

## ENVIRONMENT MANAGEMENT

Harmony between man and environment is the essence of healthy life and growth. Therefore, maintenance of ecological balance and a pristine environment has been of utmost importance to the Union Ministry of Power (MoP). NTPC being the leading organization under the ministry in the areas of power generation, has been taking various measures discussed below for mitigation of environment pollution due to power generation.

### Environment Policy & Environment Management System

Driven by its commitment for sustainable growth of power, NTPC has evolved a well defined environment management policy and sound environment practices for minimising environmental impact arising out of setting up of power plants and preserving the natural ecology.

**National Environment Policy:** At the national level, the Ministry of Environment and Forests had prepared a draft Environment Policy (NEP) and the Ministry of Power along with NTPC actively participated in the deliberations of the draft NEP. The NEP 2006 has since been approved by the Union Cabinet in May 2006.

**NTPC Environment Policy:** As early as in November 1995, NTPC brought out a comprehensive document entitled "NTPC Environment Policy and Environment Management System". Amongst the guiding principles adopted in the document are company's proactive approach to environment, optimum utilisation of equipment, adoption of latest technologies and continual environment improvement. The policy also envisages efficient utilisation of resources, thereby minimising waste, maximising ash utilisation and providing green belt all around the plant for maintaining ecological balance.

**Environment Management, Occupational Health and Safety Systems:** NTPC has actively gone for adoption of best international practices on environment, occupational health and safety areas. The organization has pursued the Environmental Management System (EMS) ISO 14001 and the Occupational Health and Safety Assessment System OHSAS 18001 at its different establishments. As a result of pursuing these practices, all NTPC power stations have been certified for ISO 14001 & OHSAS 18001 by reputed national and international Certifying Agencies.

## Pollution Control Systems

While deciding the appropriate technology for its projects, NTPC integrates many environmental provisions into the plant design. In order to ensure that NTPC comply with all the stipulated environment norms, various state-of-the-art pollution control systems / devices as discussed below have been installed to control air and water pollution.

**Electrostatic Precipitators:** The ash left behind after combustion of coal is arrested in high efficiency Electrostatic Precipitators (ESPs) and particulate emission is controlled well within the stipulated norms. The ash collected in the ESPs is disposed to Ash Ponds in slurry form.

**Flue Gas Stacks:** Tall Flue Gas Stacks have been provided for wide dispersion of the gaseous emissions ( $\text{SO}_x$ ,  $\text{NO}_x$  etc) into the atmosphere.

**Low- $\text{NO}_x$  Burners:** In gas based NTPC power stations,  $\text{NO}_x$  emissions are controlled by provision of Low- $\text{NO}_x$  Burners (dry or wet type) and in coal fired stations, by adopting best combustion practices.

**Neutralisation Pits:** Neutralisation pits have been provided in the Water Treatment Plant (WTP) for pH correction of the effluents before discharge into Effluent Treatment Plant (ETP) for further treatment and use.

**Coal Settling Pits / Oil Settling Pits:** In these Pits, coal dust and oil are removed from the effluents emanating from the Coal Handling Plant (CHP), coal yard and Fuel Oil Handling areas before discharge into ETP.

**DE & DS Systems:** Dust Extraction (DE) and Dust Suppression (DS) systems have been installed in all coal fired power stations in NTPC to contain and extract the fugitive dust released in the Coal Handling Plant (CHP).

**Cooling Towers:** Cooling Towers have been provided for cooling the hot Condenser cooling water in closed cycle Condenser Cooling Water (CCW) Systems. This helps in reduction in thermal pollution and conservation of fresh water.

**Ash Dykes & Ash Disposal Systems:** Ash ponds have been provided at all coal based stations except Dadri where Dry Ash Disposal System has been provided. Ash Ponds have been divided into lagoons and provided with garlanding

arrangements for change over of the ash slurry feed points for even filling of the pond and for effective settlement of the ash particles.

Ash in slurry form is discharged into the lagoons where ash particles get settled from the slurry and clear effluent water is discharged from the ash pond. The discharged effluents conform to standards specified by CPCB and the same is regularly monitored.

At its Dadri Power Station, NTPC has set up a unique system for dry ash collection and disposal facility with Ash Mound formation. This has been envisaged for the first time in Asia which has resulted in progressive development of green belt besides far less requirement of land and less water requirement as compared to the wet ash disposal system.

