

Frequently Asked Questions

Q1. Why is it essential to take regulatory consent from AERB for operating medical diagnostic X-ray equipment?

What is the mechanism to have supervisory eyes over the safe use of diagnosis instruments like CT Machine, C-Arm etc. in the larger interest of public health in safety from the adverse effect of this instrumental use?

Kindly give details of steps taken by AERB to ensure adequate protection to public, patient & staff from operating radiation unit.

Ans. The mission of AERB is to ensure that the use of ionizing radiation and nuclear energy in India does not cause undue risk to the health of people and the environment. AERB enforces regulatory requirements to ensure safe operation of X-ray equipment such as Cath Lab equipment, Computed Tomography machines, C-Arm, Mammography machines, General purpose Industrial Radiography machines etc. The primary mechanism of regulation is ensuring design safety of the machine by issuance of Type Approval (for the model prototype). The shielding adequacy around X-ray equipment room is ensured by issuance of Layout Approval. The operational safety of X-ray equipment is ensured by issuance of Registration / License to the utility after review of all aspects related to radiation safety and after ensuring that patient, staff and public are adequately protected. Moreover, continued safety is ensured by review of the periodic safety status reports submitted by the radiation units. AERB also carries regulatory inspections on a sample basis to ensure safe operation of these X-ray equipment. Hence, a regulatory consent from AERB is essential to ensure radiation safety in operating the X-ray equipment in that institutions.

Q2. What is maximum / permissible radiation exposure limit in India? Who is the deciding authority?

What is the limit of MPD (Maximum Permissible Dose) in India today? How it has been reduced?

Ans. Atomic Energy Regulatory Board (AERB), constituted on November 15, 1983 by exercising the powers conferred by the Atomic Energy Act is the regulatory authority which stipulates the dose limits in India. The dose limits revise based on recommendation of ICRP (International Commission on Radiological Protection) from time to time. Current Dose

Limits are given in AERB Directive No. 01/2011 (Ref: No. No.CH/AERB/ITSD/125/2011/1507 dated April 27, 2011). This AERB directive is available on AERB website www.aerb.gov.in.

Q3. Is there any limit of X-ray exposure done by a radiographer in one single day? Is there any limit of X-ray exposure done by a radiographer fixed by Any Authority, Any State Govt. / Central Govt. or by Atomic Energy Regulatory Board or by Radiological Safety Division?

How many X-ray exposures are permitted to be performed in a day as well as in a month by a Radiographer / X-ray technician?

What are the total permissible monthly duty hours of a Radiology Technician according to AERB rules and regulations?

How many X-rays CT Scan special procedures beside Mammography an individual radiographer can do in case of adult as well as pediatric patient in a single day? Please attach relevant document for the same.

How many working hours a day for nuclear medicine physician / technologist / radiological safety officer in nuclear medicine department as per AERB guidelines?

If a technologist is force to work for more than 8 hours a day, where the complaint should be lodge and what action would be taken against the person who is responsible for it? Is there any organization or body who monitor the working hours of radiotherapy technologist?

Ans. AERB has not stipulated any limit in respect of the maximum / mandatory working hours in a day / week / month and / or maximum number of exposures permitted to be performed in a day / week in a radiation facility. AERB does not monitor the working hours of radiation workers, as there is no stipulation by AERB in this regard. However, the employer and the radiation worker shall ensure that the radiation dose received due to working in radiation area shall not exceed the occupational dose limits specified by AERB. The radiation dose limits specified by AERB for radiation workers are as follows :

- 1) The cumulative effective dose over a block of five years shall not exceed 100 mSv.
- 2) The effective dose in any calendar year during a five-year block shall not exceed 30 mSv.
- 3) (a) The equivalent dose in any calendar year to the lens of the eye shall not exceed 150 mSv
(b) The equivalent dose in any calendar year to the skin, the hands and feet shall not exceed 500 mSv.

- 4) In case of a woman worker of reproductive age, once pregnancy has been established, the conceptus shall be protected by applying a supplementary equivalent dose limit to the surface of the woman's abdomen (lower trunk) of 2 mSv for the remainder of the pregnancy.

Q4. Why not radiation risk allowance should be recommended by AERB itself for radiographers, being the sole regulator for implementation of radiation protections rules and competent authority?

Is there any risk leave for the radiation worker in the hospital? Whether radiation risk allowances are being given to radiographers in other nation of the world?

Ans. There is no risk leave and/or risk allowance prescribed by the Atomic Energy Regulatory Board (AERB) for radiation workers in India. As per Atomic Energy (Radiation Protection) Rules, 2004, there is no provision for any radiation / hazard leave, radiation allowance or any other type of allowances for employees working at radiation facilities such as hospitals, medical diagnostic centers etc.

Giving radiation risk allowance / risk leave to radiation workers is not even recommended by IAEA (International Atomic Energy Agency). AERB has adopted the policies which are in line with IAEA recommendations.

Q5. What kind of radiations are emitted from X-ray Machines? How dangerous they are? How to detect radiations from X-ray Machines?

Ans. Ionizing radiations i.e. X-rays are generating from the X-ray machines, when they are in operation. X-rays are a form of electromagnetic radiation of high energy and very short wavelength, which is able to pass through many materials. X-rays are produced within the machine by interaction of accelerated electrons with a metal target. No external radioactive material is involved.

Although Ionizing radiations such as X-rays are carcinogenic, they are safe when they are used properly. The chances of being harmed from X-rays is extremely small as compared to natural radiation, which may pose a greater risk. Effects of ionising radiation is published in detail in standard literature such as UNSCEAR Reports.

Detection of X-rays is possible by using appropriate measuring and monitoring instruments such as dosimeters, survey meters etc.

Q6. Why radiation monitors and dosimetry devices should be available where radiation installations are operated? Where I can get information about radiation monitors, dosimetry devices etc.?

Kindly give list of appropriate personnel monitoring devices to be provide to all radiation workers.

Do you recommend dosimeters to X-ray lab technicians? If an institute / hospital forced Radiographers to do duty of X-ray without TLD then what legal action can be taken against the institute / hospital?

Can a Radiology Technician be posted in Radiography room / portable radiography when he has not been provided a TLD badge or any other dose monitoring device?

Ans. Personal radiation monitoring devices or Dosimeters like TLD and Self Reading Pocket Dosimeters are used to measure the radiation dose received by radiation workers. All radiation workers should use appropriate personnel monitoring badges (TLD badges). TLD badges are mandatory for occupational workers to wear while working in a radiation zone to ensure that the doses received by the radiation workers are within the AERB stipulated dose limits. The addresses of AERB accredited laboratories provide TLD services are mentioned in AERB website www.aerb.gov.in and the same can be downloaded through the below link:

<https://elora.aerb.gov.in/ELORA/PDFs/Guidelines%20for%20users.pdf>

It is the responsibility of the employer (Institute / Hospital) to provide TLD badges to radiation workers. As per Atomic Energy (Radiation Protection) Rules, 2004 and AERB Safety Codes, personnel monitoring services shall be provided to radiation workers and dose records shall be maintained. In case of any institution violating the prescribed regulatory requirements, AERB is empowered to suspend / modify / withdraw the licence / registration issued to that X-ray installation or seal the X-ray installation(s) in accordance with Rule 10 and 31 of the Atomic Energy (Radiation Protection) Rules, 2004.

Any violation in this regard can be complained to the authorities of facility concern and to the Competent Authority i.e. Chairman, Atomic Energy Regulatory Board (AERB), under Atomic Energy (Radiation Protection) Rules, 2004.

Q7. Kindly give details about who should use TLD badges, where to wear TLD badges, where to store and how long can be use TLD badges.

Ans. TLD badge is used to measure the radiation dose to which the user is exposed while working in radiation area. TLD is a type of radiation dosimeter, which measures exposure due to ionizing radiation. It does not protect the user from the radiation. TLD badges to be used by

the worker involved in radiation related work. The dark room technicians, sweepers helpers etc. need not normally be provided with TLD badges.

A TLD badge allotted to one user should not be shared by any other person. There are two types of TLD badges, Chest badge & Wrist badge. One TLD badge i.e. Chest badge should be worn compulsorily at the chest level. If a lead rubber apron is used, TLD badge should be worn under the lead apron at the chest level. The dose recorded by the TLD badge worn at the chest level represents the whole body dose equivalent. In special cases, depending upon the nature of radiation work, if the doses to the hands and forearms are expected to be significantly higher than at the chest level, additional Wrist badges may be procured and used. Examples of such categories are persons handling radioisotopes from close distances and radiologists / doctors doing the special investigations.

TLD badges should be stored in RADIATION FREE AREAS where there is no likelihood of any radiation exposure. Places such as X-ray rooms, rooms in which radioactive materials are stored, handled or used and areas in the immediate vicinity of such rooms are NOT RADIATION FREE AREAS and should be avoided for storing the TLD badges.

Depending upon the type of facility, TLD service to an institution may be on monthly or quarterly basis. After one service period, the used TLD badges have to be replaced by the fresh badges.

Q8. What are the requirements to establish Nuclear Medicine, Radiotherapy and Radiology department in a hospital?

Ans. The requirements to be complied for Nuclear Medicine facility are given in AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011 and the AERB Safety Guide titled “Consenting Process for Radiation Facilities”, AERB/RF/SG/G-3. This AERB Safety Code stipulates the radiation safety requirements in handling radioactive materials for nuclear medicine applications.

The requirements for issuance of license for operation of Radiotherapy facility are given in AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011, and the AERB Safety Guide titled “Consenting Process for Radiation Facilities”, AERB/RF/SG/G-3. This AERB Safety Code stipulates the radiation safety requirements in the design, installation and operation of radiation therapy sources, equipment and installations.

The requirements to obtain license for X-ray equipment in Diagnostic Radiology department are given in AERB Safety Code on “Radiation Safety in Manufacture, Supply and Use of Medical Diagnostic X-Ray Equipment”, AERB/RF-MED/SC-3 (Rev.2), 2016 and the AERB Safety Guide titled “Consenting Process for Radiation Facilities”, AERB/RF/SG/G-3. This AERB Safety Code is intended to govern radiation safety in design, manufacture, installation, operation and decommissioning of X-ray generating equipment for medical diagnostic purposes.

Q9. What action should be taken by AERB against those hospitals / clinics / diagnostic centres which are operating Nuclear Medicine, Radiotherapy and Radiology department without obtaining approval or license from AERB?

Ans. As per the records available with AERB, all Nuclear Medicine facilities, Radiotherapy facilities & Diagnostic Radiology centres operating in the country possessing radiation sources / radiation generating equipment are licensed by AERB. However, if any radiation sources / radiation generating equipment is found to be in operation without a license from AERB, appropriate regulatory action as deemed fit will be initiated against such facility as per the provisions of the Atomic Energy Act & Rules. Section 24 of the Atomic Energy Act, 1962 and Rule 35 of the Atomic Energy (Radiation Protection) Rules, 2004 give the provision for the punishment and penalties to be imposed in case of any violations.

Q10. Which authority takes actions against those hospitals / clinics / diagnostic centres which are operating Nuclear Medicine, Radiotherapy and Radiology department without obtaining approval or license from AERB? Which authority / officer investigates these centres?

Ans. Chairman, AERB is the Competent Authority to initiate appropriate action against such facilities, in case of violation. Any person authorised by the Competent Authority is empowered to investigate the facilities found to be operating radiation sources / radiation generating equipment without license from AERB or he can delegate this responsibility to any official from AERB.

