RADIOACTIVE WASTES MANAGEMENT AT NARORA ATOMIC POWER STATION IN INDIA

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1.0. INTRODUCTION

Narora Atomic Power Station is the fourth Nuclear Power Station having twin units each of 220 MWe capacity. It is situated on the bank of river Ganga at Narora in District, Bulandshahr (U.P.) & is 140 km. away from New Delhi, the Capital city of India. It is the first standardized and totally indigenous PHWR type Nuclear Power Station.

2.0. RADIOACTIVE WASTE MANAGEMENT

The waste management facility at Narora Atomic Power Station provides facility for segregation, collection, treatment, storage & safe disposal of liquid & solid radioactive waste. The philosophy of waste management is based on the principle of ALARA(As low as reasonably achievable) taking the economic and social factor into account. Three principles governing the management of radioactive wastes are (i) dilution and dispersal of low level wastes (ii) delay, decay and dispersal of waste containing short lived radio-nuclides and (iii) concentration and containment of high active wastes containing long lived radio nuclides after conditioning. The waste management facility is functionally divided into following four systems.

2.1. LIQUID EFFLUENT SEGERATION SYSTEM

This system is located in service building & provides collection & segregation at source of all the liquid wastes generated in the station based on level of activity & chemical nature so as to

- Minimize cross contamination
- To facilitate judicious decision in respect of management of each category of waste.

In this system, control over waste volume & activity generation is imphacised at source itself. Liquid waste received is sampled, monitored and pumped for treatment or dilution & discharge depending on activity content. All liquid waste carrying lines are of Stainless Steel & hydrotest at regular intervals are carried out to ensure it's integrity.

2.2 TREATMENT & DISPOSAL SYSTEM

The basic philosophy of various techniques such as chemical co-precipitaiton, flocculation & sedimentation is to concrete and contain as much activity as possible, prior to their discharge in an environmentally acceptable manner. Decontamination by chemical treatment involves co-precipitaiton using phosphates, ferro-cyanides, hydroxides etc. for effective removal of radio nuclides like Cs^{137}, Cs^{134} ,Co^{60} & Sr^{90}. For dissolve activity decontamination factor of 10-20 & for suspended activity, decontamination factor of 90-100 is achieved. Low active organic waste is soaked in vermiculite & disposed off in drums as solid waste.

Treated waste is stored in post-treatment tank. Finally, it is re-circulated for homogenization, sampled & after filtration is injected into the condenser cooling water blow down line for dilution. Diluted waste is released to the flowing canals. On line proportional sampler is provided at the final outlet to check the specific activity level in diluted waste water being released. Sludge generated from the chemical treatment forms a part of solid waste. Activity released through liquid route is maintained well below Tech. Spec. limit and accounts for 5% & 50% of Tech. Spec. limit of gross Beta -Gamma and Tritium respectively.

2.3. SOLID WASTE MANAGEMENT SYSTEM

Radioactive solid waste generated consists of contaminated process equipment parts, protective clothing, used particulate filters, concentrated sludge, spent resin, cotton, papers & packaging materials. Control over intermixing of inactive waste with active waste is exercised to restrict the active waste generation. All radioactive solid waste as received is categorized on the basis of dose rates and physical characteristics of the waste depending upon the treatment and handling processes. These are as follows:

1. Waste with contact surface dose rate $\leq$ 200 mR/h.
2. Waste with contact surface dose rate > 200 mR/h but $\leq$ 2 R/h.
3. Waste with contact surface dose rate > 2R/h.

The waste collection at the source is being done to achieve proper segregation at the origin itself. For this purpose, administrative procedure and control is being exercised. Category-I waste is collected in unshielded standard drums with polythene bags inside. These bags are sealed after it is filled with wastes and drums are capped before despatch to solid waste management facility. category-II waste is collected in drums provided with local shielding, whereas category-III waste mainly consisting of spent resins is collected in adequately shielded casks & transported to solid waste management facility in a dedicated truck provided for this purpose. Conditioning /treatment of solid waste depends upon it's nature as mentioned below:

1. Non-combustible, compactible are baled to reduced its volume by factor of 5.
2. Combustible waste is incinerated to reduce it's volume by a factor of 35-40.
3. Spent filters and metallic parts are embedded in cement.
4. Sludge is immobilized in cement & vermiculite.
5. Spent resins are immobilized in polymer matrix.

As far as disposal of the waste is concerned, these are disposed in engineered container near surface disposal facility at plant site. Very low level waste package (2.5 mR/h.) are disposed in the vermiculite lined earth trenches. The waste package/containers having dose rate from 2.5 mR/h. to 50 R/h. are disposed in reinforced cement and concrete vaults whereas those having dose rate > 50 R/h. are disposed in retrievable steel lined high integrity containers.

2.4. GASSIOUS WASTE MANAGEMENT

An extensive ventilation system consisting of pre-filter and HEPA filters collects potentially active exhaust air from such areas as Reactor Building, spent fuel handling and storage area, the decontamination center and the heavy water management area. The active and potentially active exhaust air is routed to a gaseous effluent exhaust duct. This exhaust flow is monitored for noble gases, tritium, iodine and active particulates before being released to the atmosphere through 145 Meter high stack. Signals from the iodine, wide range gamma and particulate monitors are recorded in control room. Tritium monitoring is carried out by laboratory analysis of bubbler samples. Activity releases are maintained well below technical specification limit.

3.0 ENVIRONMENTAL MONITORING

Around solid waste disposal area, regular monitoring of underground water is being done by a series of monitoring bore wells to check the integrity of waste management facility. For assessment of environmental impact, a fully equipped environmental surveillance and micro meteorological laboratory is established which is functioning under directorate of health and safety, Bhabha Atomic Research Center. It carries survey upto 30 km. radius from Plant site & analysis of more than 1000 samples of water, soil, vegetation & food material are carried out. So far NAPS has not shown any environmental impact in its surroundings. The maximum dose to the public is 1-2% of the limit of 100 mrem/year recommended by International Commission on Radiation Protection (ICRP).

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