**Ash Water Recycling System:** Further, in a number of NTPC stations, as a proactive measure, Ash Water Recycling System (AWRS) has been provided. In the AWRS, the effluent from ash pond is circulated back to the station for further ash sluicing to the ash pond. This helps in savings of fresh water requirements for transportation of ash from the plant.

The ash water recycling system has already been installed and is in operation at Ramagundam, Simhadri, Rihand, Talcher Kaniha, Talcher Thermal, Kahalgaon, Korba and Vindhyachal. The scheme has helped stations to save huge quantity of fresh water required as make-up water for disposal of ash.

**Dry Ash Extraction System (DAES):** Dry ash has much higher utilization potential in ash based products (such as bricks, aerated autoclaved concrete blocks, concrete, Portland pozzolana cement, etc.). DAES has been installed at Unchahar, Dadri, Simhadri, Ramagundam, Singrauli, Kahalgaon, Farakka, Talcher Thermal, Korba, Vindhyachal, Talcher Kaniha and BTPS.

**Liquid Waste Treatment Plants & Management System:** The objective of industrial liquid effluent treatment plant (ETP) is to discharge lesser and cleaner effluent from the power plants to meet environmental regulations. After primary treatment at the source of their generation, the effluents are sent to the ETP for further treatment. The composite liquid effluent treatment plant has been designed to treat all liquid effluents which originate within the power station e.g. Water Treatment Plant (WTP), Condensate Polishing Unit (CPU) effluent, Coal Handling Plant (CHP) effluent, floor washings, service water drains etc. The scheme involves collection of various effluents and their appropriate treatment centrally and re-circulation of the treated effluent for various plant uses.

NTPC has implemented such systems in a number of its power stations such as Ramagundam, Simhadri, Kayamkulam, Singrauli, Rihand, Vindhyachal, Korba, Jhanor Gandhar, Faridabad, Farakka, Kahalgaon and Talcher Kaniha. These plants have helped to control quality and quantity of the effluents discharged from the stations.

**Sewage Treatment Plants & Facilities:** Sewage Treatment Plants (STPs) sewage treatment facilities have been provided at all NTPC stations to take care of Sewage Effluent from Plant and township areas. In a number of NTPC projects modern type STPs with Clarifloculators, Mechanical Agitators, sludge drying beds, Gas Collection Chambers etc have been provided to improve the effluent quality. The effluent quality is monitored regularly and treated effluent conforming to the prescribed limit is discharged from the station. At several stations, treated effluents of STPs are being used for horticulture purpose.

### **Environmental Institutional Set-up**

Realizing the importance of protection of the environment with speedy development of the power sector, the company has constituted different groups at project, regional and Corporate Centre level to carry out specific environment related functions. The Environment Management Group, Ash Utilisation Group and Centre for Power Efficiency & Environment Protection (CENPEEP) function from the Corporate Centre and initiate measures to mitigate the impact of power project implementation on the environment and preserve ecology in the vicinity of the projects. Environment Management and Ash Utilisation Groups established at each station, look after various environmental issues of the individual station.

### **Environment Management During Operation Phase**

NTPC's environment friendly approach to power has already begun to show results in conservation of natural resources such as water and fuel (coal, oil & gas) as well as control of environmental pollution. As already mentioned earlier, NTPC has chalked out a set of well defined activities that are envisaged right from the project conceptualisation stage so that during the entire life cycle of the power plant, NTPC is fully compliant with various environment regulations and a pristine environment and ecological balance is maintained in and around its power station and townships. Following is brief description of some of the measures taken during the operation phase of the stations.

Performance enhancement and up-gradation measures are undertaken by the organisation during the post operational stage of the stations. These activities have

greatly helped to minimise the impact on environment and preserve the ecology in and around its power projects. These measures have been enumerated as follows.

**Monitoring of Environmental Parameters:** A broad based Environment Monitoring Programme has been formulated and implemented in NTPC. All pollutants discharged from the power plant such as stack emission, ash pond effluent, main plant effluent, domestic effluent and Condenser Cooling Water (CCW) effluent are monitored at the stipulated frequency at the source itself and at the points of discharge. In addition to the above, ambient air, surface water and ground water quality in and around NTPC plants are regularly monitored to assess any adverse impacts as a result of operation of the power plant.

