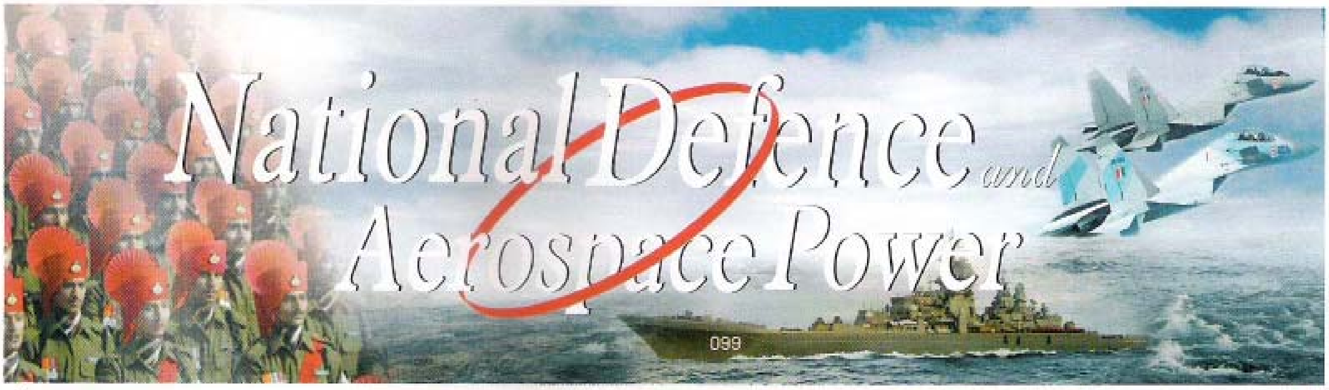

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RADIATION SAFETY: HOW PREPARED ARE WE ?

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Any incident involving nuclear facility or material expectedly invites media attention and public concern. It is hardly surprising about the Mayapuri incident that led to raising of many questions on the issue of nuclear safety and security in India. Both national and international media raised the question, *how prepared are we* to safeguard radioactive sources and tackle radiation disaster. The IAEA, while demanding an explanation from India, called it "the most serious global instance of radiation exposure since 2006".[1] But, a deeper understanding of the fact would reveal that the incident was not owing to the lack of our regulatory or technological competence, but because of the inevitable gap between the knowledge and technology we possess and the magnitude of challenges on the ground.

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The Material Involved

Given the interest generated in the subject, the moment appears right to take a serious look at some relevant issues. First of all, Cobalt-60, used in the Chemistry Department irradiator received from Canada in 1970, is an excellent gamma source, much more penetrating than alpha or beta radiation and has a much longer range. One microcurie of Cobalt-60 has a life span of more than one decade and emits 1332.5 KeV of energy.[2] This is used for various purposes – in fabrication work, especially steel welding, in radiotherapy for treating cancer, for food irradiation, in industrial radiography such as nucleonic gauges for thickness measurement, in well-logging operations, in research laboratories, etc.

In India, use of ionising radiation sources for various applications in different areas has registered phenomenal growth.[3] Radioactive materials used for industrial and medical applications are estimated at over 12,000 units[4] which include 300 telecobalt therapy units, 100 accelerators, over 2,000 Computed Tomography scan units, 150 nuclear medicine centres, 1400 industrial radiography cameras, 8000 nucleonic gauges and 14 gamma radiation processing plants.[5] Many more academic and research institutions might have unaccounted radioactive devices procured before the AERB was formed. Generally facilities and equipments that use radioactive materials including Cobalt-60 require license or authorisation by the AERB. In India, Cobalt-60 is supplied by the Board of Radiation and Isotope Technology and is imported under strict licensing process. Any replacement of Cobalt-60 used equipment needs AERB consent and must be returned to the original supplier. But security arrangement at facilities that use these materials, do not essentially accorded adequate attention. According to one viewpoint, "Physical protection at these sites is rather lax, at best comparable to the protection provided at a jeweller shop."[6]