Q11. Please give the information regarding average and range of radiation dose to patients in following procedures 1) Interventional Procedure 2) CT Examinations 3) Nuclear Medicine Procedure. Which among these are associated with high radiation dose to staff?

Ans. Typical effective doses for patients in X-ray based Interventional Procedures are in the range of 10-100 mSv. Typical effective doses for patients in CT Examinations are in the range of 2-10 mSv. However, with safe design considerations, work practice and use of appropriate personal protective devices, radiation doses to occupational workers always remain well below the limit prescribed by AERB.

Radiation dose to staff depends on the type of investigation and protocol followed in the institution. Interventional Radiology Procedures generally involve relatively higher potential doses to staff compared to the other practices mentioned above.

Q12. How the radiation dose to the patients and staff being monitored by AERB-RSD in CT Scan, Interventional Procedures and Nuclear Medicine Procedures over the past one decade?

Ans. Radiation exposure of staff working in radiation facilities is verified by AERB through personnel monitoring of individual radiation worker(s) at their work places. Individual patient dose(s) during Interventional Procedures and CT Scans are recorded (electronic formats) in the radiology centers / hospitals in the country, which can be verified during inspection.

Q13. Does AERB have any say regarding medical exposure to patients?

Ans. Primarily Medical exposures mean exposures from either X-rays or radionuclides towards a) clinical diagnosis or b) towards treatment for medical conditions; mostly cancer. These exposures are prescribed by medical practitioners, as per the requirement. Thus, Medical exposures fall under the over-arching responsibility of patient welfare and is best decided upon by the medical practitioner. However, AERB's oversight towards patient safety extends towards use of design approved equipment, their periodic Quality Assurance and operation of these equipment by qualified personnel.

Q14. Please give the information, whether the following approvals from Atomic Energy Regulatory Board are mandatory for (a) Type Approval (b) Layout Approval (c) Obtaining regulatory consent (d) Submission of installation QC report of the scanner / machine (e) Appointment of RSO (f) Submission of annual report applicable to X-ray, CT Scan, Interventional Radiology and Cath Lab centers?

Ans. (a) **Type Approval** : Approval issued by the Competent Authority based on evaluation of the device to ensure that it conforms to safety standards. Type Approval/NOC will be issued

only if the equipment satisfies the safety requirements of this safety code and the standards in force. Only type-approved and NOC-validated equipment shall be marketed and used in the country.

(b) X-ray Room Layout and Shielding Requirement : No X-ray unit shall be licensed unless the layout of the proposed X-ray installation is approved by the Competent Authority. All the rooms associated with the facility shall be located away from the general public area. The room housing X-ray equipment shall have an appropriate area to facilitate easy movement of staff and proper patient positioning. Appropriate structural shielding shall be provided for walls, doors, ceiling and floor of the room housing the X-ray equipment so that radiation exposures received by workers and the members of the public are kept to the minimum and shall not exceed the respective limits for annual effective doses prescribed by the Competent Authority.

(c) Regulatory Consent : No diagnostic X-ray equipment shall be operated for patient diagnosis unless Licence for operation is obtained from the Competent Authority. Licence/Registration shall be obtained only after the installation of diagnostic X-ray equipment as per Layout and Shielding Requirement prescribed by AERB from radiological safety considerations. The Licence accorded by the Competent Authority shall be renewed before its expiry.

(d) Quality Assurance (QA) Requirements : The end user shall ensure that periodic QA of the equipment is carried out by agencies authorized by the regulatory body.

(e) Appointment of RSO : X-ray department shall have a RSO approved by the Competent Authority. The RSO may either be the employer himself / herself or an employee to whom the employer shall delegate the responsibility of ensuring compliance with appropriate radiation safety / regulatory requirements applicable to his X-ray installation. The minimum qualification and training shall be as prescribed by the Competent Authority.

(f) Submission of Periodic Safety Reports : The utility shall submit periodic safety reports in the format and frequency specified by the regulatory body.

Q15. As per AERB rules, how long AERB should take to clear application for NOC, Type Approval, Approval of Layout and Registration / License of medical diagnostic X-ray equipment? Have you uploaded this time frame on your website? If AERB does not complete processing of an application within stipulated period who is liable for loss to manufacturer / supplier due to delay by AERB in application processing?

Ans. As per Rule 8 (Issuance of licence) of Atomic Energy (Radiation Protection) Rules, 2004, the licence shall be issued within a period of one hundred and eighty days from the date of receipt of the application subject to the condition that all the requirements for issuance of the licence have been duly fulfilled by the applicant. However, the lead time followed by AERB at various stages of consenting process for radiation facilities is as per AERB Safety Guide for “Consenting Process for Radiation Facilities”, AERB/SG/G-3, 2011.

Application processing includes review of proper submission by the applicants to AERB. AERB always issues the consents within the stipulated time period, provided that the submission of required documents are proper and information provided therein is correct. In cases where the information provided is not correct or incomplete, AERB communicates with the applicants through phone calls, emails or issuing advisory letters for fulfilling the requirements for processing the application.

Q16. Will AERB give Layout Approval / Registration or License to Diagnostic Centres / Hospitals purchased machines, not Type Approved by AERB from organization or individual not authorized supplier / dealer of manufacturer?

What action AERB will take against Hospitals / Diagnostic Centres purchased CT Scan machine from individual / organisations not authorized supplier / dealer of manufacturer?

Can any individual or any other private company other than principal manufacturer, supply and install CT Scan without manufacturer’s authorization? Will AERB issue License to such CT Scan?

Ans. As per AERB Safety Code on “Radiation Safety in Manufacture, Supply and Use of Medical Diagnostic X-Ray Equipment”, AERB/RF-MED/SC-3 (Rev.2), 2016, Only Type-Approved and NOC-validated equipment shall be marketed / supplied and used in the country. AERB issues Type Approval to X-ray equipment such as CT Machines, Fluoroscopes, C-Arm, Mammography and Dental X-ray Machines etc. based on evaluation of the device to ensure that it conforms to safety standards. Type Approval/NOC will be issued only if the equipment satisfies the safety requirements of this safety code and the standards in force.

The detail of the supplier / manufacturer of the X-ray equipment is asked in the user application and verified at the time of review. It is the mandatory requirement for utilities that The employer shall procure NOC validated/ Type Approved X-ray equipment from authorized suppliers and after obtaining procurement permission from the Competent

Authority. AERB would initiate appropriate regulatory action in accordance with Atomic Energy (Radiation Protection) Rules, 2004 against the Hospitals / Diagnostic centres using X-ray equipment, which is not Type Approved by AERB.

AERB authorised Suppliers and Service Agencies can supply and install diagnostic X-ray Equipment to the end-users. The details of authorised service agencies is available on AERB website www.aerb.gov.in and the same can be downloaded through the following link :

<http://www.aerb.gov.in/AERBPortal/pages/English/t/XRay/forms/authorisedagencies.pdf>

Type Approval for X-ray equipment issued by AERB to Manufacturer / Suppliers has a validity for three years. The approval also gives details of the manufacturer / supplier supplying the X-ray equipment. The list of NOC / Type Approved Medical Diagnostic X-ray Equipment is available on AERB website www.aerb.gov.in and the same can be downloaded through the following link :

<http://www.aerb.gov.in/AERBPortal/pages/English/t/XRay/forms/typeapproved.pdf>

Q17. What are the rules to be followed by Manufacturer and Supplier for marketing X-ray equipment in India? Is regulatory authority, AERB prescribed this in any documents?

What is the procedure to be followed by supplier to Import of X-ray equipment and to get Type Approval from Atomic Energy Regulatory Board?

Ans. AERB Safety Code for Medical Diagnostic X-ray Equipment and Installation, AERB/SC/MED-2 (Rev-1), 2001 and Amendment to AERB Safety Code on Medical X-ray Equipment and Installations issued vide Ref: No. AERB/RSD/MDX/SC-Amendment/2012/14285 dated 26/11/2012 by AERB stipulate responsibilities of indigenous Manufacturer for production and marketing of their X-ray equipment and responsibilities of Supplier for marketing of X-ray equipment. This Safety Code also prescribes procedures for import of X-ray equipment and to get Type Approval from AERB. The above documents are available on AERB website www.aerb.gov.in.

Q18. Whether type approval certificate expired X-ray equipment are allowed to be used by CT Scan centres / Hospitals or allowed for import? If any such order / instruction was not issued, whether such approval expired X-ray equipment were directed to be withdrawn from usage by Scan centres / Hospitals throughout India?

Ans. Type Approval certificate is issued to supplier(s) of medical diagnostic X-ray equipment subject to meeting the design (built-in) safety criteria by diagnostic X-ray equipment. This

certificate facilitates the supplier to import and supply diagnostic X-ray equipment at user-institutions. However, expiry of Type Approval certificate does not impact on the use of medical diagnostic X-ray equipment at user-institutions. For import of pre-owned (Used / Refurbished) medical diagnostic X-ray equipment, AERB recently revised the regulatory requirements and accordingly does not insist on validity period of Type Approval certificate on such import.

Q19. If any customer purchased CT Scan from authorized seller and after that he take the services from unauthorized sources and that unauthorized person changes / replaces the parts / tubes with other than the original part / tube (Hybridization). In that case, Does the AERB Type Approval number remains valid? If no then what action can be taken if any customer used not recommended parts / tubes?

Ans. Type Approval issued by AERB does not remain valid once the parts / tubes are replaced, unless the replacement is carried out by the original manufacturer / supplier. In case modifications are carried out on a Type Approved X-ray equipment, without prior approval of AERB, the applications from such users / customers would not be considered for issuance / renewal of regulatory consents for its use.

Q20. OEMs (GE, Siemens etc.) have sold several hundred pre-owned CT Scanners in India. Please elaborate whether these CT Scan Centers using second-hand CT Scanners have been given permission by AERB to operate.

Detail list of CT Scan models “Type Approved” by AERB is available on AERB website. Can I buy a pre-owned CT Scanner whose name appears in this list?

Ans. Pre-owned CT Scanners can be purchased only if they are refurbished by the original manufacturers / suppliers, who have obtained permission from AERB for refurbishment of the said models. AERB issues consents for installation and use of refurbished X-ray equipment supplied by authorized supplier / dealer who has AERB permission for sale and installation of refurbished equipment.

AERB takes regulatory action against organizations / individuals who have supplied refurbished X-ray equipment which were not refurbished by the original manufacturer.

Q21. Please mention all the acts related to import Pre-owned radiology equipment. Please give me a copy of the list of service agency (authorized by AERB) for import of used / refurbished CT Scanner.

Ans. Import of pre-owned medical diagnostic X-ray equipment is regulated by “Regulatory requirements for supply and use of pre-owned (used/refurbished) medical diagnostic x-ray equipment” dated February 25, 2015 issued by AERB, which is available in AERB website www.aerb.gov.in. The same can be downloaded through the below link :

<http://www.aerb.gov.in/AERBPortal/pages/English/t/documents/xraynews.pdf>

Following service agencies are permitted by AERB for supply of pre-owned (used / refurbished) diagnostic X-ray equipment :

SI No.	Institute Name	City / District
01.	SANRAD MEDICAL SYSTEMS PRIVATE LIMITED	Bangalore
02.	CURA HEALTHCARE PRIVATE LIMITED	Chennai
03.	SOMA TECH PVT LTD	Vadodara
04.	SHREEJI SCAN SERVICES	Vadodara
05.	KSBIOMED HEALTHCARE PVT. LTD.	Ahmedabad
06.	RAD MEDICAL	Raisen
07.	ALLIANCE MEDITECH PVT LTD.	Raisen
08.	RADIMAGE TECHNOLOGIES PVT LTD	Faridabad
09.	ADVANCED SCAN SUPPORT TECHNOLOGY PVT LTD	Faridabad
10.	MEDIRAYS CORPORATION	Thane
11.	ABDIEL BIOMEDICAL SERVICES	Kapurthala
12.	VERTEX MEDICAL PRIVATE LIMITED	Noida
13.	HORIZON MEDITECH PRIVATE LIMITED	New Delhi

Q22. How the pre-owned equipment supplier will get the Procurement Permission? Whether the Procurement Permission addresses the end user or Importer (Service / Supply Agency)? Is the equipment need to be abide Pollution Control Board norms also?

