सत्यमेवजयते

GUIDELINES ON DESIGN, CONSTRUCTION, O&M
and
ANNUAL CERTIFICATION
of
COAL ASH PONDS

Central Pollution Control Board

Ministry of Environment, Forest and Climate Change
Government of India

Central Electricity Authority

Ministry of Power
Government of India

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Issued by:

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Disclaimer

These guidelines have been prepared solely for the benefit of thermal power plants in India. No liability is accepted with respect to its use. This disclaimer shall apply notwithstanding that these guidelines may be used by other persons for any application.

Acknowledgement

CPCB and CEA extends thanks to all the power utilities and the thermal power stations for furnishing the data and information for bringing out these guidelines on ash ponds and their annual certification.

We are grateful to the Chairperson-CEA, Chairperson-CPCB, Member (Hydro)- CEA and Member Secretary-CPCB for the valuable support and guidance in preparation of these guidelines.

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आज़ादी का अमृत महोत्सव

FOREWORD

Indian coal fired thermal plants generates approximately 270.82 million metric tonnes of ash every year on an average from burning of coal. The utilization of ash has increased from about 9.63 % in 1996-97 to a level of 95.95% in 2021-22 on all India basis.

MoEF&CC estimates that ash dumps occupy nearly 40,000 hectares of land. The ash ponds are metres high and are prone to leaking and breaching, posing serious ecological and public security dangers.

The Ministry of Environment & Forests and Climate Change (MoEF&CC) has issued Notifications on ash utilization dated 31st December 2021 and its amendment dated 30th December, 2022 which supersedes all the earlier notifications. The environmental norms aspire to use the ash to 100 percent. Given the gravity of the coal ash crisis in India, regulating ash ponds with standard guidelines was urgently required and the same was also highlighted in the notification.

I wish to express my appreciation to the officers and staff of Civil Design Division, CEA who have taken initiative and have compiled this guidelines taking inputs from the power utilities. I believe that this guideline would be useful for all the stakeholders and shall help in better ash management, design and construction and aid in country's climate goal.

(**Ghanshyam Prasad**)

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Acknowledgement

Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India has issued Notification No. S.O. 5481 (E) dated 31December, 2021 (and amended it by Notification No. S.O. 6169 (E) dated 30th December, 2022) that mandates coal and lignite thermal power plants in the country to achieve 100% ash utilization in every three year cycles and further mandates utilisation of legacy ash in ten years from its implementation date 01 April 2022 provided the un-operational ash ponds are not stabilised and reclaimed within three years.

Further, in order to prevent ash spilling accidents and breaches of ash ponds embankments/dykes the Notification prescribes in Para A(6) that 'the technical specifications of operational as well as stabilized and reclaimed ash ponds or dykes shall be as per the guidelines of the Central Pollution Control Board (CPCB) made in consultation with the Central Electricity Authority (CEA)' and that 'these guidelines shall also lay down a procedure for annual certification of the operational as well as stabilized and reclaimed ash pond or dyke on its safety, environment pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt, etc.'

I would like to place on record my appreciation of the efforts made by the officers of Civil Design Division of CEA and IPC-II Division of CPCB in preparation of these guidelines as per Para A(6) of the Notification and extend by thanks to them and also their senior officers who guided them in this task.

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PREFACE

With great pleasure and pride I present the comprehensive guidelines on the design, construction, maintenance and operation of pond ash. These guidelines have been developed with an objective to provide engineers, practitioners and stakeholders a valuable resource that will aid them in the efficient and sustainable management of pond ash.

Management of ash at coal / lignite based Thermal Power Stations in the country is a challenging task, in view of large quantity of ash being generated and further to meet the target of achieving 100% utilization of Ash in a time bound manner, as prescribed in MoEF&CC Notification of 31st December, 2021 and its amendment dated 30th December, 2022. The land acquisition for creating ash dykes for ash disposal facilities at thermal power plants is becoming difficult. Disposal of ash, if not managed well, will become serious environmental issue.

I am confident that these guidelines will also be useful to all the stakeholders involved in ash management in the country for planning, design, construction as well as operation and maintenance the ash pond.

I would also like to place on record my appreciation of the efforts made by the officers and staff of Civil Design Division, CEA. Any suggestions/views as well as intimations for any unintended errors observed in this document may kindly be sent to:

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Acknowledgement

Pond ash, a by-product of coal combustion, has gained increasing recognition as a valuable material in various engineering applications. This document would serve as a roadmap for professionals involved in the design, construction, maintenance, and operation of projects involving ash.

The development of these guidelines has been a collaborative effort, bringing together a diverse team of experts from within our organization and beyond. I would like to extend my appreciation to all the officers & staff of CD Division who have contributed to these guidelines.

Thanks are also extended to all the Power Utilities and the Thermal Power Stations for furnishing the data and information for bringing out these guidelines on ash ponds and its annual certification.

I am thankful to the Chairperson-CEA, Chairperson-CPCB, Member (Hydro), CEA and Member Secretary, CPCB for their support, worthy suggestions and guidance in the preparation of these guidelines.

In particular, acknowledgements and thanks are extended to the following contributors:

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Useful definitions/Explanation

Ash: All the coal or lignite ash generated at TPP, such as ESP Ash (Electro Static Precipitator), dry Fly Ash, Bottom Ash (BA), Pond Ash and Mound Ash for the purpose of utilization**.**

Fly Ash: Ash Extracted from flue gases by any suitable process.

Bottom Ash: Ash collected separately at the bottom of the boiler furnace.

Pond Ash: Fly ash or bottom ash or both mixed in any proportion and conveyed in slurry / paste form and deposited in pond / lagoon.

Mound Ash: Fly ash or bottom ash or both mixed in any proportion and conveyed in dry form and deposited dry.

Legacy Ash: The ash stored in all the ash ponds or dykes other than operational ash pond or dyke designated for temporary storage of ash before 1st April 2022.

Ash Dyke: Ash Dyke/Ash ponds are well engineered structures used for storage of bottom ash and fly Ash generated at Thermal Power Stations. A single ash dyke/ash pond may contain multiple lagoons for ash storage based on operational requirements, and other associate structures such as Overflow lagoons/Silting basins etc.

CHAPTER 1

INTRODUCTION

1. General

The combustion of coal in Thermal Power Plant (TPP) produces Coal Combustion Residues (CCRs) which is a collective term referring to fly ash, bottom ash, boiler slag, and fluidized bed combustion ash. After ignition at high temperature the coal resolve in to different solid fractions. Most of the fine dust entrained by the flue gases leaving the boiler and collected by fabric filter or electrostatic precipitator is known as **precipitated fly Ash (PFA)**, which results 80% of the total coal combustion. The rest of 20% particle, including unburned carbon settle to the bottom of the boiler called **Bottom Ash (BA)**. Because of economic viability, thermal power stations most widely dispose both precipitated fly ash and bottom ash together as a slurry to the pond in which it stored for a longer period. As the reuse potential of ash has been increasing during recent years, segregated storage of fly ash and bottom ash is likely to gain popularity among power plant considering better economical returns from sale of fly ash.

According to the notification of Union Ministry of Environment, Forest & Climate Change (MoEF&CC), Ash means all the coal or lignite ash generated at TPP, such as ESP Ash (Electro Static Precipitator), dry Fly Ash, Bottom Ash (BA), Pond Ash and Mound Ash fort the purpose of utilization.

Schematic view of a thermal plant indicating the process of generation of fly ash and bottom ash is shown in the following figure 1.

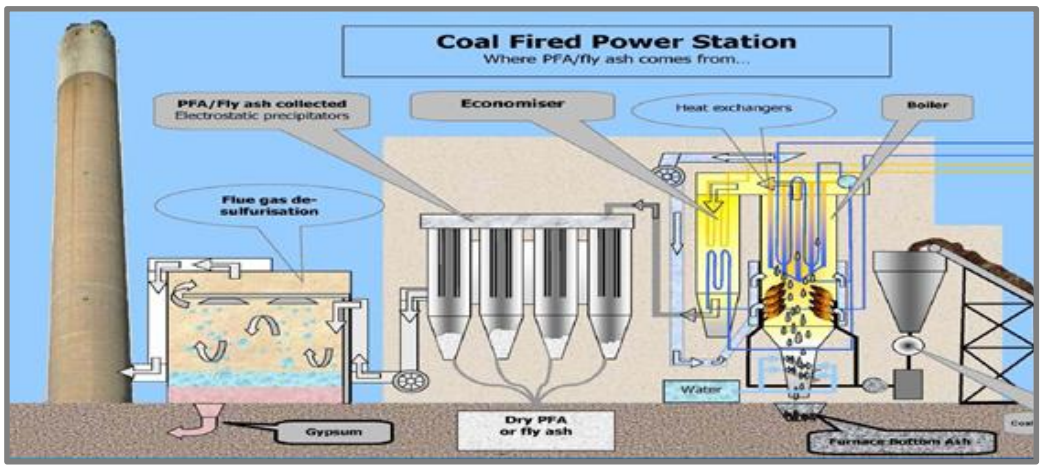


Fig 1. Schematic view of a thermal plant indicating the process of generation of fly ash and bottom ash

Presently in India, more than 40,000 hectares of land is occupied for storage of this huge quantity of ash. Over a period of time, the fly ash disposal can cause problems like large surface setting lagoons for storage, infiltration of transport of water from deposit to soil, dust carryover in wind from dried lagoons and leads ecological and environmental imbalances if proper safeguards are not taken in their design, construction, operation and maintenance.

Environmental pollution by the coal based thermal power plants are cited to be the major source of pollution affecting the general aesthetics of environment in terms of land use, health hazardous and air, soil and water in particular and thus leads environmental dangers. Safe disposal and gainful utilization are the prime concerns to safe guard the interest of environmental system

In India about 73% of the total electrical energy is generated from coal-based source. Annually about 271 million tons of Ash as solid waste/ by product being released during the process of generation of electricity by combustion of pulverized bituminous, sub bituminous, and lignite coal. Indian coal has low calorific value (3500 Kcal/kg), and results 30-60% of ash content. India's major source of power, even in the near future, is going to remain coal based thermal power plants hence, Ash disposal would continue to be a subject of priority since environmental issues holds greater importance in this century.

Though it has been proven to be a resource material for various uses such as earth material, ingredient for cement manufacture, raw material for manufacture of bricks, tiles and aggregates, the demand for ash may not at all time match with the supply of ash, which is produced 24x7, as the power plant operates. This requires a suitable system for storage of ash till its user is found and the economic use of the ash is explored.

Union Ministry of Environment, Forest and Climate Change (MoEF&CC) of India has issued notifications to address utilization of ash for various purposes.

1.1 Physical and Chemical Properties of Fly Ash

Physical, chemical and mineralogical properties of Fly Ash in general varies as they are influenced by coal source / quality, combustion process, degree of weathering, particle size and age of the ash. In addition, the particle size of ash at different locations and depth in the ash pond distinctly based on the length and width of the pond, flow rate, existing natural slope *etc*.

As per the ASTM standards India bituminous and sub bituminous coal results class F ash and lignite coal ash is class C type having high degree of self-hardening capacity.

Particle size of Ash varies widely from 0.1 µm to 900 µm with specific surface area greater than 0.1038m^2 /gm. Fly Ash is a non-degradable, non-perishable, inert material. Typical properties of Ash are represented in table-1 below:

Table 1: Typical Properties of Fly Ash*

Engineering Properties	***Range***	
Grain size,%	Bottom Ash	PFA(pulverized fly ash)
Clay	0	0
Silt	15-40	60-90
Sand	50-80	05-20
Gravel	0	0
Specific Gravity	1.58-2.24	1.58-2.2
Maximum Dry Density(gm/cc)	1.004	1.037
Optimum Moisture Content.%	39.4	60.6
Effective Cohesion(Kg/cm^2))	0	0
Effective angle of shearing resistance degree	42	34
Coefficient of Permeability (cm/sec)	10^{-2} to 10^{-4}	10^{-5} to 10^{-8}

Chemical constituents	**Range (%)**	
	Bottom Ash	PFA
Silica (SiO_2)	70.0	73.2
Alumina($Al2O_3$)	24.4	21.3
Iron Oxide (Fe_2O_3)	2.50	2.56
Calcium Oxide (CaO)	0.50	0.60
Magnesium Oxide (MgO)	1.1	1.0
Sulphur Oxide(SO_3)	0.5	0.5

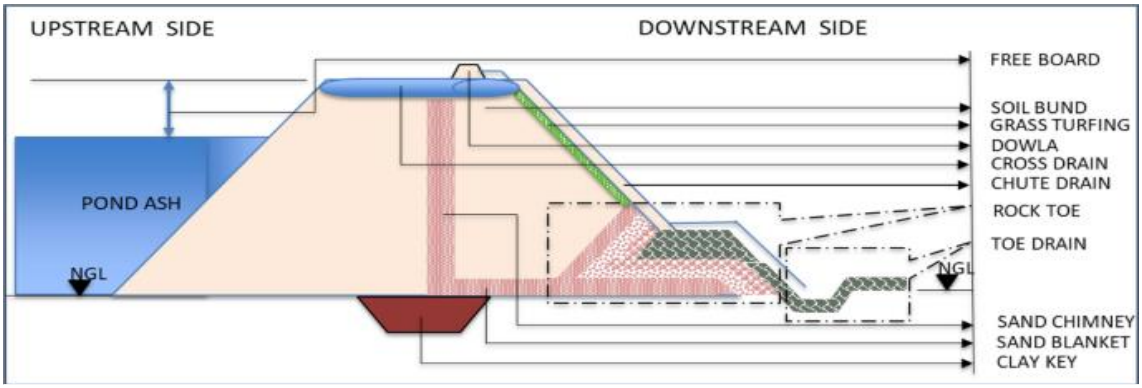
Note The values given in the table are tentative values only for guidance exact values shall be as per actual field tests.*

1.2 Ash Pond/ Dykes

Ash Dykes Ash Dyke/Ash ponds are well engineered structures used for storage of bottom ash and fly Ash generated at Thermal Power Stations. A single ash dyke/ash pond may contain multiple lagoons for ash storage based on operational requirements, and other associate structures such as Overflow lagoons/Silting basins etc. At the disposal areas, storage space is created by constructing ash dyke embankments all around, within which ash particles will be allowed to settle and the decanted water is allowed to escape though outlet structure.

The dyke around the ash disposal area is constructed in multi-stage. Initially a starter dyke is constructed utilizing earth excavated from the ash disposal area itself and when it is filled with discharged ash the height of ash dyke embankment is raised. Power plants in India have

been generally using ash as the main construction material for subsequent dyke raisings, over the ash dyke to reduce cost. Over the ash core in raising dyke, a layer of earth (generally>500mm thick) is laid to protect ash from erosion due to wind and water since ash is a light material compared to earth. For the purpose of design and construction of embankment with ash, and the principles of Soil Mechanics are applied. Typical section of ash dyke is shown below in figure 2



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1.3 Ministry of Environment and Forests and Climate Change (MoEF&CC) Notifications

Fly Ash Mission, a Technology Project in Mission Mode of Government of India, was commissioned during 1994 as a joint activity of Department of Science & Technology (DST), Ministry of Power (MoP) and Ministry of Environment and Forests and Climate Change (MoEF&CC) with Department of Science & Technology as nodal agency. The Fly Ash Mission was set up to promote research in the area of fly ash utilization so that fly ash could be gainfully utilized instead of its disposal in ash ponds. Ministry of Environment & Forests and Climate Change, Government of India issued 1st Notification on Fly Ash Utilization in September 1999, which was subsequently amended in 2003, 2009 and 2016 stipulating targets for fly ash utilization for Thermal Power Stations and use of fly ash by construction agencies within a prescribed radius of any thermal power station.

Ministry of Environment and Forests and Climate Change (MoEF&CC) vide Notification No. S.O. 5481 (E) dated 31st December, 2021, issued a notification on Ash utilization by coal and lignite thermal power plants which shall be applicable for Financial Year 2022-23 onwards. Further an amendment to this notification was issued vide Notification No. S.O. 6169 (E) dated 30th December, 2022.The notification as published and its amendment is placed at Annexure-I, II for reference.

The notification mandates 100% ash utilization. The relevant clauses of the notification after incorporation of amendments are reproduced here for reference:

A(4) Every coal or lignite based thermal power plant shall be responsible to utilise 100 per cent ash (fly ash and bottom ash) generated during that year, however, in no case shall utilisation fall below 80 per cent in any year, and the thermal power plant shall achieve average ash utilisation of 100 per cent in a three years cycle:

Provided that the three years cycle applicable for the first time is extendable by one year for the thermal power plants where ash utilisation is in the range of 60-80 per cent, and two years where ash utilisation is below 60 per cent and for the purpose of calculation of percentage of ash utilisation, the percentage quantity of utilisation in the year 2021- 2022 shall be taken into account as per the table below:

Utilisation percentages of thermal power plants	*First compliance Cycle to meet 100 per cent utilisation*	*Second compliance cycle onwards, to meet 100 per cent utilisation*
>80 per cent	*3 years*	*3 years*
60-80 per cent	*4 years*	*3 years*
<60 per cent	*5 years*	*3 years*

Provided further that the minimum utilization percentage of 80 per cent shall not be applicable to the first year and first two years of the first compliance cycle for the thermal power plants under the utilization category of 60-80 per cent and <60 per cent, respectively.

Provided also that 20 per cent of ash generated in the final year of compliance cycle may be carried forward to the next cycle which shall be utilized in the next three years cycle along with the ash generated during that cycle.

Provided also that new thermal power plants commissioned on or after the date of publication of this notification shall follow the first compliance cycle similar to the compliance cycle specified for thermal power plants having utilization per cent less than 60 per cent. as specified in the table.

Note: The utilization targets as per the applicable compliance cycle shall commence from 1st April, 2022.

(5) The unutilised accumulated ash i.e. legacy ash, which is stored before the publication of this notification shall be utilised progressively by the thermal power plants in such a manner that the utilization of legacy ash shall be completed fully within ten years from 1st April, 2022 and this will be over and above the utilisation targets prescribed for ash generation through current operations of that particular year:

Provided that the minimum quantity of legacy ash in percentages as mentioned below shall be utilised during the corresponding year and the minimum quantity of legacy ash is to be calculated based on the annual ash generation as per installed capacity of thermal power plant.

Year from date of publication	*1st*	*2nd*	*3rd -10th*
Utilisation of legacy ash (in percentage of Annual ash)	*At least 20 per cent*	*At least 35 per cent*	*At least 50 per cent*

Provided further that the legacy ash utilisation shall not be required where ash pond or dyke has stabilised and the reclamation has taken place with greenbelt or plantation or solar power plant or wind power plant as per the guidelines issued by the Central Pollution Control Board (CPCB) as specified in sub-para (6) and the concerned State Pollution Control Board shall certify in this regard. Stabilization and reclamation of an ash pond or dyke including certification by the State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall be carried out within a three years from 1st April, 2022. The ash remaining in all other ash ponds or dykes shall be utilised in progressive manner as per the above mentioned timelines.

Note: The obligations under sub-paragraph (4) and (5) above for achieving the ash utilisation targets shall be applicable from 1st April, 2022.

Provided that ash stored in all ash ponds or dykes other than operational ash pond or dyke designated for temporary storage of ash as specified in sub-para (6) shall constitute the legacy ash and either to be reclaimed or stabilised or utilised.

(6) Any new as well as operational thermal power plant may be permitted operational ash pond or dyke for temporary storage of ash within an area of 0.1 hectare per Mega Watt (MW). Technical specifications of operational as well as stabilized and reclaimed ash ponds or dykes shall be as per the guidelines of the Central Pollution Control Board (CPCB) made in

consultation with the Central Electricity Authority (CEA) and these guidelines shall also lay down a procedure for annual certification of the operational as well as stabilized and reclaimed ash pond or dyke on its safety, environment pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt, etc. and shall be put in place within three months from the date of publication of this notification:

Provided that up to two operational ash ponds or dykes for thermal power plants commissioned before 31st December, 2021, having installed capacity less than or equal to 1600 MW, and up to four operational ash ponds or dykes for thermal power plants having installed capacity more than 1600 MW, having multiple lagoons, within the specified area from the existing ash ponds or dykes, may be designated with clear demarcation along with coordinates, and shall inform to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 31st March, 2023:

Provided further that one ash pond or dyke shall be permitted in case of new thermal power plants or expansion of existing thermal power plants commissioned on or after 31st December, 2021, which shall inform the details of demarcation along with coordinates to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) within 3 months from the date of commissioning of thermal power plant or by 31st March, 2023, whichever is later Provided also that coal and lignite based thermal power plants shall not be allowed to further establish or designate any new operational ash pond or dyke:

Provided also that specification of 0.1 hectare per Mega Watt (MW) of an operational ash pond or dyke shall not be applicable for the thermal power plants commissioned before 03rd November, 2009.

The scope of guidelines shall cover the siting/location/planning, technical specifications /design & engineering standards disposal system regulation and procedure for maintenance and annual certification to ensure that the ash storage shall be safe and ash utilization shall fulfill the requirement of the plant and comply with the MoEF&CC norms. The factors affecting the environment i.e. land for ash disposal, pollution on Groundwater and surface water bodies, fugitive dust emission and failure/breach of ash dyke.

SECTION-A

(Siting, Design and Engineering Standard for New Ash Ponds)

CHAPTER 2

ASH CONVEYANCE FROM PLANT TO ASH POND

2. Disposal of Fly ash

The generated ash is disposed of in well designed, constructed and maintained ash ponds generally in wet slurry form. At specific location, compared to wet ash disposal system, dry ash disposal system may also be suitable. In new projects, due to inherent benefit of the system, high concentration slurry disposal (HCSD) system is being preferred to reduce land and water requirements as well as to prevent contamination of ground water.

Basically, thermally power projects are to be provided with systems for 100% dry ash extraction and storage and supply of ash to various entrepreneurs for promoting ash utilization. As per MOEF&CC notification clause no A (8), Each TPP shall install dedicated dry Fly Ash silos for storage of at least 16 hours of ash based on the installed capacity having separate access roads so as to ease the delivery of ash.

The unutilized ash may be disposed-off using mainly three types of ash disposal systems:

a. Wet Disposal in lean slurry form into ash dyke/ mine voids
b. Dry Disposal in Ash Mound form
c. Wet Disposal in High Concentrated Slurry form into ash dykes

The details of all the above systems are described in the following sections.

2.1 Wet Disposal in Lean Slurry Form:

This system is widely used in India. The system consists of extraction of fly ash from Electro Static Precipitator (ESP), conveying to fly ash silos and slurry mixing tanks and pumping slurry to disposal area using centrifugal pumps. A free-flowing lean ash slurry is made with water, which is pumped into storage areas. Ash disposal pond/lagoons are formed by constructing dykes (embankments) made of earth / ash or using natural depressions such as mine voids and the slurry is discharged into the lagoons from pipelines. Ash particles settle in the lagoons and clear water above the ash surface is decanted. Decanted water is taken out through water escape structure and recirculated to plant through an

Ash Water Recirculation System (AWRS) for reuse in ash disposal system. A photograph of a typical lean slurry is shown in figure 3.

Figure 3: Lean Slurry Disposal System

Fresh deposits of ash are in the form of marsh. However, over a period of time, especially when overlain by several layers, these ash deposits get consolidated into high density layers with little or no free water. This system has following limitations:

1. Due to high velocity wear and tear of pipes is more
2. The dykes are designed as dams and are always filled with slurry, with a risk of breach/seepage it needs continuous operation and maintenance.

