid build times remain the norm in other parts of the world. China's median build-time since 2000 is five years and 10 months; South Korea's is six. The delays experienced by the west are regulatory and managerial failures, not technological ones.

There's also a perception that nuclear power is dangerous, yet the data show it's as safe as wind and solar. People believe that it's expensive, yet the International Energy Agency finds it to be "the least cost option for low-carbon generation". Perhaps it's bad for the environment? Well, the United Nations Economic Commission for Europe concludes it has the lightest ecological burden of any power source. And how on earth do you solve the problem of nuclear waste? Finland – with a grid that's 40% nuclear – has a working geological storage solution.

In fact, nuclear power's biggest obstacle is its terrible PR. It's the monster of the energy world, but like all monsters, the reality is rather different. It's a tragedy that we've been splitting atoms in nuclear power stations for longer than we've known we were causing the climate to change.

Solving the energy problem solves a tangle of others: economic, humanitarian and environmental. I envisage a future where nuclear reactors – complemented by wind turbines and solar panels – power the world. A future where clean, constant and plentiful energy awaits, and where prosperity doesn't cost the earth

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https://www.theguardian.com/books/2025/jul/06/can-we-afford-to-be-afraid-of-nuclear-power

Nuclear and Radiological Emergency, National Perspective: Key issues & Challenges

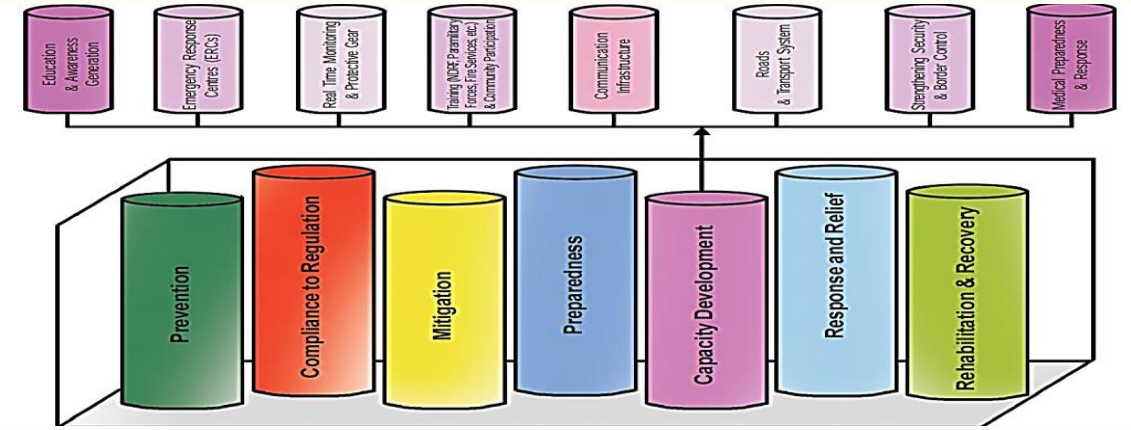
(S K Ghosh, Former Head DRI, AERB and Former Sr Consultant, NDMA, sujay11a@gmail.com)

1.0 Introduction to Nuclear and Radiological (N&R) Emergency Preparedness:

The Indian National Vision is to prevent nuclear and radiological emergencies which are essentially man-made in nature. However, in rare cases of their occurrence, due to natural or man-made factors beyond human control, such emergencies will be so managed through certain pre-planned and established structural and non-structural measures by the various stakeholders, that it minimise risks to health, life and the environment.

Even while we have an enviable and impeccable record of safety and virtually fail-safe arrangements in all our nuclear & radiological establishments, the possibility, however, remote it may be, of human error, systems failure, sabotage, earthquake and terrorist attacks leading to the release of radioactive matter in the public domain, cannot be entirely ruled out. This article briefly describes the N&R emergency management framework, roles and responsibilities of stakeholders, key issues, challenges and initiatives taken at national level.

The Mainstays of the Nuclear/Radiological Emergency Management Framework



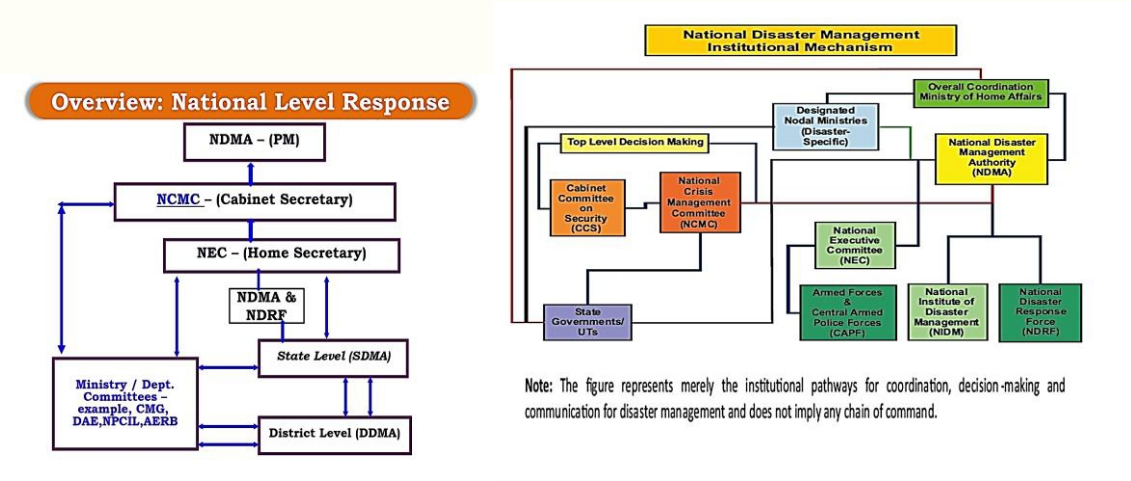
2.0 Changes in Regulatory Requirements:

Based on the lesson learned from Mayapuri Radiological incident & Fukushima Daiichi NPP accident, safety regulations in AERB have under gone a lot of changes to prevent such incidents in the future. Through e-licensing system (e-LORA) of AERB, all the radioactive sources in public domain are continuously monitored and tracked. All NPP design should demonstrate that during accident like Design Extension Condition (DEC) without core melt (multiple failure situations and rare external events), there is no necessity of protective measures in terms of sheltering or evacuation for people living beyond Exclusion Zone, no

necessary control on agriculture or food banning to be limited to a small area and to one crop. And during Severe Accident (Design Extension Condition with core melt), there is necessity to demonstrate that no permanent relocation of population is needed and the need for offsite interventions is limited in area and time.

3.0 Coordination Structures for N&R Emergency at National Level:

The overall coordination of disaster management rests with the Ministry of Home Affairs (MHA). The Cabinet Committee on Security (CCS) and the National Crisis Management Committee (NCMC) are the key committees involved in the top-level decision-making with regard to disaster management. The National Disaster Management Authority (NDMA) issued guidelines on "**Management of Nuclear and Radiological Emergencies**"and "**Manual on Medical Management of Nuclear and Radiological Emergencies"** and SOPs to handle unforeseen radiological incidents/ accidents. These documents provide further necessary guidance. The following figures represent the overall institutional pathways for coordinated decision making and communication for disaster management including N&R emergency.



4.0 Responsibility Framework for N&R Emergency:

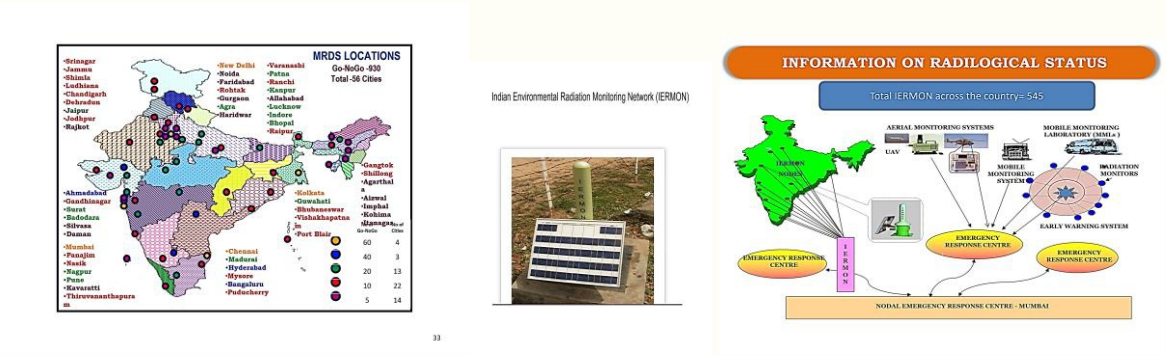
The complex and extensive nature of the task of building disaster resilience is presented in a concise form along with the responsibility framework in National Disaster Management Plan (NDMP) 2019. The main stakeholders in nuclear emergency response are the Ministries of Home Affairs, Defence, Health and Family Welfare, Transport, Railways, Civil Aviation, Urban Development, Earth Sciences, Petroleum and Natural Gas; and Departments of Atomic Energy, Space, India Metrological Department and other concerned central and state departments; scientific and technical institutes; professional bodies like Indian Nuclear Society(INS); nongovernmental organisations; corporate sector; and the community.
The table below is the summary/extract of the table provided for N&R emergency management in NDMP-2019, (Refer table-7.14 for further detail).

Roles and Responsibilities of Stakeholders		
Function	**Agencies**	**Role**
Preparedness	DAE, NDMA, NDRF, DRDO, AERB*	Maintain stock of monitoring instruments, safety kits & first aids, setting of ERCs and Trained NDRF Personnel. *Appoint, and maintain areas wise details of RSO, trained medical personnel, first responders, trained volunteers, etc.
Monitoring and Warning network	DAE, MHA, MOD	Establish set ups for monitoring, warning systems including IERMON.
Warning, Information, Data	DAE, MHA, NEC, NDMA	Quick, clear, effective dissemination among central and state agency.
Setting reliable and dedicated communication network	NDMA, DDMA, SDMA, DAE	To set up reliable and dedicated communication network at national level with the help of MHA.
Response	DAE, MHA, NDMA, NDRF	Nodal ministries for central assistance.
Decontamination centre	DAE, SDMA, DDMA	Decontamination of radioactive particles.
Shelters	NDMA, SDMA, DDMA, ULBs	Identification of safe buildings and sites to serve as temporary shelters near nuclear installations, Construction of multipurpose shelters near nuclear installation,
Training	MHA, DAE, NDMA, NDRF	Enhancing public awareness, Training to SDRF and other stakeholders.
Developing Capability for response	MHA, NCMC, DAE, MOD, AERB	Prepare nuclear/radiological emergency management plan for metros and other important cites.
Awareness generation.	DAE, NDMA, NDRF, NIDM	Carry out Mass media campaign.
Curriculum Development	MHRD, DAE	Relevant subjects should be included in the school/college syllabus throughout the country.
Mock Drills / Exercises	DAE, NDMA, NDRF, AERB all Gov. Ministries	Promoting the planning and execution of emergency drills.
Setting Regulatory Standard and Improve regulatory cover.	AERB, DAE	Prepare and enforce Safety and regulatory requirements. To set up regional regulatory centres for better coverage of safety and regulatory aspects
Overall Governance	DAE	Providing co-ordination, technical inputs, and support.