Ans. For Procurement Permission, Applicant needs to submit the form “Application for Permission for Procurement of Pre-owned X-ray Equipment” and other relevant documents mentioned in the application to Radiological Safety Division, AERB. This application form can be downloaded through the below link :-

www.aerb.gov.in/AERBPortal/pages/English/t/XRay/forms/preowned.pdf

Permission for procurement of Pre-owned Medical Diagnostic X-ray equipment is issued to the end users with a copy to the authorised supplier / service agency.

AERB issues regulatory approvals from radiation safety view point only. For radiation safety requirement, 'Permission for Procurement' issued by AERB is to be submitted to Customs for clearance of imported Medical Diagnostic X-ray equipment (New / Pre-owned), X-ray tubes and X-ray tube inserts. Applicant has to obtain all other applicable clearances from other statutory State / National level authorities.

Q23. If Atomic Energy Regulatory Board after inspection of X-ray machines of any hospitals and nursing homes instructs for not to use the X-ray machine for patient diagnosis due to unnecessary exposure of radiation, then can it be used further?

Ans. Diagnostic X-ray equipment can be used again in such a case, if Diagnostic X-ray equipment satisfies the QA performance tests requirements as specified in AERB Acceptance Test Report for Diagnostic X-ray Equipment.

Q24. Is Quality Assurance test mandatory for a X-ray equipment? Kindly state the periodicity, set for Quality Assurance test to be performed on all radiation equipment & accessories including X-Ray, CT Scan, C-Arm etc.

Ans. It is mandatory to get the Quality Assurance test done periodically of all the X-ray equipment. As of today, the routine Quality Assurance tests for X-ray units should be carried out once in two years and that of CT Scan should be carried out annually.

Q25. Is it ok to have the Radiological Diagnostics Lab in the area where there are more general public?

What is AERB's stand on X-ray equipment installed at residential localities?

Ans. AERB has stipulated requirements in AERB Safety Code, AERB/SC/MED-2 (Rev.1) on "Safety Code for Medical Diagnostic X-ray Equipment and Installations" and its amendment vide Ref: No. AERB/RSD/MDX/SC-Amendment/2012/14285 dated 26/11/2012. It is the responsibility of the employer of the institution to demonstrate radiation safety infrastructure of the installation and ensure that the installation is safe for the workers and public at large.

AERB evaluates the X-ray installation room design from purely radiation safety standpoint and the requirements of Safety Code. Hence, a diagnostic X-ray facility designed as per the

regulatory requirements is safe to operate without posing any radiological hazard to the residents of a building emplaced with medical diagnostic X-ray unit and related equipment.

Q26. Kindly give details of room layout requirements for X-ray equipment and installation as per AERB guideline.

For setting up X-ray lab in India by commercial health check up concerns, what are the prescribed norms for the following factors : (i) Location whether it can be set up in a residential locality (ii) Layout plan and Shielding thickness particularly about the walls of the room where X-ray machine is to be installed.

Ans. The requirements of Room layout for an X-ray installation are given in AERB Safety Code for Medical Diagnostic X-ray Equipment and Installation, AERB/SC/MED-2 (Rev-1), 2001 and Amendment to AERB Safety Code on Medical X-ray Equipment and Installations issued vide Ref: No. AERB/RSD/MDX/SC-Amendment/2012/14285 dated 26/11/2012 by AERB. This Safety Code is available on AERB website www.aerb.gov.in and Amendment to this Code can be downloaded through the following link :

<http://www.aerb.gov.in/AERBPortal/pages/English/t/XRay/Amendment.pdf>

Rooms housing diagnostic X-ray units and related equipment shall be located as far away as feasible from areas of high occupancy and general traffic, that are not directly related to radiation and its use.

The layout of rooms in an X-ray installation shall be such that the number of doors for entry to the X-ray rooms shall be kept to the minimum. The unit shall be so located that it shall not be possible to direct the primary X-ray beam towards dark room, door, windows, and control panel or areas of high occupancy.

The room housing an X-ray unit shall have an appropriate area to facilitate easy movement of staff and patient positioning. Appropriate structural shielding shall be provided for walls, doors, ceiling and floor of the room housing the X-ray unit so that doses received by workers and the members of public are kept to the minimum and shall not exceed the respective annual effective doses as prescribed by the Competent Authority.

Q27. Is there any standard layout plans published for X-ray, CT Scanner, Interventional Radiology and Cath lab centers by AERB? If yes, please give copies of such layouts.

Please give the following documents, Layout plan in respect of erection of spiral CT-Scan, Digital X-ray and Format for submission of layout details of spiral CT Scan and Digital X-ray.

Ans. AERB has published Standard Layout of X-ray Installation, CT Installation, Interventional Radiology Installation, Mammography Installation etc. The Standard Layouts published by AERB can be downloaded through the following link :

<https://elora.aerb.gov.in/ELORA/PDFs/Guidelines%20for%20users.pdf>

For special cases, adequate shielding of the X-ray installation may be evaluated depending on the type of X-ray unit, patient workload, room dimensions, area of the room, wall construction materials, occupancy etc. as per the AERB Safety Codes.

AERB has been issuing License for Operation to X-ray equipment after verification of Layout Plan from radiation safety viewpoint. In current licensing process, AERB is not issuing separate Layout Approval to the institutes, now it is a part of the Registration / License application.

Q28. Please give information on whether shielding thickness of walls, ceilings and floors of X-ray, CT scanner room and Cath lab room varies depending on the type of scanner, slices of scanner, type of the CT scan and number of scans performed every day?

Please give the information about the policy adopted by AERB in deciding permission to perform a given number of CT scans or interventional procedures based on the shielding thickness and type of the scanner / machine?

Ans. Shielding thickness of the walls of CT / Cath lab room are prescribed by AERB on the basis of maximum feasible workload of the facility and distance of wall(s) of Cath lab room from the centre of patient table or distance of wall(s) of CT room from isocentre of CT equipment. Layout of Medical Diagnostic installations are designed taking into account the maximum workload (No. of patients / Procedure per day) of the facility.

Q29. Is it necessary to obtain License from AERB for the Operation of the Radiological equipment in the Radiology Department or Radiology Diagnostic Lab? Does such centre need to renew its Operation License every year?

Is it mandatory to obtain Registration from the Board to operate any kind of radiation equipment in any setup (small or large)? For what time such approval granted by your good self remains valid?

Ans. It is mandatory requirement that every user / utility of medical diagnostic X-ray equipment such as CT Machines, Fluoroscopes, C-Arm, Mammography and Dental X-ray Machines etc. in the country shall obtain licence / registration from AERB to operate the X-ray equipment. As per AERB Safety Code, No such Diagnostic X-ray equipment shall be operated unless licensee obtains license and / or registration from the Competent Authority, AERB.

AERB issues registration and / or license for the operation of such X-ray equipment, after verification of all aspects related to radiation safety for patient, operator and members of public. While issuing registration / license the following are verified :

- Whether equipment is Type approved
- Whether Qualified Staff are operating the equipment
- Whether TLD badges are provided to the staff operating the equipment
- Whether there is a Radiation Safety Officer in the institute

Validity period of the registration / license for the operation of X-ray equipment is 5 years from the date of issuance. License for operation of X-ray equipment needs to be renewed after every 5 years.

Q30. What criminal action is being taken against Medical Diagnostic X-ray installations which have not got Registration / Licence from AERB?

What action does AERB takes against such Hospital(s) who have installed X-ray equipment without obtaining approval of AERB? Who is responsible for this?

Details of penal action which can be taken by AERB for running an X-ray testing labs / CT Scan without permission of AERB and mention the relevant section(s) of the relevant Act.

Ans. It is the statutory requirement of the hospitals / medical diagnostic X-ray centres to obtain License / Registration from AERB. Though the X-ray equipment are of low hazard potential, it is important that they are installed and operated in accordance with radiological safety requirements specified by AERB. AERB issues the requisite License / Registration after ensuring that they conform to the specified safety requirements. In case of any hospital / medical diagnostic X-ray centre violating the prescribed regulatory requirements, AERB is empowered to suspend / modify / withdraw the License / Registration issued to that institution or seal the X-ray installation(s).

As per Rule 3 of Atomic Energy (Radiation Protection) Rules, 2004, no person shall establish or operate a radiation facility without a Licence. It is the responsibility to the user to comply

with the stipulations of the Atomic Energy Act, 1962 and Rules promulgated under this Act. As per section 24 of the Atomic Energy Act 1962, whoever contravenes any Rules made under section 17 of the Act shall be punishable with imprisonment for a term which may extend to five years, or with fine, or both. As per Rule 31 of Atomic Energy (Radiation Protection) Rules, 2004, the radiation installation may be sealed in case of contravention of any of the provisions of these rules. For further details please refer the relevant Act and Rule(s), which are available on AERB website www.aerb.gov.in.

Q31. Is it required License from AERB for usage of MRI Scan unit for patient scanning in Diagnostic Centers?

What are the actions will be taken against Diagnostic Centers for use of MRI Scan units for patient scanning without permission from AERB?

Kindly furnish details of safety steps taken by while doing functional MRI, MR tractography, MR mammography, 4D ultrasound with tomography etc.

Ans. MRI equipment, Ultrasound or Sonography machine etc. do not emit ionizing radiations. Since Atomic Energy Regulatory Board is responsible for regulating safe usage of ionizing radiations only, MRI equipment, Ultrasound or Sonography machine etc. does not come under regulatory purview of Atomic Energy Regulatory Board.

Q32. If I use a mobile X-ray machine alone, will I get license from authorities? If no, why?

There are currently 3 vehicle Scanners operating in Mumbai which are used in public areas. Will a repeat of the Delhi incident occur (cobalt source found in Delhi scrap market) due to public being exposed to harmful X-Rays radiation? Corrective measures taken by AERB to ensure that public in general are not exposed to harmful radiation.

Ans. AERB issues license for every X-ray equipment including mobile X-ray machine after verifying compliance with regulatory requirements.

Incident like that happened at Delhi Scrap Market is unlikely to occur with the X-ray equipment if they are used properly. Because, X-rays can only be produced only when external electric power is supplied. Without external power supply, the X-ray tube is non hazardous in nature from radiological safety stand point.

During scanning of vehicles (e.g. scanning at RGSL), public is required to remain outside the cordoned off area as decided by AERB considering radiation safety. This ensures the safety

of the public. Whenever a user deploys a vehicle scanner with due consent from AERB, it is mandatory to follow the radiation safety standards.

Q33. What is the thickness require of lead sheet in mobile unit for mammography installation? How much mammography harmful for ladies? How many maximum number of mammography tests we can implement on patients in whole life?