2.2 Wet Disposal in High Concentration Slurry Form:

This is an advance system of wet disposal with fly ash concentration of 60% to 70% of ash by weight. Due to high concentration of ash, it is pumped through high pressure slurry pumps to disposal area and needs steel pipes for conveying slurry. Flexible pipes are used at disposal area. Centrifugal pumps have also been tried for conveying high concentration slurry to long distance in one plant and reported to be working satisfactorily.

High concentration slurry is homogeneous in nature which ensures that no water is released when slurry is discharged in the ash disposal area. Dense, compact deposit is formed with rapid drying. High concentration slurry attains relatively steep slopes at the point of disposal. A photograph of a typical high concentration system is shown in Figure 4.

Figure 4: High Concentration Slurry Flowing on Slopes which dries out by the time it travels 30-40 m from the source

High Concentration Slurry Disposal (HCSD) system has the following advantages and limitations.

Advantages of High Concentration Slurry Disposal (HCSD):

1. HCSD reduces water and land requirement, it is ecofriendly, no leachate discharge
2. Low water consumption with respect to lean slurry disposal and no release of free water at disposal
3. As the slurry travels at slow speed, wear and tear of pipes is less
4. High concentration slurry is easy to dig and can be used for various purposes at a later stage
5. Low maintenance of ash dyke
6. Danger of breaching the dyke is negligible.

Limitations of High Concentration Slurry Disposal (HCSD):

1. Ash pipes often get choked due to high concentration slurry
2. Seamless steel pipes for conveying HC slurry are required.
3. High concentration slurry disposal requires high pressures.

2.3 Dry Ash Disposal System:

This system is entirely different from the wet disposal system. In the dry ash disposal system, furnace bottom ash (FBA) and pulverized fly ash (PFA) are transported in moistened form from Hydro bins and Silos respectively to ash mound site on fixed belt conveyors in enclosed gantries. In the ash mound area ash is disposed of by various types of equipment like fixed, extendable, shift able and mobile belt conveyors, a crawler mounted boom spreader, a crawler mounted bucket wheel reclaimer and a variety of wheeled and crawler mounted mobile equipment. At present, it is being used at only one station – National Capital Thermal Power Station at Dadri.

For surface stabilization and dust suppression at the mound, a number of measures are applied depending upon the nature of surface (flat, finished slope or natural ash dump surface), such as surface compaction & landscaping, sprinkling of water and polymers, spreading of cut grass and vegetation by growing grass, shrubs & trees. As the mound construction proceeds and finished slopes are available, the same are covered with grass & plantation. It is proposed to cover the entire ash mound area by plantation. Photographs of dry ash disposal system are shown in following Figure 5,6.

Figure 5 : Dry Ash Mound at NCTPS, Dadri (Working Front)

Figure 6: Dry Ash Mound at NCTPS, Dadri (After Stabilization and Plantation)

Dry ash Disposal has several advantages over the above two systems:

1. Less land Requirement
2. Less water Requirement
3. Less risk of Ground Water Pollution
4. Progressive restoration of ash disposal site as useful land in form of Park

However, it has certain constraints and limitations too, such as:

1. High maintenance Cost.
2. Dependency on weather/climate conditions. Difficult to operate during rains
3. Constraints of distance. It is preferred if disposal area is near to plant

2.4 Recommended system for conveyance of ash from plant to ash pond:

1. New plants shall use high concentration slurry disposal system for ash ponds.
2. The Existing plants shall carry out feasibility study to switch over to high concentration slurry disposal system and submit the report and time bound action plan for construction to SPCBs.
3. In case of ash mounds, dry ash disposal system which is a requirement of the process shall be used.

CHAPTER 3

PLANNING OF ASH POND

3. General

Coal ash is produced by coal-based thermal power plants (TPPs) for power generation. There are two types of ash produced by TPPs, i.e. fly ash (80%) and bottom ash (20%). The fly ash is collected by electrostatic precipitators from the flue gases of power plants, and the bottom ash is collected from the bottom of the boilers. The ash generated by TPPs is generally disposed by one of following two ways:

(1) Dry Disposal: Ash collected in the ESP Hoppers is removed in dry form by using either vacuum system or pressure system and is conveyed to a buffer hopper. The ash is transported in dry form by pneumatic conveying to the storage site. Ash is spread in layers which are amenable to adequate compaction. To facilitate compaction additional water is added into the ash.

(2) Wet Disposal: Fly and bottom ashes are mixed with suitable proportion of water and pumped out from the TPPs as slurry in the ash pond. It is the most commonly used as it is less expensive ash management practice worldwide. The mixed fly and bottom ashes in ash pond is called pond ash.

3.1 Ash Pond

Ash ponds are engineered dam and dyke facilities used for storage of bottom ash and Pulverized Fly Ash (PFA) generated at Thermal Power Stations. Ash ponds are also used to enable water to separate from the fly ash slurry. Water from the Ash ponds is recycled back, reducing the use of fresh water. Ash ponds use gravity to settle out large particulates (measured as total suspended solids) from the thermal power plant.

3.2 Parameters for Design and Construction of Ash Pond

3.2.1 Quantity of Ash

The quantity of Ash produced in a power plant will depend upon the ash content in the coal and total quantity of coal used by thermal power stations.

3.2.2 Storage Volume

In-situ dry density of pond ash varies from 0.78 to 1.05 gm /cc, specific gravity refer table 1 chapter-1 page 4 of the guidelines. In absence of the site specific data, average density of 1.00 tons/m^3 may be taken for storage volume calculations in wet disposal system. The design life of the ash pond varies from plant to plant and based on site conditions and ash utilization rate in view of latest notification for ash utilization.

3.2.2.1 Lagoon Size

A minimum area shall be provided for each of the lagoons, depending upon the discharge rate of slurry, the specific gravity of ash particles, and the size of smallest particles of ash to ensure proper sedimentation of ash particles.

In the absence of data, the smallest size of ash particles may be assumed as 0.002 mm, unless reliable ash test results are available for that project. Particles settling velocities are inversely proportional to the viscosity of water which will vary with temperature and for sizing calculation, the value at 5^{o}C may be considered.

3.3 Land Requirement

As per clause no A(6) of MOEF&CC notification (Dec,2021) and its amendment dated 30th December,2022- *Any new as well as operational thermal power plant may be permitted operational ash pond or dyke for temporary storage of ash within an area of 0.1 hectare per Mega Watt (MW).* However, from storage point of view the area required could be less considering ash utilization as per MOEF notification.

3.4 Height of Ash Dyke

The ash dyke shall be designed for ultimate heights (starter dyke and subsequent raisings) based on ground topography, foundation soil, availability of construction materials etc. The minimum height of ash dyke is finalized based on natural ground level in ash pond area, High Flood Level (HFL), ash water recirculation requirements and free board requirements as per IS code. In general, starter dyke height of the storage lagoon is made in the range of 10m-15m. The ash dyke embankments are to be analyzed and designed as water retaining structures conforming to IS: 7894, IS:12169 & IS:9429.

The initial starter dyke shall be constructed using earth in new project. In case of expansion projects ash may be used for starter

dyke construction. In such cases expert advice shall be obtained for taking precautions design. However, below HFL, ash shall not be used as fill. The raising of ash dyke may be done using ash with a minimum 500 mm thick earth cover subject to satisfying the stability criteria as laid down in IS 7894. However, the thickness of earth cover may be increased based on expert advice depending upon site and geology, rainfall etc. Internal drainage shall be as indicated in the construction drawing.

3.5 Site Selection:

The main aspects to be considered are the distance to the ash dyke, properties of coal, topographical conditions, geological locations, meteorological conditions etc. To protect the environment due to ash disposal various site-specific studies like topographical survey, earlier land use map, drainage pattern, environmental impact assessment, archives, meteorological data, hydrological studies, geotechnical investigations are carried out at the proposed site.

Recommended siting conditions:

i) Site should be selected to ensure that the base can be located no less than 5 ft above the upper limit of the uppermost aquifer, or it must be demonstrated that there will not be any hydraulic connection between the base and the uppermost aquifer due to normal fluctuations in groundwater elevations.

ii) The ash ponds should be located at least 500 m away from the HFL/ FRL of the Rivers/ Reservoirs

iii) Site should not be located in wetland.

iv) Site should not be located within 60 m of the outermost damage zone of a fault that had displacement in Holocene time, unless it is demonstrated that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity.

v) Site should not be located in seismic impact zones unless it is demonstrated that all structural components including liners, Ash Water collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

vi) Site should not be located in an unstable area unless it is demonstrated that good engineering practices have been incorporated into the design to ensure that the integrity of the structural components will not be disrupted.

3.6 Configuration

The scheme for ash disposal generally envisages two lagoons for bottom ash (BA) with one common over flow lagoon (OFL) and one lagoon for fly ash (FA) with one silting basin. The silting basin is to be used for collecting excess rainwater to ensure dyke safety. The dykes are planned with various numbers of raisings depending on maximum height of starter dyke, capacity requirement and foundation conditions. Well type water escape structure with flexible opening are envisaged for decanting water from storage lagoon to over flow lagoon for recirculation through Ash water recirculation system (AWRS). Spillways shall also be envisaged for discharging excess rainwater from storage lagoons/OFL. BA Storage lagoon and OFL are necessarily to be provided with impervious liner using bentonite-blended soil or equivalent to ensure no ground water contamination.

The topography of the ash dyke area is undulating terrain with varying levels. The total length of the starter dyke may be in few kilometers. Typical configuration of ash pond is shown in following figures 7 and 8.

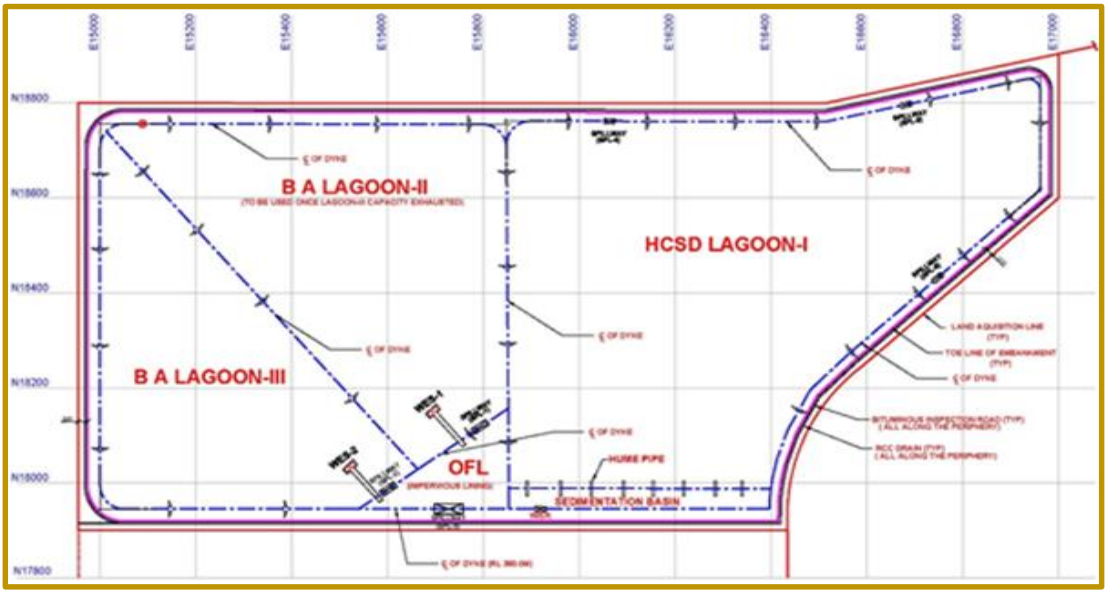


Figure 7: Typical layout of ash pond

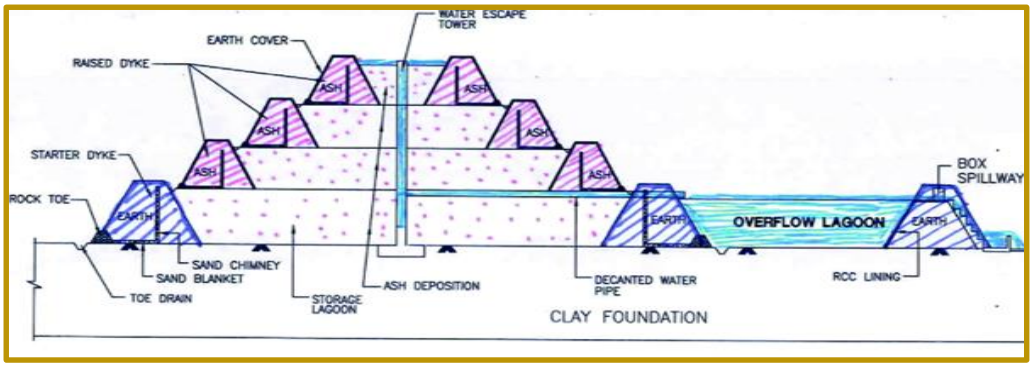


Figure 8: Typ Section of storage lagoon and OFL

3.7 Type of Embankment

From the point of view of material of fill, an earthen embankment can be classified as:

I. Homogeneous Embankment
II. Zoned Embankment
III. Earth and Rock Fill Embankment

3.7.1 Homogeneous Embankment

A homogeneous embankment is one which consists of practically uniform materials throughout. This type of embankment is suitable where the readily available soils show little variation in permeability or soils of contrasting permeability are available only in minor quantities.

For embankment in ash disposal areas, soil excavated from the disposal area itself shall be made use of, as far as possible. Within the limited areas of lagoons in the order of 300 to 500 acers, not much variation is expected in the soil characteristics, in the top one to two metre depth from surface. Hence homogeneous embankment can be constructed in general. Typical homogeneous ash dyke section is shown in following figure 9.

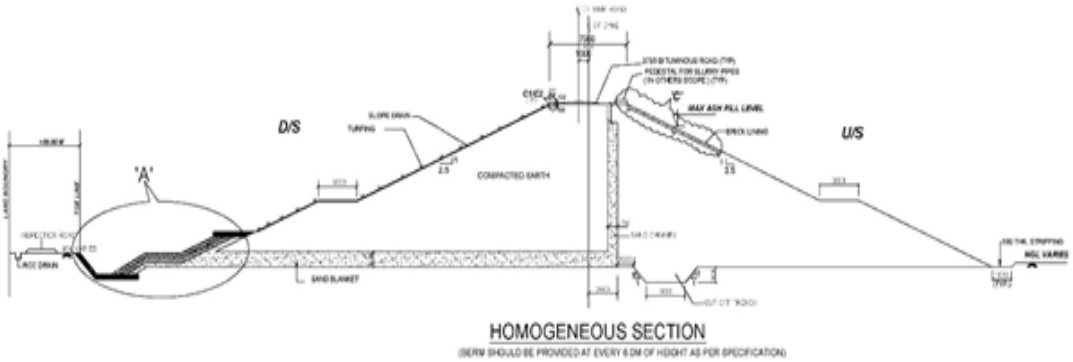


Fig 9. Typical homogeneous ash dyke section

3.7.2 Zoned embankment

A zoned embankment consists essentially of an inner or enclosed impervious zone supported by two or more outer zones of relatively pervious materials. Thus the scheme of zoning may divide the dyke into three or more zones, with the supporting zones increasing in

coarseness of particle size and perviousness towards the outer slope. For this type of embankment, it is essential that materials of different size ranges should be available either in different borrow areas or at different levels in the same borrow area.

For zoned embankments, materials of contrasting permeability will have to be brought from outside in large quantities which may be uneconomical and result in loss of additional storage volume which could have been obtained with excavation of material from within the ash disposal areas. Typical zoned ash dyke section is shown in following figures 10.

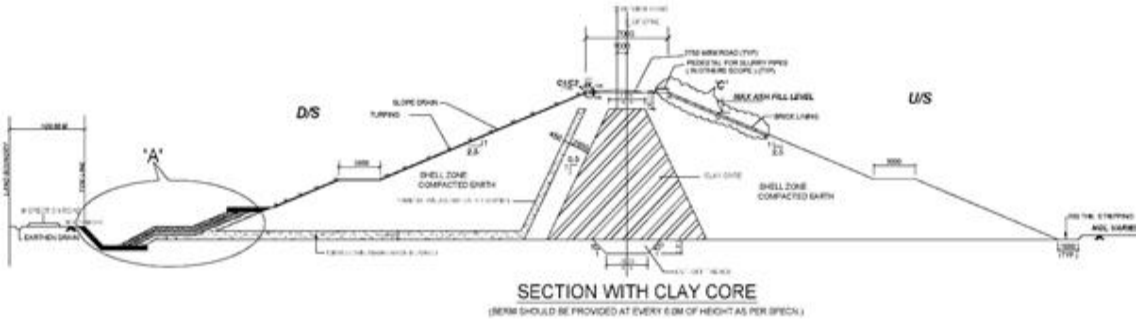


Fig 10. Typical zoned ash dyke section

3.7.3 Earth and Rock Fill Embankment

An earth and rock fill embankment consist of an earthen embankment "core "covered with large rock fill on the upstream or downstream slope, or on both. The earth-fill portion of the embankment may be zoned with two or more layers of soil or by graded filter layer. The selection of rockfill is governed by the availability of material and consideration of economy and structural stability. This configuration is normally avoided unless good construction soil is not readily available at the ash disposal site.

3.8 Over Flow Lagoons (OFL)

Over flow lagoons are provided with overflow type spillway with stilling basin. The capacity of overflow spillway is decided based on the water used in making slurry and flow generated by rainfall over the pond area.

3.9 Water Escape Structure (WES)

Construction of well type Water Escape Structure (WES) in each bottom ash lagoon with intermediate openings with provision of closing when ash level rises opening is provided for taking out the decanted water from storage lagoon to overflow lagoon for recirculation through AWRS pump house. The flexible opening provided in the WES wells would be used to

maintain optimum water cover over the deposited ash in the lagoon under charge to prevent any fugitive dust emission from storage lagoon.

Any pipe embedment inside the dyke body is a vulnerable point from the dyke safety point of view and extreme care shall be taken. Preferably a single pipe shall be provided in case of new construction of Ash dyke However the actual requirement of number of pipes shall be as per detailed design. Cut off collar and diaphragm, filter may also be provided in the pipe embedment inside the dyke body.

Draw off pipes shall be provided from the water escape wells such that their outlet level is 0.25 m above the maximum water level in the overflow lagoon. If the pipes are to be kept above ground level, suitable earthen/ ash embankment shall be provided along the pipe routed to support the pipes. The size of well/wells shall be sufficient to also draw out the rainwater collected within the ash pond in addition to the decanted water from the ash slurry.

Approach bridges/bunds shall be provided for access to wells from the dyke tops. A typical sketch of WES is shown below.

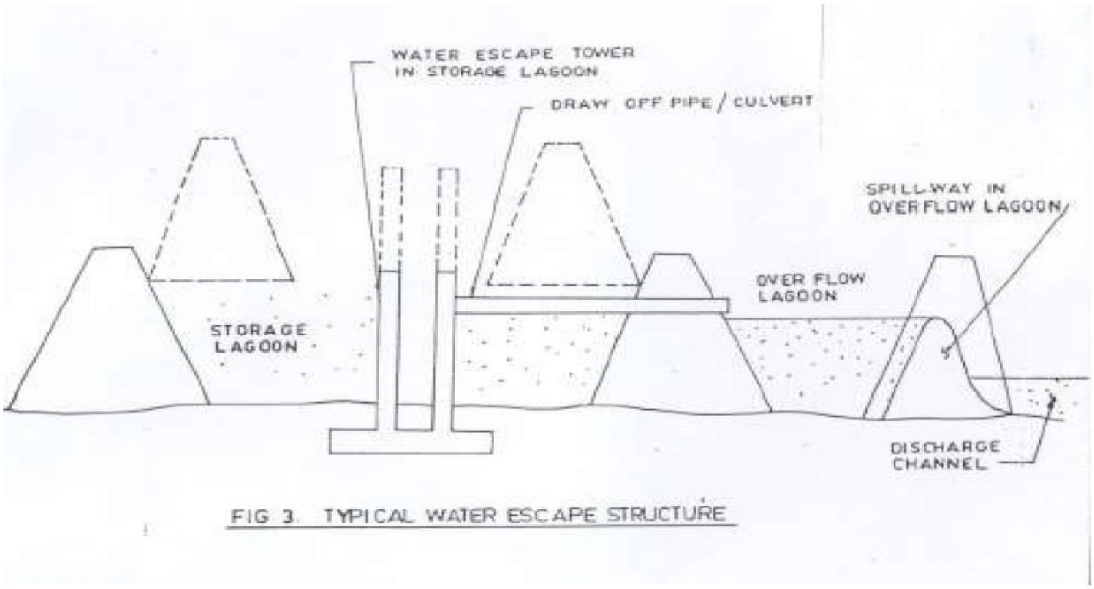


Fig 11: Typical Water Escape Structure (WES)

3.10 Requirement of Toe drain/ Seepage water pump house

National Green Tribunal (NGT) & State Pollution Control Boards (SPCBs) have issued directive for zero discharge from Plant and prohibiting any discharge of liquid effluent from ash dyke into the river or any surface water body.

Accordingly, the toe drain water from the ash dykes is not to be discharged into the nearest river/ water body and needs to be recirculated. In recent projects, the above aspect is taken care during the engineering of the AHS/ Ash dyke package where in toe drain water is envisaged to be pumped back into ash dyke for recirculation.

3.11 Requirement of inspection road for dyke and ash/ash water pipe corridor

In view of heavy and frequent movement of vehicles on ash dyke, the following needs to be considered:

1) Inspection/ Service and dyke top road all along the periphery of ash dyke may be provided.

2) The WBM road on the dyke shall be designed for heavy loads at least 40 MT as per IRC guidelines.

3) It is advisable that along with WBM, minimum 100mm thickness of BM (Bituminous macadam) and 40 mm thickness of BC (Bituminous concrete) is to be provided for smooth movement of inspection/maintenance vehicles.

4) Top width of the dyke shall be 6 m to accommodate a Single lane road of about 3.75 m width with shoulder on both sides on the top of dyke throughout the length of lagoons having provisions for the overtaking zone of 10 m width.

5) Provision of guard wall/posts along edge on either side of ramp with fluorescent white & black colors stripe paints may be made, wherever feasible.
6) At each entry point for vehicle movement, there is need to widen the dyke top up to 10m on either side of entry point by 50 m considering double lane road. The base width of dyke shall be increased accordingly considering the slope of the dyke.
7) Ash dyke embankment should not be used for regular plying of heavily loaded vehicles; however, exit/ entry of the vehicles into or from ash pond may done by Site by providing additional number of suitable approaches/ ramps on either side as per requirement and site condition.
8) Wherever ramps are required as per site requirement to approach on the dyke top, suitable drainage provision through number and size of pipes to be decided depending upon discharge at toe drain shall be provided.
9) At the junctions between approach road & dyke top, the kerb shall be replaced by suitable hump as per site conditions. Provision of Safety poster and required road safety signage at each side of Dyke road for ensuring safe transportation.

3.12 Slurry discharge points for Lean slurry disposal

Multi point discharge shall be adopted to (i) achieve more or less uniform ash filling within the lagoon, (ii) completely utilize the available storage capacity and (iii) maintenance of water cover throughout to avoid island formations of ash within the lagoon leading to fugitive dust problem.