5.0 Arrangement for N&R Emergency Management in Public Domain:

DAE has established 25 Radiation Emergency Response Centre (RERC) to deal with any N&R incident. The Emergency Control Room (ECR) is located at DAE Headquarter, Mumbai & also at NPCIL, Headquarter, Mumbai and they functions 24 x 7. BARC has installed 545 ~~of~~ Indian Environmental Radiation Monitoring Network (IERMON) at different parts of the country. IERMON provides online environmental radiation information during both normal and emergency situations.

NDMA implemented a pilot project, "Mobile Radiation Detection System (MRDS)" under which police personnel in 56 cities have been trained and equipped for management of radiological emergency in public domain. This project is expected to significantly enhance the safety status in public areas against mishandling, malicious use of radioisotopes, Radiological Dispersal Devise, transport accident, orphan sources etc. Radiation monitors are installed at major entry ports in India (Airport, seaports etc.). The figures below show locations of MRDS and IERMON.



6.0 Lesson learned from Fukushima Daiichi Nuclear Disaster:

This is the first major NPP accident in the internet age. Accordingly, internet information about the risks of radiation exposure increased public concerns. Emergency management plans in Japan at the time of the Fukushima Daiichi accident were inadequate to deal with the magnitude of the accident, requiring emergency responders to improvise. Decision-making processes by government and industry officials were challenged by the lack of reliable, real-time information on the status of the plant, offsite releases, accident progression, and projected doses to nearby populations. Coordination among the central and local governments was hampered by limited and poor communications. The on-going offsite response to the Fukushima Daiichi Accident amply demonstrates that clean-up and resettlement of evacuated populations (collectively described here as "recovery") is a complex process.

7.0 Key Issues and Challenges:

N&R emergency preparedness is very complex and multidimensional matrix that need to be addressed with various inputs parameters having many uncertainties (e.g source term, meteorological data, model use for prediction of dispersion, human behaviour, socio-economic impact etc) and the results are very sensitive to some inputs.

The following key issues need deep routed thoughts for successful management of N&R Emergency.

7.1 Role played by DC/DM in N&R Emergency Management

The most critical type of emergency of a NPP is an off-site emergency where members of the public get affected. Local administration particularly DC/DM and man power at DDMA and SDMA faces high turnover. Keeping them agile to manage off-site nuclear emergency is a challenging task. It is important to educate and regularly update the senior public functionaries like the district or state-level officials and first responders who have to manage the radiation emergency. This would also include RSOs, civil defence personnel and home guards, police and fire and emergency services personnel and medical professionals.

Risk appetite for scientific community/technocrat and administration/population/ministers are different. As information received through social media may create confusion to decision makers, utmost care need to be exercised before initiating action.

7.2 Handling of N&R Emergency like other Disasters

There is an issue of cultural dimension among local population. For all natural disasters, local population/common public through their previous experience manage the disaster by themselves initially without any support from government or administration. However, in case of nuclear emergency the required experience is missing and there are lot of ifs and buts in the mind of common public. This warrants a constant dialogue by faithful and trusted person/organization to build confidence among local population to alleviate the unreasonable fears about nuclear incidents, loss of house/property and permanent relocation.

7.3 Greater Role of State Disaster Management Authority (SDMA)

SDMA has a greater role for arranging all supports/logistics for Disaster Risk Reduction (DRR) including nuclear accidents. Presently the empowerment of local administrative authorities is not adequate. For offsite nuclear emergency, DC/DM/ Incident Commanders (IC) solely depends on states for all logistics and funds support. The required list of instruments, equipment and protective gear necessary for the various response teams need to be procured by the concerned SDMAs and DDMAs in advance for timely response action. SDMA should keep experienced N&R consultants to advise them regularly. This needs to be addressed by every states having operating NPP. SDMA should also take part during regular N&R emergency mock drill.

7.4 Decision Support System (DSS)

DSS is intended to provide comprehensive and timely information to emergency managers on an emergency situation arising from a nuclear accident. Based on the source term and weather conditions, DSS estimates the release of radionuclide concentration (in air and ground), the projected dose and exposure to public. These estimates are used to provide guidance for affected areas to take appropriate protective actions in the public domain to handle the emergency. The results of estimate are to be displayed on a Geographical Information System (GIS) platform for visualization and appropriate actions to be taken by decision makers. This information should also be made available to

central, state and district authority.