Ans. Being self-shielded collimated beam and relatively low output of mammography equipment, protective barrier of 0.5 mm lead equivalence is sufficient for shielding purpose. Complete guidelines for shielding of X-ray installations including mammography equipment is available on AERB website www.aerb.gov.in.

There is no definite proof that mammograms increase the risk of cancer. Mammography is a justified diagnostic practice as the benefit outweighs the harmful effect associated with it. The decision on mammography scan depends on clinical judgement, which needs to be justified by the medical practitioner.

Q34. Kindly give the minimum qualification for the appointment of Radiographers or X-ray technologist in any Government / Private hospitals in India. Is it that all Government hospital must follow AERB recruitment rule, in case of appointment of radiographers, otherwise it is a violation of AERB Act?

What is the criteria to fix the minimum qualification to Radiographer by AERB? What is the minimum educational qualification for a) Radiographer b) Jr.Radiographer c) X-ray technician or technologist?

What is the minimum qualification for a Radiographer to work in a Radiodiagnosis Department?

Ans. The basic educational qualification for X-ray technician / Radiographer in a Diagnostic Radiology department, as per amendment to AERB Safety Code, vide Ref: AERB/RSD/MDX/Sp-order/2012/14316 dated Nov 26, 2012 is “Radiographer’s / X-ray Technologist’s course (including in-field training in diagnostic radiology) passed from recognized Institution / Board / University”.

All diagnostic radiology institutions / hospitals (private & government) should appoint the candidates for the post of radiographers / X-ray Technologist as per qualifications specified by AERB.

Q35. Please give the list of institutes recognised by AERB which are providing training to radiographers?

Ans. AERB has not conducted training programmes for X-ray technologists / Radiographers and not given recognition to any institute for providing training to X-ray technologists / Radiographers. The training programmes are conducted by Radiological Physics & Advisory Division (RP&AD), BARC, Mumbai. However, AERB conducts periodic awareness programmes in Radiation Safety for radiographers.

“The Radiation safety and quality assurance in diagnostic radiology” courses are conducted at Centre for Training and Certification in Radiation Safety (CT& CRS), BARC, in collaboration with Association of Medical Physicists of India (AMPI). For further details please visit AMPI website www.ampi.org.in.

Q36. Is it mandatory to an Institution / University to get approval from AERB to conduct Radiodiagnosis Technology / Medical Imaging Technology course?

Is there any list of AERB approved courses on Radiodiagnosis Technology / Medical Imaging Technology?

Ans. AERB does not approve any course. AERB prescribes qualification requirements for X-ray Radiographers / Technologists and syllabi for training of such personnel in radiation safety aspects at all levels. For such institutions which approach AERB for assessment of their Medical Technology / Radiography Courses, AERB ensures that course is in line with the above prescribed requirements as stipulated by AERB so that after successful completion the candidates are recognized to work as radiation worker in the relevant field.

Q37. Recruitment Rule for X-ray technician or Radiographer of various Govt. Sector / Non-Govt. Sector is Matriculation (10th Class) with Diploma or Certificate in Radiography, in this situation are they eligible for registration from AERB for running medical diagnostic radiology department?

Ans. It is a mandatory requirement that all X-ray installations shall have a radiologist / related medical practitioner or a qualified X-ray technologist with adequate knowledge of radiation protection, to operate the X-ray unit.

For qualification and experience required for personnel in medical diagnostic X-ray installations, please see AERB Safety Code for Medical Diagnostic X-ray Equipment and

Installation, AERB/SC/MED-2 (Rev.1), 2001, which is available on AERB website www.aerb.gov.in.

Q38. What are the duties and responsibilities of a Radiologist, Non-radiologist, Radiographer, X-ray attendant in a Radiology Department?

What is the nature of work and responsibility of X-ray technician / Radiographer working in diagnostic radiology centre or hospital?

Duties and responsibilities, in detail of a) Radiographer b) Jr. Radiographer c) X-ray technician d) Radiologist.

Ans. The duties and responsibilities of Radiographer / X-ray technician / Jr.Radiographer as per the AERB Safety Code for Medical Diagnostic X-ray Equipment and Installation, AERB/SC/MED-2 (Rev.1), Section 5.2.5 of Chapter 5 “Personnel requirements and responsibilities” are as follows :

X-ray technologist and other attending staff shall ensure appropriate patient protection, public protection and operational safety in handling X-ray equipment and other associated facilities.

The duties and responsibilities of Radiologist as per this AERB Safety Code, Section 5.2.4 of Chapter 5 are as follows :

The radiologist shall undertake an X-ray examination on the basis of medical requirement. He/she shall so conduct the examination as to achieve maximum reduction in radiation dose to the patient while retaining all clinically important information.

AERB Safety Code for Medical Diagnostic X-ray Equipment and Installation, AERB/SC/MED-2 (Rev.1), 2001 is available on AERB website www.aerb.gov.in.

Q39. Who is authorised to apply the X-ray radiation on human patients, animals, patients and in other fields? Who is authorised / qualified to perform the positioning work in a radio-diagnostic facility meant for humans as well as for animals?

Who is qualified to consider the quantum of radiation doses to be delivered to the human / animal patients?

Ans. Trained Radiographers / X-ray technologists are authorised to operate the X-ray equipment after obtaining licence for operation from AERB. Trained Radiographer / X-ray technologist or medical practitioner as stipulated in AERB Safety Code is qualified to perform the positioning work and giving radiation exposure to the patient in a radio-diagnostic facility.

It may be noted that the intent of radiation exposure to patient in diagnostic radiology is not to deliver radiation doses to the patient but to obtain radiographic image for improvements in the diagnosis and treatment. However the radiation doses delivered shall be as low as reasonably achievable (ALARA).

Q40. Who will handle C-Arm, Junior radiographer or radiographer? In few hospitals radiographers are forced to operate C-Arm machine, whether this is legal according to radiation safety rules?

Is it necessary that only an X-ray technician should go and operate the C-arm machine or any other person who any sufficient knowledge and experience in handling it can operate it? What protection measures should be taken by that person?

Who is authorized to operate C-Arm Machine (running X-Ray Fluoroscopic Unit) in Operation Theatre in hospital?

Ans. As per AERB's requirements, C-Arm machine shall be operated by qualified radiographer / X-ray technician or related medical practitioner. He / She shall operate the C-Arm machine in accordance with the safe operating procedures and using protective accessories i.e. wear a lead (equivalent) apron of 0.25mm thickness while working with C-Arm.

Q41. The Guidelines to open diagnostic centre in the country having all medical diagnostic facilities such as CT Scan, C-Arm etc. Can I open it in the area having flats for general public? What precautions should be taken for the general public?

Please give the required information to install CT-Scan and X-ray Machines? What are the procedures to be followed? Please give the list of currently running CT-Scan and X-ray centers in India?

Ans. Regulatory Requirements / Guidelines to establish Medical Diagnostic centre having facilities such as general purpose X-rays, CT Scan and Mammography are stipulated in AERB Safety Code for Medical Diagnostic X-ray Equipment and Installations, AERB/SC/MED-2 (Rev.1), 2001 and its amendment published on November 26, 2012. Both the documents are available on AERB website www.aerb.gov.in.

In order to ease the procedures for filling of applications and obtaining regulatory consents, Registration / License, AERB has launched a state of the art online licensing system e-LORA (e-Licensing of Radiation Applications). Guidelines for Applying for Licence of Diagnostic Radiology X-ray Equipment through e-LORA System is available on AERB website and the same can be downloaded through the following link :-

<https://elora.aerb.gov.in/ELORA/PDFs/Guidelines%20for%20users.pdf>

List of licensed Medical Diagnostic X-ray facilities in the country are available on AERB website and this can be downloaded through following link :-

<http://www.aerb.gov.in/AERBPortal/pages/English/t/XRay/forms/xraylist.pdf>

Q42. What preventive measures are taken against exposure to harmful radiations in Radiotherapy establishments?

Ans. The preventive measures to minimise the effect of ionizing radiation from radiotherapy practises are ensuring built-in safety and operational safety of the equipment housing radioactive material and radiation generating equipment. It is ensured that the room housing such equipment are provided with adequate radiation shielding. AERB has published Safety Code for radiotherapy practices, i.e. Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011. The objective of this code is to stipulate the radiation safety requirements in the design, installation and operation of radiation therapy sources, equipment and installations in order to ensure that radiation workers and members of the public do not receive radiation dose in excess of the limits specified by the Competent Authority.

AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011 is available on AERB website www.aerb.gov.in.

Q43. Please give list of Radiation Therapy Centers in India to whom AERB has given Clearance as per Guidelines of AERB. Do all these centres have taken approval of layouts, have precommissining inspection, approval of licenses, submission of annual reports and renewal of licenses by AERB?

Ans. This list of Radiation Therapy Centers in India is also available on AERB website and the same can be downloaded through following link :-

<http://www.aerb.gov.in/AERBPortal/pages/English/t/forms/regforms/radiotherapy/radiotherapy.pdf>

All these radiotherapy centres have obtained layout plan approval and license from AERB. They submit annual status report on regular basis.

Q44. What are the prescribed qualifications for the post of Radiotherapy Technologists as per AERB norms?

What is the minimum qualification required to be appointed as radiotherapist / radiotherapy technician / radiotherapy technologists to work in a Radiotherapy department?

Ans. The minimum qualification stipulated as per AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011 for Radiation Therapy Technologist is as follows :

- i. 10+2 or equivalent examination with science subject from a recognized university or board

&

- ii. 2 years radiation therapy technologist course or equivalent based on the minimum course content prescribed by the competent authority passed from a recognized institution with infield training in radiotherapy.

For further information, please refer AERB Safety Code AERB/RF-MED/SC-1 (Rev.1), 2011, which is available on AERB website www.aerb.gov.in.

Q45. What is the educational qualification for the post of “Medical Physicist” in Radiotherapy department?

What is the minimum eligibility criteria (qualification) to be appointed as Physicist (Medical) in Radiotherapy Centre in India? Duties and responsibilities of a Medical Physicist in Radiotherapy department.

Ans. As per the AERB Safety Code on “Radiation Therapy sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011, a Medical Physicist shall have:

- (i) A Post Graduate degree in Physics from a recognized university;
- (ii) A Post M.Sc. diploma in radiological/medical physics from a recognized university; and
- (iii) An internship of minimum 12 months in a recognized well-equipped radiation therapy department.

OR

- (i) A basic degree in science from a recognized university, with physics as one of the main subject ;
- (ii) A post graduate degree in radiological/medical physics from a recognized university; and
- (iii) An internship of minimum 12 months in a recognized well-equipped radiation therapy department.

The duties and responsibilities of Medical physicists in a Radiotherapy department are stipulated in this AERB Safety Code, AERB/RF-MED/SC-1 (Rev.1), which is available on AERB website www.aerb.gov.in.

Q46. I would like to know the Scope of practice for the Radiotherapy Technologist in India. Is there any organization or body who monitor the working hours of radiotherapy technologist? If Atomic Energy Regulatory Body (AERB) is a regulatory authority for radiotherapy technologist, then what steps has been taken for the education development or maintains the professional competency for radiotherapy technologist?

Ans. As per AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011, a radiation therapy facility in the country shall have adequate number of qualified Radiation Therapy Technologists. The duties and responsibilities of Radiation Therapy Technologists are stipulated in this AERB Safety Code.

AERB does not monitor the working hours of radiation workers, as there is no stipulation for working hours by AERB. This does not come under the purview of AERB.