Ash slurry shall be discharged in a lagoon starting from the areas near the well and progressively shifting from the well area to the areas away from the well. No discharge shall be allowed on the slopes. A minimum of 5H (H is the Height of the embankment) shall be maintained from the heel of the embankment. The discharge shall also ensure that ash surface is not exposed anywhere above the water level.

3.13. Slurry discharge points for HCSD disposal

It is recommended to locate the discharge spigots at every 200 meter intervals by providing T sections on top of the main dyke. A blind flange should isolate each T open end. There will be 2 or 3 discharge lines at each discharge spigot going inside the storage area depending of the number of main discharge lines on the top of the relevant dyke.

Just downstream each T the piping should also be isolated from the slurry flow in order to avoid clogging of this pipe by slurry.

3.14. Rehabilitation of the storage area

After completion of the storage area operations, designated areas can be rehabilitated by covering these areas by top soil and vegetation after checking stability and consistency. It is advised that a civil engineering survey is to be executed to verify the stability of the filled area and to advise in a cultivation scheme/solar or wind power plants or other purposes as allowed under Ash Utilization Notification.

CHAPTER 4

DESIGN PROCEDURE FOR ASH POND

4. General

In general, for Ash disposal, Starter Dyke of height 10-15m height and subsequent raisings of 3-5m height each (effective height) for future storage are considered. The stability analysis is to be performed for starter ash dyke without raising and with each subsequent raising separately for static and seismic cases as per IS 7894. The starter dyke to be constructed first and subsequent raisings to be constructed in stages after the starter dyke is filled with ash to its capacity. Homogeneous embankment is generally preferred using earth for starter dyke and ash in dyke raisings with 500mm(min) thick earth cover. Typical section of Ash Pond with upstream raisings is shown below fig 12

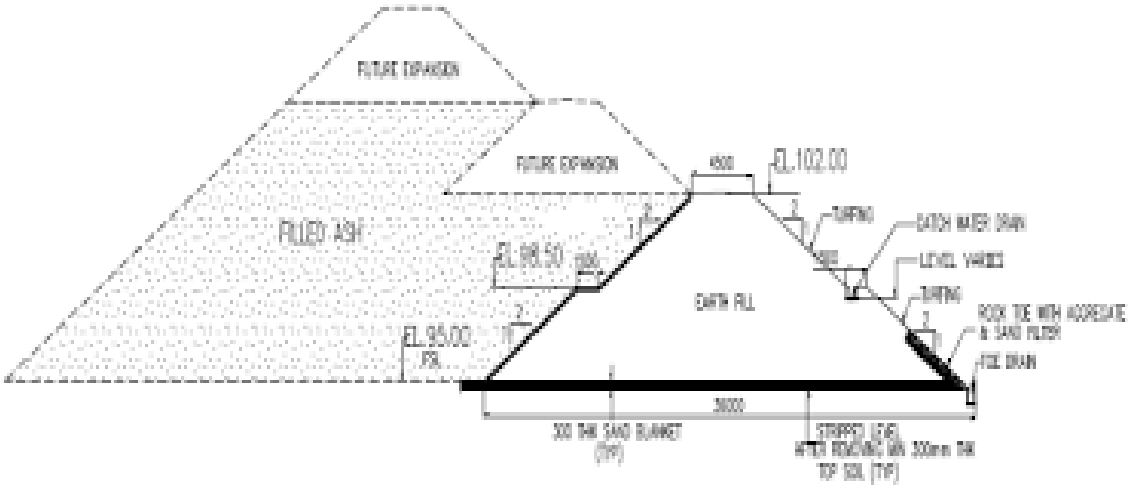


Fig 12 Typical section of Ash Pond

The topography of the proposed ash dyke area shall be evaluated. The top levels of dyke in different lagoons are to be decided based on the ground topography, ash characteristics, ash disposal system and foundation conditions.

4.1 Stability

The stability of the dyke embankments is checked for
i) static and
ii) seismic conditions as per IS: 7894.

The Criteria for safe design of earthen dyke should be in line with IS:12169 (Criteria for Design of Small Embankment Dams) and IS:8826 (Guidelines for Design of Large Earth & Rock-fill Dams) as applicable.

The basic requirements for design of embankment dams are to ensure:

a) safety against overtopping;
b) stability, and safety against internal erosion

c) base design and Ash water collection to prevent infiltration

d) run-on control and runoff control & collection

4.2 Factors to be considered for safe design of ash dyke embankments.

1) There should be no danger of over topping. This involves sufficient spillway capacity, and adequate net free board, considering also the settlement of the dam and foundations. In seismic zones, extra allowance is needed for free board. A minimum free board (from water level to top of the dyke) of 1.5m is suggested for ash ponds as per IS 10635.

2) The location of the outlet/spillway shall be such that by suitably locating the ash slurry discharge pipe outlets, the fringes of the ash dyke all around are filled up first. The top of the outlet shall be decided so as to ensure continuous flow of slurry water towards the outlet without allowing heading up of water along the fringes of dyke.

3) The seepage line should not cross the downstream face above one third height of the dyke. This is to prevent “sloughing” of the face and possible failure. If the seepage line meets the downstream face, the toe softens by saturation and due to adverse seepage forces, a local failure at the toe may occur. This is avoided by the provision of internal drainage arrangement in the dyke. In case of no data, the top seepage line (phreatic line slope may be taken as 1(V):6(H), sloping down wards.

4) Water passing through or under the dyke should be unable to remove material of the dyke or foundation. This criterion is meant for protection against piping failures and involves provision of filters in the embankment section, and seepage control measures for foundations.

5) There should be no opportunity for free flow of water from upstream to downstream face. Free flow may occur through internal cracks, along conduits or after erosion caused by leaks from pressure conduits, at joint with masonry or concrete sections or with abutments, through

layers left loosely compacted, through holes made by rats or animals or those left by rotten roots of dead trees etc. Once a concentrated leak starts, it is almost impossible to avoid failure. Precautions have to be taken against all these eventualities.

6) The upstream and downstream slopes should be stable against the most adverse conditions to which they can be subjected. Both slopes have to be checked for end of construction condition when rapid mechanized construction is carried out, which generates large undissipated pore pressures in the compacted layers. Instability may also arise from presence of thin pervious seams in clay foundations which may transmit high consolidation pore pressures generated under the embankment by its load to lightly loaded areas beyond the toe of the dam and thus cause failure.

7) In seismic zones any of the above conditions may have to be combined with seismic effects.

8) The foundation shear stresses should be smaller than the shear strength to provide a suitable margin of safety. This problem is likely to arise in case of foundations of highly plastic clays, the period just after the construction of dam being the most critical.

9) Both the upstream face and the downstream face should be properly protected against wave action and rain cuts.

4.3 Geotechnical investigation

Detailed investigations shall be conducted to find out the properties of foundation soil within the proposed ash pond area including permeability of soil. The dyke shall be founded on a firm stratum suitable ground improvement if required shall also be carried out based on geotechnical investigation.

Detailed laboratory tests shall be conducted to establish the physical, chemical and engineering properties of soil and analysis of subsoil water. In case, grained surface is not suitable, it should be used only after ground improvement based on the detailed Geotechnical investigation report. Based on properties of founding soil and fill material, the stability and seepage analysis shall be carried out.

Detailed investigations shall be conducted to find out the properties of foundation soil as well as the borrow area soil for starter dyke embankment, filter material. Detailed investigations shall include but not be limited to the following:

i) Foundation Soil along the alignment of dyke embankment

a. Collection of disturbed and undisturbed samples and conducting Standard Penetration Test in Boreholes.
b. Collection of undisturbed samples from trial pits.
c. Conducting field permeability test in bore holes by pumping in/out tests depending upon the position of Ground Water Table and in trial pits by percolation test. Packet tests in rock.
d. Laboratory tests to determine
   1) Bulk density and moisture content
   2) Grain size analysis
   3) Liquid limit and plastic limit
   4) Shrinkage limit
   5) Specific gravity
   6) Unconfined compression test
   7) Tri-axial test - U-U test, C-U test and C-D test on undisturbed samples.
   8) Compressibility of foundation material

ii) Borrow area material

Laboratory test to determine:
1) Grain size analysis
2) Liquid limit, plastic limit and shrinkage limit
3) Specific gravity
4) Standard Proctor Compaction Test
5) Tri axial shear test - U-U test, C-U test and C-D test on samples compacted to 95% of Standard Proctor Density.
6) One dimensional Consolidation test on samples compacted to 95% of Standard Proctor Density.

iii) Filter material (Sand filter)

The following laboratory tests on sand/ bottom ash (filter material) are required to be carried out. Further analysis regarding suitability of sand/ bottom ash as filter media w.r.t. base material of ash dyke embankment.

i) Grain size Distribution
ii) Density (Bulk & Dry)
iii) Permeability test (Laboratory)
iv) Specific Gravity
v) Atterberg limits, if non-plastic the same shall be reported.

4.4 Design criteria

For defining the profile of the phreatic line across the dyke section, a comprehensive seepage analysis shall be done for the ultimate height of the dyke, with full water inside and tail water (if any due to H.F.L.), on outside of the dyke, before doing the stability analysis. The slope stability analysis of the dyke for ultimate stage shall be done for steady seepage condition both for static and dynamic (earthquake) cases as per IS. 7894

-Code of Practice for Stability Analysis of Earth Dams. Dyke shall be designed as per best engineering practice including IS and studies by reputed institutions. The design is done for the ultimate height and the unutilized ash to be stored on temporary basis/ emergency use. Base should have required liner system and Ash Water collection system to prevent infiltration. Design should ensure run-on control and runoff collection and disposal. HCSD system is designed to be operated generally at an ash concentration of 55 to 65%. This ensures drying of HCSD slurry within short period of time. Hence no liner is necessitated in HCSD System.

MINIMUM DESIRED VALUES OF FACTORS OF SAFETY AND TYPE OF SHEAR STRENGTH RECOMMENDED FOR VARIOUS LOADING CONDITIONS AS PER IS 7894-1975

Case No.	**Loading Condition of Dam**	**Slope Most Likely to be Critical**	**Pore Pressure Assumptions**	**Type of Shear Strength Test to be Adopted**	**Minimum Desired Factor of Safety**
I	Construction condition with or without partial pool*	Upstream and downstream	To be accounted for by Hilf's method	QR+	1.0
II	Reservoir partial pool	Upstream	Weights of material in all zones above phreatic line to be taken as moist and those below as buoyant	R S+ +	1.3
III	Sudden drawdown: a) Maximum head water to minimum with tail water at maximum b) Maximum tail water to minimum with reservoir full	Upstream Downstream	As given in 5.4.2 of IS 7894 As given in 5.4.5 of IS 7894	R S+ + R S+ +	1.3 1.3
IV	Steady seepage with reservoir full	Downstream	As given in 5.5.2 of IS 7894	R S+ +	1.5
V	Steady seepage with sustained rainfall	Downstream	As given in 5.6.1 of IS 7894	R S+ +	1.3
VI	Earthquake condition: a) Steady Seepage b) Reservoir full	Downstream Upstream	As given in case IV As given in Case II	R S+ + R S+	1.0$ 1.0$

Case No.	Loading Condition of Dam	Slope Most Likely to be Critical	Pore Pressure Assumptions	Type of Shear Strength Test to be Adopted	Minimum Desired Factor of Safety
				+	

Q-Unconsolidated Undrained Test, R-Consolidated Undrained Test, S-Consolidated drained Test

*Where the reservoir is likely to be filled immediately after completion of the dam, construction pore pressure would not have dissipated and these should be taken into consideration

+This is to be adopted for failure plane passing though impervious foundation layer.
+ S test may be adopted only in cases where the material is cohesion less and free draining.
+

$ Values are according to IS:1983-1975 "Criteria for earthquake resistant design of structures (Third revision).

Note: These factors of safety are applicable for the methods of analysis mentioned in this standard.

4.5 OTHER BASIC DESIGN GUIDELINES

In addition to the structural stability requirements for the design of ash dyke, some basic design guide lines are given below:

a) Lagooning system

The water from the storage lagoons shall escape to the overflow lagoon (OFL) through RCC water escape well type structures and RCC hume pipes of suitable diameter. These hume pipes shall be encased with a rectangular RCC section, with minimum lining thickness of 250 mm at bottom & 150 mm on all other sides.

The water from the OFL shall escape through a RCC box culvert spillway. The outfall structure shall have stair-way type energy dissipating devices on the downstream slope of the dyke.

b) Design of Embankment

The design of embankment shall be done by a process of successive trials and refinements. The following steps may be followed.

Select a trial embankment section incorporating the available materials, with the following parameters.

i) Top width – is usually kept upto 3 to 10 m metre having a WBM road of with 100 mm and 150 mm of base & sub-base respectively.

One overtaking space shall be provided on each side on Top of the dyke. Ramp at one location shall also be provided.

ii) Free board - 1.5 metre minimum. Higher free board shall be provided if required from the anticipated wave height and from run up point of view.

iii) Side slopes - Minimum 2.5 Horizontal to 1 Vertical for earthen/ash embankment or as per design whichever is gentler.
3m wide berms shall be provided for all slopes at about 6 metre height intervals.

iv) Impervious - Bottom of all the pond shall be provided with a Liner minimum of 300 mm thick Impervious Liner (bentonite mixed soil or HCSD layer)/LDPE/HDPE liner.

v) Internal drainage arrangement:

a) Sand chimney of minimum 0.5 metre thickness, upto 1.0 m below dyke top.
b) Sand blanket of minimum 0.5m depth.
c) Rock toe at the downstream toe of the embankment. Height of the rock toe should be a minimum 1.2 metre as per provisions of IS 9429. With the above drainage arrangements, the phreatic line is expected to follow the drainage path.
d) The exit gradient of seepage flow near the downstream toe shall be checked by drawing flow nets. The exit gradient shall not exceed about 0.14. If the gradient is more than this value, the dyke slope will have to be flattened to reduce the gradient.

c) Slope protection works

i. On the downstream slopes, where the annual rainfall is less than 200cm. and where there is no existence of water collections, turf soding is sufficient.
ii. When the annual rainfall is more than 200cm, downstream slopes shall be protected by minimum 30cm thick stone pitching. Wherever, there are chances of water accumulation on the downstream side, the slope shall be protected by stone pitching of

suitable thickness, depending upon the wave height likely to act on the slope, in the region from below the toe of the dyke embankment 1.5 metre above the maximum water level to 1.5 metre minimum water level.

iii. On the upstream slope, dry fly ash brick packing (brick on flat) shall be provided for the top portion or use sand bags, tyres (or any other method if lining is provided) for a vertical height of 3 mts from the dyke top considering 1.5 m free board.

iv. On the top of the dyke, Water Bound Macadam surfacing shall be made for movement of vehicles, which will also give protection to the earth surface against rain and wind erosion.

d) Cut-off trench

If foundation material is very impermeable, a nominal cut-off trench shall be provided in the portion upstream of sand chimney, to increase the drainage path of any seepage oncoming at the junction between the embankment and its foundation. A minimum bottom width of 4m shall be provided for the cut-off trench to facilitate compaction with rollers. If rock is available at a depth less than 1 metre, the cut-off trench may be stopped at the rock level itself. The effect of cut-off trench is not taken in the design and it is only provided as an additional precaution against piping failure in foundation. For more details, relevant IS codes may be referred.

e) Instrumentation

In order to monitor the performance of ash dyke during construction and operation the following instruments should be installed at an approximate distance of 500 metre along the alignment of the dyke and at critical locations.

a) Piezometers
b) Surface settlement markers

f) Sand Blanket, Chimney and filter

The material for blanket, chimney and sand filters shall consist of clean sound and well graded coarse sand. The materials shall be free from debris, wood, vegetable matter and other deleterious matter. The gradation of sand material/bottom ash shall meet the requirements as per IS 9429.The filter materials shall be suitably compacted to a firm condition to achieve a relative density of 70%. Bottom ash meeting filter criteria shall be used in lieu of sand as filter material based on availability.

CHAPTER 5

CONSTRUCTION MATERIAL

5. Embankment Material

Earth embankments can be built with all kinds of materials ranging from broken rock to silty soils, clays and ash. For a homogeneous section, materials of low permeability and low plasticity are preferable. In zoned section, two broad categories of materials may include many grades of permeability. Even random materials can be accommodated in non-critical portions of the section. The following materials are suitable for homogeneous dykes, considering their permeability, shear strength, compressibility and workability.

The embankment fill material for dyke shall belong to any one of the soil classification namely 'CH', 'CI', 'CL', 'CI-CL', 'MH', 'MI', 'ML-CL', or 'SC'.as per IS 1498-1970

5.0.1 Suitability of Soils for Construction of Earth Dams

Relative Suitability	Homogeneous Dykes	Zoned Earth Dam		Impervious Blanket
		Impervious Core	Pervious Core	
Very Suitable	GC	GC	SW,GW	GC
Suitable	CL,CI	Cl,CI	GM	CL,CI
Fairy Suitable	SP,SM,CH	GM, GC, SM, SC,CH	SP,GP	CH,SM
Poor	-	ML,MI,MH	-	-
Not suitable	-	OL,OI,OH,Pt	-	-

Cut of trench filling to be done using above fill materials and prepared by blending the soil, with minimum 4 percent bentonite to achieve a permeability not more than $1X10^{-6}$ cm per second.

The above fill material should be free from logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the dyke.

5.2 Raising by Fly Ash

Ash may be used for construction of embankment in case of raising. Ash to be brought to the site from the ash pond/ location identified. Pond ash to be excavated from a minimum distance of five times height of embankment or 25m from heel of the proposed embankment of upstream & centre-line raising whichever is more.

For the earth cover (minimum 500 mm) to be provided over ash core, in the case of ash embankments, the soil shall consist of sandy loam free of admixtures of stiff clay, refuse, stumps, roots, rock, brush, weeds or other material which would be detrimental to the proper development of the vegetation growth. The earth should meet following grading analysis.

- Sand 20% to 75%
- Silt 10% to 60%
- Clay 5% to 30%

A suitable grading and thickness of earth cover should be adopted based on design requirement for stability and permeability.

5.2.1 Fly Ash

The following information on the Fly Ash to be used for dyke raising should be evaluated before commencement of work:

1. Particle size of the material
2. The maximum dry density (MDD) and optimum moisture content (OMC) as per IS code specified test, and the graph of density plotted against moisture content, for this test. In general, fly ash of compacted density lower than 1.1 gm/cc shall not be suitable for embankment construction. The design parameters should be rechecked, when fly ash of lower densities is encountered.
3. Shear strength parameters, for evaluation of the stability of proposed slopes and the bearing capacity of foundations located on the fill.
4. Compressibility characteristics, for predicting the magnitude and duration of the fill settlement.
5. Permeability and capillarity are required to assess seepage and to design drainage systems.
6. For typical geotechnical properties of Fly Ash refer Table 1 given under Clause 1 of introduction chapter.

5.2 Drainage/Filter Material

Drainage Filter:

Filters are extremely important in ash dykes and are used to prevent piping and erosion of foundation materials. Filters are constructed in layers, each of which is coarser than the one below it, and for this reason they are often referred to as reversed filters. A filter must comprise granular material fine enough to prevent soil particles being washed through it and yet coarse enough to allow the passage of water and shall be designed as per IS 9429

i. $\frac{D_{50} \text{ of filter}}{D_{50} \text{ of base material}} < 25$

ii. $\frac{D_{15} \text{ of filter}}{D_{15} \text{ of base material}} = 6 \text{ to } 19/>5$

iii. $\frac{D_{85} \text{ of filter}}{D_{15} \text{ of filter}} > 5$

(The above equation ensures that the filter layer has permeability several times higher than that of the soil it is designed to protect)

iv. $\frac{D_{15} \text{ of filter}}{D_{85} \text{ of base material}} < 5$

(The requirement of the above equation is to prevent piping within the filter. The ratio D15 (filter)/D85 (base) is known as the *piping ratio*.)

v. The gradation curve of the filter material shall be nearly parallel to the gradation curve of the base material.

vi. The filters shall not contain more than 5% by weight of materials finer than 0.075 mm size.

vii. The sand filter layer shall be considered as the base material for coarser filter layer.

viii. The filter material shall be suitably compacted to a firm condition to achieve a relative density of 70%.

ix. In addition to the above, the provisions for filter as given in "IS: 9429-Code of practice for drainage system for Earth and Rock Fill dam", also shall be followed.

For sand- material, the grading shall be decided as per filter criteria specified above, so that the embankment fill material is prevented from being carried away through the blanket, chimney and filters.

5.3 Rock Toe Material

The rock material used for the rock toe shall satisfy the following condition:

a) Specific gravity shall not be less than 2.50 (As per IS 1122)

b) Sulphate soundness- Less than 10% loss of weight after 5 (Five) cycles (As per IS 1126)

c) Aggregate Impact value shall not exceed 30% (As per IS 2386)

d) Water absorption shall not exceed 2.5% (As per IS 2386)

e) In slake durability test (as per IS 10050), the percentage retain after two ten (10) minutes cycles shall be more than 85 %.

Rock toe shall be formed with rock material consisting of sound, durable and well graded broken rock obtained from approved quarries and shall be of approved quality prior to being transported to the area of deposition. The materials shall range in size from 10 to 45 cm. All brush, roots or other perishable materials shall be removed from rock-fill during spreading and shall be transported to a disposal area.

The rock available from the excavation of water escape structure/stripping/drain channel etc. which satisfy the quality requirements specified above. These shall be washed, cleared, and broken into required size and stacked separately.

Similarly, rock materials for rock toe satisfying the quality requirements specified above can also be obtained from rock available within the land acquired for construction of ash pond divide bund, if it is found suitable. The rock will be broken to required size and shape and will be cleaned before utilized.

5.4 GENERAL REQUIREMENTS OF HDPE/LDPE LINER

i. The HDPE geo-membrane manufactured from first quality virgin resin only to be used. Blending of resins shall not be allowed. No recycled or reworked geo-membrane shall be used except edge trim generated during the manufacturing process (no more than 10%).
ii. The geo-membrane shall be free of plasticizers.
iii. The geo-membrane shall be free of leachable additives.
iv. The geo-membrane shall be free of factory seams.

v. The geo-membrane shall be free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, blisters, pits, tears, holes, pores, pinholes, voids, un dispersed raw material, any sign of contamination or other defects that may affect serviceability, and shall be uniform in color, thickness and surface texture.
vi. The geo-membrane shall be capable of being seamed in the field to yield seams that areas resistant to waste liquids as the sheeting.
vii. HDPE/LDPE material to be used shall meet the minimum requirements of GRI Standard GM13.

5.5 GENERAL REQUIREMENTS OF NON WOVEN GEOTEXTILE

i. The non-woven geotextile shall be manufactured from first quality virgin resin. Blending of resins shall not be allowed. No recycled or reworked geotextile shall be used except edge trim generated during the manufacturing process (no more than 10%).
ii. The geotextile shall be free of plasticizers
iii. The geotextile shall be free of leachable additives.
iv. The geotextile shall be free of factory seams.
v. The geotextile shall be free from dirt, oil, foreign matter, scratches, cracks, creases, bubbles, blisters, pits, tears, holes, pores, pinholes, voids, un dispersed raw material, any sign of contamination or other defects that may affect serviceability, and shall be uniform in color, thickness and surface texture.
vi. The geotextile shall be capable of being seamed in the field to yield seams that are as resistant to waste liquids as the sheeting.