\7.5 Medical management of exposed personnel

The district authorities are responsible for medical management of public by establishing the required infrastructure and facilities. Triage should be conducted based on traditional Medical and Surgical considerations. Generally, radiation dose is not immediately life threatening, hence co-morbid medical/surgical conditions requiring priority attention should be addressed first. Suitable training should be given to medical practitioner (both general & emergency medical staff) for making them aware of clinical symptoms of radiation exposure. Since radiation injuries are uncommon, these aspects always take a back seat. Managing the sick due worry but are physically fit is also equally difficult. Regular training of doctors should be continued.

7.6 Radiation Monitoring during Emergency

Detailed procedures and the capability for radiation monitoring of the affected area and population during an emergency may be available at the respective ESLs attached to each NPP site. However, adequately trained manpower, logistic & infrastructure and coordination with operating organization, NDRF, SDRF, DC/DM etc need to be holistically evaluated. Radiation dose monitoring/ limits for all emergency workers need to be documented and made available to all stakeholders in advance. Laboratories for testing/ sampling of foodstuffs and water to be identified in targeted regions by Ministry of Health & Family Welfare (MoH & FW).

7.7 Effective Implementation of National Guidelines and Verification of Compliances

For the effective implementation of the National Guidelines, it is extremely important that the various plans at different levels of administration for disaster management of nuclear/radiological emergencies/disasters are mainstreamed into the developmental process and the necessary allocation of funds are obtained from the concerned ministries/departments of central and state governments with assistance of the planning commission.

7.8 Priority on Sheltering over Evacuation

General public would prefer sheltering over evacuation. The choice of sheltering should be done after making proper assessment of risk of radiation exposure due to the movement of plume with other external hazards taken into consideration.

7.9 Creating a Pool of Radiological Safety Officers (RSO) at the National Level

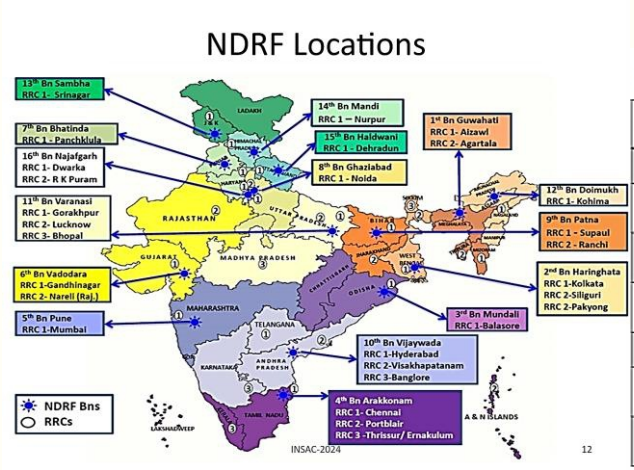
A nationwide capability for utilisation of the services of a large number of RSOs for managing large-scale nuclear disasters should be considered on priority. RSO database should also be made available to SDMA, NDMA and MHA.

8.0 Recent Initiatives by MHA, NDMA and NDRF:

Like conventional disaster management plans, N&R emergency plan is also implemented following a bottom-up approach, where the community, in association with individuals, non-governmental organisations, community-based organisations, private sector, etc., will develop and implement

the emergency management programme tailored to their local needs. Hon'ble Home minister took a briefing meeting from NDMA and NDRF in 2022 about their role during N&R emergency. After detail review, the Hon'ble HM gave few important directions for further actions by all stakeholders. Based on the directions, the followings initiatives are taken by all the stakeholders.

1) At present NDRF have 16 Battalion spread across the country. MHA directed NDRF to deploy one team in each district, nearest to NPP location. Existing NDRF team locations and its distances from each NPP have been shown in Figure below. NDRF is in the process of augmenting its team with 34 additional RRCs. NDRF has several trained RSOs & required expertise to act quickly. It was also noted that NDRF is a deputationist force wherein the trained officials of CBRN get repatriated to their respective CAPFs after completion of their tenure. Necessary directions are issued by MHA to the various CAPFs to make available those trained manpower, in case of any emergency.



Location of Nuclear Sites & nearest NDRF Establishment

S.N.	NAME OF NUCLEAR SITES	DISTRICT / STATE	NEAREST NDRF UNIT/RRC	APPROXIMATE DISTANCE FROM NPP	Proposed RRC/Bn loc.
1.	Kakrapar	Surat/ Gujarat	06 Bn Vadodara/ Gujarat	165 km	-
2.	Kalpakkam	Kancheepuram/ Tamil Nadu	RRC Chennai, Tamil Nadu (04 Bn)	71 km	-
3.	Narora	Bulandshahr / Uttar Pradesh	08 Bn Ghaziabad, Uttar Pradesh	122 km	-
4.	Kaiga	Uttara Kannada/ Karnataka	RRC Bangalore Karnataka (10 Bn)	486 km	Goa, 5 Bn (120 Km)
5.	Rawatbhata	Chittorgarh / Rajasthan	RRC Nareli / Ajmer (06 Bn)	257 km	-
6.	Tarapur	Palghar/ Maharashtra	RRC Mumbai / Maharashtra (05 Bn)	121 km	-
7.	Kuddankulam	Tirunelveli/ Tamil Nadu	RRC Thrissur / Kerala (04 Bn)	383 km	Tirunelveli (TN), 4 Bn (80 Km)

INSAC-2024

2) Presently, NPP officials provide training to the identified District Administration Officials, including the Responsible Officer / Incident Commander, prior to conduct of Off-Site Emergency exercises at NPPs and to the new DC/DM immediately after they take charge in the respective districts. Based on the direction from MHA, NDMA initiated half yearly feedback meeting with all the DC/DMs responsible for managing offsite emergency. High level team comprising of officials from NDMA, NDRF, SDMA, DDMA and district health services regularly visit NPP sites. Few photographs taken during important activities are shown below.



