6.1 OPERATING PLANTS AND THEIR PERFORMANCE

The first Plutonium Plant at Trombay reprocesses research reactor spent fuel with a capacity of 60 tons per year. The second and third plants are located at Tarapur and Kalpakkam and reprocess spent fuel from power reactors. Each of these plants has an operating capacity of 100 tons per year. Reprocessing capacities are being augmented in a phased manner to match the Pu requirement.

The planning of reprocessing capacity has to match with the requirement of Pu and U-233 by fast breeder reactors (FBRs) and advanced pressurized heavy water reactors (AHWRs).

The Trombay plant, commissioned in 1964, reprocesses natural Uranium, Aluminium clad metallic fuel. The head end process involves chemical de-jacketing and dissolution in concentrated nitric acid under reflux conditions. This is followed by a decontamination cycle, a partition cycle and two separate parallel cycles for the purification of uranium and plutonium based on PUREX process.

The successful operations of this plant not only provided the required Plutonium but also gave sufficient impetus for acquisition of skills in the domain of reprocessing. These included, optimization of process parameters for improved performance, operational safety, waste minimization, development of equipment and systems for higher plant throughput, techniques for representative sampling and their analyses, on-line instrumentation and data acquisition etc.

The second plant located at Tarapur and commissioned in 1975 reprocesses zircaloy clad oxide spent fuel using chop-leach technique for the head end.

Besides providing the required Plutonium, several campaigns of reprocessing have also been carried out under international safeguards in this plant, thereby, providing valuable experience in material accounting practices adhering to the international standards.

The third plant at Kalpakkam caters to the needs of reprocessing zircaloy clad natural uranium oxide spent fuel from PHWRs. This plant serves as a standard design for future plants aiming at attaining the nameplate capacity with sustained operations.

In view of the inherent corrosive environment and due to the poor choice of materials in the initial days, it was imperative to
decontaminate and decommission (D&D) the Plutonium plant, Trombay for effecting the necessary replacements to extend its life. This opportunity was also utilized to modify and enhance the capacity of the plant. The entire decommissioning programme was meticulously planned and successfully carried out. The success of the decommissioning operations could be gauged from the insignificantly low background levels of radiation fields ultimately achieved, the absence of transferable contamination on cell surfaces, and the fact that personnel exposures were well within the prescribed limits. Extent of D&D of the cells permitted almost unrestricted access into the cells for carrying out fresh installation. The decommissioned and augmented plant started operating from 1983 onwards.

Around 40 years of experience in the spent fuel reprocessing based on PUREX process has given the confidence that this technology can be successfully employed for the recovery of both U and Pu with yield exceeding 99.5%. Substantial reduction in waste volume has been achieved over the years by resorting to salt free reagents. Evaporation followed by acid reduction by formaldehyde is used to reduce the high level waste volume. The overall decontamination factors for the Pu and U products from fission products exceed $10^6$ and are handled subsequently with minimum radiation protection.