Materials

The nonwoven thermally bonded or needle punched or any equivalent geotextile shall be used. The geotextile shall be made of polyethylene or Polypropylene or polyester or similar fibers manufactured through machine made process of heat bonding or needle punching techniques. The mean Values of Geo-textile shall be as shown in Table-3

Table 3. Guide property of non-woven geotextile

Properties	**Mean Values**	**Test Method**
i) Mechanical		
Wide width Strip Tensile	5 kN/m	EN ISO 10319
Elongation	30-50 %	EN ISO 10319
CBR Puncture resistance	2500	EN ISO 12236
ii) Hydraulic		

Apparent opening size	85 micron	EN ISO 12956
Permeability	45 l/m2. sec	EN ISO 11058
iii) Physical		
Mass per unit area	150-300 g/sq.m.	
Thickness	1 to 2 mm	

Note: Above properties are indicative and for guidance purpose only.

CHAPTER 6

CONSTRUCTION AND SEEPAGE CONTROL

6. Introduction

Construction is a critical phase in achieving a safe dyke. Modern construction equipment permits to achieve speed with quality. Generally, a starter dyke is constructed and subsequent raising is done by either upstream / inward raising or downstream/ outward raising.

In d/s method the volume of ash to be handled is more. This may add to ash utilization. Depending upon the seismic zone the method of construction may be finalized. In seismic zone V d/s method appears to be a better option than u/s construction. The various methods are shown below in figure 13.

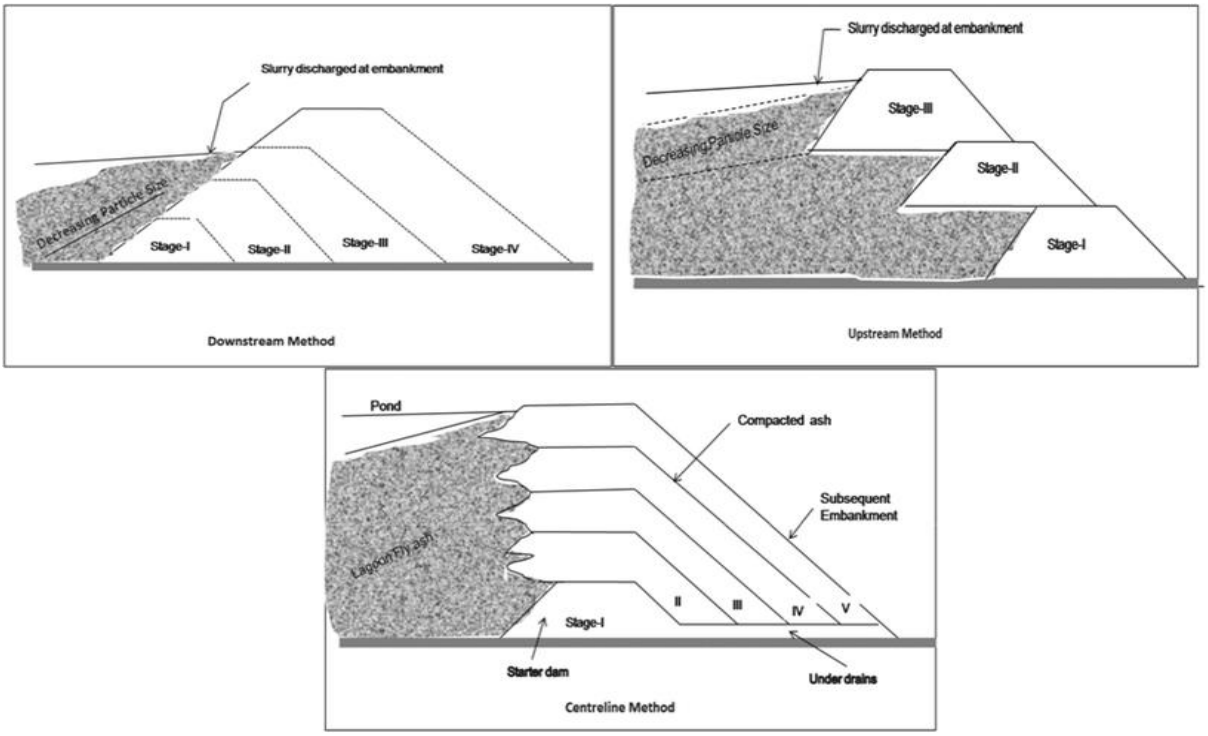


Figure 13: Showing methods of dyke construction

6.1. Preparation of Embankment Sub-Surface

6.1.1 Clearing and Grubbing

This work consists of cutting, removing and disposal of trees, bushes, shrubs, roots, grass, rubbish, etc., from the alignment and within the area of land which will accommodate the embankment, drains and such

other areas as specified on the drawings. During clearing and grubbing, adequate precautions against soil erosion, water pollution, etc are required.

All trees, stumps, etc., falling within fill area should be cut to at least 500 mm below ground level and pits shall be filled with suitable material and compacted thoroughly so as to make the surface at these points conform to the surrounding area.
The entire area meant to receive the ash and earth filling shall be stripped to a depth of minimum 150 mm. The exact depth of stripping shall be depending upon the nature of topsoil and the vegetation present.

All organic matter, vegetation, roots, stumps, bushes, rubbish, swamp materials, etc. shall be removed from the site. The stripping material and other unsuitable materials as referred above shall be kept far away from the area to be filled up so that these do not get mixed up with filling material and disposed of to an identified area.

6.1.2 Stripping and Storing of Top Soil

When constructing embankment using ash, the top soil from all areas to be covered by the embankment foundation should be stripped to specified depth not exceeding 300 mm and stored in stock piles of height not exceeding 2 m, for use in covering the fly ash embankment slopes (if soil is suitable), cut slopes and other disturbed areas where revegetation is desired. Top soil should not be unnecessarily trafficked either before stripping or when in stockpiles. Also, these shall not be surcharged or otherwise loaded and multiple handling should be kept to minimum.

6.1.3 Setting Out

After the site has been cleared, the limits of embankment should be set out true to lines, curves, slopes, grades and sections as shown on the drawings. The limits of the embankment should be marked by fixing batter pegs on both sides at regular intervals as guides before commencing the construction. The embankment should be built sufficiently wider than the design dimensions so that surplus material may be trimmed, ensuring that the remaining material is of the desired density and in position specified, and conforms to the specified slopes. Bench marks and other stakes should be maintained as long as they are required for the work.

6.1.4 Dewatering

Compaction of fill material at around optimum moisture content should be ensured. If the foundation of the embankment is in an area with stagnant water, it is feasible to remove it, the same should be, and the area of the embankment foundation should be kept dry. Care should be

taken to discharge the drained water so as not to cause damage to works, crops or any other property

6.1.5 Leveling

All existing undulations, holes, cavities, excavations made for plate load rests and other soil investigations, etc. shall be filled with pond ash having requisite moisture content. The ash thus filled shall be compacted with the help of vibratory rollers so as to achieve Dry Density of not less than 95% of Maximum Dry Density at optimum moisture content as per IS – 2720 (Part-VII). This would result in a levelled surface upon which layer wise filling and compaction of ash can be done.

6.2 Excavation of Pond Ash from Borrow Area

6.2.1 Site Clearance

All areas required for borrowing shall be cleared of all trees and stumps, roots, bushes, rubbish and other objectionable material. Particular care shall be taken to exclude all organic matter from the material to be placed in the fill. All materials thus cleared, which can be burnt shall be completely burnt. Balance shall be disposed off as specified. The cleared areas shall be maintained free of vegetation growth during the progress of the work.

6.2.2 Stripping

Borrow area shall be stripped of top layer by a depth of minimum 150 mm. The exact depth of stripping shall be decided depending upon the nature of top layer and the vegetation present.

6.2.3 Borrow area watering & dewatering

The natural moisture content of material in the borrow areas as well as the optimum moisture corresponding to the Proctor's maximum dry density for the material in the particular borrow area shall be obtained from laboratory tests. Additional moisture, if required, shall be introduced into the borrow area by watering well in advance of excavation to ensure uniformity of moisture content. If in any borrow area before or during excavation there is excess moisture, steps shall be taken to reduce the moisture by the selective excavation to secure the materials of required moisture content by excavating drainage ditches, by allowing adequate time for drying or by other means. To avoid formation of pools

in the borrow areas during excavation operations, drainage ditches from borrow areas to the nearest outlets shall be excavated so as to obtain homogeneous mix. In general, all materials from a particular borrow area shall be a mixture of materials obtained for the full depth of cut.

6.3 Construction of Pond Ash

6.3.1. Filling of Cut off Trench

The cut off trench shall be filled up in layers not exceeding 300mm in compacted thickness using impervious soils CL or CI type having permeability less than 1 x 10^{-6} cm/sec, to be obtained from approved borrow area. The suitability or otherwise of the material shall be determined by laboratory tests. In case clayey soil of the specified quality is not available, alternatively manufactured impervious soil by blending required quantity bentonite (not less than 4 percent) to available soil to achieve the specified permeability also can be used. Blending of bentonite with earth shall be done in dry form in a concrete mixer. Each layer of earth deposited shall then be compacted to have a dry density not less than 98% of the maximum dry density (standard proctor) for the soil with suitable tractor drawn heavy sheep foot tamping rollers or by any other method. The compaction shall 'have to be uniform throughout the length and breadth of each layer. The roller should be made to travel over the entire section of each layer so that the earth is fully compacted and the roller leaves no visible marks on the surface.

6.3.2 Trenches for water escape pipes

Before placing the water escape pipes within the embankment, construction of dyke upto 600 mm above the RCC lining for pipes shall be carried out without actually placing the pipes. Later on, trenches shall be excavated for pipes and lining work, pits for cut-off collars and diaphragm filters. These trenches shall then be filled using naturally available CL-ML type soil (plasticity index 7-20) or with manufactured soil by blending with bentonite to achieve specified plasticity. Earth layers deposited in these trenches shall be compacted with plate compactors to have a dry density not less than 100 percent of the maximum dry density (standard proctor).

6.3.3 Impervious core

The spreading of the next layer shall be carried out only after the underlying layer has been approved. The impervious core of the dyke shall be made with approved clayey soil brought from elsewhere and I or

with manufactured soil by blending the available sandy silty soil with bentonite (not less than 4 per cent by volume) to achieve the permeability not more than 1 x 10^{-6} cm/sec. The procedure for laying and compaction shall be the same as specified for the shells of dyke.

6.4 Placing the fill material

The materials for embankment shall be obtained from the approved borrow areas and available excavated material to the extent possible. In general, all materials from the particular borrow area shall be a mixture of materials obtained for the full depth of the cut. Earth material available from the excavation of cut-off trench etc. if found suitable can also be used for the embankment construction.

The distribution and gradation of materials throughout the fill shall be as shown in the approved drawings or as directed. The fills shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. The combined excavation and placing operations shall be such that the materials when compacted in the fill will be blended sufficiently to produce the specified degree of compaction and stability.

No stones, cobbles or rock fragments, having maximum dimensions of more than 10 cm shall be placed in the fill. Such stones and cobbles shall be removed either at the borrow pit or after being transported to the fill but before the materials in the fill are rolled and compacted. The materials shall be placed in the fill in continuous horizontal layers; stretching right across the whole section, not more than 30 cm in compacted thickness and rolled.

During construction a small transverse slope from center towards the edges should be given to avoid pools of water forming due to rains. The surface of materials to be placed thereon, shall be moistened and or worked with harrow, scarifier or other suitable equipment, in an approved manner to a sufficient depth to provide a satisfactory bonding surface before the next layer of fill material is placed. If the rolled surface of any fill is found to be too wet for proper compaction, it shall be raked up, allowed to dry, or shall be worked with a harrow or any other approved equipment to reduce the moisture content to the required amount and then it shall be re-compacted before the next layer is placed.

When compacting the fill material against steep rock abutment or walls or masonry or concrete structure the construction surface of embankment shall be sloped away from rock or masonry or concrete structures for a distance of 3 m to 4 m at an inclination not steeper than

6 horizontal to 1 vertical. If the foundation surface is too irregular to allow the use of a large roller directly against a structure rock outcrop, the roller shall be used to compact the fill material as close to the structure or the outcrop as possible and the portion of the embankment directly abutting against the rock or the structure shall be compacted with pneumatic hand compactors/tampers in thin layers. The moisture content of the fill material placed against the rock or the structure shall be high enough to allow it to be compacted into all irregularities of the rock or the structure. Care shall be taken in placing the first layer of the fill so that no damage is caused by the hauling machinery to the base grade as this may get concealed by the spread layer or fill. Sheep foot roller shall not be employed for compacting till the thickness of the layers already compacted by other means is greater by 30 cm than the depth of the feet on the roller drum. The material for the first layer shall be at moisture content sufficient to enable bonding of the fill with the rock surface.

6.4.1 Weather Conditions

Embankment materials shall be placed only when the weather conditions are satisfactory to permit accurate control of the moisture content in the embankment materials.

6.4.2 Moisture Control

Prior to and during compacting operations, the materials in each layer of fill shall have a moisture content about 2% less than the optimum moisture content, in the case of cohesive soil. In the case of cohesion less material including ash, the placement moisture content may have only little effect on the compaction behavior of the fill and hence appropriate moisture content required from other site considerations such as dust suppression etc, may be adopted. As far as practicable the materials shall be brought to the proper moisture content in the borrow area before excavation. If additional moisture content is required, it shall be added on the embankment by sprinkling water before rolling the layer. If the moisture content is greater than required, the material shall be spread and allowed to dry before starting rolling. The moisture content shall be uniform throughout the layer of materials. If the moisture content is more or less than the range of the required practicable moisture content, or if it is not uniformly distributed throughout the layer, rolling shall be stopped and shall be started again only when the above conditions are satisfied.

6.4.3 Degree of Compaction

While the specification provides that equipment of a particular type is to be deployed and used, compaction shall be done to achieve 95% standard Proctor density by mechanical means. Thickness of each compacted layer shall be maximum 300 mm.
Tamping (sheep foot) rollers or pneumatic rollers shall be used for compacting cohesive materials and pneumatic rollers and vibratory rollers shall be used for compacting cohesion less materials including ash. Any other suitable type of compaction equipment also can be employed after necessary field trials about their effectiveness.

6.5 Rolling and tamping

6.5.1 Rolling

When each layer of material has been conditioned so as to have the proper moisture content uniformly distributed throughout the material, it shall be compacted by passing the roller. The exact number of passes shall be decided based on compaction trials to be conducted in the field before start of work. The layers shall be compacted in strips overlapping not less than 0.6 metre. The rollers or loaded vehicles shall travel in a direction parallel to the axis of the dyke. Density tests shall be made after rolling and the dry density attained shall be not less than 95% of maximum dry density (Standard Proctor) obtained in the Laboratory for the type of material used.

6.5.2 Tamping

Rollers will not be permitted to operate within 1.0 M of concrete and masonry structures. In locations where compaction of the till material by means of the roller is impracticable or undesirable the material shall be specially compacted as specified here in at following locations:

a) Portions of the dyke embankment adjacent to masonry structures.
b) Earth ash in dyke embankment adjacent to steep abutments,
c) Earth ash fill at locations specifically designated.

Fill shall be spread in compacted layers not more than30 cm in compacted thickness and shall be moistened to have the required moisture content. When each layer of material has been conditioned to have the required moisture content it shall be compacted to achieve the dry density of not less than 95%of Maximum Dry Density (Standard Proctor) by special rollers, mechanical tampers, hand held vibratory tampers or by other approved methods, and all equipment and methods

used shall be subject to approval based on evidence of actual performance. The moisture control and compaction shall-be equivalent to that obtained in the fill material actually placed in the dyke embankment.

6.6 Liner

Ash Pond lining is used to minimize any damage to the groundwater resource due to leaching of metals from fly ash. Liners can be classified depending upon their functional arrangement or type of material (clay, geo-synthetic etc) .As per the design requirement impervious soil liner or geo-membrane or geotextile liner may be provided. The following are the guidelines for the same

6.6.1 Impervious Liner using Soil

The compacted thickness of liner shall not be less than 300 mm. The suitability or otherwise of the material shall be determined by laboratory tests. In case clayey soil of the specified quality is not available, alternatively soil blended with required quantity of bentonite (not less than 4 percent by volume) to achieve the specified permeability also can be used with the same specified procedure for laying and compaction. Blending shall be done by suitable means. Layer of liner laid shall be compacted to have a dry density not less than 90% of the maximum dry density (standard proctor) for the soil with suitable rollers.

Bentonite is a fine textured colloidal clay. Sodium bentonite shall be used for the work. Laboratory tests shall be conducted to determine the percentage of bentonite needed to achieve the desired permeability of not more than $1x10^{-6}$ cm/sec. Soil to be used for liner shall be free from organic matter, debris etc.

The work broadly involves laying of clayey soil (or) mix of soil & bentonite, mixing of soil & bentonite, spreading the mix, compacting & Testing of Permeability.

6.6.2 Subgrade Preparation for Impervious liner

The subgrade surface should be prepared by minimum 300 mm stripping, grading, watering wherever required, and removing all vegetation, rocks, and other matter which could penetrate the Impervious Liner or decrease the uniformity of the mixture. The prepared surface shall be compacted by at least 2 passes of 8 Ton - 10 Ton roller.
In case earth for formation of dyke is borrowed from inside the lagoon where Impervious liner is to be provided, after borrowing fill material from the lagoon, the excavated surface shall be prepared with compaction by

two passes of 8 Ton - 10 Ton roller and slope shall be maintained to 1V:4H.

6.6.3 Mixing, placing & compaction of manufactured impervious soil

For mixing of soil & bentonite, any of the following method can be chosen

6.6.3.1 Mix in Other Place:

Soil & bentonite shall be mixed thoroughly in dry condition in a mixture and water shall be added, once the mix attains uniformity, the mix will be transported to site and spread over the prepared surface of lagoon to get each compacted thickness not more than 300 mm.

6.6.3.2 Mix In Place: Alternatively soil shall be spread in layers and the required bentonite shall be spread over the soil surface. The bentonite shall be spread uniformly across the accepted subgrade surface at the specified application rate. The bentonite shall be thoroughly mixed and compacted to get each compacted layer thickness not more than 300mm.

6.7 GEOMEMBRANE LINER

LDPE/HDPE liner may be provided on bottom of ash pond of the ash dyke as per requirement and to be anchored at heel of ash dyke.

Impermeable LDPE/HDPE lining of thickness minimum 1000 micron with permeability of $1x10^{-6}$ cm/sec and jointing of LDPE/HDPE lining with double wedge fusion welding, to prevent seepage. The liner shall be placed over minimum 50 mm thick fine sand. Arrangement for holding the liner in position by providing necessary RCC beam at top level of embankment shall be kept. The liner shall be protected by geotextile (250 GSM) overlain by 50 mm thick Plain Cement concrete of Grade (M20).

6.7.1 Cushion Layer below HDPE/LDPE Liner

The liner shall be laid over a minimum 50 mm thick layer of natural sand/ manufactured crushers and/ bottom ash. The material shall be clean with little or no fines conforming to IS1498 unless specified otherwise. The thickness and other arrangement shall be as per the details given in the drawing.

6.7.1.1 Field Placement of The HDPE/LDPE Liner

a) General Requirements:

The placement procedure used for the geo-membrane liner shall include the conditions listed below.

i. **Weathe**r: Geo-membrane shall not be placed when the air temperature is above 40^{o}C or below 5^{o}C unless it can be by trial welds that acceptable welds can be made at the prevailing temperature. Geo-membrane shall not be placed when there is any rainfall or snowfall, in the presence of excessive moisture due to fog or dew, in ponded water, on a frozen subgrade, or during high winds.

ii. **Panel Layout**: The panels shall be placed in accordance with the Manufacturer's panel layout drawing to ensure that they are placed in the proper direction for seaming.

iii. **Panel Deployment**: Only the panels that can be anchored and seamed together in one shift shall be unrolled. Unroll and layout panels in as close to the final position as possible. Pulling geo-membrane panels should be minimized to reduce the chance of permanent tension. The methods and equipment used to deploy the panels shall not damage the geo-membrane or the supporting surface. Wrinkles shall be minimized. However, enough slack shall be provided in both directions so that there will be no tension in the geo-membrane at the lowest expected operating temperature.

iv. **Precautions to Prevent Wind Damage:**
If possible, work shall be oriented in the direction of the prevailing wind. Provide adequate temporary loading and/or anchoring of the geo-membrane by the use of sandbags, tires or other means which will not damage the geo-membrane, to prevent uplift of the geo-membrane by wind.

v. **Other Precautions to Prevent Damage:**
Protection of the geo-membrane from damage due to foot traffic on the slopes shall be provided. Provisions of facilities for safe entrance and egress of employees from sloped depressions is required.

b) Field Seaming:

Method of Seaming: The primary welding procedure for seams shall be double wedge fusion welding. Extrusion welding shall be used only for repairs, detail work, and for seaming where double wedge fusion welding is not possible. The rods used for extrusion welding shall be of the same

type of resin as the geo-membrane. The use of solvents or adhesives is not permitted.

General Requirements for Seaming: On slopes steeper than 10 horizontal to 1 vertical, seams shall be oriented parallel to the line of maximum slope (oriented up and down, not across the slope) when possible. No seams oriented across the slope shall be used.

i. Seams parallel to the toe of the slope shall be located a minimum of 5 feet (1.5 m) from the toe.
ii. Seams parallel to the crest of the slope shall be located a minimum of 2 feet (600 mm) from the crest.
iii. Seams on the floor of the pond shall be overlapped so that the upslope sheet is positioned above the down slope sheet.
iv. Seaming shall extend to the outside edge of panels to be placed in the anchor trench.
v. Seams at corners of three or four sheets shall be completed with a patch having a minimum dimension of 24 inches (600 mm), and extrusion welded to the parent sheets. All cross seams between the two rows of seamed panels shall be welded during the coolest time of the day to allow for contraction of geo-membrane.

c) **Trial Welds Prior to Beginning Seaming**

Trial welds are required for pre-qualification of personnel, equipment and procedures for making seams on identical geo-membrane material under the same climatic conditions as the actual field production seams will be made. Trial welds shall be made as follows:

i. Prior to each seaming period.
ii. Every 4 to 5 hours (i.e., at the beginning of the work shift and after the lunch break).
iii. Whenever personnel or equipment are changed.
iv. When climatic conditions result in wide changes in geo-membrane temperature.
v. When requested by QC & QA (Quality Control & Quality Assurance) Geo-membrane Inspector for any seaming crew or piece of welding equipment if problems are suspected.
vi. Once qualified by passing a trial weld, welding technicians shall not change parameters without performing another trial weld.
vii. Trial welds shall be made on both double wedge fusion welds and on extrusion welds. A test strip shall be prepared by joining two pieces of geo-membrane; each piece shall be at least 6 inches (150 mm) wide.

viii. The length of double wedge fusion welded seams shall be a minimum of 10 feet (3 m) long.
ix. The length of an extrusion welded seam shall be a minimum of 4 feet (1.2 m) long.