3) On clarity of accident progression, MHA inquired how long it takes to provide an assessment for initiating response in public domain. On this, it was informed to MHA that, analysis have shown that minimum response lead time will be in days for initiating higher level responses calling for actions in the public domain. This is true even in the case of the most severe emergency situation conceivable, which will have extremely low probability of occurrence and hence very unlikely to happen. MHA also asked DAE to analyse the latest nuclear disaster data to validate the assumptions of analysis.
4) For hotline communication and road connectivity, DAE was advised to include them in the minimum regulatory surveillance for the new NPP, so that these requirements become integral part of the planning and design of NPP sites. It was ensured that hotline communication has been established for all seven NPP sites and evacuation routes around all the existing NPPs are already identified and documented as a regulatory requirement.
5) Regarding health sector preparedness to handle N&R emergency, considerable work has been done by MoH&FW. Construction of ten (10) secondary level Chemical Biological Radiological &Nuclear (CBRN) medical management centres at designated urban/semi-urban/rural hospitals under the central sector scheme "Health Sector Disaster Preparedness and Response have

been taken up. Training of doctors and medical staff on treatment of CBRN related injuries on regular basis is being done by MoH&FW and database is maintained.

9.0 Way forward to meet vision 2047:

9.1 GIS-based Digitized Emergency Preparedness Plan and Response System

Modern emergency preparedness and response systems depend largely on GIS for ensuring effective and prompt response. At present, response plans in the vicinity of nuclear power stations and cities are based on the data collected from census and conventional maps. They do not have GIS-based databases and digitised maps of appropriate scale, which are required to make full use of the software tools available for impact assessment and decision making for the management of emergencies. Some works have already been initiated for few NPP sites. However, it should be integrated for all seven existing sites and merged with national response system. The state governments, assisted by MHA, should take expeditious initiatives for completing this task.

9.2 Use of Digital Technology for Management of N&R Emergency.

There is a need for speedy dissemination of disaster alerts to maximum persons in order to ensure preparedness, both by the common person as well as the responding agencies. NDMA has conceived a National Project "COMMON ALERTING PROTOCOL (CAP) BASED INTEGRATED ALERT SYSTEM (SACHET)" to integrate the Alert Generating Agencies (IMD, CWC, INCOIS, DGRE, FSI), Alert Disseminating Agencies (TSPs, TV, Radio, Cable TV, social media, Indian Railways, Coastal Sirens, GAGAN etc) and the Disaster Management Authorities (SDMAs) on a CAP based platform. This should be utilized for N&R emergency also.

The mobile applications are developed by IAEA to prevent, detect, and respond to incidents of the illicit trafficking and theft of nuclear and other radioactive material. Likewise Tools for Radiation Alarm and Commodity Evaluation (TRACE) and the Personnel Alarm Assessment Tool (PAAT) may also be useful. Work need to be initiated to develop mobile Apps for N&R emergency management.

9.3 Enhancing Public Awareness about Nuclear/Radiation Hazards

The lack of public awareness is a major constraint in handling and objectively responding to N&R emergencies. Further, presently there is no mechanism for maintaining a knowledge base or case studies in the public domain on the events of previous emergencies and their consequences. As a result, the lessons that should have been learnt from the handling of those emergencies have been lost sight of. To overcome this, sincere and concerted efforts are needed to create awareness amongst the general public with the target audience of school and college students, teachers, technocrats and government officials.

9.4 Strengthening the Disaster Management (DM) Communication Infrastructure

A reliable communication infrastructure is one of the key elements in any response mechanism. Presently, the DM communication linkage from the district

to the state headquarters and then to the national level (including linkages with DAE with regard to a radiation emergency) is neither dedicated nor adequate. The creation of a dedicated National Disaster Communication Network (NDCN) is on the anvil at NDMA as a part of the mitigation project. It is an important requirement because public networks like landline telephones and mobile or cellular phones are the first to collapse due to a sudden increase in traffic in the event of an emergency.

9.5 Social inclusion for DRR of N&R Emergency.

Hazards do not discriminate based on human social conditions, but human responses to disasters often do. Existing socio-economic conditions mean that disasters can lead to different outcomes for demographically similar communities, where the most vulnerable groups also suffer disproportionately on multiple counts compared to others. Latest NDMP-2019 has a dedicated chapter on these aspects.

At Fukushima, about 90% of deaths were for persons above 66 years of age. Severe health risk was associated with the rapid evacuation of elderly population. The world is ageing. Globally, 10% of the world's population is already over the age of 60. As on 2022, 149 million people in India were aged 60 or older, which was 10.5% of the country's population. The population of PWD in India, as per census 2011, is 2.68 Cr, which is 2.2% & majority live in rural areas. The elderly population is expected to surpass the number of children (aged 0 to 15 years) by 2047. We need to consider this aspect while making an attempt to evacuate during unexpected N& R emergency.