The role of AERB with respect to Radiation Therapy Technologist is limited to prescribing the minimum qualifications and radiation safety syllabus.

Q47. What are the courses and institutions approved by AERB for Radiotherapy Technologists as of now? Is it mandatory to an Institution / University to get approval from AERB to conduct Radiotherapy Technology course? Please give the copy of the list of AERB approved courses on Radiotherapy Technology.

I would like to know the list of the Institute, hospital or medical college conducting Radiotherapy Technologist course name year wise after Freedom in order from past to present. Please give details, the syllabus of Radiotherapy technologist is standard for Diploma / PG Diploma / B.Sc. Radiotherapy or different.

Ans. AERB does not approve any course. However, AERB ensures that the courses are in line with requirements as stipulated by AERB i.e. with respect to entry level qualification, duration of course, incorporation of radiation safety syllabus, affiliation from any recognized Board / University and provision of in-house field training, so that after successful completion the candidates are recognized as suitably qualified to work as Radiation Therapy Technologist. After publication of AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011, AERB intimated all the radiotherapy institutions in the country to approach AERB, in case they are conducting any

Radiation Therapy Technologist course, so that AERB can assess whether they are in line with AERB requirements. Many institutions approached AERB thereafter.

AERB only prescribes radiation safety syllabus required for Radiation Therapy Technologist Course and the other part of the syllabus as deemed fit for the course is prerogative of the Board / University affiliating the course. The course details such as course commencement date, eligibility criteria, age limit etc. are as per rules of the particular Board / University and such information is not available with AERB.

The list of Radiotherapy Technologist courses in the country, which are in line with AERB requirements is available on AERB website www.aerb.gov.in and the same can be downloaded through the following link :-

<http://www.aerb.gov.in/AERBPortal/pages/English/t/forms/regforms/radiotherapy/radiotherapycourse.pdf>

Q48. Can AERB allow or delegate the power to draft the course curriculum of ‘Radiation Therapy’ and regulate the ‘Radiation Therapy’ sector to MoHFW or any other body? Since When AERB is framing the course curriculum or regulating the ‘Radiation Therapy’ sector? Please give the list of relevant notification / order / guidelines etc.

Ans. Drafting of course curriculum on ‘Radiation Therapy’ is not under the purview of AERB. In principle AERB started regulating Radiotherapy practice after formation of AERB in 1983. To strengthen the regulation in Radiotherapy practices, AERB has published Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011.

Q49. Name the institutions, which are conducting Medical Physics courses from the decades. Do all other institutions are well equipped in line with the requirements? Please give the list of equipment and facilities associated with all institutions conducting Medical Physics course.

Please give the course starting date, AERB inspection dates and AERB approval dates for M.Sc. Medical Physics / Diploma in Radiological Physics courses in India.

Whether the person holding B.Sc. degree in Physics from UGC recognized University and having percentage of marks less than 60% in aggregate degree is eligible to get admission in M.Sc. Medical Physics / Medical Radiation Physics in an institution whose course is in line with AERB requirements?

Ans. AERB does not approve any course. However, a committee constituted by Head, Radiological Physics & Advisory Division (RP&AD), BARC, Mumbai is existing since 2012, for assessing Medical Physics courses in line with AERB requirements. When course curriculum is found to be in line with the AERB requirements, AERB communicates the respective institution mentioning therein that candidates passing the course are eligible to work as Medical Physicist in the country. At present 18 Medical Physics courses are found to be in line with AERB requirements in the country.

The inspection of institutes conducting Medical Physics courses was started by this committee from 2012 onwards and therefore, AERB does not have information regarding equipment and associated facilities available for such courses which was started prior to 2012. However, it was decided in the relevant committee of AERB that all the institutes conducting Medical Physics course will be inspected by the above committee and their course will be reviewed to assess whether they are in-line with AERB requirements.

Q50. What are the requirements to be completed as per AERB guidelines to operate a Radiotherapy department in a Hospital?

Kindly give details regarding setting up a Radiotherapy unit in a private institution in the country.

Ans. AERB Safety Code on “Radiation Therapy Sources, Equipment and Installations”, AERB/RF-MED/SC-1 (Rev.1), 2011 stipulates the radiation safety requirements in the design, installation and operation of radiation therapy sources, equipment and installations. This Safety Code elaborates the safety provisions as applicable to radiation therapy practices. AERB Safety Code, AERB/RF-MED/SC-1 (Rev.1), 2011 is available on AERB website www.aerb.gov.in.

AERB has launched a state of the art online licensing system e-LORA (e-Licensing of Radiation Applications) for obtaining requisite regulatory consents from AERB. Guidelines for obtaining requisite approvals for Radiotherapy Facilities through e-LORA System is available on AERB website and the same can be downloaded through the following link :- <https://elora.aerb.gov.in/ELORA/PDFs/eloraRTGuidelines.pdf>

Q51. What preventive measures are taken against exposure to harmful radiations in Nuclear Medicine department of hospitals?

Ans. As per Atomic Energy (Radiation Protection) Rules, 2004, license to operate any radiation facility depending on the practice, is accorded only after fulfilling the regulatory

requirements in the respective AERB Safety Codes. The license for operation is issued to the facility only after review of all aspects related to radiation safety and after ensuring that patient, staff and public are adequately protected. Moreover, continued safety is ensured by review of the periodic safety status reports submitted by the radiation units.

AERB has published Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011. This code stipulates radiation safety requirements in handling radioactive materials for diagnostic and therapeutic operations in nuclear medicine practices in order to ensure that workers and members of the public are not exposed to radiation in excess of limits specified by the Competent Authority.

AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011 is available on AERB website www.aerb.gov.in.

Q52. Please mention rules related to minimum number of Nuclear Medicine Technologists with number of equipment. Is one technologist enough to operate more than one equipment like Gamma Camera and PET-CT?

How many qualified Nuclear Medicine Technologists, RSO and Nuclear Medicine Physician are required in order to set up a new nuclear medicine department as per AERB guidelines? what is their duties and responsibilities? Is the requirement same for already existing nuclear medicine department having the same kind of facility (Both PET-CT & Gamma Camera with SPECT-CT)?

Ans. The minimum staff requirement for a Nuclear Medicine Facility is specified in the AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011. As per this Code, at least one nuclear medicine technologist with qualifications stipulated in the Safety Code is required for a Nuclear Medicine Facility. The requirement stipulated in this Safety Code is same for new as well as already operating facility.

The duties and responsibilities of Nuclear Medicine Physician, Nuclear Medicine Technologist and RSO in a Nuclear Medicine department are covered under Chapter 3 of Section 3.3, 3.4 & 3.5 of the AERB Safety Code, AERB/RF-MED/SC-2 (Rev.2).

AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011 is available on AERB website www.aerb.gov.in.

Q53. What are the rules and regulations related to minimum qualifications of Nuclear Medicine Technologist for Nuclear Medicine centre?

What is the educational qualifications for the post of “Medical Physicist” in Nuclear Medicine department?

If any student has passed B.Sc. (MT) Radiography, M.Sc. (Physics) and M.Sc. (Nuclear Medicine Technology), Can he / she eligible for the post of “Medical Physicist” in Nuclear Medicine department?

Ans. As per AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011, Nuclear Medicine Physician and Nuclear Medicine Technologist and RSO are mandatory staff requirements for a nuclear medicine facility and qualifications of these personnel should be as per the aforesaid AERB Safety Code. However, in some of the government institutions the Nuclear Medicine Technologists in nuclear medicine department are designated as Medical Physicists. The designation given by the institution is prerogative of the respective institution / employer and the same is not under the purview of AERB. AERB accepts only the minimum qualifications as laid down in the AERB Safety Code.

For further information, please refer AERB Safety Code AERB/RF-MED/SC-2 (Rev.2), 2011, which is available on AERB website www.aerb.gov.in.

Q54. What is the difference between the Nuclear Medicine Technician and Nuclear Medicine Technologist in Nuclear Medicine department? What is the minimum qualification for the Nuclear Medicine Technician and Nuclear Medicine Technologist?

Ans. The qualification for Nuclear Medicine Technologist is given in the AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011. As per this Safety Code, there is no requirement of a technician in Nuclear Medicine department and hence the qualification for Nuclear Medicine Technician is not defined.

Q55. Is it mandatory to obtain authorization / approval / permission of AERB to start any educational course curriculum in the field of Nuclear Medicine (e.g. M.Sc. in Nuclear Medicine, Post Graduate Diploma in Nuclear Medicine etc.)? If yes, then what infrastructure, facility and faculty AERB has made mandatory to start such course work by any educational institute / university?

Ans. AERB does not approve any course. However, there is a committee constituted by Head, Radiological Physics & Advisory Division (RP&AD), BARC, Mumbai wherein the application received by the institute for carrying out such courses are assessed. If the course curriculum is in line with AERB requirements then AERB communicates the respective

institution mentioning therein that candidates passing the course are eligible to work as Nuclear Medicine Technologist and appear in the RSO Certification examination conducted by RP&AD, BARC.

Q56. Please give list of AERB approved Institutes which are conducting the M.Sc. (Nuclear Medicine Technology) / DMRIT or PGDNMT (Post PG diploma) like programmes in all over India.

Ans. The list of AERB approved Institutes which are conducting the M.Sc. (Nuclear Medicine Technology) / DMRIT or PGDNMT (Post PG diploma) like programmes in India is available on AERB website www.aerb.gov.in & the same can be downloaded through the following link :-

http://www.aerb.gov.in/AERBPortal/pages/English/nuclear_medicine/Nuclear_Medicine_jsp.action

Q57. What are the guidelines to establish Nuclear Medicine department in a well equipped hospital in India?

Ans. AERB Safety Code on “Nuclear Medicine Facilities”, AERB/RF-MED/SC-2 (Rev.2), 2011 stipulates radiation safety requirements in handling radioactive materials for diagnostic and therapeutic operations in nuclear medicine practices. This Safety Code elaborates safety provisions applicable to nuclear medicine applications.

AERB Safety Code, AERB/RF-MED/SC-2 (Rev.2), 2011 is available on AERB website www.aerb.gov.in.

Guidelines for Applying for Licence of Nuclear Medicine Facility through e-LORA (e-Licensing of Radiation Applications), an online licensing System launched by AERB is available on AERB website and the same can be downloaded through the following link :-

https://elora.aerb.gov.in/ELORA/PDFs/Guidelines%20for%20users_NM-1.pdf

Q58. What are the rules and regulations for AERB registration for Radiography Service Organisations / Companies / Industries? Please give details of approval granted to such Industries for conducting Radiography test in their premises as on date.

Ans. The industrial radiography agencies are governed by the following main regulations :

(a) Atomic Energy Act, 1962

(b) Atomic Energy (Radiation Protection) Rules, 2004

(c) Atomic Energy (Safe disposal of radioactive wastes) Rules, 1987 and

(d) AERB Safety Code on Industrial Radiography, AERB/RF-IR/SC-1 (Rev.1), 2016

(e) AERB Safety Code on Safe Transport of Radioactive Material, AERB/NRF-TS/SC-1 (Rev.1), 2016

AERB does not grant approval for conducting Radiography test to any Industries / Institutions. AERB ensures availability of source storage facility with the industrial radiography institutions prior to issuance of License for handling industrial radiography source(s) by the institutions.

Q59. Please give details of manpower or staff to be required in an Industrial Radiography unit as per AERB norms.