The QA Geo-Membrane Inspector shall witness the fabrication of each test strip. All test welds shall be tested by destructive testing. Testing can be done as soon as the seam cools. If any of the test specimens fail, a new test strip shall be fabricated and the tests repeated for the new strip. If additional specimens fail, the seaming apparatus and the seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and successful trial welds have been achieved. If the specimens pass the tests, production seaming operations can begin.

d) Preparation for Seaming:

i. Prior to seaming, the surface of the geo-membrane shall be wiped with a clean cloth to ensure that it is clean and free from moisture, grease, dust, dirt, and debris of any kind before seam welding is started.
ii. The panels shall be adjusted so that the seams are aligned to eliminate wrinkles and fish mouths. Where necessary, fish mouths and wrinkles shall be cut to achieve flat overlap.

e Seaming:

i. Seaming shall be performed in accordance with the Manufacturer's accepted procedure.
ii. Double Wedge Fusion Welds:
iii. The panels shall be overlapped a minimum of 4 inches (100 mm) prior to welding. Vehicle mounted automated hot wedge welding apparatus shall be used to make the seam.
iv. Extrusion Fillet Welding:
v. Geo-membrane overlap shall be a minimum of 3 inches (75 mm) for extrusion welding. Panels shall be temporarily bonded using a hot air device prior to extrusion welding. The edge of the geo-membrane to be fillet welded shall be pre-beveled before heat-tacking the seam in place. The seam overlap shall be ground (abraded) no more than one hour prior to welding. Grinding shall be performed in accordance with the Manufacturer’s instructions in a manner that does not damage the geo-membrane. Grinding shall not extend more than 1/4 inch past the area to be covered with extrudate during welding. All grind marks shall be covered with extrudate.

6.7.2 Non-Destructive Field Testing :

i) General

a. All non-destructive field testing shall be performed and documented by the Geo-Membrane Contractor.
b. The QC & QA Geo-membrane Inspector shall observe all non-destructive test procedure one hundred (100) percent of the seam length shall be tested using nondestructive procedures to check the continuity of the field seams.
c. Non-destructive testing is not meant to qualify seam strength.
d. Air pressure testing shall be performed in accordance with ASTM D5820 and GRI GM6.
e. Vacuum Box testing shall be performed in accordance with ASTM D5641 and as specified herein.
f. Continuity testing shall be performed as seaming progresses or as soon as a suitable length of seam is available, not at the completion of all field seaming.

ii) Double Wedge Fusion Welded Seams:

a) Double fusion welded seams shall be tested using air pressure testing.
b) The procedure for testing shall be as specified in GRI GM 6 for the type and thickness of geo-membrane in use.
c)
d) The repaired seam shall be re-tested as required until all leaks are identified, and repaired, and the seam passes a subsequent air pressure test.
e) When the geometry of a double wedge fusion weld makes air testing impossible or impractical, vacuum testing may be used to test the seam.

iii) Extrusion Welded Seams:

a) Extrusion welded seams shall be tested using vacuum chamber testing in accordance with ASTM D5641.
b) The completed seam shall exhibit no leakage when tested between 4 and 8 psi minimum vacuum for approximately 10 seconds.
c) If leaks are discovered during testing, they shall be located, marked, and repaired.
d) The repaired area shall be re-tested and exhibit no leakage.

6.7.3 Destructive Testing :

i) Testing:

a) Destructive testing shall be performed by an independent third party laboratory employed by the Geo-membrane Contractor on samples cut from production welds in the field by the Geo-membrane Contractor.

b) Samples shall be taken to the third party laboratory and tested for shear strength and peel adhesion. For double wedge seam samples, both welds shall be tested for peel adhesion.

6.7.4 Repair of Defects and Seams

i) Patching

a) Patching shall be used to repair large holes, tears and destructive sample locations.
b) All patches shall be round, oval, or shall have rounded corners.
c) All patches shall be made of the base geo-membrane material and shall extend a minimum of 3 inches beyond the edges of the defect.
d) Patches shall be extrusion welded to the base sheet.

ii) Grinding and Welding

Grinding and welding shall be used to repair sections of extruded fillet seams with small defects.

iii) Spot Welding:

Spot welding shall be used to repair small tears, pinholes, or other minor localized flaws.

6.7.5 Heel Anchor Trench Excavation and Backfilling of HDPE Liner

The geo-membrane liner shall be anchored at heel. The excavation for anchor trench shall be done by the contractor to the lines and widths shown on the drawings prior to placement of the liner. Excavated anchor trench shall be filled with fly ash bricks or crushed aggregates carefully so that sufficient anchorage is ensured while laying the HDPE membrane. Refer for Typical detail showing LPDE/HDPE liner works figure 14.

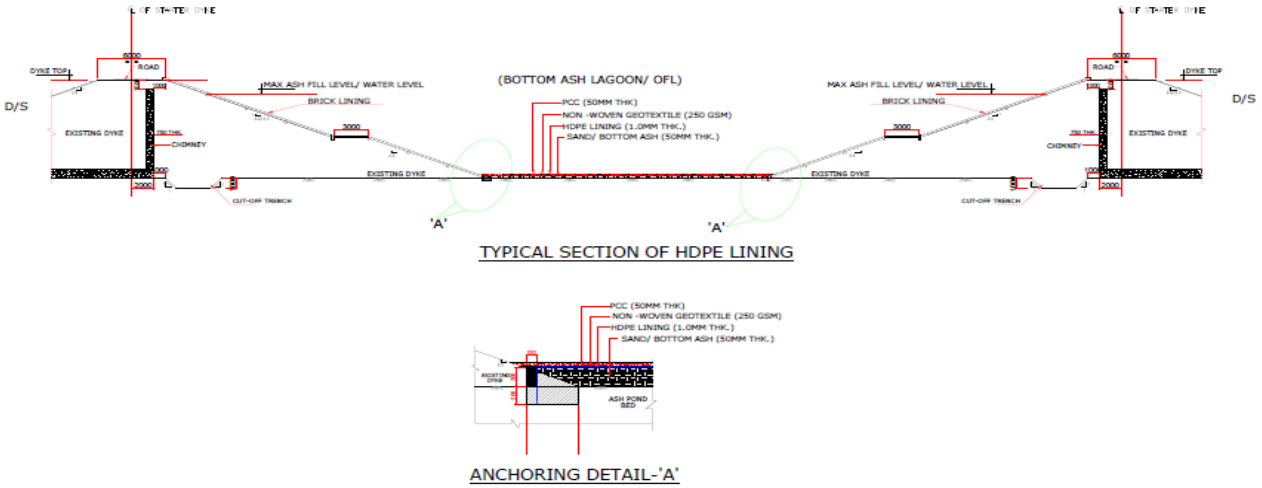


Figure 14: Typical detail showing LDPE/HDPE liner works

6.7.6 Laying and Installation of Geotextile

1) Panel Layout:

a) Prior to manufacture and delivery of the geotextile, a panel layout of the surface to be lined shall be made. Each panel to be used for the installation shall be given a numeric or alphanumeric identification number.

b) The panel identification number shall be related in writing to the manufacturing roll number that identifies the resin type, batch number, and date of manufacturer.

c) The panel layout shall be made considering the following requirements:

i. Panel lengths shall include slope gain and anchorage.
ii. Perpendicular tie-ins shall be made a minimum of 5 feet (1.5 m) beyond the toe of the slope.
iii. A minimum of 6 inch (150 mm) overlap shall be allowed at double fusion welded seams. All field seams on slopes shall be oriented parallel to the slope (oriented along, not across the slope.
iv. The number of seams in corners or odd shaped geometric locations shall be minimized.

2) Packaging

a) The geotextile shall be delivered to the project site in rolls each wrapped securely with a protective covering installed at the manufacturing facility. The covering shall prevent the entrance of water, vermin and dirt, and shall be adequate for protection against ultraviolet exposure. No material shall be folded.

b) A label shall be attached to each roll of the geotextile identifying the following:

i. Manufacturer
ii. Product Identification, which can be traced back to the origin of the base material (resin supplier's name, resin production plant, resin brand name type, resin brand number, and production date of the resin).
iii. Date of manufacture of the geotextile.
iv. Roll identification number.
v. Geotextile thickness and type.
vi. Roll dimensions (length and width)
vii. Batch number
viii. Order number
ix. Panel number

c) Packaging and transportation shall be the responsibility of the Manufacturer.

3) Handling of Rolls

The method of off-loading the geotextile at the project site shall not cause any damage.

The rolls shall be placed on a smooth surface free of rocks and standing water.

4) Cushion Layer below Geotextile

The Geotextile shall be laid over a 150 mm thick layer of natural sand/ manufactured crusher sand/ bottom ash. The material shall be clean with little or no fines conforming to IS 1498 unless specified otherwise. The thickness and other arrangement shall be as per the details given in the drawing.

6.7.7 Field Placement of the Liner

General Requirements:

The placement procedure used for the geotextile liner shall include the conditions listed below.

i) Weather:

Geotextile shall not be placed when the air temperature is above 40^{o}C or below 5^{o}C unless it can be demonstrated by trial welds that acceptable welds can be made at the prevailing temperature. Excessive moisture due to fog or dew, in ponded water, on a frozen subgrade, or during high winds.

ii) Panel Layout:

a) The panels shall be placed in accordance with the panel layout drawing to ensure that they are placed in the proper direction for seaming.
b) If panels are installed in a location other than indicated on the panel layout drawing, the revised location shall be indicated on an "as-built" layout drawing.

iii) Panel Deployment:

a) Only the panels that can be anchored and seamed together in one shift shall be unrolled.
b) Unroll and layout panels in as close to the final position as possible. Pulling geotextile panels should be minimized to reduce the chance of permanent tension.
c) The methods and equipment used to deploy the panels shall not damage the geotextile or the supporting surface. Wrinkles shall be minimized. However, enough slack shall be provided in both directions so that there will be no tension in the geotextile at the lowest expected operating temperature.

iv) **Precautions to Prevent Wind Damage:**

a) If possible, work shall be oriented in the direction of the prevailing wind.
b) Provide adequate temporary loading and/or anchoring of the geotextile by the use of sandbags, tires or other means which will not damage the geotextile, to prevent uplift of the geotextile by wind.

v) **Other Precautions to Prevent Damage:**

a. Protection of the geotextile from damage due to foot traffic on the slopes shall be provided.
b. Provisions of facilities for safe entrance and egress of employees from sloped depressions is required.

6.7.8 Crest Anchor Trench Excavation and Backfilling of geotextile

The geotextile liner shall be anchored in anchor trench at the top and bottom of the slope and at berm locations as shown on the Design Drawings. The excavation for anchor trench shall be done by the contractor to the lines and widths shown on the drawings prior to placement of the liner. Excavated anchor trench shall be filled with fly ash bricks or crushed aggregates carefully so that sufficient anchorage is ensured while laying the HDPE membrane.

6.8 Dressing and Trimming of the Slopes

The outer slopes of the embankments shall be neatly dressed to line as the placing of other fill progresses. Compaction shall extend over the full width of the embankment and the material in the slopes shall be compacted as for the rest of structure. To ensure proper compaction at the outer edge, the fill shall be constructed for a minimum of 0.5m extra width on either edges or the outer edge trimmed to specified width and slope, as per construction drawings, after completion of the dyke section up to top, in different stretches of the alignment. No slope shall be left without trimming to design slope. The trimmed slope surface shall be checked for adequate compaction as specified in the Quality Assurance checklist and under-compaction, if any, shall be corrected.

6.9 Provision for Settlement

While forming the embankment, due allowance of 1 percent of the vertical height or as appropriate shall be made to allow for settlement so as to maintain the top of the dyke at designed elevation.

6.10 Drainage Filter and Rock Toe

6.10.1 Sand Blanket

Sand blanket shall be laid subsequent to site clearance, stripping and excavation, if any. The foundation area shall be cleared before laying the bottom layer of blanket material.

Filter material shall be laid in layers not exceeding 500 mm. Water as necessary shall be sprinkled before compaction. Care shall be taken to ensure that materials of different layers do not get mixed, both at the time of placing and during compaction.
Extreme care shall be taken when placing materials in the zone to obtain a fill free from lenses, layers and streaks of segregated materials. After the layers of filter blanket material and intermediate sand layer materials have been laid and compacted earth fill material shall be laid.

6.10.2 Sand Chimney

Sand chimney of specified thickness shall be laid at the specified location by excavating and removing the already compacted embankment material exposing sand chimney in the lower layers earlier laid, and refilling the trench with sand in layers. The layer of sand shall be well watered and rammed. The depth of each layer of chimney to be laid shall not be more than 500 mm. The excavated material can be reused in the embankment area. While excavating the earth for filling sand for chimney drain, the top layer of sand which has been mixed with earth, shall also be removed.
Alternatively, the sand chimney can also be laid in layers simultaneously with the laying of each layer of earth fill. In such case, the top level of sand layer shall always be kept at about 100 cm above earth level on both sides. Each layer of sand shall be well watered and rammed. Care shall be taken to avoid mixing of earth and sand.

6.10.3 Sand Filter

The sand filter underneath the rock-toe and between rip rap and the bund shall closely follow the levels of the embankment in the area. Sand filter shall be laid subsequent to stripping of foundation and/or trimming of slope of compacted bund. The excavated earth shall be removed from the working area and stockpiled at a place. The surface to receive the sand filter shall be properly cleaned before laying of filter material. The sand filter shall be laid in layers; the thickness of the layers shall not be more than 500 mm. Water as necessary shall be sprinkled before compaction. The sand layer shall be well watered and rammed. Care shall be taken that materials of different layers do not get mixed, both at the time of placing and during compaction. The sand filter material shall be clean, sound, durable and well graded. No debris, wood, deleterious material etc., shall be permitted. Accumulations of soil caused by contamination shall be removed. Refer figure 15 for typical details below.

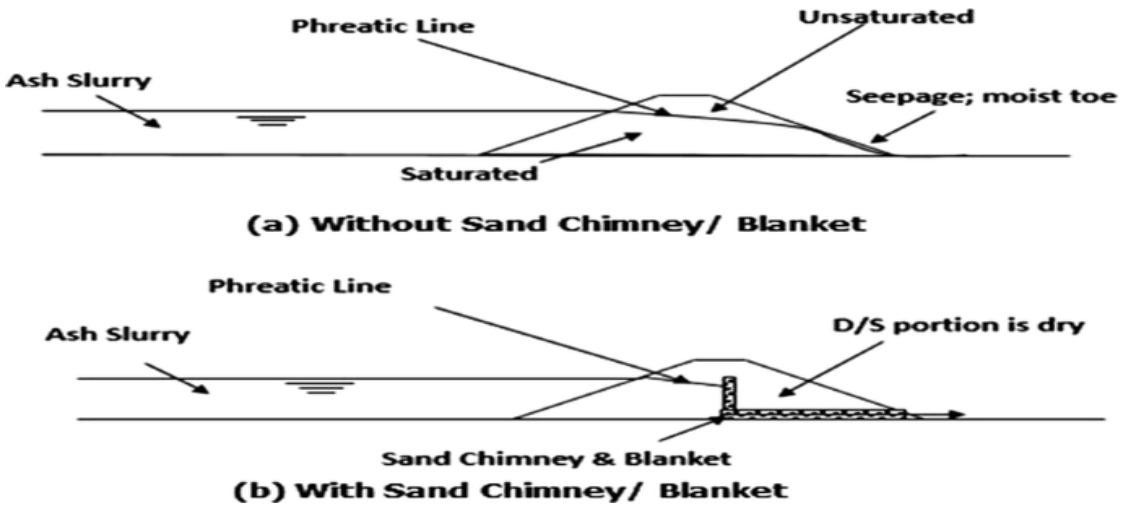


Fig 15 Typical detail of Sand filters

6.10.4 Graded coarse aggregate filters

The coarse aggregate material shall consist of durable well graded broken rock of hard stone variety from the specified quarries and shall be approved prior to being transported to the area of deposition. The materials shall range in the size from 10mm to 75mm and shall satisfy the filter criteria.

The rock material used in the aggregate filters shall satisfy the following condition:

a) Specific gravity shall not be less than 2.50. (As per IS: 1122)
b) Sulphate soundness less than 10% loss of weight after 5 (As per IS: 1126) (Five) cycles
c) Aggregate Impact value shall not exceed 30%(IS 2386)
d) Water absorption shall not exceed 2.5% (As per IS: 2386)
e) In slake durability test (as per IS: 10050), the percentage retained after two ten (10) minutes cycles shall be more than 85%.

6.10.5 Rock toe

The rock material used for the rock toe shall satisfy the quality requirements. Rock toe shall be formed with rock material consisting of sound, durable and well graded broken rock obtained from approved quarries and shall be of approved quality. The materials shall range in size from 10 to 45 cm. All brush, roots or other perishable materials shall be removed from rock-fill during spreading and disposal.

The rock available from the excavation of water escape structure1 stripping drain channel etc. which satisfy the quality requirements specified and found suitable for construction of rock toe may be used. These shall be washed, cleared, and broken into required size and stacked separately.
Similarly, rock materials for rock toe satisfying the quality requirements specified can also be obtained from rock if any available within the land acquired for construction of earthen dyke, if it is found suitable. The rock shall be broken to required size and shape and will be cleaned before utilized. Typical section of rock toe is shown below fig 16.

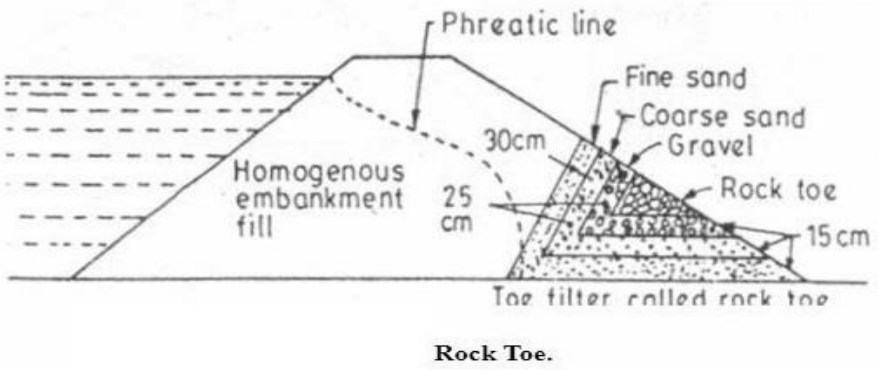


Figure 16: Typical section of Rock Toe

6.11. Placing of Rock toe

The stone pieces shall be hand placed to obtain a stable, well graded and free draining fill. The rock toe shall be constructed in layers so that the smaller rock fragments shall be placed adjacent to the filter of embankment and the large rock fragments near the outer edge of the rock toe. The rock fill shall be hand placed spread and roughly levelled in layers not greater than 30 cm in thickness in order to maintain a reasonably uniform surface and ensure that the completed fill will be stable and do not contain any voids having least dimension larger than 50 mm.

Contamination of the rock with finer materials from any other zones shall be avoided. Accumulations of soil caused by contamination shall be removed. Rock materials shall not be dumped directly but shall be hand placed in layers.

6.11.1 Rip rap on the slope of embankment

Rip rap shall be hand placed on the upstream slopes of the dam embankment as per IS: 8237 "Code of practice for Protection of slope

for reservoir embankments". The thickness of the riprap layer shall be as indicated in the drawings. The thickness shall be measured normal to slope of the embankment. The rock materials used for rip-rap shall satisfy the quality requirements specified.

The rip-rap material shall consist of the most durable rock fragments or approved quality selected for the purpose. The quality of individual rock fragments shall be dense, sound and resistant to abrasion, and shall be free from cracks, seams, shale partings, conglomerate bands and other defects that would tend to increase unduly their susceptibility to destruction by water and weathering action. The shape of the individual rock fragment shall be angular. Fragments having thickness less than 50% of their maximum dimensions shall not be used as rip rap. The stones shall be evenly distributed over the paved area. The average weight of stones shall be 15 Kgs. for 300 thick rip rap and 50 Kgs. for 600 thick rip rap.

These stones shall be placed on the edge with a longer dimension normal to the slope. Rock fragments and spells shall be tightly driven into the interstices to wedge the rip rap in place and close direct opening to underlying slope. The wedging shall be done with the largest chip practicable, each chip being well driven home with a hammer so that no chip can be removed by hand. Stones shall be laid in a compact manner beginning at the bottom of the slope. Rip rap shall be placed along with the till so that a minimum of break down will occur during placing and spreading.

6.12. QUALITY ASSURANCE

This check list is intended to be an aid in identifying aspects of testing materials and workmanship. All test results must be submitted promptly. The following minimum checks/tests shall be carried out by the contractor for ash and earth at his cost.

6.12.1 Sampling, Testing and Quality Assurance

Quality of compacted material shall be controlled through periodic checks on fly ash gradation, the compaction process or the end product, singly or in combination as directed. The end product must conform to the specifications.

6.12.2 Control Test on Borrow Material

If fly ash from more than one source is being used at the project site, monitoring must be done to identify the ash type being placed. The tests

required to be conducted on fly ash to be used as borrow material for embankment are indicated IN Quality Assurance checklist table provided. The frequency of testing indicated refers to the minimum number of tests to be conducted. The rate of testing must be stepped up as found necessary, depending on the compaction methods employed at the project IS Heavy Compaction Test.

Moisture Content: Frequency of testing shall be as per Quality Assurance Checklist Table provided below. The Samples collected for testing moisture content should be representative of the material being placed. Because fly ash may air dry relatively rapidly, samples should not be taken from the surface of the lift, but should represent the overall moisture content.

6.12.3 Analysis and Acceptance of Density Results

Analysis and Acceptance of Density Results shall be as specified under Quality Assurance Checklist Table below. The determination of density shall be in accordance with IS: 2720 (Part 28)-1974. Test locations shall be chosen by random sampling technique.

QUALITY ASSURANCE CHECK LIST

Item No.	**Type of Test**	**Frequency/Quantum of Check**	**Ref. Document**	**Acceptance norms**
1. ASH/EARTH BORROW AREA				
A)	Standard Proctor density	Once in 20,000 M^3 Of fly ash/earth	IS:2720 (Part- VII)	
B)	Moisture Content	Same as 1A) above	IS:2720 (Part- VII)	
2. ASH/EARTH WORK				
A)	In-Situ Dry Density	Once for every 2,000 M3 or part thereof of ash & earth in each layer	IS:2720 (Part-II &XXIX)	Not less than 95% of Standard Proctor Dry Density

B)	Moisture Content	-do-	IS:2720 (Part-II)	As per specification

CHAPTER 7

OPERATION AND MAINTENANCE OF ASH POND

7. INTRODUCTION

This section of the guidelines outlines the activities for operation and maintenance, and periodic inspection programs which will ensure safe operation of the dyke.

Preventive measures provide timely repair of dykes. An emergency action plan shall be kept in place so that the site management shall ensure to obtain safe operation of dyke.

7.1. METHOD OF SLURRY DISCHARGE

The slurry discharge near the water escape structure shall be done in the initial stages and after filling the area near the wells slurry shall be discharged at other locations.

7.2. Decanting System

The Total Suspended Solids of decanted water effluent shall be as 100 PPM measured weekly unless specified by State Pollution Control Board otherwise. For this purpose, samples shall be regularly collected and checked for TSS. A register shall be maintained with records of such measurements. In case the TSS is more than the permissible value sufficient, time for decantation shall be maintained. For increasing the decantation time, increasing the height, of spillway may not be a practical solution always.