Acknowledgement: I would like to express my gratitude to MHA, NDMA, NDRF, DAE and AERB. Inputs, pictures and diagrams have been used in this article are mainly from open literatures, website and my interactions/association/work with the above said organizations. I must also place on record my sincere gratitude and appreciation for the guidance and constructive suggestions made by Shri S K Mishra and Dr A. Rama Rao.

Snippets on recent developments in energy sector aimed to fight climate change.

Advancements in Steam Turbine Efficiency for Modern Power Generation: Reducing Costs and Emissions
Steam turbine technology is not stagnant. Advanced designs are incorporating innovations in blade design, advanced materials, precision manufacturing, and high-energy steam cycles, delivering significant
https://www.powermag.com/advancements-in-steam-turbine-efficiency-for-modern-power-generation-reducing-costs-and-emissions/?utm_source=omeda&utm_medium=email&utm_campaign=pwrgasdirect+eletter&oly_enc_id=1950A0974023F5V

September 2025 Power Magazine
https://www.nxtbook.com/accessintelligence/POWER/pwr-re-tech_september-2025/index.php

Aalo Atomics Secures Capital, Regulatory Backing for 2026 Modular Nuclear Project at INL, Eyes Potential First Data Center Pairing
Advanced nuclear firm Aalo Atomics has secured new capital and regulatory backing to complete construction of its 10-MWe Aalo-X reactor at Idaho National Laboratory (INL). The project, recently selected under…
https://www.powermag.com/aalo-atomics-secures-capital-regulatory-backing-for-2026-modular-nuclear-project-at-inl-eyes-potential-first-data-center-pairing/?utm_source=omeda&utm_medium=email&utm_campaign=pwrnews+eletter&oly_enc_id=1950A0974023F5V

Debunking Nuclear Power's Biggest Misconceptions and Why It's Needed Today
Despite nuclear power's unmatched ability to produce reliable, carbon-free energy at scale, it is often dismissed by clean energy advocates in favour of renewable resources like wind and solar. Cost…
https://www.powermag.com/debunking-nuclear-powers-biggest-misconceptions-and-why-its-needed-today/?utm_source=omeda&utm_medium=email&utm_campaign=pwrnews+eletter&oly_enc_id=1950A0974023F5V

How Biogas Is Solving Data Canters' Clean Energy Challenge

https://www.powermag.com/how-biogas-is-solving-data-centers-clean-energy-challenge/?oly_enc_id=1950A0974023F5V

Green Hydrogen Production Group Closes on Major Investment
A California-based hydrogen production group said it has completed a funding round in support of the company's first 100-kilotonne carbon dioxide removal (CDR) commercial facility. Equatic, which is considered a…

https://www.powermag.com/green-hydrogen-production-group-closes-on-major-investment/?utm_source=omeda&utm_medium=email&utm_campaign=pwrnews+eletter&oly_enc_id=1950A0974023F5V

Nuclear Industry Ponders Risks of Building New Reactors
Everybody is now jumping on the pro-nuclear bandwagon. With U.S. electricity demand ramping up due to the rapid build-out of energy-intensive data canters across the country, there is finally broad…

https://www.powermag.com/blog/nuclear-industry-ponders-risks-of-building-new-reactors/?utm_source=omeda&utm_medium=email&utm_campaign=pwrnews+eletter&oly_enc_id=1950A0974023F5V

Groups Partnering to Develop AI Software to Speed Nuclear Reactor Construction
A software group that uses artificial intelligence (AI) to help automate processes said it was joining with a nuclear power deployment company on an AI-driven system to accelerate construction of…

https://www.powermag.com/groups-partnering-to-develop-ai-software-to-speed-nuclear-reactor-construction/?utm_source=omeda&utm_medium=email&utm_campaign=pwrnucleardirect+eletter&oly_enc_id=1950A0974023F5V

A European consortium whose goal is to develop Eagles-300, a next-generation lead-cooled small modular reactor (SMR) that could be commercialised and deployed globally in 2039, has signed an agreement with three regulators to officially begin an international pre-licensing initiative.
European SMR Consortium Signs Agreement With Three Regulators To Begin Pre-Licensing Initiative

IAEA Completes Research Project On Security Of Nuclear Supply Chain: The International Atomic Energy Agency has completed a research project to address counterfeit, fraudulent and suspect items in the nuclear supply chain.
https://www.iaea.org/newscenter/news/tackling-counterfeit-items-in-the-nuclear-supply-chain

Nuclear power will remain part of South Korea's energy mix while the government works to rapidly reduce coal, oil and natural gas as part of its efforts to tackle climate change, environment minister Kim Sung-whan said.
South Korea Will Not Pursue Complete Nuclear Phaseout, Minister Says

US-based Flowserve and India's Core Energy Systems Ltd have formed a collaboration to locally manufacture primary coolant pumps for India's pressurised heavy water reactor (PHWR) nuclear plants in a "landmark" move that accelerates the realisation of the US-India 123 Agreement.
Coolant Pump Collaboration Accelerates Realisation Of US-India Nuclear 123 Agreement

