

ENVIRONMENT

Technologies for Better Quality of Life

ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE AT NUCLEAR POWER PLANTS

A well-equipped Environment Survey Laboratory (ESL) is established at each Nuclear Power Plant Site by BARC well before the commissioning of the plant. The primary aim of the environmental monitoring programme is to demonstrate compliance with the radiation exposure limits set for members of public. In pre-operational phase, ESLs generate baseline data on the levels of external radiation dose and concentration of natural radioactivity (Uranium & Thorium and their daughter products, Potassium-40 etc.) and radionuclides due to global weapon fallout (Strontium-90, Cesium-137 etc.). This requires a detailed measurement of these radionuclides in different environmental matrices (air, water, fish, silt, sediment, soil, vegetation, goat thyroid, vegetable, milk, grass, crops, fruits, meat and other dietary items) covering 30 km radial distance around the plant. The number and type of samples and sampling frequency is optimised for each site on the basis of the nature of operating facilities, utilization of local natural resources, existence of population clusters and related demographic data.



Environment Survey Laboratory at Kalpakkam, Tamil Nadu

Mainly three types of environmental samples are collected and analyzed. The first category of samples are directly relevant to the estimation of dose received by the members of public like drinking water, air and locally produced dietary items consumed by the public. The second category are trend indicators for build up of radionuclides, if any, such as weeds, sediment, soil, grass etc. The third category includes sensitive indicator organisms that accumulate specific radionuclides to a great extent and these serve as very sensitive detectors or markers. For example goat thyroid for the detection of low levels of fresh radioactive fallout of Iodine-31.

In the operational phase, the ESL continuously monitors the external radiation exposure levels in the environment, measures meteorological parameters and analyzes the distribution and concentration of reactor related radionuclides in samples of different environmental matrices to assess the contribution, if any, from the plant releases.



Doppler SODAR (Sound Detection and Ranging) system. BARC collaborated with SAMEER, Mumbai for this development work.

In general, even after thirty years of operation of nuclear power plants, the levels of radionuclides in terrestrial samples such as soil, crop, vegetation, milk, meat, egg etc. are at global weapon fallout levels and there is no significant contribution from plant operations. In aquatic samples such as water, fish and sediments in the vicinity of discharge area show a small increase in the levels of Hydrogen-3 and Cesium -137, but the levels are insignificant from health point of view.

Experience of extensive environmental monitoring has shown that even a hypothetical individual staying at plant exclusion boundary (1.6 km) will receive only about 8% of dose limits (1 mSv/y) prescribed for members of public, in case of Tarapur Atomic Power Station, Rajasthan Atomic Power Station and Madras Atomic Power Station, and less than 1% in case of Narora Atomic Power Station, Kakrapar Atomic Power Station, Kaiga Generating Station, and RAPS-3 & 4 due to improved design features. At distances greater than 1.6 km, the doses to the members of public continuously get reduced and are insignificant compared to doses received from natural sources.

MOBILE RADIOLOGICAL LABORATORY



Mobile Radiological Laboratory (On right) Inside View of Mobile Radiological Laboratory

To assess the radiological impact in the unlikely event of a nuclear accident / large scale disaster or accidents involving transport of radioactive materials, a Mobile Radiological Laboratory (MRL) has been designed and commissioned by Bhabha Atomic Research Centre (BARC) for rapid off-site (public domain) deployment. It is capable of speedy collection of data to evolve and implement suitable remedial strategy.

The laboratory is equipped with the necessary radiation measuring devices to carry out the required environmental and radiological monitoring. It is furnished with facilities to generate base line data for important areas such as proposed sites for nuclear facilities, and can be used for routine environmental and radiological monitoring. This mobile laboratory is also expected to play a vital role in enhancing the public awareness about the facts of radiation.

MRL has been designed for a continuous outdoor operation of two weeks. It is partitioned into four compartments, which among other facilities, accommodate

Counting Laboratory Cabin fitted with necessary equipment for radiation measurements and identification of important radionuclides, and Whole Body Monitor Cabin for *in vivo* monitoring of persons.

Air-conditioning units are provided for maintaining the required temperature in the MRL for operating the equipment. Two diesel generators are installed to provide the required power-supply during field operation. A five-member team, including a driver, is needed for optimal field operation.

Functions of the Mobile Laboratory

Radiological Functions

- In-situ measurements for the identification of radioactive contaminants and assessment of ground deposition of radioactivity and evaluation of dose rate due to ground deposition.
- Collection of air samples to evaluate gross alpha and beta activity and radionuclide identification using gamma spectrometry.
- Assessment of contamination levels in foodstuffs like milk, vegetables, drinking water etc. to arrive at a basis for their use or rejection.
- Measurement of external radiation dose received by the members of the public.
- Assessment of the suspected internal contamination of any person and / or representative groups of population.
- Measurement of meteorological parameters such as, wind speed, wind direction, air temperature, solar radiation and relative humidity for assessing radioactive fallout levels beyond the monitoring place.

Routine Monitoring

- Assessment of levels of radioactivity in soil, water, biota and foodstuffs for the development of base line data as well as continued monitoring.
- Measurements of terrestrial gamma background dose rates.
- Measurement of gross alpha and gross beta activity in air and gamma spectrometry measurements at proposed sites.
- Periodic 3D mapping of monitored environmental parameters over a defined area to enable the evaluation of environmental impact due to the operation of nuclear facilities.

Other Activities

- Co-ordination with the aerial survey team by providing them the monitored data of the region.
- Providing monitoring support to the new/developing sites where laboratory facilities may not be available.
- Demonstrations related to radiation safety and emergency preparedness.