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It is easy to point fingers towards the AERB as it has no inventory of radioactive materials sourced from abroad prior to its own existence. But, as per the end-user agreement, the onus is on the supplier to ensure return of the defunct radioisotopes. At best, the user could have taken the responsibility of their safe-keep or disposal. All these years, the BARC has been collecting the materials from the users for disposal. How the gamma cell irradiator of Delhi University was overlooked is undoubtedly a serious concern. First, the facilities that received such materials before the AERB was established have been unaccounted by it subsequently. Second, the personnel in charge of these materials in Delhi University have been retired and since the irradiator was not in use for 25 years, it was completely forgotten by the subsequent staffs in charge that it contained radioactive material. Third, neither the scrap market is equipped with radiation detection devices nor the scrap workers have any radiation awareness. So there exist serious gaps at each level, starting from the suppliers' responsibility to the users' onus, from waste disposal to the public awareness.

This does not mean that India has no capability to safeguard its radioactive sources or to quickly respond to radioactive disaster. In fact, Delhi Police could promptly trace the source of supply and BARC could effectively contain the situation. Also the medical team responded efficiently in saving some life. But what is worrisome is our complacency and callousness about possible accidents like this which no one has ever imagined. Considering the magnitude of radioactive materials used in the country and the security arrangement in place, there would be no guarantee that a Mayapuri like incident will not happen again.

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Indian vendors get large scrap consignment from distant places. They are transported to ship-recycling yard or industrial areas in the country that receive consignments from other countries. In India, Alang in Bhavnagar district of Gujarat recycles half of all the ships salvaged around the world. Even some scrap recovered after the collapse of the twin towers in the US is claimed to have come to Mayapuri.[7] Dealers in this market get scrap metals "from across the world", and "mostly from China".[8]

Who's Folly?

According to the National Hazardous Waste Management Strategy (2009) estimates, there are about 30,000 industries generating hazardous waste of the order of 6 Million Tonns per annum in the country.[9] As per the Hazardous Waste regulations, industries are required to store hazardous waste for a period not exceeding 90 days. The waste could either be recycled or disposed off in captive or common Treatment, Storage and Disposal Facilities (TSDF) available in every state. In this case, how this scrap from Delhi University slipped into the market is a matter of speculation.

As far as control over such material is concerned, Section 17 of the Atomic Energy Act 1962, specifically referred to making ensure safe use of radiation generating plants. Before the AERB was set up in 1983, the Directorate of Radiation Protection (DRP) was responsible for radiation protection programme including radiation surveillance in hospitals, industries and research institutes. It suggests that the coordination between the DRP and AERB was absent after the former was established. However, the AERB protocol prescribes strict regulations for their supply, maintenance, and disposal. It recommends the design, transport packaging, surveillance procedures through the Review Committee for Applications of Radiation (SARCAR) for all non-DAE installations. To receive and operate radiotherapy machine, the minimum requirement prescribed with fixation of responsibilities (Atomic Energy Rules 2004) are (a) hospital – the owner, (b) a licensee – head of the institution, and (c) radiation safety officers (RSOs). High intensity sources such as teletheraphy units, accelerators and radiation processing units require an RSO at Level III (most qualified), diagnostic nuclear medicine applications require RSO at Level II and simple diagnostic radiography units need to employ an RSO at Level I. Any other facilities that use radioactive material require individual license or authorisation by the AERB. The SARCAR recommend granting of authorisations for disposal or radioactive wastes generated in medical, industrial, agriculture and research applications under the Atomic Energy Rules 1987. Particularly, the Radiological Safety Division (RSD) is responsible for carrying regulatory inspections of all non-DAE radiation facilities. The gamma radiation processing plants are inspected once a year while radiotherapy units are inspected once in three years. Surprise inspections are also conducted periodically. Any unit that fails to carry out their duties as per AERB stipulations are asked to surrender their authorization certificates, and radiography sources are recalled.

A large number of radioactive consignments, nearly 80,000 per year, containing radioactive materials are being transported within, and many more also transit through, the country. A Committee on Safe Transport of Radioactive Material (COSTRAM) therefore has been constituted in May 2003 to review safety aspects of transport of these materials.