Only where the wells are provided with precast slabs, the raising of spilling level may be feasible by inserting slabs. However, where the spilling level is fixed at FRL in the beginning itself, there is not scope for raising the spilling level.

The practical way for efficient decantation is adequate lagoon size commensurate with the rate of inflow and efficient ash filling management (i.e judicial shifting of slurry discharge points).

7.3. Maintenance of Ash Dyke

It is very important to constantly inspect the ash dyke and carryout necessary remedial measures wherever certain abnormal conditions are observed/noticed. Following aspects have to be monitored and recorded during inspection of the dyke:

i. **Design slopes**: The slopes shall be maintained as per the drawings. In case of deficiency, makeup the slopes preferably by similar material. The reason for any abnormal change in settlement shall be investigated

ii. **Top width**: The top width of the dyke shall be as per drawings. In case of any deficiency, the same shall be made up immediately.

iii. **Top level of dyke**

Top level of dyke shall be as mentioned in drawings. Any deficiency shall be made up immediately. Settlement/ sinking if any shall be immediately rectified by additional earth fill. The reason for any abnormal settlement shall be investigated.

iv. **Free board**

Freeboard as mentioned in the design shall be maintained.

v. **Earth cover and turfing**

Earth cover on the slopes mentioned in the drawings shall be maintained. Any erosion or deficiency in the slope, the same shall be restored with earth-cover of 0.5 m compacted thickness immediately.

vi. **u/s slope protection**

Slope protection shall be maintained as mentioned in drawings/specification.

vii. **WBM road, Kerb /dowel wall, slope drains**

These shall be as mentioned in the drawings. Defects if any shall be attended immediately.

viii. Rock toe, toe drain, berm, rock pitching and etc.

Rock toe, toe drain, berm, rock pitching and etc. shall be maintained as per the drawings. Dislodgements/defects if any shall be corrected immediately.

ix. Instrumentation

Piezometers surface settlement marker shall be maintained in working condition and protected from cattle grazing or theft. Defective instruments shall be replaced.

Other details like spillway, Water Escape Structure (WES) etc design bed gradient of drains not specifically mentioned but assist in maintaining the safety of dyke shall be attended properly.

x. To avoid erosion on u/s slope due to discharge points, the discharge points of the chute be extended inside the lagoon up to 5H from heel of dyke ('H' is the avg height of dyke).

xi. From Safety point, provide railing or construct a safety wall of about 1.5m height around WES wells above envisaged top level of wells using brick masonry.

xii. HCSD system is designed to be operated generally at an ash concentration of 55 to 65%. This ensures drying of HCSD slurry within short period of time. Operating the HCSD system at lower ash concentration will lead to accumulation of water, which prevents drying of HCSD in the dyke thereby defeating the basic intent of adopting HCSD System in power plant. So, the operation philosophy of HCSD is to be complied strictly.

7.4 Wet patches/softening on downstream slope

If the wet patches found to appear on the slopes, the area adjacent to downstream of the rock toe shall also be inspected. Corrective measures shall be taken immediately.

Frequency of inspection

i) As such in fair weather, dyke inspection shall be carried out once in every 15 days and in monsoon season inspection is to be carried out every week or less depending on condition of ash dyke.

All the operating and non-operating dykes shall be inspected practically after events like earthquake, cyclone, heavy rains, high flood in the river, etc. and a report prepared based on the observation, if any damage is noticed, the same shall be rectified as per the maintenance guidelines. If no suitable guidelines are found for the nature of the damage, the designer of the dyke shall be consulted immediately.

ii) Measurements on the instruments such as piezometers and settlement etc during inspections shall be recorded. Frequency may be increased during monsoon period and proper records to be maintained.

7.5 Preventive Measures:

The pond area which is under operation shall be inspected on regular basis. If any subsidence, sink holes or crates are noticed on the surface of pond, the downstream side at the same location shall be inspected for any other signs of weakness/abnormality in the nearby area. Immediate preventive measures shall be taken A site report of such observations shall be recorded if necessary be communicated to the designer.

i) Breach:

One of the main cause for breach of dyke/distress to the dyke is overtopping. To prevent overtopping, the design free board shall be ensured throughout the operating lagoons. Encroachment into free board must be avoided by advance planning of construction of the dyke raising in the other lagoons.

All efforts shall be made to,

(a) Ensure that future (next) lagoon shall be kept ready before the ash level reaches the maximum design fill level.

(b) Freeboard as mentioned in the design shall be maintained.

(ii) Erosion and Slope Protection:

The erosion beneath / on the dyke slope is responsible for the subsidence and instability of the dyke. Some of the major causes are rain cuts, insufficient soil cover / turfing etc.

Erosion on the u/s and d/s slope can be prevented by ensuring:

(a) Compaction to the specified density both in the levelled portion of the dyke as well as on slopes.

(b) Erosion of u/s slope of soil cover provided on ash embankment shall be prevented by pitching brick on the edge / ash cement mortar lining preferably from the bed level or heel of the dyke upto the top level.

(c) Erosion of downstream can be prevented by turfing and proper compaction of soil at sides besides providing slope drains to guide water from the dyke tops. Suitable geotextile may be used to avoid erosion of slopes.

(d) By providing ripraps on the downstream wherever it is subjected to rainwater.

(e) All the rainwater from the dyke top shall be drained into the slope drains. These shall be inspected & maintained on regular basis.

(f) Ensure proper gradient for the surface water to be drained through drains on the slopes.

(g) Connection of dowel bank/wall & drain is maintained for draining surface water from dyke top into the slope drains.

(h) Trees shall not be allowed to grow on the slopes and on dyke tops.

(i) It is necessary to fill all the gullies/cuts with earth and compact slopes and provide turfing much ahead of monsoon. Geotextiles may be provided for slope protection.

(iii) Seepage and Piping

Piping or sand boiling is one of the main cause for excessive settlement or instability of the dyke. There are several reasons for this, however one of the main causes is improper drainage. This is primarily due to filter material not meeting the Filter design criteria.

Other causes may be due to use of oversized borrow material in the fill, insufficient cover or turfing, improper slope protection on the upstream slopes, encroachment into free board, rat holes etc.

Improper connection between slope drain and toe drain, connection between the WES and Pipes or the construction jointing WES are also

probable causes for seepage and piping. To prevent seepage and piping, the following shall be ensured:

(a) The filter material shall satisfy the filter design criteria.

(b) Toe drain shall be clear of any blockages.

(c) The invert of the toe drain should be below the blanket drain.

(d) The discharge/ seepage water shall be monitored for its suspended particles.

(e) The cross-drain pipes from the toe drain shall be clear of all blockages.

(f) The construction joints between old and new construction shall be properly keyed.

(iv) Water Logging

In case of pervious foundation, the seepage from ponds can inundate the neighboring fields, causing damage to the fields. Water logging at the downstream shall be avoided to prevent subsidence/instability of the dyke. One of the main cause is improper connectivity from toe drain to natural drain.

To overcome this defect, a seepage barrier may be constructed around the dyke by means of a grout curtain or by any other suitable seepage barrier. Other suitable methods like artificial drainage through reverse sand wicks/relief wells, sand blanket surface loading etc., pumping arrangement may have to be provided. Intermittent sumps may also be considered in case of highly water logged areas. For details of relief wells refer IS 5050:1992.

(v) Place reverse filter layer

Providing relief wells near the affected area for safe exist of the seepage water. Observe the condition and monitor the outflow from the relief wells. A register shall be maintained recording rate of flow from each relief well. Such measurements shall be taken at a frequency of 15 days. If any of the discharge pipes from the relief well is found to have been blocked, the same shall be cleared for effective relief of the seepage water.

(vi) Gulley formation

Gulley formation on the downstream face due to surface water flow during rain can be prevented by maintaining grass turfing and by selecting non-erodible earth cover during the dyke construction. Further slope drains at intervals of 25-30 m will also help to avoid gulley formations. If any gully formation is noticed, the same shall be back-filled with cohesive soil and covered with grass turfing.

(vii) Rat holes/animal burrows

During inspection, if any rat holes or animal burrows are noticed, the same shall be plugged immediately using sand compacted by rod and then plug at the top with earth. The holes shall be filled and covered with grass turfing.

(viii) Growth of plants

Plants/trees shall not be allowed on the dyke top or slopes. Only shallow rooted grass and shrubs can be allowed. If any plant growth is noticed, the area shall be cleared by removing all the roots, plug the area with selected soil and cover with grass turfing.

(ix) Choking of surface drainage

i) Stagnation of seepage water in the drains is not desirable. This may be due to deposition of soil particles in the drain. All toe drains and surface drains shall be cleaned periodically by removing silt or vegetation for smooth flow. Design bed gradient shall be maintained.

ii) Site/operation shall maintain record of total inflow into the ash dyke thorough various discharge pipes by suitable measuring system.

iii) For routine maintenance works of ash dykes like repair of rain cuts/rat holes/gulley's/plugging of wet spots/cleaning of rock toe & peripheral drains, each station shall have Annual maintenance contract for ash dykes.

7.6 MONITORING THE DYKE

To confirm the performance of the dyke as per the design requirements, it is essential to monitor the performance of the dyke throughout its operation. Instruments commonly provided for such monitoring are listed below:

a) Settlement gauges along the top and slopes of dyke.

b) Piezometers, minimum 3 to 4 nos. at critical sections to check the phreatic line during various stages of operation to verify the efficiency of internal drains.

c) Suitable device shall be installed at convenient location for Monitoring of free board. All the instruments for monitoring purpose mentioned above shall be protected against damage by the local people and by movement by vehicles and cattle. The measuring instruments shall be kept under safe custody and regularly cleaned to prevent corrosion and malfunctioning. The batteries, if any shall be regularly charged or replaced.

A typical Checklist for inspection is placed at *Annexure A*

7.7 OTHER GENERAL RECOMMENDATIONS

Following are necessary for effective operation and maintenance of the ash dyke:

i. Toe drain and surface drain shall be kept clean for smooth water flow and shall be inspected for non- choking at least once in month.

ii. Unauthorized entry into ash pond area shall be prohibited and display boards shall be installed at prominent locations. To avoid sabotage security guards for vigilance of the ash dyke area round the clock is preferable.

iii. To facilitate inspection and maintenance the entire dyke perimeter shall have accessible roads with at least WBM topping. All around the dyke alignment there shall be a single lane inspection road at ground level, besides roads on dyke tops in all phases. At least one road (either at the ground level or at the starter dyke (top) shall be bitumen covered and connected to a bitumen covered approach road in order to ensure an all-weather approach to ash dyke area.

iv. Flood lights on the dyke area as required may be provided for inspection purpose. These lights need to be turned on only in case of inspection during night and during emergency.

v. A site office/pota cabin may be considered at the ash pond area. The same may be provided with telephone and transport facility.

It is desirable to have an ash management group responsible for inspection and monitoring of the ash dyke and take corrective and preventive measures where required.

vi. One dedicated Vehicle should be allotted for ash dyke maintenance group and for dyke construction.

7.8 Manpower Requirement

Site management shall ensure adequate and complete staff to perform its functions in operation, inspection, and maintenance of dyke safety. It is essential that support personnel and equipment/facilities are provided to accommodate the needed maintenance activities.

7.9 Emergency action Plan Planning

Pre planning is required to identify condition which could lead to failure. In order to initiate measures to prevent failures is top priority. Measures shall be in place to minimize the effects of such failures. There shall Provision of Emergency management plan of Ash Dyke breach defining the roles & responsibilities of each individual and thereby escalating its effectiveness by Mock Drill practice

The Emergency Preparedness plan is given in *Annexure B*.

7.10 GUIDELINES FOR CONTROL OF FUGITIVE DUST FROM ASH PONDS

Suggested Measures to be adopted for Fugitive Dust Control are as under:

7.11 OPERATIVE LAGOON

Ponding of Water and Maintenance of Freeboard:

In the operative lagoon, ponding of water is essential in the operating lagoon to ensure proper sedimentation of ash particles. The water cover will also help in spreading ash deposition to farther distances from inlet points towards water escape structure. In case of any non-uniform deposition of ash along the periphery of the dyke due to insufficient number of discharge points, flexible pipes of HDPE etc. may be utilized

for uniform ash deposition, in the ash deficient pockets. The discharge points may be shifted /extended before the ash emerges out of the design water surface depending on availability of safe access. The lighter and flexible pipes may also be used for the farther extensions, deep into the lagoon for which floating supports, made of any lighter material may be explored for such pipes, so that the discharge pipe may float just on the ponded water surface. Maintenance of water cover will also eliminate fugitive dust emission from the ash lagoons. Free board is kept from various design considerations and it should meet the IS. Freeboard as mentioned in the design shall be maintained. The operative lagoon is designed in such a way that decant water, before escaping, should cover entire ash surface in the lagoon, by ponding and by maintaining the design freeboard.

By maintaining the freeboard as mentioned above, the ash settles uniformly under water and till the time ash deposition level is below the design level, i.e., below the overflow level of the water escape structure, the dust emission from the operative lagoon will be under control and can be eliminated by ensuring water cover in the entire lagoon area.

7.11.1 Rolling and Compaction:

The construction activities for raising of dykes and borrowing of ash will usually be going on near the periphery. Hence in the central region of the lagoon and some of the peripheral areas with no construction activities, the ash surface may be rolled and compacted which will reasonably stop the ash particles being lifted away by the mild wind flow over the surface. Rolling and compaction of ash surface with occasional wetting as per requirement, is techno-economically a better option for such undisturbed areas. However, during strong summer winds, the dust emission can be controlled, in such areas, through occasional and controlled slurry/water discharge, so that the ash surface is kept just wet. In such areas, covering the ash surface with thin layer of earth is also an alternative solution but it will not be effective without any proper compaction of the overlaying earth.

7.11.2 Slow/Occasional Discharge of Water/slurry to Wet Ash Surface:

Even in the non-operative lagoon, had the ash filling been stopped before the design freeboard is encroached, the dust emission from the ash dyke could be minimized by occasional slurry/water discharge, at a low discharge rate (i.e., by slow filling) into the non-operative lagoon to just wet the ash surface. The non-operative lagoon shall not be kept dry for long time and raising to be effected at the earliest. And since the ash surface will be below the designed level, major area of the ash

surface can easily be made wet. In case, local ponding is required in some areas, small ponds may be created using small height ash bunds confined with empty cement bags filled with ash.

For the borrow area, used for borrowing ash for dyke construction during ash dyke raising, the dust emission, may be controlled locally by sprinklers, etc and these measures in the borrow areas may also be suitably included in the scope of the contractor, for dyke raising.

7.11.3 Sprinkler System

Each station shall prepare scheme for controlling fugitive dust emission. If spray is to be done, technical specifications, pipe line layout shall be prepared by TPP's based upon typical schematic of sprinkler system as given in this document.

The lagoons especially on the perimeter, where the fugitive dust is severe, swivel type sprinklers are to be provided at every 50 metre. The sprinkler size shall be minimum 65mm.

For providing water to the sprinklers, following arrangement is required:

a) A permanent pump house is to be provided near overflow lagoon having adequate pumping capacity and head to meet requirement. The water from overflow lagoon shall be used for sprinkling purpose.

b) Temporary sumps on the ash pond, where the slurry is not being discharged, shall be constructed out of brick masonry of 10 m dia. and 1.5 m depth, in which the water shall be pumped. The size of the sump may vary depending on the site requirement. Near these sumps, pumps of adequate pumping capacity and head may be installed to meet sprinkling requirement. The pipe network shall be made using used ash disposal pipes.

c) Power supply for the pumps, may be taken from the nearby source. Flexible portable Sprinkling system with suitable pumps may also be adopted as a convenient dust suppression technique from embankments under raising, inoperative lagoons & also on localized high deposition of ash in operative lagoons. A typical sketch showing the schematic arrangement for the sprinkling system is shown below Figure 17

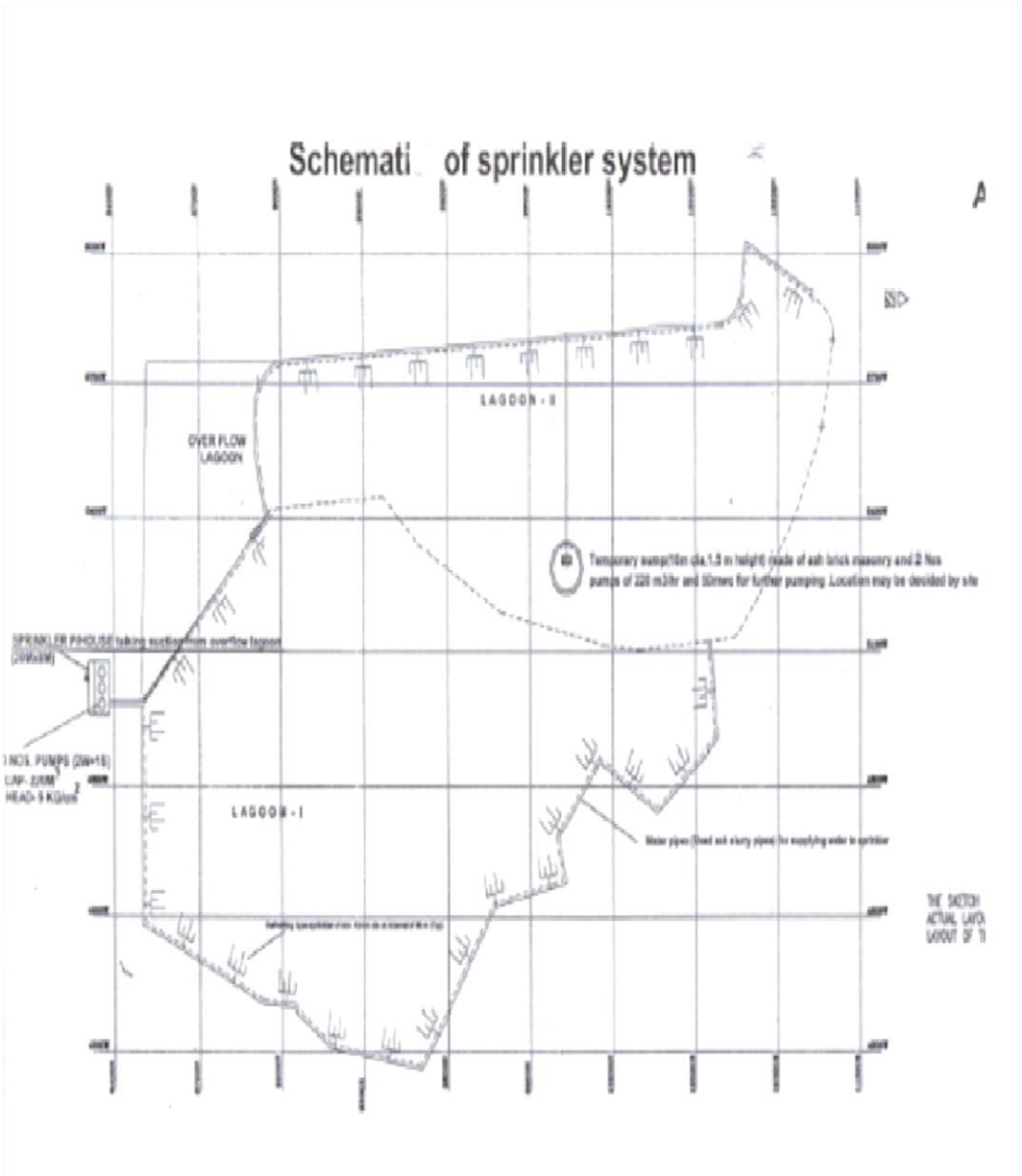


Fig 17: Typical sketch showing the schematic arrangement for the sprinkling system

7.12. Precautions for Overfilling Tendency

It has been observed that to utilize the lagoon storage capacity to the maximum possible extent, some of the project sites tend to overfill the ash ponds upto levels more than the design fill levels.

During intermediate stages for raisings, overfilling does not enhance the overall storage capacity of the ponds, except that it creates problems of ash flying, as the ash emerges out in the freeboard area above the

design water level. These higher spots, where the ash has emerged above the water surface, contribute to the dust emission, even in the operative lagoon and it will be difficult to wet these higher spots subsequently.

In non-operative overfilled pond, there is always a danger of rain water flowing from the higher ash filled area towards the dyke bund during heavy downpours and in the process, may result in the failure of dyke due to overtopping. A freeboard of 1.5 m is normally kept to avoid all such problems and accordingly the invert level of water escape structure is also kept 1.5m below the top of the dyke, called the design ash fill level.

It is therefore, advisable not to overfill the dykes and to take immediate measures for the areas already overfilled (if any), by suitably guiding the water towards the water escape structure (i.e., away from the peripheral dyke) to stop the rain water from over-topping the dyke.

ANNEXURE-A

CHECK LIST OF ASH DYKE INSPECTION

1) Name of the Project:
2) Inspection Date;
3) Name of the Inspection officer:-
4) Season of Inspection Pre-monsoon/Monsoon/Post-Monsoon:-

Sr no	**A) Ash Lagoon Details**	LAG 1	LAG 2	Remarks
1.	Water level in the operation lagoon			
2.	TSS of Water effluent (Going outside/for recirculation)			
3.	Whether any ash surface is exposed above water			
4.	If ash surface is exposed above water level whether ash is flying anywhere			
5.	Whether water flowing through all the opening of the WES			
6.	Approximate head of water flow over the well slabs, 150mm			
7.	Approximate depth of water flow over ash surface around/near the operating water scape structure(WES)			
8.	Whether any inter slab leakage of ash of present in the water escape wells			
9.	Whether water flow is obstructed by floating plants or any other floating bodies near the vents in the WES			
B)	**DYKE**	LAG1	LAG2	
a)	Top level of Dyke			
b)	Whether there is any signs of settlement on the top of dyke			
c)	Whether any sign of sinking/Caving-in/bulging/boiling on i) Upstream slopes ii) Downstream slope iii)On the foundation very near to the downstream toe:			
d)	Whether any seepage is observed on i) Upstream slopes ii) Downstream slope iii)On the foundation very near to the downstream toe:			

e)	Whether any wet spots/areas are present i) Downstream slope ii)On the foundation very near to the downstream toe:			
f)	Whether any longitudinal cracks are observed on: i) On the top of dyke ii) The upstream slope iii) The downstream slope			
g)	Whether any transverse cracks are observed in: i) On the top of dyke ii) The upstream slope iii) The downstream slope			
h)	If any cracks are observed on the tip and the slopes i)Whether the cracks on the top & Slopes are continuous. ii) Whether the cracks are lengthening with time iii) Whether the cracks are widening with time if seepage is observed on the slope or near the d/s toe.			
	DUMPING PATTERN IN ASH POND	Lagoon 1:	Lagoon 2	
	SIGNATURE OF INSPECTION OFFICERS			

ANNEXURE B

EMERGENCY PREPAREDNESS REPSONSE PROCEDURE (EPRP) FOR ASH DYKE BREACH

SOURCE OF HAZARD	Escape of Ash slurry into adjacent land
Area & Location where it is being handled	Below the land of ash dyke
Case of emergency	Breach of ash dyke
Emergency Response	
Procedure to tackle	Inform to the Shift-in-charge, Engineer& Fire Station about the breach as soon as it is observed. - Inform higher authorities about the incident. –Ask for help from Maintenance Staff & O&M-Civil deptt. To stop the flow of: - Ash slurry to outside the dyke - Attend to the failed area
Personal safety	First-Aid Kit available i) Operation Control Room ii) CHP Control Room iii) First aid Centre (Plant); iv) CISF Control Room First Aid centre (Plant-"O" Mtr. Service building Ambulance:-"O" Mtr. Service building Hospital : round the clock medical aid available in township Provision of Display of Emergency Contact Numbers in the ash dyke.
Mitigation	Divert the discharge into other ponds or lower the slurry level. If required lower the invert of water escape structure, spilled ash around Ash Dyke shall be collected and put back into the Ash Dyke. At least 400-500 sand/ash filled bags shall be kept in readiness at site. A truck/tractor shall always be available. At any point of time, availability of local labor of 100 members should be kept in readiness in case of any emergency exists. The annual maintenance contractor/AHP contractors should also be available in case of emergency.
Immediate measure for plugging	Plug the breach section by dumping Sand bags. Once breach is plugged, the section shall be restored to original section of dyke by proper keying the new construction with existing construction.