Ans. The minimum personnel requirements for a Industrial Radiography facility is prescribed in the AERB Safety Code on Industrial Radiography, AERB/RF-IR/SC-1 (Rev.1), 2016

The qualifications and responsibilities of persons required in an Industrial Radiography Facility are covered under Chapter 4 of the AERB Safety Code, AERB/RF-IR/SC-1 (Rev.1).

AERB Safety Code for Industrial Radiography, AERB/RF-IR/SC-1(Rev.1), 2016 is available on AERB website www.aerb.gov.in.

Q60. What are the guidelines prescribed by AERB for setting up a Radiographic unit for Industrial purposes?

Ans. AERB Safety Code for Industrial Radiography, AERB/RF-IR/SC-1 (Rev.1), 2016 stipulates the requirements for radiation safety in handling industrial gamma radiography exposure devices and X-ray generating equipment for industrial radiography. This Safety Code elaborates the safety provisions applicable to radiological safety of industrial radiography operations and security of radiography devices/ sources. AERB Safety Code, AERB/RF-IR/SC-1 (Rev.1), 2016 is available on AERB website www.aerb.gov.in.

AERB has launched a state of the art online licensing system e-LORA (e-Licensing of Radiation Applications) for obtaining requisite regulatory consents from AERB. Guidelines for submission of application for various consents pertaining to Industrial Radiography practice through e-LORA System is available on AERB website and the same can be downloaded through the following link :-

<https://elora.aerb.gov.in/ELORA/PDFs/Guidelines%20for%20consents.pdf>

Q61. Whether Radiology department can work without RSO? What are the Rules prescribed by AERB to authorize a person to function as RSO in Radiation unit?

Ans. Requirement of Radiological Safety Officer (RSO) is mandatory for operation of every radiation facility as stipulated in Rule 19 of Atomic Energy (Radiation Protection) Rules, 2004. License is not issued by AERB, without availability of RSO.

The person having appropriate qualifications as stipulated in the respective AERB Safety Code is to be nominated by the employer of the institution and has to be approved by the Competent Authority, AERB.

Rule 22 of Atomic Energy (Radiation Protection) Rules, 2004 prescribes responsibilities of the Radiological Safety Officer in a radiation facility.

Q62. How many types of RSO Certificates are there in? Give the full information about all certificates and also its eligibility criteria, duration, exam details.

What is the eligibility criteria to write RSO Level-I, II & III Certification examination as per AERB guidelines? Give the list of Qualified RSOs (RSO-I, II & III) who have passed the certification of RSO from RS Division of AERB from the starting of certification.

Please specify & differentiate the Authority, Position / Rank with qualification of RSO Level-III, II & I approved by AERB across hospitals in India.

Ans. AERB does not conduct Radiological Safety Officer (RSO) course or certification examinations. AERB does not have the list of qualified RSOs. Radiological Physics & Advisory Division (RP&AD), BARC, Mumbai is conducting RSO Certification programme. AERB only approves the candidates after successful completion of RSO Certificate examination. The details regarding the eligibility criteria and other information may please be obtained from Head, RP&AD, BARC, CT&CRS Building, Anushaktinagar, Mumbai -400 094.

It may be noted that presently there is no categorization of RSOs and the approval is issued for specific practices such as Radiotherapy, Diagnostic Radiology, Nuclear Medicine, Industrial Radiography etc. The earlier practice of RSO level III, II & I, which was based on risk associated with the radiation facilities has been abolished. However, minimum requirements of a candidate to be designated as RSO are stipulated in AERB Safety Codes for specific practices, which are available on AERB website www.aerb.gov.in.

Q63. What are the duties and responsibilities of Radiological Safety Officer (RSO) Level I, II & III in a radiation facility?

Ans. It may be noted that presently there is no categorization of RSOs and the approval is issued for specific practices. AERB Safety Code, AERB/RF-MED/SC-1 (Rev.1) stipulates the requirements and responsibilities of Radiological Safety Officer (RSO) in Radiotherapy facility. The requirements and responsibilities of Radiological Safety Officer in Nuclear Medicine facility are covered under Chapter 3 of AERB Safety Code, AERB/RF-MED/SC-2 (Rev.2) and in Diagnostic Radiology facility this is covered under Chapter 5 of AERB Safety Code, AERB/SC/MED-2 (Rev.1). Chapter 4 of AERB Safety Code, AERB/SC/IR-1 covers the requirements and responsibilities of Radiological Safety Officer in Industrial Radiography facility. All these AERB Safety Codes are available on AERB website www.aerb.gov.in.

Q64. Please confirm whether the regulatory inspection of the facility, which are licensed by AERB has been carrying out or not. If yes, indicate time schedule for such inspection.

Does AERB have any mechanism to authenticate the information provided by Diagnostic centres / Hospitals to get AERB license?

Ans. AERB conducts regulatory inspections to verify compliance with the safety requirements as stipulated in the Atomic Energy Act and Rules and AERB Safety Codes. Regulatory Inspections of Radiation facilities are carried out on random basis across the country by AERB as per AERB Safety Manual on “Regulatory Inspection and Enforcement in Radiation Facilities”, AERB/RF/SM/G-3. The institutes to be inspected are selected for inspections periodically on random basis. The inspection frequency of the facility for different practices is given in the above Safety Manual.

Q65. Please give guidelines for disposal of radioactive waste from research laboratories / hospitals in India. Where are all the radioactive waste disposed off?

Ans. Guidelines for disposal of radioactive waste from research laboratories and hospitals in India is governed by the AERB Safety Guide AERB/RF/SG/RW-6, titled “Management of Spent Radioactive Sources and Radioactive Waste Arising from the Use of Radionuclides in Medicine, Industry and Research, including Decommissioning of Such Facilities” and Atomic Energy (Safe Disposal of Radioactive Waste) Rules, 1987. These documents are available on AERB website www.aerb.gov.in.

The radioactive sources most commonly used are usually of low activity unsealed sources and disposed off using the principle of dilute and disperse. These sources after their useful life will be discharged through the main sewerage line connected to the hospital.

Q66. What are transportation rules and regulations concerned to safety and security of radioactive materials in India?

Ans. Transportation of radioactive material in India is governed by the Safety Code on “Safe Transport of Radioactive Material”, AERB/NRF-TS/SC-1 (Rev.1), 2016 published by Atomic Energy Regulatory Board (AERB). This code is based on the International Atomic Energy Agency (IAEA) “Regulations for the Safe Transport of Radioactive Material”.

Q67. Give the list of Radiation accidents, associated with radiation facilities happened in India which is reported to AERB and the Investigation reports and further actions taken by AERB.

Ans. The list and details of incidents with radiation safety implication over the past years are available in AERB Annual Reports, which is available on AERB website. The radiation accident at Mayapuri scrap market, New Delhi, in April 2010 is the major radiation accident in India. No such disasters have taken place in any other state after Mayapuri. The regulatory mechanism on legacy sources has been improved thereafter.

The detail of Mayapuri accident is available in AERB Newsletter Vol. 23, Jan-Jun 2010, which gives details on outcomes of investigation and further actions taken by AERB. The newsletter is available on AERB website www.aerb.gov.in.

Q68. Is AERB making any efforts to tackle radioactive emissions from different Diagnostic Radiology centres and apprising people in general about the harm caused thereby to human health? if yes what are these efforts?

Ans. Atomic Energy Regulatory Board (AERB) takes all efforts that there is no undue risk because of the use of Ionizing Radiation as well as use of Nuclear energy in the Radiation & Nuclear establishments throughout the country.

AERB has structured procedures for safety reviews & regulatory inspections of all these Nuclear and Radiation facilities. AERB gives public information through its periodic Press Releases, Annual Report, Newsletters, and Direct Interviews with print and electronic media. AERB conducts public awareness programs periodically on various safety related

issues for the benefit of various stakeholders and the public. AERB gives periodical advertisement in the newspapers for abiding by these statutory requirements with respect to radiation safety. AERB carries out safety reviews of the facilities at different stages of siting, construction, commissioning, operation and decommissioning. AERB also carries out periodic regulatory inspections of such facilities as per statutory AERB codes, guides, manuals etc.

Further, AERB has also established its own Regional Regulatory Centers (RRC) at Chennai, Kolkata and Delhi for catering to the Southern, Eastern and Northern regions of the country respectively.

Q69. What is the need of directorate of radiation safety agency in various states of India? What is the status of directorate of radiation safety agency of various state?

Ans. There are a several thousands of medical diagnostic X-ray facilities dispersed in the country which need to be regulated by AERB. Decentralization of inspections of these facilities is one of the options considered for effective safety regulation of such installations. In this regard, AERB has initiated process for formation of Directorate of Radiation Safety (DRS) under Health and Family Welfare Department of every state, to carry out regulatory inspections of X-ray facilities (of the state) and support the utilities in obtaining license / registration from AERB.

Radiation Safety Agency is made functional in FOUR States (Kerala, Mizoram, Chhattisgarh and Tripura). The other EIGHT State Governments that signed an MoU with AERB are as follows: (1) Madhya Pradesh, (2) Tamil Nadu, (3) Punjab, (4) Gujarat, (5) Himachal Pradesh, (6) Maharashtra (7) Odisha and (8) Arunachal Pradesh. Follow-up is in progress to enter an agreement with other States and make them functional.

Q70. Effect of ionizing radiation to general public and staff by the Medical Diagnostic Centres, Immunity / Disease / Infection or any side effects please give details.

Ans. Harmful effects of ionising radiation (X-rays) on human beings depend on the magnitude of absorbed dose. The magnitude of radiation absorbed dose must be very high for causing any detectable biological effects. It shall be noted that detectable chromosomes aberration reveals only on exposed individual for radiation absorbed dose greater than 100mSv. Any side effect occurs at still higher doses. AERB prescribes annual dose limits for general public as 1mSv/year and for occupational worker as 30 mSv/year, which is much below the dose which could cause any biological / side effects.

Q71. Details of the provision of the Act and Rules under which the private sector is permitted to handle most Radio Active Mineral including monazite included.

Ans. As per Section 14 (1) of the Atomic Energy Act, 1962, License is required from Department of Atomic Energy (DAE) for handling prescribed substances. For this purpose, the Atomic Energy (Working of Mines, Minerals and Handling of Prescribed Substance) Rules, 1984 were framed under the Act. DAE has been notifying the list of Prescribed Substances from time to time. Consequent to the notification on the Schedule of Prescribed Substances notified by DAE which came into force from January 1, 2007, Thorium (natural) exceeding 1000kg and Uranium (natural) exceeding 100kg are notified as prescribed substances and handling of such quantities of thorium and uranium in a year would require license from DAE.

Private Beach Sand Mineral players involved in the exploitation of beach sands for the separation of heavy minerals such as ilmenite, rutile, leucoxene, garnet, sillimanite and zircon do not require license from Department of Atomic Energy under the Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substance) Rules, 1984 as the above said heavy minerals are no longer prescribed substances as per the notification issued by DAE. However, license from AERB under Rule (3) of the Atomic Energy (Radiation Protection) Rules, 2004 is required for handling of these heavy minerals with respect to radiation safety as these are associated with radioactive monazite. A Gazette notification has already been issued in this regard. As per the said Gazette notification, Beach Sand Minerals (BSM) processing facilities carrying out mining and mineral separation for production of ilmenite, rutile, leucoxene zircon, sillimanite, garnet & monazite and physical and chemical processing of these BSM are required to apply for license under Rule (3) of the Atomic Energy (Radiation Protection) Rules, 2004. Those facilities which are not carrying out mining but are engaged in procuring raw material from other parties for further processing are also issued licenses under the Atomic Energy (Radiation Protection) Rules, 2004.