**On-Line Data Base Management:** In order to have better control on pollution and to achieve effective environment management in and around NTPC stations, it is imperative to have an on-line, reliable and efficient environment information system on the plant operational and environmental performance parameters at all three levels i.e generating Stations, Regional Headquarters and Corporate Centre. In consideration of the above, a computerized programme, namely "Paryavaran Monitoring System" - PMS, which could provide reliable storage, prompt and accurate flow of information on environmental performance of Stations was developed and installed in NTPC. This software facilitates direct transfer of environment reports and other environment related information from stations to the Regional Headquarters and Corporate Centre. The PMS has already been implemented at Corporate Centre, the Regional Headquarters and most of the Stations.

This system has helped in achieving continuous improvement in NTPC's environment performance through improved monitoring and reporting system by using the trend analysis and advanced data management techniques.

**Environment Reviews:** To maintain constant vigil on environmental compliance, Environmental Reviews are carried out at all operating stations and remedial measures have been taken wherever necessary. As a feedback and follow-up of these Environmental Reviews, a number of retrofit and up-gradation measures have been undertaken at different stations.

Such periodic Environmental Reviews and extensive monitoring of the facilities carried out at all stations have helped in compliance with the environmental norms and timely renewal of the Air and Water Consents.

**Upgradation & Retrofitting of Pollution Control Systems:** In order to keep pace with the changing norms and ensure compliance with statutory requirements in the

field of pollution control, NTPC keeps an open mind for Renovation and Modernisation (R & M) and Retrofitting and Upgradation of pollution monitoring and control facilities in its existing stations. It is important to mention that such modifications/retrofit programs not only helped in betterment of environment but also in resource conservation.

High efficiency Electro-Static Precipitators (ESPs) of the order of 99.5% and above have been provided at NTPC stations for control of stack particulate emissions. However, the ESPs of a number of stations were built prior to the promulgation of the Environment (Protection) Act, 1986 and notification of emission control standards under this Act. Remedial measures have already been taken up and implemented to improve the efficiency of the existing ESPs at various NTPC stations. ESP performance enhancement programme by adopting advanced micro-processor based Electrostatic Precipitator Management System (EPMS) was installed at its power stations at Singrauli, Ramagundam, Korba, Farakka, Rihand, Vindhyachal and Unchahar. Additional ESPs were retrofitted in the older power stations, namely at Badarpur and Talcher Thermal. As a result of the above retrofits, the emission of Suspended Particulate Matter (SPM) has been brought down appreciably at the above stations and is maintained within the present statutory limit of 150 mg/Nm<sup>3</sup>. In new projects, the ESPs have been designed for a maximum permissible outlet dust emission of 50 mg/Nm<sup>3</sup> to meet the likely stringent emission norms in the near future.

### **Resources Conservation**

With better awareness and appreciation towards ecology and environment, the organization is continually looking for innovative and cost effective solutions to conserve natural resources and reduce wastes. Some of the measures include:

- Reduction in land requirements for main plant and ash disposal areas in newer units.
- Capacity addition in old plants, within existing land.
- Reduction in water requirement for main plant and ash disposal areas through recycle and reuse of water.
- Efficient use of Fuel (Coal, Natural gas and Fuel oil) and
- Reduction in fuel requirement through more efficient combustion and adoption of state-of-the-art technologies such as super critical boilers

### **Waste Management**

Various types of wastes such as Municipal or domestic wastes, hazardous wastes, Bio-Medical wastes get generated in power plant areas, plant hospital and the

townships of projects. The wastes generated are a number of solid and hazardous wastes like used oils & waste oils, grease, lead acid batteries, other lead bearing wastes (such as gaskets etc.), oil & clarifier sludge, used resin, used photo-chemicals, asbestos packing, e-waste, metal scrap, C&I wastes, electrical scrap, empty cylinders (refillable), paper, rubber products, canteen (bio-degradable) wastes, building material wastes, silica gel, glass wool, fused lamps & tubes, fire resistant fluids etc. These wastes fall either under hazardous wastes category or non-hazardous wastes category as per classification given in Government of India's notification on Hazardous Wastes (Management and Handling) Rules 1989 (as amended on 06.01.2000 & 20.05.2003). Handling and management of these wastes in NTPC stations have been discussed below.

**Municipal Waste Management:** Domestic or municipal waste is generated in households at townships. This waste is segregated into bio-degradable and non-biodegradable wastes at source itself in different coloured containers and thereafter the two types are disposed separately. Bio-degradable waste is spread uniformly in identified low lying areas and thereafter it is covered with soil for use later as manure after composting. The segregated non bio-degradable waste is disposed off separately in other identified low lying areas and is spread out uniformly.