It may be true, many medical equipment under AERB's supervision are either defunct or malfunctioning but they nevertheless are controlled and on number of occasions the AERB has taken disciplinary actions against units for violating safety norms. In April 1995, the AERB sent directives to the Medical Superintendent of a Hospital in New Delhi and to the Health Secretary of Delhi State. Another such action was taken in October 2003 necessitating a ban on radiotherapy treatment by a unit in Delhi. While discharging these regulatory functions, the AERB also effectively handles problems of missing and orphan radioactive materials. In September 1993, it recovered three radioactive sources in Coovum River, allegedly stolen from the premises of a foreign company engaged in oil well-logging operations. Regarding the Mayapuri incident, one should understand how the 'Operation Cobalt' by the BARC team made the area safe by promptly locating and recovering the materials amidst huge scrap within 24 hours.

How Prepared Are We?

Though India has bad record of implementation, nevertheless it has formulated appropriate regulations, devised technological equipments for prompt response. A network of 18 Emergency Response Centres (ERC)[10] with skilled Emergency Response Teams (ERT), comprising the Aerial Survey Team (AST), Field Monitoring Team (FMT), Source Recovery Team (SRT), Assessment and Advisory Team (AAT), Medical Team (MT) and Bioassay Team (BT), have been established in different parts of the country, with BARC (Mumbai) as the nodal agency. As per provision, in case of any such incident, an urgent response would be extended after conducting a Quick Impact Assessment (QIA) through Impact Assessment Software (IAS) specially developed in BARC to predict the impact. As per the arrangement, the ERC nearest to the site of such incident will be activated by the centralised Emergency Communication Room (ECR – Mumbai) of the Crisis Management Group (CMG) of the DAE, on receipt of confirmation. The CMG coordinates between various state and central agencies to facilitate an effective response to such emergencies. During past few years, the first-responders – custom officials, police, fire brigade personnel and paramilitary forces – are being trained to handle radiological emergencies. State of the art monitoring systems and methodology are developed and kept in readiness in various parts of the country. Systems already developed by India and in operation are:

As India is preparing for a giant step in nuclear energy production and more nuclear materials would be used in the decades ahead, more innovative ways of reaching out to the gaps in our system of monitoring, response and damage control will have to be found.

1. The radiation detection devices or sensors are installed at vital places like airports and sea ports;

2. The Aerial Gamma Spectrometry System (AGSS) has been developed to be installed in aircraft for quick impact assessment by aerial surveys. Aerial Monitoring Methodology is developed for the quick assessment of large scale ground contamination, locating and identifying radioactive orphan sources, tracking of radioactive plume;

3. The Environmental Radiation Monitoring with Navigational Aid (ERMNA) system for periodic mobile radiation monitoring of major cities;

4. The Compact Aerial Radiation Monitoring System (CARMS) for remote aerial monitoring;

5. The Environmental radiation monitoring systems (Indian Environmental Radiation Monitoring Network-IERMON) with data transfer facilities to Emergency Response Centres;

6. For effective counter-measures and rescue operations, the Geographical Information System (GIS) is used to obtain details of the shelter locations, road network, buildings, population density, water bodies, agriculture, etc. of an affected area to initiate urgent protection actions; and

7. Environmental radiation monitoring is conducted by state of the art systems like CARMS, ERMNA, AGSS, etc. by aerial survey, sea, road and rail routes. Till March 2007, at least 13 major aerial surveys have been conducted on different cities of the India.

However, there is always scope for improvement given that there may be gaps in actual application. The existing safety and security arrangement seem to be focussed more on nuclear power plants. So far, disaster involving any Indian nuclear plants is nil, probably owing to stringent security and safety arrangements in and around the facilities. In the same way, security of radioactive material used in other facilities requires to be given equal attention. Unfortunately, level of public awareness about radiological materials is abysmally low. Regular training courses are arranged by nuclear power plants for the public of surrounding area but no curriculum on radiation awareness is prescribed in schools or in other institutions in the area. Also there is lack of adequate numbers of trained police and medical personnel to carry out prompt detection and action in this regard. Perhaps the scientific-political leadership is extra cautious to avoid unnecessary public panic as the popular perception on anything radioactive is blurred. Therefore, the DAE and AERB face a dual challenge of dealing with risks involving the safety of nuclear materials and inadequate public perception.