Q72. What are the policies, guidelines, rules & regulations regarding the allocation of thorium and other minerals / sands- blocks / mines / fields and their augmentation by the private sector / companies?

Ans. AERB is not involved in allocation of thorium and other minerals / sands and their production and export by private companies. AERB issues license to the private beach sand mineral facilities involved in the separation of minerals like ilmenite, rutile, garnet, sillimanite or / and zircon under the Atomic Energy (Radiation Protection) Rules, 2004 and the concern is safe

disposal of tailings containing some amount of monazite generated during the separation of minerals. AERB regulates the Beach Sand Mineral facilities only with respect to radiation safety stand point so that disposal of tailings enriched with monazite does not cause any unacceptable impact on the workers, public and environment.

The rules and regulations for this are given below and are available on AERB website www.aerb.gov.in.

- 1) The Atomic Energy (Radiation Protection) Rules, 2004
- 2) Gazette Notification S.O.1210 published in the Gazette of India dated 9-5-2009

It may be noted that the mining leases are granted by the respective State Government and are not under the purview of AERB.

Q73. What are the polices / guidelines, Rules & Regulations regarding the export of thorium by Govt and/or/as well as private sector companies?

Ans. AERB is not involved in policy making for export of thorium. As per information available with AERB, no private companies are involved in the production of monazite and thorium. From radiological safety point of view AERB, issues No Objection Certificate (NOC) for the export of thorium by Indian Rare Earths Limited under the Atomic Energy (Radiation Protection) Rules, 2004.

Q74. What are the documents related to the directions or orders issued by Atomic Energy Regulatory Board (AERB), in the last 10 years, in order to regulate or control the illegal production of radioactive minerals like monazite etc from coastal placer sands of East and West coasts of the country, especially by private mining companies?

Give list of companies which are separating monazite and how they dispose the same.

Ans. The regulatory control exercised by the Atomic Energy Regulatory Board (AERB) on private beach sand mineral facilities is limited only with respect to radiological safety at work place and safe disposal of monazite enriched tailings. It is clarified that private beach sand mineral facilities are not permitted to produce monazite. Only Indian Rare Earths Ltd. of DAE is separating monazite and the separated monazite is stored in trenches for further processing in future.

Non-DAE facilities are involved in the separation of other heavy minerals excluding monazite. In such facilities when the quantity of tailings generated is large and the monazite content in the tailings is relatively low (less than 5%), the tailings have to be disposed by mixing with

silica rich sand and backfilled at the mined out site. If the monazite content in the tailings is high (more than 5%) and the quantity of tailings generated is comparatively less then it has to be stored in trenches and topped with silica rich sand to bring the radiation level to the background level.

Q75. Whether AERB has issued any guidelines till date, on manner of disposal of Monazite rich tailings? If yes please give details.

Ans. AERB has issued Safety Guidelines for safe disposal of monazite rich tailings which is contained in the document, AERB Safety Guidelines on “Radiological Safety in Handling Beach Sand Minerals and Other Naturally Occuring Radioactive Materials”, AERB/FE-FCF/SG-5. This Safety Guideline is available on AERB website www.aerb.gov.in.

Q76. Kindly inform how many beach mineral separation plants obtained license from AERB under the provisions of Radiation Protection Rules, 2004.

Ans. AERB has issued license to private parties and government authorities (Indian Rare Earths Ltd. of DAE and The Kerala Minerals & Metals Ltd. of Kerala State) under the Atomic Energy (Radiation Protection) Rules, 2004.

At present twenty two Non-DAE beach sand mineral facilities and three Indian Rare Earths Ltd. facilities of DAE having license under the Atomic Energy (Radiation Protection) Rules, 2004.

It may be noted that the mining leases are granted by the respective State Government and are not under the purview of AERB.

Q77. Is there any Regulation regarding registration of establishments that use radioactive elements in their premises in order to keep a tab on how many operational / proposed establishments have Radioactive facilities?

Ans. All the establishments using radioactive materials are required to follow Atomic Energy Radiation Protection Rules, 2004 and Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 promulgated under Atomic Energy Act, 1962 as the case may be.

Also, AERB issues safety codes, guides, manuals and standards periodically which are needed to be followed by the establishments. As per Atomic Energy (Radiation Protection) Rules, 2004 license is to be obtained in the form of Consent / Registration / Authorization / Approval from

the regulatory body Atomic Energy Regulatory Board (AERB) for establishing, operating and decommissioning of the radiation facility.

Q78. How many safety review committees have been set up by the government of India ever since 1947 to review the safety of nuclear and atomic plants? What were the findings and recommendations of these committees? What was action taken based on these reports?

Ans. Nuclear and radiation facilities in India are presently regulated by Atomic Energy Regulatory Board (AERB). AERB was constituted on November 15, 1983 under the Atomic Energy Act 1962. During Silver Jubilee celebrations in November 2008, the board published a commemorative book titled ‘25 Years of Safety Regulation’. This book, besides detailing the current regulatory system, gives a historic account of the evolution of regulatory framework for nuclear and radiation safety in India.

Following the occurrence of nuclear events (like Three Mile Island, Chernobyl, Narora fire) of greater safety significance in India and abroad, various committees were constituted to learn the lessons and recommend corrective actions for Indian Nuclear Power Plants (NPPs). Details of these committees and actions taken in Indian NPPs aftermath of these nuclear events are also detailed in this book.

The book is available on the website of AERB www.aerb.gov.in and may be referred for details.

Q79. How many nuclear power plants running in India, and how many are under construction?

Ans. At present, Nuclear Power Plants are operating at seven sites in six states. There are twenty operating nuclear power plants in the country with a total installed capacity of 5680 MWe, the details of which are as follows:

States	Nuclear Power Plants	Installed capacity
Rajasthan	RAPS -1 RAPS -2 RAPS 3-6	1 x 100 MWe = 100 MWe * 1 x 200 MWe = 200 MWe 4 x 220 MWe = 880 MWe
Karnataka	KGS 1-4	4 x 220 MWe = 880 MWe
Maharashtra	TAPS -1&2 TAPS -3&4	2 x 160 MWe = 320 MWe 2 x 540 MWe = 1080 MWe
Uttar Pradesh	NAPS-1&2	2 x 220 MWe = 440MWe
Tamil Nadu	MAPS 1&2 KKNPP -1	2 x 220 MWe = 440 MWe 1 x 1000 MWe= 1000 MWe

Gujarat	KAPS 1&2	2 x 220 MWe = 440 MWe
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*RAPS -1 Under Shutdown now.

There are six Nuclear Power Plants in the country with an installed capacity of 4300 MWe are under construction / commissioning. The details of which are as under:

1. Kudankulam, Tamil Nadu (KKNPP Unit 2 ; 1 x 1000 MWe) – Under commissioning
2. Kakrapar, Gujarat (KAPP Unit 3 & 4 ; 2 x 700 MWe) – Under construction
3. Rawatbhata, Rajasthan (RAPP Unit 7 & 8 ; 2 x 700 MWe) – Under construction
4. Kalpakkam, Tamil Nadu (PFBR, 500 MWe) – Advanced construction stage

Nuclear Power Plants (NPPs) which are coming up are as under:

1. Kudankulam, Tamil Nadu (KKNPP Unit 3 to 6 ; 4 x 1000 MWe) – Siting consent given
2. Gorakhpur, Haryana (GHAVP Unit 1 to 4 ; 4 x 700 MWe) – Siting consent given
3. Jaitapur, Maharashtra (JNPP Unit 1 to 6 ; 6 x 1650 MWe) – For Siting consent, safety review in progress

Q80. How many nuclear power plants operating in the country fall in seismic zones?

Give names of operating nuclear power plants & nuclear power projects under construction on the fault line and number and names of these nuclear power projects in seismically active region along with their zones.

Ans. There is no operating nuclear power plant and no nuclear power project under construction on fault line or high seismic region. As per the Indian national standard, BIS 1893-2002, India is grouped into four seismic zones designated as zone-II, III, IV and V as per the level of seismic hazard, with Zone II depicting lowest seismic hazard and zone V indicating the highest seismic hazard. No nuclear power plants are located in zone-V, the zone with highest seismicity. The NPPs located in other zones (zones II to IV) are designed for seismicity following state of the art methodology which evaluates the maximum earthquake potential of the site in a conservative manner.

Number and names of operating nuclear power plants in seismically active region along with their zones are given in table -1 below:

Table -1

Name of Nuclear Power Plant	No. of reactor units	Seismic Zone as per IS 1893
Rajasthan Atomic Power Station – 1 to 6	6	II
Kaiga Atomic Power Station – 1 to 4	4	III
Tarapur Atomic Power Station – 1 & 2	2	III
Tarapur Atomic Power station – 3 & 4	2	III
Narora Atomic Power Station – 1 & 2	2	IV
Madras Atomic Power Station – 1 & 2	2	III
Kudankulam Nuclear Power Project – 1	1	II
Kakrapar Atomic Power Station – 1 & 2	2	III

Number and names of nuclear power projects under construction in seismically active region along with their zones are given in table -2 below:

Table -2

Name of Nuclear Power Project	No. of reactor units	Seismic Zone as per IS 1893
Kudankulam Nuclear Power Project – 2	1	II
Kakrapar Atomic Power Project – 3 & 4	2	III
Rajasthan Atomic Power Project – 7 & 8	2	II
Prototype Fast Breeder Reactor	1	III

Q81. Which is / are the applicable standard(s) (Codes & Guides) for design approval of a Nuclear Power Plant? Since when this / these standard(s) (Codes & Guides) for design approval of a Nuclear Power Plant is / are in force? When was the last revision done? What were the compelling reasons for those revisions? Please give comparative table of changes showing 'before & after'.

Ans. For setting up of Nuclear Power Projects and Research Reactors in India, AERB issues various consents for the stages of Siting, Construction, Commissioning, Operation and Decommissioning. The AERB requirements for review towards issuing Consent / Approval of an NPP site are provided in the document AERB/NPP&RR/SG/G-1, "Consenting Process for Nuclear Power Plants and Research Reactors". This is available in AERB website: www.aerb.gov.in. There are 19 published design safety guides which elaborate various requirements and furnish approaches for their implementation.

AERB has published the Safety Code on Siting of Nuclear Power Plants in the year 1990. Safety Guides were published progressively during 1998 to 2008. Last revised design code was published in December 2009. New sections introduced in the revised code are safety objectives, management of safety, principal technical requirements and plant design requirements. The revised code covers considerations in design for severe accidents, use of system design capabilities beyond originally intended function and available means or support from other units for multi-unit plants to mitigate the consequences of severe accidents. New clauses are added on comprehensive safety assessment to confirm that the design meets the safety requirements set out at the beginning of the design process.

Design requirements for dealing with ageing of all structures, systems and components important to safety are introduced. New requirements are laid for moderator system, computers in systems important to safety, emergency control center etc. Introducing requirements on grid-plant interaction enlarges the scope of electrical system. The requirements on equipment qualification and human factor in design of a plant are updated.

Q82. Is it correct that AERB is the final authority to give Site approval for Jaitapur Nuclear Power Project? What is the role of AERB for setting up of Nuclear Power Plants in the country?