**Hazardous Waste Management:** NTPC being a proactive organization, the handling and disposal of hazardous wastes are done as per the Hazardous Wastes (Management & Handling) Rules 1989 (as amended in 2003) guidelines issued by Government of India for the treatment, storage and disposal of hazardous wastes. Scientific study on management and handling of hazardous wastes was carried out at a few NTPC stations to adopt the best practices so that there is a complete compliance with statutory requirements. In NTPC stations, the Hazardous Wastes (Recyclable) are sold / auctioned to registered recyclers / refiners. The other hazardous wastes such as the activated carbon resins, used drums (hazardous) chromium (Cr-III electrolytes, used petro-chemicals, asbestos packings, used torch batteries, ribbon, toners / cartridges, mixed wastes (waste oil, water & cotton) filters, earth contaminated with synthetic oil (FQF) glass used & sodium silicate, lamps & tubes etc. fall under the category of Hazardous Wastes (Non-Recyclable). These wastes are small in quantity and are stored in properly identified locations. As per the notification, hazardous wastes (non-recyclable) are to be sent to State Pollution Control Board (SPCB) approved common treatment storage and disposal facility (TSDF).

**Bio-Medical Waste Management:** Hospital (or Bio-medical) wastes get generated from hospitals and they include urine bags, human anatomical wastes, plaster of

paris waste, empty plastic bottles of water & glucose, blood & chemical mixed cotton, blood & urines tubes etc. these wastes are segregated and are placed in buckets of different colours as per the notification for Bio-Medical Waste (Management & Handling) Rules. The seggregated bio-medical wastes are either disposed through the SPCB approved agency or they are treated in autoclaves before disposal into bio-medical waste disposal pits. The treated bio-medical waste is spread uniformly and covered with 10 cm thick soil in bio-medical waste disposal pits.

### Land Use / Bio-diversity

As a policy, NTPC lays special emphasis on land use and Bio-diversity by way of development of green belts, energy plantations, reclmation of abandoned Ash Ponds and EIA and ecological monitoring in the project areas and its surroundings.

**Reclamation of Abandoned Ash ponds:** The reclamation of abandoned ash pond sites is a challenging task. NTPC has reclaimed temporary ash disposal areas at some of its projects namely Ramagundam, Talcher Thermal, Rihand, Singrauli and Unchahar through plantation and converted these sites into lush green environments. Extensive plantations have also been undertaken on dry ash mound at NTPC-Dadri. It is planned to reclaim all the abandoned ash disposal areas by plantation.

**Green Belts, Afforestation & Energy Plantations:** What's more, in a concerted bid to counter the growing ecological threat, NTPC is undertaking afforestation programmes covering vast areas of land in and around its projects. Appropriate afforestation programmes for plant, township and green belt areas of the project have been implemented at all projects.

In order to enhance green cover in the areas around our projects, as a responsible corporate citizen, NTPC till date has planted more than 18 million trees at its projects throughout the country. The afforestation has not only contributed to the aesthetics but also has been serving as a 'sink' for the pollutants released from the station and thereby protecting the quality of ecology and environment in and around the projects. Thrust has also been given to bio-diesel plantation and around 4.8 lakh energy plants including Pongamia and Jatropha have already been planted. A pilot project for extraction of seeds from these bio-diesel plants has also been set up.

### Ecological Monitoring & Scientific Studies

NTPC has been a leader in the industrial sector of India in undertaking scientific studies related to thermal power generation. NTPC has pioneered several scientific studies in collaboration with national/ international institutions to develop an environmental databank e.g. Detailed Geohydrological Studies to understand the impact of ash pond leachate on ground water and Ecological Impacts Monitoring through Remote Sensing Data have been carried out at its operating stations as discussed below.

**Environment Impact Assessment Studies:** Environmental Impact Assessment (EIA) Studies are inevitably undertaken to evaluate potential negative impacts as well as to formulate Environmental Management Plans to overcome the identified impacts. Based on the recommendations of Environmental Impact Assessment Study and Environmental Management Plan (EMP) and the conditions stipulated in the clearances from Ministry of Environment and Forests and State Pollution Control Boards,

These studies consists of impact assessment in the area of the land use, water use, socio-economic aspects, soil, hydrology, water quality, meteorology, air quality, terrestrial and aquatic ecology and noise. These studies are conducted before starting the construction as well as after operation of the plant and gives comprehensive status of the environment as existed before construction as well as in the post operational stages of the project.