A nuclear energy renaissance could create a shortfall in the supply of uranium with output from today's mines expected to halve between 2030 and 2040 as existing deposits are exhausted.
Nuclear Renaissance Could Create Shortage Of Uranium Supply, Says WNA

France's president Emmanuel Macron and Germany's chancellor Friedrich Merz have agreed to recognise the role of nuclear power in Europe's energy transition, potentially ending years of friction between the countries over energy policy, including subsidies for reactors.
Macron And Merz Agree To Recognise Role Of Nuclear In Europe's Energy Transition

Clean Core 'Granted Licence' To Export Thorium Fuel To India: For just the second time in nearly two decades, Washington has granted an export licence to a US company planning to sell nuclear technology to India, MIT Technology Review reported.
https://www.technologyreview.com/2025/08/29/1122839/this-american-nuclear-company-could-help-indias-thorium-dream/

Dr Shivram Bhoje

9th April 1942 to 16th September 2025

Shivram Baburao Bhoje, a distinguished Indian nuclear scientist and Padma Shri awardee of 2003, passed away at his Kolhapur residence on 16th September afternoon. Indian Nuclear Society pays deep homage to the departed soul.

Late Bhoje remembered by his former colleague Shri K K Vaze, Former Group Director, BARC

My tribute to my senior and more than that my Guru Late S B Bhoje

After graduating from BARC Training School in 1974 I had opted to join IGCAR (then Reactor Research Centre RRC) and I had the good fortune to work with Shri Bhoje for 15 long years. That was a golden period of my career, learning new things and applying them to the structures and components of Fast Breeder Test Reactor as well as to PFBR.

Under his guidance I got to learn many new things such as finite element method, use of SAP4 code for stress analysis, ASME Code Section III with novel concepts such as Primary and Secondary stresses and earthquake engineering with concepts like response spectrum, OBE, SSE etc.

When the French government curtailed the co-operation after our Peaceful Nuclear Explosion in 1974, it brought in a period of challenges and struggle. Shri Bhoje was the main person of the team who overcame all the challenges and made FBTR operational in 1985.

Long before that, when French reactor RAPSODIE on which FBTR design was based; developed leakage, Shri Bhoje took it upon himself to fully understand the root cause and design and implement a suitable modification in FBTR to avoid its recurrence. FBTR continues to be a flagship of IGCAR even today.

Shri Bhoje had played a pivotal role in Design and Development of PFBR. I remember the days when the conceptual design of PFBR was being documented with design notes on the major components: Main Vessel, Roof Slab, Core Support Structure, Grid Plate etc. The Second Stage of Homi Bhabha's Three Stage Program was taking shape.

His mantra to us was work hard, understand the basics as well as the state-of-the-art and use it in your work. Sadly, PFBR has encountered various problems during commissioning and is yet to be operational.

Bringing PFBR to criticality and then to full power will be the best tribute that we can pay to Padma Shri S. B. Bhoje, one of the pioneers of the Fast Reactor Programme in India.

Report on Lecture Titled

I-131 MIBG Therapy (1995-2025) in India

Speaker: Dr V Rangarajan, Head, Dept. Of Nuclear Medicine & Molecular Imaging, Tata Memorial Centre, Mumbai

Venue: Multipurpose Hall, TSH, BARC

Time & Date: 1100 hrs, 12th July 2025

Indian Nuclear Society organised a talk by Prof. V. Rangarajan, Head, Dept. of Nuclear Medicine & Molecular Imaging, Tata Memorial Centre at 11 AM on Saturday, 12th July, 2025 at Multipurpose Hall, TSH, Anushaktinagar. Dr D.K.Shukla, Chairman AERB graced the occasion as the Chief Guest of the programme.

The talk covered the history of radiotherapy treatment using I-131 during the period 1995-2025 with a special mention on the recently completed successful treatment of a 17 year old boy suffering from aggressive form of relapsed Neuroblastoma cancer with a very high radiation dose for the first time in the country. This was carried out after obtaining proper authorization from AERB. Prof. V. Rangarajan was closely involved in successfully treating the teenager using 800mCi of I131-MIBG at ACTREC, TMC (in collaboration with BRIT, AERB and BARC).

Radio Chemistry and Isotope Group (RCIG), BARC had carried out the relevant research for the radioisotopes and BRIT had developed the same for the treatment purpose.

The programme was attended by the invited guests; CE, BRIT, AD, RCIG, BARC, Dr. R.B. Grover, Member AEC, Senior officials from BARC, BRIT, AERB, INS members and the Members of INS executive committee.

The programme began with the welcome speech by Dr. H. Mishra, Member EC, INS and coordinator of the programme. As a part of his welcome speech, Dr. Mishra welcomed the Chief Guest, Guest speaker and other guests with flower bouquets and introduced the members of the new Executive Committee of INS.

This was followed by the address of Prof. V. K. Manchanda, President, INS who briefed the audience about the INS activities. He called upon the members to interact with the society actively as this synergy will make INS a vibrant body which can address the issues related to nuclear science and technology in more effective manner.