Ans. AERB is the authority to give Site approval for a nuclear power plant based on the review of safety issues in the scope of AERB. In addition, Site has to obtain necessary clearance from MoEF and other statutory bodies. Only Radiological Impact Assessment on Environment is reviewed by AERB. Other environmental aspects are looked at by MoEF and State Pollution Control Board.

For setting up of Nuclear Power Plants and Research Reactors in India, AERB issues various consents for the stages of Siting, Construction, Commissioning, Operation and Decommissioning. The AERB requirements for review towards issuing consent / approval of an NPP Site are provided in the document "Consenting Process for Nuclear Power Plants and

Research Reactors”, AERB/NPP&RR/SG/G-1, which is available on AERB website www.aerb.gov.in. The safety review is done through a well-established multi-tier review process.

Q83. Has AERB approved Jaitapur Site for a Nuclear Power Plant? If yes, what is the capacity in MWe for which the approval was sought and given by AERB?

Ans. An application seeking consent for setting up 6 x 1650 MWe EPR based Nuclear Power Plants at Jaitapur was submitted by NPCIL on April 2010. AERB review of the NPCIL application for Siting Consent is in progress. Clearance for Siting of Jaitapur Nuclear Power Project (JNPP) by AERB has not still been issued.

Q84. Please give detailed information on accidents at nuclear power plants in the country?

Ans. International Atomic Energy Agency (IAEA) and Organisation for Economic Co-operation and Development (OECD) / Nuclear Energy Agency (NEA) has jointly prepared an International Nuclear Event Scale (INES) for promptly communicating the safety significance of events reported at nuclear installations to the public. As per this scale, events in nuclear installations are classified at seven levels; the upper levels (4 to 7) are termed as “accidents” and the lower levels (1 to 3) as “incidents”. Events which have no safety significance are classified below scale at level 0 and are termed as “deviations”.

There has been no radiation accident at any Indian nuclear power plants.

AERB brings out the information about all significant events in nuclear power plants in India and their INES ratings in its Annual Reports. These reports are available on AERB website www.aerb.gov.in.

Q85. What kinds of areas are chosen to dispose off radiation or nuclear waste?

Ans. The dispose of radioactive waste generated from Nuclear and Radiation Facilities, if any, are done after proper monitoring & ensuring that the waste discharges are within the prescribed limits. All other radioactive wastes are stored / disposed in regulated areas. No public habitation or movement is allowed in this area. This area is administratively controlled by the facility. Public areas are not chosen for disposal of radioactive waste. Also public awareness programs are conducted periodically for the benefit of general public.

Q86. How do you ensure that there are no radiation leakages from the storages and waste disposed also does not leak radiation?

Ans. To ensure that there are no leakages from radioactive waste storage facilities, the solid waste is stored in specially designed leak proof constructed structures such as Stone lined Trenches, RCC Trenches and Tile Holes. The high level radioactive liquid is immobilised into glass matrix through vitrification process and stored.

Q87. How do you ensure that there are no adverse effects of the Nuclear Wastes wherever disposed?

Ans. To ensure that there are no adverse effects of the Nuclear Wastes disposed, a public dose limit of 1000 $\mu\text{Sv}/\text{year}$ is prescribed by AERB in line with IAEA (International Atomic Energy Agency) and ICRP (International Commission on Radiological Protection) limits. The dose received by the member of public at the site boundary of existing Nuclear Power Plants is measured to be in the range of 0.56 - 40 $\mu\text{Sv}/\text{year}$ (2012) which is much less than the prescribed limit. For comparison, the average dose to a member of public due to natural radiation background is 2400 $\mu\text{Sv}/\text{year}$.

Q88. Which document shows the current method of Nuclear Waste Disposal and the sites being used for Nuclear Waste Disposal?

Are there any guidelines for liquid and solid nuclear waste and radioactive waste disposal in India? What safety measures are observed while disposing off nuclear and radioactive waste in different establishments like Power Plants, Recycling units etc.?

Ans. The nuclear waste handling, treatment, storage and disposal are carried out as per the well laid down procedures and guidelines stipulated by the Atomic Energy Regulatory Board (AERB). Any radioactive waste is disposed following the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 promulgated under the Atomic Energy Act, 1962 and the regulatory requirements laid down by AERB. AERB monitors and regulates disposal / transfer of radioactive waste from the nuclear power plants. The year wise and plant wise details of liquid and gaseous waste transferred/disposed from each of the nuclear power plants are regularly published in the annual reports of AERB. The AERB annual reports are available on AERB's website www.aerb.gov.in.

Operation of nuclear power plants generates low level radioactive solid, liquid and gaseous wastes. These are termed as radioactive effluent release. The volume and activities of these

wastes are assessed based on waste sampling, radionuclide monitoring. The low level solid, liquid and gaseous generated from nuclear power plants are disposed off as per standard approved method after ensuring compliance with the regulatory requirements. All these are in line with the international standards.

Solid waste generated from nuclear power plants is packed in suitable containers and then disposed off into specially constructed engineering modules such as Stone lined trenches, RCC Trenches and Tile Holes at Near Surface Disposal Facilities (NSDFs) depending upon activity and radionuclides. These NSDFs are located within exclusion zone boundary of the plant. NSDFs are designed and constructed to contain the radionuclides within the disposal system until the decay of radionuclides to negligible level.

Low level liquid waste is disposed to nearby water body after suitable treatment ensuring compliance with regulatory limit. The treatment system essentially comprises chemical treatment, evaporation, ion exchange and filtration. The high level active waste is immobilised in inert matrices such as cement, polymer etc and treated as solid waste.

Provisions for monitoring and periodic surveillance are provided at the waste disposal sites.

Q89. Which document shows any environmental repercussion associated with the current method of Nuclear Waste Disposal? and if so, the details thereof.

Whether Narora Atomic Power Plant authority ever conducted radioactive tests on agriculture produce like grains and cereals etc. vegetables, fruits, dairy and poultry produces within the five kilometers radius of this power plant? If yes, then when test last were conducted? Give the detailed outcome of these tests with date and year.

Which document shows that the Government is also considering conducting a survey in the areas around atomic power plants to understand the health and environmental implications? and if so, the details thereof.

Ans. There are no environmental repercussions associated due to current method of Nuclear Waste Disposal in our country. The nuclear waste handling, treatment, storage and disposal are carried out as per well laid down procedures and guidelines stipulated by the Atomic Energy Regulatory Board (AERB). These documents and guidelines are in line with the international standards.

At all of nuclear power project sites, Environmental Survey Laboratories (ESL) of Bhabha Atomic Research Centre (BARC) are established, which carry out environmental surveillance to evaluate the radiological impact due to operations of nuclear power plant on the public and the environment and the survey reports are communicated to AERB. Extensive surveys of air, water

and dietary products around the nuclear power plant sites, upto a distance of 30 km from the plant are done by Environmental Survey Laboratories (ESL) of Health, Safety and Environment Group, BARC, which is independent of the plant organization. Radiation dose to members of the public near the operating nuclear power plants is estimated based on these surveys. The annual dose to the public around these facilities are estimated every year and found to be a very small fraction of the allowable limit of 1 mSv/year specified by AERB, which is in line with the limit recommended and followed internationally.

The dose assessments to the public due to operation of the nuclear power plants at all of these sites are regularly published in the annual reports of AERB. The AERB annual reports are available on AERB's website www.aerb.gov.in.

Q90. Which document shows the details of environmental rules regulating Disposal of spent fuel?

Ans. India's nuclear power programme is based on a closed fuel cycle. India has adopted this approach considering the objectives of maximum utilisation of the energy potential of available resources and minimisation of high level waste. Indian nuclear power programme does not envisage direct disposal of spent fuel.

Q91. Which document shows that the Government is considering carrying out a safety audit of all atomic power plants in the country?

Ans. The safety reviews of the Indian Nuclear Power Plants (NPPs) are carried out by the regulatory authority, the Atomic Energy Regulatory Board (AERB). The NPPs are subjected to detailed safety reviews by AERB right from Siting, Construction, Commissioning and Operation. The License for operation of NPP is issued after satisfactory review of construction and the results of commissioning.

All atomic power plants in India are subjected to continuous safety surveillance, both by the plant management as well as through regulatory supervision by AERB. In addition, there are Periodic Safety Reviews and regular inspections at the NPP facilities by AERB.

The license for operation of NPPs require renewal once in every five years ; for which a detailed safety review is carried out as specified by AERB.

The requirements related to the above are specified in the Atomic Energy Act, 1962, the Atomic Energy (Radiation Protection) Rules, 2004, Safety Codes on 'Regulation of Nuclear and Radiation Facilities' (AERB/SC/G), 'Design of Pressurised Heavy Water Plant Reactor Based NPP' (AERB/NPP-PHWR/SC/D (Rev.1), 'Nuclear Power Plant Operation' (AERB/NPP/SC/O (Rev.1) and 'Safety Guides on Consenting Process for Nuclear Power Plants and Research Reactors' (AERB/NPP & RR/SG/G-1), 'Renewal of Authorisation for Operation of Nuclear Power Plant' (AERB/SG/O-12), 'Regulatory Inspection and Enforcement in Nuclear and Radiation Facilities' (AERB/SG/G-4) etc.

The inspection of a nuclear power plant during the project stage is carried out by AERB once in every quarter and that of an operating nuclear power plant is carried out once in every six months. The highlights of the safety review and inspection findings are published in Annual Reports.

The Copy of all these documents and reports are available on AERB website www.aerb.gov.in.

Q92. What is Minimum Educational qualification for Scientific Officer in RSD, AERB, Mumbai?

Ans. AERB does not conduct separate recruitment for any particular division of AERB. Recruitment is done for AERB to fill the vacancies and Scientific Officers recruited in AERB can be posted to any division in accordance with their qualifications and experience. AERB follows the Recruitment Guidelines laid down by the Department of Atomic Energy for Scientific & Technical Personnel. For any further information you may refer the following link :-

http://www.barc.gov.in/careers/direct_apply.html

AERB releases recruitment notification through its official website www.aerb.gov.in and print and electronic media. The recruitment notification itself mentions qualifications required to be apply for the post.

Q93. Kindly inform the rules / guidelines that were being followed for appointment on compassionate grounds during 1993. Give a list of employees appointed on compassionate grounds.

Ans. The rules / guidelines that were being followed by AERB for appointment, if any on compassionate grounds during 1993 were as per guidelines prescribed by DoPT, Ministry of Personnel Public Grievances and Pensions under OMs & Orders (Establishment) (A) (III)(a). No one has been appointed in AERB on compassionate grounds till now.

Q94. Please give information of reservation and concession for SC/ST candidates in recruitment in AERB as on today.

Ans. As far as AERB is concerned it is stated that AERB follows the instructions issued by Department of Personnel & Training in this regard.

Q95. Are there any relaxation in ACR, for promotion of SC/ST candidates in DAE and its all constituent units, give detail records of relaxation?

Ans. AERB follows the promotion norms, instructions, orders, guidelines issued by DoPT in respect of Administration, Accounts, Auxiliary Staff. However, in respect of Scientific and Technical staff (for promotion upto the grade of the post of Scientific Officer/D and equivalent) relaxed norms are adopted as per the promotion norms laid down by the Department of Atomic Energy from time to time.

Q96. Please give record and information of Employees union / Joint Consultation Council (JCC) represent by the SC/ST employees as of today.

Ans. There is no recognised Employees Association in AERB. However SC / ST Grievances Cell is set up in AERB on August 26, 1993 as per guidelines prescribed by DoPT, to address their issues.