Testing requirement	Round the clock inspection by Ash Handling Maintenance
Frequency	Yearly by O&M-Civil Ash Handling Maintenance in association with Operation Safety and Fire
RECORDS	a) Mock drill report available with safety, fire b) Actual occurrence report available c) Records as per testing requirement available

SECTION-B

(ENVIRONMENTAL ASPECTS, ANNUAL CERIFICATION, STABLIZATION AND RECLAMATION FOR OPERATIONAL AND NEW ASH PONDS)

CHAPTER 8

ENVIRONMENTAL ASPECTS OF ASH DISPOSAL AND REMEDIAL MEASURES

8. General

Coal used in coal fired power plant in India has low calorific value (3500Kcasl/kg) and resulting high ash content.

This occupies large area of useful land for its storage and followed by polluting the atmospheric environment.

8.1 Disposal of Solid Wastes

As a consequence of combustion of coal, larger particles produced through agglomeration in furnace zone, due to heavy weight, do not escape easily into the atmosphere, rather, they settle down into pipeline because of gravitational pull and are termed bottom ash. Bottom ash contains unburned carbon to the extent of 3 – 12 % and it constitutes less than 20 % of the total ash content of the coal. The remainder which enters the connective zones of the boiler is called Fly ash. Ash severely pollutes the atmosphere. Physical and chemical changes in the mineral matter and the variation between coal, fly ash and chemical distribution occurs in fly ash is based on combustion process. Coalescence of minerals during combustion found most dominant process during the transformation of coal minerals to ash. Activation of coarse fly ash particles showed more adsorption capacity by controlling gasification of the unburned carbon.

8.2 Influence of Fly Ash On Surface Water.

Since fly ash does not contain any unburnt carbon, it should be treated as separate commodity because the presence of carbon in bottom ash affects its pozzolanic activity if mixed with fly ash. Further, the pozzolanity of the freshly formed dry ash particles is seriously affected, once the particles get moistened with water.

Ash disposal in setting pond or land fill may influences the aquatic ecosystem through surface runoff and seepage nearby that area and finally result in contamination of ground water by leaching of heavy metals from the CCRs.

The water discharged from the ash pond is likely to contaminate the quality of river, channel, nallah water nearby that area eventually thus

contaminating the ground water. Some of the heavy metals, released from ash disposal, become detrimental to plant life.

8.3 Environmental Aspect of Fly Ash Disposal:

Following environmental aspects are to be ensured to avoid adverse impact on environment on account of ash disposal in ash dykes.

a) 100% recirculation of ash pond overflow and underflow

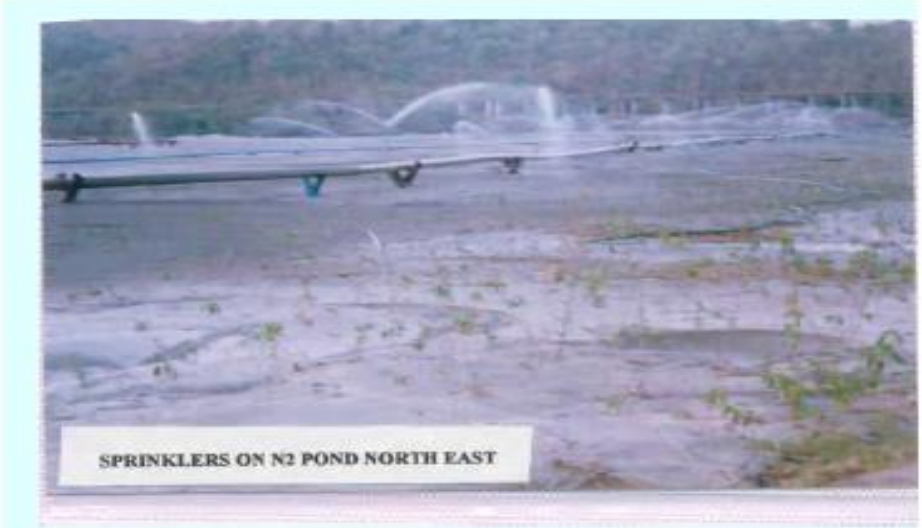
No discharge of liquid effluent from ash dyke into the river or any surface water body to be done. The supernatant from the ash dykes are to be recycled back to the plant to ensure 100% recirculation of ash pond overflow and underflow. Further, the water entrapped in deposited ash is to be collected through dyke embankment by intercepting through chimney/blanket filters, in to a toe-drain all around the dyke and recirculated back to the plant through toe-drain water recirculation system.

b) Fugitive Dust control

Dry fly ash is readily lifted up by wind due to less cohesive force in the fine solid particles. One of the conditions stipulated by MoEF&CC in environmental clearances is to control fugitive dust emission. The fugitive dust emission could be either from ash pond from

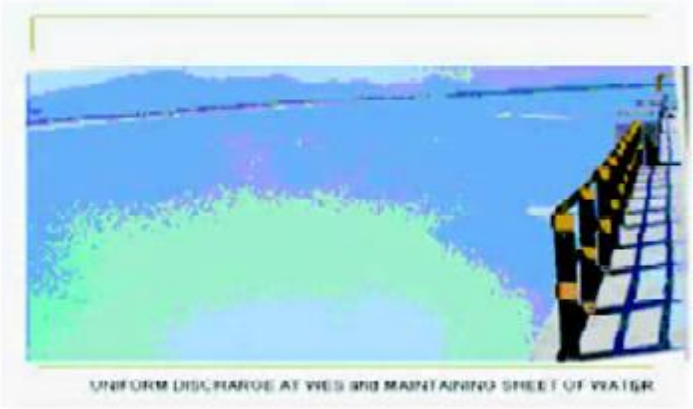
a) operating lagoon,
b) non-operating lagoon
c) abandoned ash pond.

In the operative lagoons, adequate water cover is maintained over the deposited ash to prevent any fugitive dust emission from storage lagoons. However, there may be emission of fugitive dust during evacuation of ash from storage lagoons, which shall be suppressed with proper dust suppression system using water sprinklers/any other method to maintain the wetness of ash in ponds. The water available in the OFL may be used for dust suppression system. A typical dust suppression system adopted during raising of dykes is shown in following Fig 18. for reference.



a) Safe Disposal for Control of Fugitive Dust with Sprinkler

b) Safe Disposal for Control of Fugitive Dust with Uniform Discharge and Free Board



c)Safe Disposal for Control of Fugitive Dust With Sheet of Water

Figures18: Various Dust suppression system

During transportation of ash, the truck mounted water sprinklers may also be used, if fugitive dust emission occurs along in the working areas.

At the time of finally abandoning the ash dyke, to control the dust emission, the final ash surface may be covered with 300 mm thick soil. Apart from controlling the dust emission this would also assist in the growth of vegetation over the abandoned ash dyke area. Depending upon site requirement, the abandoned ash pond area may be used for planting trees or may be put for some other use as per latest fly ash utilisation notification. The final abandoned pond level however should be sufficiently lower than the top level of the peripheral ash dyke. So that the area can be properly drained towards the existing water escape structures.

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19(a) Abandoned Dyke – Reclaimed

19 (b) Abandoned Dyke–Vegetation

c) Prevention of Ground Water contamination

The impervious liner as per actual site requirements is to be provided before discharge of ash in ash pond in order to achieve the required imperviousness of permeability not more than 1 x 10^{-6} cm/sec to prevent ground water contamination. Impervious liner (with bentonite-blended soil) may be adopted for the ash dykes in bottom ash lagoons and overflow lagoon (OFL). Where as in fly ash lagoon, the high concentration slurry (HCS) being highly viscous and self-hardening with pozzolanic properties achieves the required imperviousness of the bed in lagoon and accordingly, no additional lining may be required in fly ash lagoon disposed in HCSD mode. A typical ash dyke section with impervious liner is shown in following Fig 20. for reference.

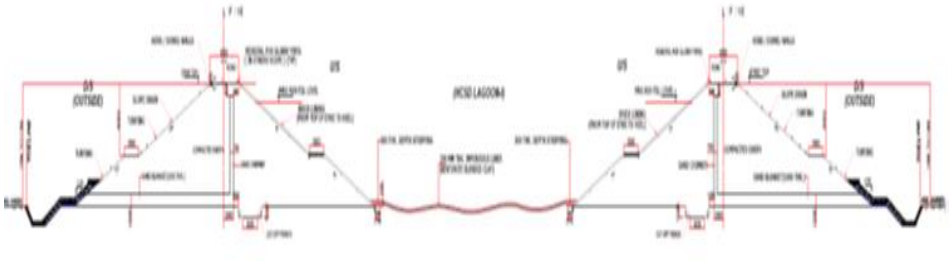

Fig 20: Typical ash dyke section with impervious liner

8.4 Health Hazards of Fly ash disposal

Fly ash disposal poses problems in the form of land use, health hazards, and hazard to entire ecosystems. Toxic trace metals present in the ash may leach out of the ash ponds and contaminate the soil, ground water and surface water, limiting the survival and growth of plants and microbial population. Medical studies have proved adverse effect on human health due to presence of respirable particulate matter <10 µm in size. Finer particles <2.5 µm have much greater impact as they can penetrate deeper into the respiratory system Dispersion of particulate matter to the surrounding environment takes place, especially when ash-handling activities on dumping sites are in progress. The air borne fly ash particles deposit on surfaces of materials and plants.

In order to combat the air pollution due to industries, the Government of India has made it mandatory to have green belt areas around the new as well as existing industries. In this regard comprehensive 'Guidelines for Developing Green Belts' have been compiled by Central Pollution Control Board, Government of India, India.

In the context of environmental pollution abatement, green belt has been defined as “a strip of trees of such species, and such a geometry, that when planted around a source, would significantly attenuate the air pollution by intercepting and assimilating the pollutants in a sustainable manner.” However, green belts also include other vegetation especially shrubs, but still the trees are the mainstays of green belts and often green belt plantation is simply referred as ‘trees’

Plants filter pollutants from the air in three ways, viz. absorption by the leaves, deposition of particulate and aerosols on leaf surface, and fallout of particulate on the leeward (downwind) side of the vegetation because of the slowing of the air movement.

Some plants can be incorporated in the green belts near the thermal power plants so that these serve as filters and remove airborne fly ash particles.

CHAPTER 9

ANNUAL CERTIFICATION OF ASH PONDS AND DYKES AND ANNUAL COMPLIANCE AUDIT OF ASH GENERATION, UTILIZATION & DISPOSAL

9. General

Ash Notification 31.12.2021 (as amended by amendment notification 30.12.2022) mandates power plants to ensure **Annual Certification of the operational as well as stabilized and reclaimed ash pond and dyke** on its safety, environmental pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt etc., according to the specification and procedures laid down by CPCB in consultation with CEA, and submit annual implementation report about the compliance of provisions in the notification by the 30th day of April, every year to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC), Central Electricity Authority (CEA), and concerned Integrated Regional Office of Ministry of Environment, Forest and Climate Change by the coal or lignite based thermal power plants.

Ash Notification 31.12.2021 also mandates that **Annual Compliance Audit of Ash Utilization and Disposal** by power plants as well as user agencies shall be conducted by auditors, authorized by Central Pollution Control Board (CPCB) and audit report shall be submitted to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 30th November every year. Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall initiate action against non-compliant thermal power plants within fifteen days of receipt of audit report.

9.1 Annual Certification of ash pond and dykes

Design and construction specifications and operation and maintenance procedures for ash ponds and dykes have been described in previous chapters. Annual certification of ash ponds and dykes shall be carried out by a qualified professional engineer for structural stability and safety assessment and to ensure that the construction, operation, and maintenance of the ash pond and ash dykes is consistent with recognized and generally accepted good engineering standards.

1. Annual certification shall be carried out once in every year and annual implementation report about the compliance of provisions in the notification shall be submitted by the 30th day of April, every year

2. Annual certification shall be by a qualified professional geotechnical engineer.
3. TPP shall make available any kind of record/Data etc required at the time of certification.

4. Certifying Expert shall examine the Compulsory Periodic Maintenance Inspection Checklist for the Ash Pond provided by TPP

5. Certifying Expert shall submit the report which shall cover the following: -

    a) Structural stability as per IS 7894 construction drawings, quality control documents, monitoring reports etc., to establish that the constructed ash dykes are technically sound and structurally sustainable.
    b) Slope Protection as per relevant IS code
    c) Adequate Spillway Capacity
    d) Dykes compaction
    e) Downstream erosion protection
    f) Environmental pollution,
    g) Available volume
    h) Mode of disposal, water consumption or conservation in disposal, ash water recycling
    i) Green belt
    j) Check list for Annual Safety Audit and Check list for Fly Ash generation and utilization
    k) Interpretations from the compulsory maintenance inspections check lists on the overall safety of the Ash Pond
    l) Details of the actions taken on the deficiencies noted during the maintenance inspections and annual certification inspection

6. Report of the annual certification shall inter alia include observations on points mentioned in Para A(6) of the notification as well as details of the actions taken on the deficiencies noted during the safety audit.

9.2 Annual Compliance Audit of Ash Generation and Utilization & Disposal

Year wise targets for utilization & disposal of ash in the permitted avenues has detailed in the Ash Notification 31.12.2021 separately for current ash generation from implementation date 01.04.2022 onwards and for legacy ash stored as on 31.03.2022 in Para A(4) and A(5) respectively.

Annual Compliance Audit of Ash Generation and Utilization & Disposal by power plants shall be conducted by auditors authorized by Central Pollution Control Board (CPCB) and audit report shall be submitted to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 30th November every year. Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall initiate action against non-compliant thermal power plants within fifteen days of receipt of audit report.

9.3 Check List for Annual Certification of Ash Ponds and Dykes (for the period 1st April-31st March) to be submitted on or before 30th April

Sr No	Component	Observations/Remarks
1.	**Name of Power Plant**	
2.	**Name of the company**	
3.	**District**	
4.	**State**	
5.	**Postal address for communication:**	
6.	**E-mail:**	
7.	**Power Plant installed capacity (MW):**	
8.	**No. of units generated (MWh):**	
9.	**Total area under power plant (ha): (including area under ash ponds)**	
10.	Method of slurry discharge water consumption or conservation in disposal, ash water recycling	.
11.	TSS of decant Water (Going outside/for recirculation)	
12.	Maintenance of Dyke.	

Sr No	Component	Observations/Remarks
	1. Top Width 2. Top level of dyke 3. Adequate Spillway Capacity 4. Free board 5. Available volume 6. Earth covering and turfing 7. U/S slope protection 8. WBM Road 9. Rock Toe, toe drain, berm, rock, pitching 10. Dyke compaction 11. D/S erosion control	
13.	Instrumentation a) Piezometer, b) surface settlement	
14.	Wet Patches/softening on down Slope	.
15.	Gully Formation	
16.	Rat holes/ animal burrows	
17.	Growth of plants	
18.	Toe drain and surface drainage system.	
19.	Facilities for inspection and maintenance of the dyke	
20.	Flooding Lighting.	
21.	Seepage or Leakage	
22.	Monolith Joints –	
23.	Foundation should be examined for damage or possible undermining of the downstream toe	
24.	Slope Stability dyke: 1. Dyke Slope stability, as per IS 7894: Dyke structural stability to be examined as per construction drawings, quality control documents,	

Sr No	Component	Observations/Remarks
	monitoring reports etc 2. Dyke slopes should be examined for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond the toe, and surface cracks which indicate movement.	
25.	Condition of Drainage Systems	
26.	Condition of Slope Protection	
27.	Environmental Pollution	
28.	Green belt	
29.	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to: - moefcccoalash@ gov.in	
30.	Signature of Authorized Signatory	

9.4 Check List for Annual Compliance Audit for Ash generation and utilization & disposal (for the period 1st April-31st March) to be submitted on or before 30th November.

Sr No	Component	Observations/Remarks
1.	**Name of Power Plant**	
2.	**Name of the company**	
3.	**District**	
4.	**State**	
5.	**Postal address for communication:**	
6.	**E-mail:**	
7.	**Power Plant installed capacity (MW):**	
8.	**Plant Load Factor (PLF):**	
9.	**No. of units generated (MWh):**	
10.	**Total area under power plant (ha): (including area under ash ponds)**	
11.	Quantity of coal consumption during reporting period (Metric Tons per Annum):	.
12.	Average ash content in percentage (per cent):	
13.	Quantity of current ash generation during reporting period (Metric Tons per Annum): Fly ash (Metric Tons per Annum): Bottom ash (Metric Tons per Annum):	
14.	Capacity of dry fly ash storage silo(s) (Metric Tons) :	
15.	Details of utilization of current ash generated during reporting period (a) Total quantity of current ash utilized (MTPA) during reporting period:	.

Sr No	Component	Observations/Remarks
	(c) Quantity of fly ash utilized (MTPA): Avenue wise break up (separately for fly ash and bottom ash): (i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels) (ii) Cement manufacturing: (iii) Ready mix concrete: (iv) Ash and Geo-polymer based construction material: (v) Manufacturing of sintered or cold bonded ash aggregate: (vi) Construction of roads, road and fly over embankment: (vii) Construction of dams: (viii) Filling up of low lying area: (ix) Filling of mine voids: (x) Use in overburden dumps: (xi) Agriculture: (xii) Construction of shoreline protection structures in coastal districts; (xiii) Export of ash to other countries: (xiv) Others (please specify): (c) Quantity of bottom ash utilized (MTPA): (i) Fly ash based products (bricks or blocks or tiles or fiber cement sheets or pipes or boards or panels): (ii) Cement manufacturing:	

Sr No	Component	Observations/Remarks
	(iii) Ready mix concrete: (iv) Ash and Geo-polymer based construction material: (v) Manufacturing of sintered or cold bonded ash aggregate: (vi) Construction of roads, road and flyover embankment: (vii) Construction of dams: (viii) Filling up of low lying area: (ix) Filling of mine voids: (x) Use in overburden dumps: (xi) Agriculture: (xii) Construction of shoreline protection structures in coastal districts: (xiii) Export of ash to other countries: (xiv) Others (please specify), if recommended by the Committee and added in notification as per para A (3): Total quantity of current ash unutilized (MTPA) during reporting period: (i) Current unutilized fly ash: (ii) Current unutilized bottom: Total cumulative quantity of current ash unutilized (MT) after 31.03.2022 as on 31 March:	

Sr No	Component	Observations/Remarks
16.	Percentage utilization of current ash generated during reporting period (per cent):	
17.	Details of disposal of ash in ash ponds (a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March (excluding reporting period): (b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons): (c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m3): (d) Total number of ash ponds: (i) Active: (ii) Exhausted (yet to be reclaimed): (iii) Reclaimed: (e) total area under ash ponds (ha):	
18.	Individual ash pond details Ash pond-1,2, etc. (please provide below mentioned details separately, if number of ash ponds is more than one) (a) Status: Under construction or Active or Exhausted or Reclaimed (b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MMYYYY): (c) Date of stoppage of ash disposal in ash pond after	

Sr No	Component	Observations/Remarks
	completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds) (d) area (hectares): (e) dyke height (m): (f) volume (m3): (g) quantity of ash disposed as on 31st March (Metric Tons): (h) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons): (i) expected life of ash pond (number of years and months): (j) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates) (k) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining l) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD) (m) Ratio of ash: water in slurry mix (1:_____): (n) Ash water recycling system (AWRS) installed and functioning: Yes or No (o) Quantity of wastewater from ash pond discharged into land or water body (m3): (p) Last date when the dyke stability study was conducted and	

Sr No	Component	Observations/Remarks
	name of the organization who conducted the study: (q) Last date when the audit was conducted and name of the organization who conducted the audit:	
19.	Quantity of legacy ash utilized (MTPA): Avenue wise break up (separately for fly ash and bottom ash: i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels): ii. Cement manufacturing: iii. Ready mix concrete: iv. Ash and Geo-polymer based construction material: v. Manufacturing of sintered or cold bonded ash aggregate: vi. Construction of roads, road and flyover embankment: vii. Construction of dams: viii. Filling up of low lying area: ix. Filling of mine voids: x. Use in overburden dumps: xi. Agriculture: xii. Construction of shoreline protection structures in coastal districts; xiii. Export of ash to other countries: xiv. Others (please specify) if recommended by the Committee and	

Sr No	Component	Observations/Remarks		
	added in notification as per para A(3): Total cumulative quantity of legacy ash utilized (MT) after 31.03.2022 as on 31 March : Total (depleted) quantity of legacy ash stored (MT) as on 31 March :			
20.	Summary:			
	Details	Quantity generated (MTPA)	Quantity utilized (MTPA) and (per cent)	Balance quantity (MTPA)
	Current ash during reporting period			Current year balance and Cumulative balance after 31.03.2022 as on 31 March both
	Legacy ash	The ash stored in all the ash ponds or dykes other than operational ash pond or dyke designated for temporary storage of ash.		Total (depleted) quantity of legacy ash stored (MT) as on 31 March:
	Total			
21.	Any other information: Soft copy of the annual			

Sr No	Component	Observations/Remarks		
	compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcccoalash@ gov.in			
22.	Signature of Authorized Signatory			

CHAPTER 10

STABILIZATION AND RECLAMATION OF ASH PONDS

10. INTRODUCTION

Despite best efforts during the last few decades' huge quantity of fly ash is disposed of in ash ponds which is posing a serious problems of land utilization.

An ash pond of 10 KM^2 size for a 500 MW power plant gets filled up with Ash up to 10m height within a period of 5 years. In many ash ponds the total depth of ash has crossed over 30 metres. These ash ponds are subsequently abandoned. It is estimated that about more 40,0000 hectares of land is under the cover of abandoned fly ash ponds in the country. These abandoned ash fly ashes are generally left as such with suitable soil cover. There is a strong need to develop reclamation for such abandoned fly ash ponds.

MOEF& CC latest Ash utilization notifications dated 31.12.21 read in conjunction with amendment to the notification dated 30.12.22 says that ash pond or dyke which has been stabilized and, the reclamation has been done with **greenbelt** ***or plantation*** *or* ***solar power plant or wind power plant***

Green vegetation cover is beneficial in many ways leading to conservation of biodiversity, and maintaining pleasant climate of the area, providing possible habitats for birds and animals. Green belt minimizes the build-up of pollution levels in urban / industrial areas by acting as pollution sinks. The main advantages of green belt in and around the industry are to control air and noise pollution. Trees help in trapping particulate matter, removing carbon dioxide and other pollutants from air and by release of oxygen into the air thereby improving the air quality. Green belt reduces the intensity of sound by deflect, refract or by absorb sound, it will function as barrier between industry and neighbour-hood. The intensity reduction depends upon the distance sound has to travel from source and width of the greenbelt. Green belt also helps in soil erosion control through improvement of soil quality and binding soil.