This was followed with felicitation of the Guest Speaker Dr. Venkatesh Rangarajan by the Chief Guest Shri D.K. Shukla and the President INS. In his address the Chief Guest Dr Shukla highlighted the positive and the proactive role played by AERB in

evaluating application and suitability of the high radiation dose to the boy, without any undue risk to the patient, medical professionals and the other people/ patients during the treatment. He further stated AERB was thoroughly involved along with other experts in working out appropriate shielding requirements and confirming the same during mock-up run. After the proper assessment, authorization was granted to ACTREC/ TMC for the treatment.

The programme ended with a vote of thanks by Shri SK Bhatia Secretary INS , followed by the national anthem.

Chief Guest Shri D K Shukla, Chairman AERB being felicitated

Prof. V Rangarajan, Head, Dept of Nuclear Medicines & Molecular Imaging, TMC, Mumbai being felicitated.

Welcome address by Dr H Mishra

President INS, Dr. V K Manchanda addressing the gathering

Group photo after the lecture by Dr Venkatesh Rangarajan

Report of INS Outreach Programme for Defence Veterans on

Benefits of Nuclear Science & Technology

Venue: Auditorium Niyamak Bhavan A, Anushaktinagar

Time & Date: 10:30 AM, 27th July 2025

The Indian Nuclear Society (INS) successfully organized an outreach programme for Defence Veterans on "Benefits of Nuclear Science & Technology" on Sunday, 27thJuly 2025 at 10:30 AM at Auditorium, Niyamak Bhavan A, Anushaktinagar. The event was aimed at informing defence veterans and creating awareness in them about the peaceful applications of nuclear science and technology. The programme was well attended by invited guests including gallantry award winners and members of the INS Executive Committee.

The event was graced by the Chief Guest **Shri V. Bhasin, Director, BARC**, and the Guest of Honour **Brigadier S. Madan**. They were felicitated by honourable EC members.

Programme Highlights:

The programme commenced with a warm welcome address by **Dr. H. Mishra**, Member, Executive Committee, INS and the coordinator of the event. This was followed by a brief yet insightful address by **Prof. V. K. Manchanda, President, INS**, who introduced the audience to the activities of the Indian Nuclear Society and highlighted the broad spectrum of benefits offered by nuclear science and technology in various sectors.

Guest of Honour, Brigadier Madan shared his personal experiences and the profound sacrifices made by soldiers in the service of the nation. His address deeply moved and resonated with the audience. **Shri S.K. Bhatia, Secretary, INS** felicitated the Guest of Honour with INS memento**.**

The Chief Guest, was then introduced by **Dr. H. Mishra** and invited to deliver his address. The chief guest elaborated on the significant contributions of nuclear science and technology in both power and non-power domains. He emphasized the pivotal role these applications play in personal life's of common man, national development, healthcare, agriculture, security and in environmental sustainability. He was felicitated by President INS with INS memento.

A special segment of the programme was anchored by **Dr. Archana Mishra**, Member, Executive Committee, INS who introduced the Nao Sena Medal (Gallantry) awardees to the audience. These decorated veterans were felicitated by the Chief Guest, and President, INS. They were also presented with INS mementos. In addition, Major Koustubh, Coordinator of Defence Veterans and Colonel Manoj Sinha were also felicitated by hon. EC Members. Latter also shared their insightful reflections on the Kargil War and India's continuous efforts towards regional peace and stability.

This was followed by the technical session featured with three distinguished talks:

Dr. Y. K. Bhardwaj delivered a captivating talk on "Non-power Applications of Nuclear Science & Technology for Prosperity & Self-Reliance", highlighting the critical role of nuclear technologies in societal development.

Shri S. K. Sinha presented an informative talk on "Nuclear Reactor Technology", focusing on its current developments and future prospects.

Dr. S. Gangotra concluded the session with an engaging talk on "Nuclear Safety, Security, and Non-Proliferation", emphasizing global collaboration and India's commitment to responsible nuclear practices.

All the speakers were felicitated by hon. EC members. They were also presented with INS mementos.

The event concluded with a Vote of Thanks delivered by the Secretary, INS and singing of the National Anthem.

President INS, Dr V K Manchanda addressing the gathering

Director, BARC addressing the gathering

Director BARC, Defence veterans and INS members in the audience

Gathering of defence veterans, audience and INS members stand to sing national anthem

Group photo after the outreach programme.

Independence Day celebrations on 15th Aug, 2025 at 11 AM at Project Square Anushaktinagar

INS and AERWA celebrated Independence Day together as the practice followed over the years reflecting the spirit of national unity. Shri Mahapatra, Director, DCSEM agreed to be the chief guest for the flag hoisting function inspite of his busy schedule on the important day. The program started with the welcome address by President, INS. He remembered the sacrifices and valour of all those who fought and brought independence to the country. It was followed by flag hoisting by Chief Guest and singing of national anthem. Shri Mahapatra in his brief address on the occasion paid his tributes to the heroes of our freedom movement and shared his vision of making Anushaktinagar a model township with respect to sports, educational and beautification plans along with conveniences. There was very good response from INS/ AERWA members. It was very colorful gathering with everyone sporting tricolour badge. Members exchanged greetings and remembered the importance of togetherness. President AERWA proposed vote of Thanks. Flag was lowered with reverence and packed gracefully in the evening.

Flag hoisting by Director, DC&SEM Shri Mahapatra in INS premises.