The EIA involves stage-by-stage evaluation of various parameters which affect the environment. Based on EIA study, wherever required, specific scientific studies are also conducted to scientifically assess the likely impact of the pollutants on the sensitive flora and fauna in the surroundings, as also, to take preventive and mitigatory measures, wherever required.

Apart from project specific EIA studies, Regional Environmental Assessment studies have been conducted for Integrated Development of Singrauli, Korba and Ramagundam areas. Such studies are of first of their kind in India and probably very few such studies have been undertaken in other countries.

**Socio-economic Studies:** Detailed socio-economic studies are undertaken to establish the socio-economic status of project affected persons and rehabilitation and resettlement plans are drawn in consultation with the state government. Rehabilitation and resettlement options include land for land (subject to availability), limited jobs with NTPC and contractors and self employment schemes. In addition, NTPC also undertakes community development activities in the surrounding villages.

**Ecological Monitoring Programme:** NTPC has undertaken a comprehensive Ecological Monitoring Programme through Satellite Imagery Studies covering an

area of about 25 Kms radius around some of its major plants. The studies have been conducted through National Remote Sensing Agency (NRSA), Hyderabad at its power stations at Ramagundam, Farakka, Korba, Vindhyachal, Rihand and Singrauli. These studies have revealed significant environmental gains in the vicinity areas of the project as a result of pursuing sound environment management practices. Some of these important gains which have been noticed are increase in dense forest area, increase in agriculture area, increase in average rainfall, decrease in waste land etc. In general, the studies, as such, have revealed that there is no significant adverse impact on the ecology due to the project activities in any of these stations. Such studies conducted from time to time around a power project have established comprehensive environment status at various post operational stages of the project.

**Geo-hydrological Studies:** NTPC has conducted several geohydrological studies of the ash disposal areas at its projects (Singrauli, Rihand, Vindhyachal, Korba, Farakka and Talcher) through reputed institutions like Indian Institutes of Technology, Roorkee; Indian Institutes of Technology, Mumbai, Centre for Studies on Man and Environment, Calcutta. All these studies conclude that the leaching of heavy metals from ash occurs only under pH 4 or below. In practice, the pH of the ash water is either neutral or alkaline (7 or above) and hence the leaching of heavy metals is highly unlikely.

### **Use of Waste Products & Services -Ash Utilization**

Ash is the main solid waste which is put into use for various products and services. NTPC has adopted user friendly policy guidelines on ash utilisation.

In order to motivate entrepreneurs to come forward with ash utilisation schemes, NTPC offers several facilities and incentives. These include free issue of all types of ash viz. Dry Fly Ash / Pond Ash / Bottom Ash and infrastructure facilities, wherever feasible. Necessary help and assistance is also offered to facilitate procurement of land, supply of electricity etc from Government Authorities. Necessary techno-managerial assistance is given wherever considered necessary. Besides, NTPC uses only ash based bricks and Fly Ash portland pozzolana cement (FAPPC) in most of its construction activities. Demonstration projects are taken up in areas of Agriculture, Building materials, Mine filling etc. The utilisation of ash and ash based products is progressively increasing as a result of the concrete efforts of these groups.

## Advanced / Eco-friendly Technologies

NTPC has gained expertise in operation and management of 200 MW and 500 MW Units installed at different Stations all over the country and is looking ahead for higher capacity Unit sizes with super critical steam parameters for higher efficiencies and for associated environmental gains. At Sipat, higher capacity Units of size of 660 MW and advanced Steam Generators employing super critical steam parameters have already been implemented as a green field project.

Higher efficiency Combined Cycle Gas Power Plants are already under operation at all gas-based power projects in NTPC. Advanced clean coal technologies such as Integrated Gasification Combined Cycle (IGCC) have higher efficiencies of the order of 45% as compared to about 38% for conventional plants. NTPC has initiated a techno-economic study under USDOE / USAID for setting up a commercial scale demonstration power plant by using IGCC technology. These plants can use low grade coals and have higher efficiency as compared to conventional plants.

With the massive expansion of power generation, there is also growing awareness among all concerned to keep the pollution under control and preserve the health and quality of the natural environment in the vicinity of the power stations. NTPC is committed to provide affordable and sustainable power in increasingly larger quantity. NTPC is conscious of its role in the national endeavour of mitigating energy poverty, heralding economic prosperity and thereby contributing towards India's emergence as a major global economy.