Magnitude of the Challenge

Inspite of all regulatory-technical arrangement in place, it can never be said with utmost certainty that incidents like Mayapuri may never recur again. Our systems, even though efficient, have not been able to monitor the circulation of these materials laterally. The Mayapuri incident indicates the obvious gap that exists between the degree of our preparedness and the magnitude of challenge on the ground. Firstly, the task of monitoring each and every material used in innumerable places scattered across the geography is stupendous. For example, by 2008, only the number of diagnostic X-ray units registered in the country stands at 50,000 approximately. Secondly, with limited resources at India's disposal, sustained outreach and individual monitoring of each and every unit is difficult. Thirdly, high level of illiteracy persists particularly among the workers involved in the unorganised sector. Outreaching to train them all would be difficult as they shift often to other sectors.

As India is preparing for a giant step in nuclear energy production and more nuclear materials would be used in the decades ahead, more innovative ways of reaching out to the gaps in our system of monitoring, response and damage control will have to be found. Some of recommendations towards a concerned approach are as follows:

Firstly, from the legal point of view, India needs legislation of a national Nuclear Technology Management Act, coordinating central and state government responsibilities in managing the radioactive resources, their safe-keep and guidelines for prompt response in case of a disaster. Though the Disaster Management Act 2005 embodies provisions for managing nuclear disasters, a dedicated policy framework with supporting infrastructure for managing radiological emergency would be preferred. The WMD Act 2005 though an overarching and integrated legislation incorporating all possible ways of controlling the radioactive material pilferage, does not clarify the responsibilities of different States implementing such provisions.

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Secondly, to control and monitor effectively the export-import and transit of radioactive material, India may consider making all its sea-ports CSI-compliant. The automated container screening and information exchange provisions of the CSI arrangement would help intercepting the movement of such materials. At present, only the Jawaharlal Nehru Port Trust (JNPT) at Mumbai is part of the initiative.

Thirdly, it is an imperative now to frame a national Nuclear Information Management (NIM) programme to address misperceptions and panic among the public. A “first action manual” with DOs and DON’Ts prescription, needs to be catered to them.

Fourthly, extensive installation of Radiation Monitoring Systems at major chock points across the country with necessary technical training of the security personnel may be considered to monitor the movement of these materials.

Fifthly and most importantly is strengthening the readiness of our medical establishment. Hospitals in different cities are needed to be equipped for handling radiation emergencies. At the fire brigade stations, first response teams need to be created and kept in readiness, especially, in industrial cities. Also, medical centres where radiological materials are used need to be staffed adequately as they could become easy targets of non-state actors.

Lastly, what is urgently required is a comprehensive inventory of facilities that received radioactive materials prior to AERB. Mayapuri incident is simply a wake up call for all not to resort to blame games; rather a concerted approach by the concerned authorities, civil society and the media would help avoiding such incidents in future.

Notes

[1] “Biggest radiation crisis in 4 years may shut DU labs”, *Hindustan Times*, 30 April 2010.

[2] “Radioactive Material Cobalt-60”, at http://newsindian.in/2010/04/09/radioactive-material-cobalt-60-imeges-videos-related-news-in-delhi/, April 9, 2010.

[3] Arun Kumar, et al, “Training Programmes in India for Safety and Security of Radioactive Sources ,” at http://www.numat.at/list%20of%20papers/arunkumar.pdf

[4] “Application of Radiation in Medicine, Industry and Research”,at

http://www.aerb.gov.in/T/sj/book/chapter9.pdf, p. 146.

[5] ibid.

[6] Rajesh M. Basrur and Friedrich Steinhausler, “Nuclear and Radiological Terrorism Threats for India: Risk Potential and Countermeasures,” at

http://jps.lanl.gov/vol1_iss1/3-Threats_for_India.pdf

[7] Aanchal Bansal, “Mayapuri market: Asia’s largest, unnoticed here”,

The Indian Express, 13 April 2010.

[8] Ibid.

[9] “National Hazardous Waste Management Strategy”, at

http://www.indiaenvironmentportal.org.in/files/NationalHazardous.pdf

[10] Pushparaja, K.S. Pradeepkumar, D.N. Sharma and H.S. Kushwaha, “Philosophy and Principles of Radiation Protection, Security of Radioactive Sources and Preparedness for Response to Radiological Emergencies”, at http://www.barc.gov.in/publications/nl/2006/200612-1.pdf

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