10.1. Preconditions for abandoning:

1) Permission from Regulatory authority: Power plant/ land owner/ agency shall obtain statutory permission from regulatory authorities such as SPCB as per the requirement.
2) Prevention of pollution: Suitable methods should be adopted and necessary arrangement should be made to prevent pollution during the complete exercise.
3) Soil Cover on the top of ash fill: The soil required for soil cover shall be excavated from nearby location. Only the minimum quantity of soil required for the purpose of cover shall be excavated from the soil borrow area. The voids so created due to removal of soil shall be filled up with ash with proper compaction and covered at top with soil cover. A 300 mm thick soil layer shall be placed over the ash fill area. This should be done as an integral part of RECLAMATION development work.
4) The final abandoned pond level however be lower than the top level of the peripheral ash dyke. So that the area can be properly drained towards the existing water escape structures.

10.2 Reclamation of Ash Disposal Facility

Following steps are required for reclamation of a site.

1. Complete dewatering

It is necessary to determine whether dewatering of the abandoned disposal is complete or has receded to required levels. As water table falls, stresses are increased on lower layers of the deposit which has detrimental effect on ash strength. As an initial planning, the design of the hydraulic fill may include provisions to accelerate dewatering once filling is complete. The degree of effectiveness of dewatering can be accessed using piezometers over a period of time.

2. Surface regrading and Site preparation

Generally, deposition of the material in a hydraulic fill is not level, but will be sloping from the discharge inlet to the point where water escapes from the pond. All existing undulations, holes,

cavities and excavations made for plate load rests and other soil investigations, etc. shall be filled with pond ash having requisite moisture content. The ash thus filled shall be compacted with the help of vibratory rollers so as to achieve dry density of not less 95% as per I.S–2720 (Part-VII). This would result in a levelled surface upon which soil cover can be done.

3. Placement of earth cover

Once the abandoned pond has been graded to approximate final configuration, it is necessary that the area to be covered with native soil and vegetated to prevent future erosion. The ash surface shall be covered with a minimum of compacted layer of 300 mm thickness of suitable earth. The thickness shall be as per design recommendations in rain prone area. Earth cover shall be laid simultaneously with the laying of compacted ash layers on side slopes. As in the case of ash layers, compacted thickness of earth layers shall not be exceeding 300 mm. The soil material used for plant cover shall be non-erodible and capable of supporting vegetation and plantation. No stones, cobbles or rock fragments, having maximum dimensions more than 25 mm shall be placed in the earth cover. Such stones or cobbles shall be removed either at the borrow pit or before it is used as Soil Cover.

10.3 Ash Pond reclamation with soil cover and green belt/plantation

Green capping is one of the popular methods to re-vegetate abandoned ash ponds of coal based thermal power plants thereby lowering the risk of contamination to the surrounding environment. It has innumerable advantages such as prevention of dust emission, checking soil erosion, stabilizing the surface areas of ash, preventing potential ground water contamination, and finally, adding native vegetation cover, which is very vital in the long term. The following measures are to be undertaken while reclamation of ash pond with green belt**.**

i. Storm water drains shall be constructed for channelizing the run-off water away from the disposal site.

ii. A 300 mm thick soil cover shall be provided to promote vegetation growth.

iii. For plantation purpose, preference shall be given to both native species and mixed culture. The species will be

selected carefully from the following groups for quick reclamation under the guidance of a taxonomist:

- Tree species for fuel wood and timber
- Forestry type tree species.
- Tree species with dense foliage for shade.
- Native species.

iv. However, fruit bearing species shall be avoided.

10.3.1 Plantation for green belt

A three tier plantation approach (consisting of large trees, smaller trees and shrubs) will be followed for overall eco-restoration of the area. This will also help in checking the surface run-off, preventing the water from percolation and maintaining the aesthetics beauty of the surrounding in general a conceptual diagram of the reclaimed ash pond is presented below in figure 21

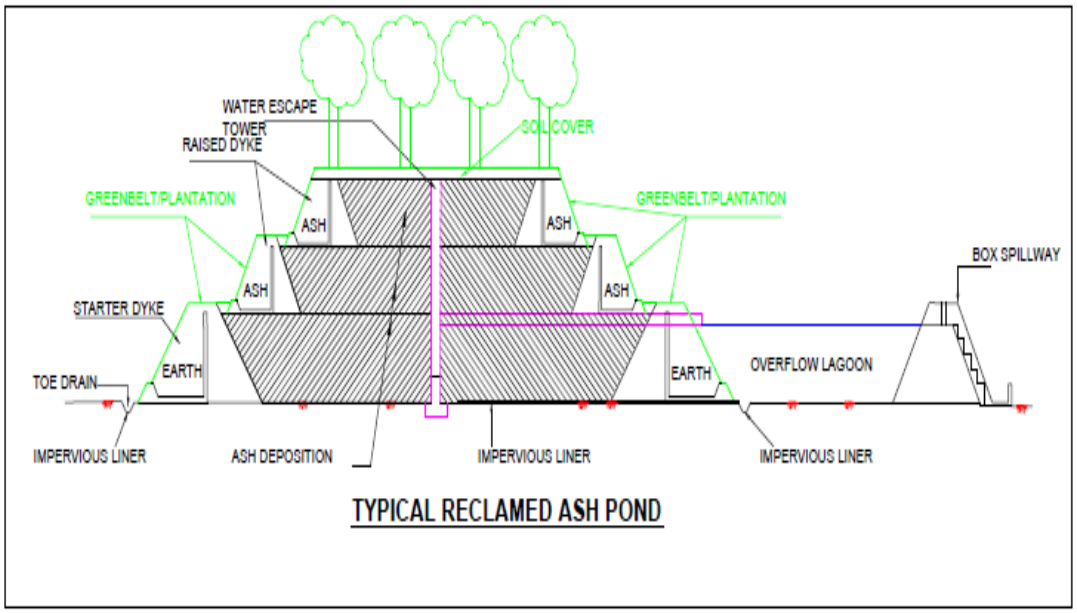

Figure 21 Typical reclaimed Ash pond

10.4 Reclamation of Abandoned Ash Pond with solar power plant or wind power plant.

Now a day there is a substantial socio economic pressure to become more environmentally aware of how we receive our power. Solar and wind power is becoming prevalent as a clean source of power. An ash pond which has been closed if can be used to generate energy in a clean way plus having financial impacts also is a need of the hour. Amendment to Fly ash utilization notification was issued vide Notification No. S.O. 6169 (E) dated

30th December, 2022 which allows reclamation of ash pons by green belts / plantations or solar power plant or wind power plant.

The power plant shall be required to undertake detailed feasibility study for provision of solar or wind power plant on the abandoned ash dyke. The design, construction and operations of the same shall be done in accordance with the recommendations of the same. Necessary statuary clearances shall be obtained by the TPP.

Proper measures shall be taken to prevent surface erosion and air and water pollution. To facilitate drainage, surface slope and surface water drains shall be provided to carry the surface run off away from the ash pond / dykes.

10.5 Precautions during reclamation activity

The following precautionary measures are required for safe working during the reclamation activity:

(i) Appropriate measures should be taken to prevent entry of cattle/livestock inside the pond area during execution period.

(ii) Water sprinkling for dust suppression during handling of Ash shall be ensured from being air borne.

(iii) After complete reclamation of the site, sign board shall be kept indicating abandoned ash pond has been reclaimed. This will help to propagate the message of provision of green belts on ash ponds and other uses such as solar power and wind power.

10.6 Annual certification of reclaimed ash ponds and dykes

Power plants shall ensure annual certification of reclaimed ash pond and dykes also in respect of safety, storm water collection and disposal, and environmental pollution and green belt etc. and shall submit report along with the certification report of operational ash ponds and dykes.

ANNEXURES

LIST OF ANNEXURES

I. Fly Ash Notification dated 31.12.2021

Fly ash notification dtd 31st Dec, 2021.pdf

II. Fly Ash Amendment Notification dated 30.12.2022

Flyash amendment Notification dated 30th December, 2022-1.pdf

III. IS Codes and References

रजिस्ट्री सं. डी.एल.- 33004/99 REGD. No. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

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CG-DL-E-01012022-232336

असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)

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पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 31 दिसम्बर, 2021

का.आ. 5481(अ).—केन्द्रीय सरकार ने भारत सरकार के तत्कालीन पर्यावरण और वन मंत्रालय की अधिसूचना सं. का.आ. 763 (अ) तारीख 14 सितम्बर, 1999 द्वारा कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्रों से तीन सौ किलोमीटर के विनिर्दिष्ट व्यास के भीतर ईंटों के विनिर्माण के लिए उपजाऊ मिट्टी के उत्खनन को प्रतिबंधित करने के लिए और भवन निर्माण सामग्री के विनिर्माण में और संनिर्माण क्रियाकलाप में फ्लाई-राख के उपयोग को बढ़ावा देने के लिए निदेश जारी किए हैं;

और, प्रदूषणकर्ता भुगतान सिद्धांत (पीपीपी) के आधार पर, ऐसा करके कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्रों द्वारा फ्लाई-राख का 100 प्रतिशत उपयोग सुनिश्चित करते हुए और फ्लाई-राख प्रबंधन प्रणाली की संधारणीयता के लिए पूर्वोक्त अधिसूचना को और अधिक प्रभावकारी ढंग से कार्यान्वित करने हेतु, केंद्रीय सरकार ने मौजूदा अधिसूचना की समीक्षा की;

और प्रदूषणकर्ता भुगतान सिद्धांत के आधार पर पर्यावरणीय प्रतिकर निर्धारित किए जाने की आवश्यकता है;

और, विनिर्माण को बढ़ावा देकर तथा निर्माण कार्य के क्षेत्र में राख आधारित उत्पादों तथा भवन निर्माण सामग्रियों के प्रयोग को अनिवार्य करके उपजाऊ मिट्टी को संरक्षित करने की आवश्यकता है;

और, सड़क बनाने, सड़क एवं फ्लाई ओवर के रेलिंग बनाने, तटरेखा की सुरक्षा का उपाय करने, अनुमोदित परियोजनाओं के निचले क्षेत्रों को भरने, खनित स्थलों को फिर से भरने में मिट्टी की सामग्रियों से भरने के विकल्प के रूप में राख उपयोग को बढ़ावा देकर उपजाऊ मिट्टी और प्राकृतिक संसाधनों को संरक्षित करने की आवश्यकता है;

और, पर्यावरण को सुरक्षित करना तथा कोयला अथवा लिग्नाइट आधारित ताप विद्युत संयंत्रों से सृजित फ्लाई राख के निक्षेपण तथा निपटान की रोकथाम करना आवश्यक है;

और, उक्त अधिसूचना में जो 'राख' शब्द का प्रयोग किया गया है उसमें कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्रों से सृजित फ्लाई-राख और बॉटम-राख दोनों शामिल हैं;

और, केंद्रीय सरकार प्रदूषणकर्ता भुगतान सिद्धांत के आधार पर, पर्यावरणीय प्रतिकर की प्रणाली सहित राख के उपयोग के लिए एक व्यापक ढांचा लाना चाहती है;

अत: पर्यावरण (संरक्षण) नियम, 1986 के नियम (5) के उप-नियम (3) के खंड (घ) के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) और उप-धारा (2) के खंड (v) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, भारत सरकार के पर्यावरण एवं वन मंत्रालय की अधिसूचना जो का.आ. 763 (अ) तारीख 14 सितम्बर, 1999 द्वारा भारत के राजपत्र, असाधारण भाग ।।, खंड 3, उप खंड (i) में प्रकाशित का अधिक्रमण करते हुए, कोयला या लिग्नाईट आधारित ताप विद्युत संयंत्रों द्वारा राख के उपयोग के संबंध में प्रारूप अधिसूचना जो सा.का.नि. 285 (अ) तारीख 22 अप्रैल, 2021 द्वारा भारत के राजपत्र, असाधारण, भाग-2, धारा 3, उप धारा (i) में प्रकाशित की गई थी जिसमें उन सभी व्यक्तियों से जिनका इससे प्रभावित होना सामान्य है उस तारीख से, जिसको उक्त प्रारूप उपबंधों की शासकीय राजपत्र में अंतर्विष्ट प्रतियां जनता को उपलब्ध करा दी गई थी, साठ दिनों के अवसान से पूर्व आक्षेप और सुझाव आमंत्रित किए गए थे।

और उक्त प्रारूप अधिसूचना के संबंध में उससे संभावित तौर पर प्रभावित होने वाले सभी व्यक्तियों से प्राप्त आक्षेपों और सुझावों पर केंद्रीय सरकार द्वारा सम्यक रूप से विचार कर लिया गया है;

अत: पर्यावरण (संरक्षण) नियम, 1986 के नियम (5) के उप-नियम (3) के खंड (घ) के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) और उप-धारा (2) के खंड (v) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए और अधिसूचना का.आ. 763 (अ) तारीख 14 सितम्बर, 1999 का उन बातों के सिवाय अधिकांत करते हुए जिन्हें ऐसे अधिक्रमण से पूर्व किया गया है या करने का लोप किया गया है, केन्द्रीय सरकार कोयलों या लिग्नाईट आधारित ताप विद्युत संयंत्रों से राख के उपयोग के संबंध में निम्नलिखित अधिसूचना जारी करती है, जो इस अधिसूचना के प्रकाशन की तिथि से प्रवृत्त होगी, अर्थात्

क. फ्लाई-राख और बॉटम-राख का निपटान करने हेतु ताप विद्युत संयंत्रों (टीपीपी) के उत्तरदायित्व.-

(1) प्रत्येक कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्र (जिनमें कैप्टिव और/या सह-उत्पादन केंद्र शामिल हैं या दोनों) की यह प्राथमिक जिम्मेदारी होगी कि वह अपने द्वारा सृजित राख (फ्लाई-राख और बॉटम-राख) का उप पैरा (2) में दिए गए पारि-अनुकूल तरीके से 100 प्रतिशत उपयोग सुनिश्चित करे;

(2) कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्रों से सृजित राख का उपयोग केवल निम्नलिखित पारि-अनुकूल प्रयोजनों के लिए किया जाएगा, अर्थात्:-

(i) फ्लाई राख पर आधारित उत्पाद अर्थात्: ईंट ब्लॉक टाइल, फाइबर सीमेंट शीट, पाइप, बोर्ड, पैनल का विनिर्माण;

(ii) सीमेंट विनिर्माण, रेडी-मिक्स कंक्रीट;

(iii) सड़क निर्माण और फ्लाई-ओवर के रेलिंग का निर्माण, राख और जिओ-पॉलीमर आधारित निर्माण सामग्री;

(iv) बांध का निर्माण;

(v) निचले क्षेत्र को भरना;

(vi) खनन कार्य से रिक्त हुए स्थान को भरना;

(vii) सिंटर्ड या शीत–बद्ध राख संचय का विनिर्माण;

(viii) मृदा परीक्षण के आधार पर नियंत्रित तरीके से कृषि;

(ix) तटीय जिलों में तटरेखा संरक्षण संरचनाओं का निर्माण;

(x) अन्य देशों को राख का निर्यात;

(xi) समय-समय पर यथाधिसूचित किसी अन्य पारि-अनुकूल प्रयोजन के लिए।

(3) अध्यक्ष, केंद्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) की अध्यक्षता में एक समिति गठित की जाएगी जिसमें पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय (एमओईएफसीसी), विद्युत मंत्रालय, खान मंत्रालय, कोयला मंत्रालय, सड़क परिवहन और राजमार्ग मंत्रालय, कृषि अनुसंधान एवं शिक्षा विभाग, सड़क कांग्रेस संस्थान तथा राष्ट्रीय सीमेंट एवं भवन सामग्री परिषद के प्रतिनिधियों को सदस्यों के रूप में शामिल किया जाएगा, जिसका प्रयोजन राख के उपयोग के पारि-अनुकूल तौर-तरीकों की जांच करना, उनकी समीक्षा एवं अनुशंसा करना तथा प्रौद्योगिकीय विकासों तथा पणधारी से प्राप्त अनुरोधों के आधार पर उप-पैरा (2) में यथोल्लिखित ऐसे तौर-तरीकों की सूची में समिति द्वारा सुझाए गए तौर-तरीकों को शामिल करना या किसी तौर-तरीके को सूची से हटाना या उसमें संशोधन करना है। जब भी इस प्रयोजन के लिए अपेक्षित हो, यह समिति राज्य प्रदूषण नियंत्रण बोर्ड या प्रदूषण नियंत्रण समिति, ताप विद्युत संयंत्र और खानों के प्रचालकों को आमंत्रित कर सकती है। इस समिति सिफारिश के आधार पर, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय ऐसे पारि-अनुकूल प्रयोजन प्रकाशित करेगा।

(4) प्रत्येक कोयला या लिग्नाइट आधारित ताप विद्युत संयंत्र उस वर्ष के दौरान सृजित राख (फ्लाई-राख और बॉटम-राख) का 100 प्रतिशत उपयोग करने हेतु उत्तरदायी होगा; तथापि, किसी भी स्थिति में, किसी वर्ष में राख का उपयोग 80 प्रतिशत से नीचे नहीं होगा और साथ ही, उस ताप विद्युत संयंत्र को तीन वर्ष की अवधि में 100 प्रतिशत औसत राख के उपयोग का लक्ष्य प्राप्त करना होगा :

परंतु, यह और कि पहली बार के लिए लागू तीन वर्ष के चक्र को ऐसे ताप विद्युत संयंत्रों, जहां राख का उपयोग 60-80 प्रतिशत के बीच होता है, एक वर्ष के लिए और ऐसे संयंत्रों, जहां राख का उपयोग 60 प्रतिशत से कम है, दो वर्ष के लिए बढ़ाया जा सकता है, और राख के उपयोग की प्रतिशतता की गणना के प्रयोजन के लिए वर्ष 2021-2022 में उपयोग की प्रतिशत प्रमात्रा को नीचे दी गई तालिका के अनुसार ध्यान में रखा जाएगा:

तापीय विद्युत संयंत्रों के उपयोग की प्रतिशतता	100 प्रतिशत उपयोगिता प्राप्त करने के लिए प्रथम अनुपालन चक्र	100 प्रतिशत उपयोगिता प्राप्त करने के लिए द्वितीय अनुपालन चक्र
>80 प्रतिशत	3 वर्ष	3 वर्ष
60-80 प्रतिशत	4 वर्ष	3 वर्ष
<60 प्रतिशत	5 वर्ष	3 वर्ष

परन्तु, ताप विद्युत संयंत्रों के लिए 80 प्रतिशत न्यूनतम उपयोग प्रतिशतता, क्रमश: 60-80 प्रतिशत और <60 प्रतिशत की उपयोगिता की श्रेणी के तहत आने वाले ताप विद्युत संयंत्रों के लिए प्रथम अनुपालन चक्र के पहले वर्ष और पहले दो वर्षों पर लागू नहीं होगी।

परन्तु, अनुपालन चक्र के अंतिम वर्ष में सृजित 20 प्रतिशत राख को अगले चक्र में भी ले जाया जाएगा जिसका उपयोग उस अनुपालन चक्र के दौरान सृजित राख के साथ अगले तीन वर्षों में किया जाएगा।

(5) अप्रयुक्त संचित राख अर्थात् लीगेसी राख, जिसका इस अधिसूचना के प्रकाशन से पहले भंडारण किया गया है, को ताप विद्युत संयंत्र (टीपीपी) द्वारा इस रीति से क्रमिक रूप से उपयोग में लाया जाएगा, कि लीगेसी राख को इस अधिसूचना के प्रकाशन की तिथि से दस वर्षों के भीतर पूरी तरह उपयोग कर लिया जाएगा और यह उस विशिष्ट वर्ष के चालू संचालनों के माध्यम से राख उत्सर्जन के लिए निर्धारित उपयोग लक्ष्यों से अतिरिक्त होगा।

परन्तु, निम्नलिखित प्रतिशतताओं में यथा उल्लिखित लीगेसी राख की न्यूनतम मात्रा का उपयोग तास्थानी वर्ष के दौरान कर लिया जाएगा और लीगेसी राख की न्यूनतम मात्रा की ताप विद्युत संयंत्र की संस्थापित क्षमता के अनुसार वार्षिक राख उत्सर्जन के आधार पर की जानी है।

प्रकाशन की तिथि से वर्ष	पहला	दूसरा	तीसरा-दसवां
लीगेसी राख का उपयोग (वार्षिक राख की प्रतिशतता)	कम से कम 20 प्रतिशत	कम से कम 35 प्रतिशत	कम से कम 50 प्रतिशत

परन्तु, यह और कि लीगेसी राख का उपयोग वहां अपेक्षित नहीं है, जहां राख के तालाब या डाइक स्थिर हो गए हैं और हरित पट्टी के निर्माण या पौध रोपण से पुनरूद्धार किया गया है और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड इस संबंध में प्रमाणित करेगा। किसी राख तालाब या डाइक के स्थिरीकरण और भूमि-उद्धार का कार्य, जिसमें केन्द्रीय प्रदूषण नियंत्रण बोर्ड या राज्य प्रदूषण नियंत्रण बोर्ड द्वारा प्रमाणन शामिल है, इस अधिसूचना के प्रकाशन की तारीख से एक वर्ष के भीतर किया जाएगा। अन्य सभी राख के कुंड या डाइक में शेष बचे राख का उपयोग ऊपर उल्लिखित समय-सीमाओं के अनुसार क्रमिक रूप से किया जाएगा।

टिप्पण: राख के उपयोग के लक्ष्यों को हासिल करने के लिए उप पैरा (4) और (5) के अधीन दायित्व 01 अप्रैल, 2022 की तारीख से लागू होंगे।

(6) किसी भी नए तापीय विद्युत संयंत्र (टीपीपी) में 0.1 हेक्टेयर प्रति मेगावाट (एमडब्ल्यू) क्षेत्रफल के साथ आपातकालीन या अस्थायी राख कुंड की अनुमति दी जा सकती है। राख के तालाब या डाइकों का तकनीकी विर्निदेश, केन्द्रीय विद्युत प्राधिकरण (सीईए) के परामर्श से केन्द्रीय प्रदूषण नियंत्रण बोर्ड द्वारा बनाए गए दिशानिर्देशों के अनुसार होगा और ये दिशानिर्देश राख के कुंड या डाइक के संबंध में इसकी सुरक्षा, पर्यावरणीय प्रदूषण, उपलब्ध प्रमात्रा, निपटान का तरीका, निपटान में जल की खपत या संरक्षण, राख जल पुनर्चक्रण और ग्रीन बेल्ट आदि के वार्षिक प्रमाणन के लिए कार्यविधि भी निर्धारित करेंगे और इस अधिसूचना के प्रकाशन की तारीख से तीन महीनों के भीतर प्रस्तुत किए जाएंगे।

(7) प्रत्येक कोयला या लिग्नाईट आधारित ताप विद्युत संयंत्र यह सुनिश्चित करेगा कि राख की लदाई, उतराई, ढुलाई, भंडारण और निपटान पर्यावरणीय दृष्टि से अनुकूल रीति से किया गया है और वायु और जल प्रदूषण की रोकथाम के लिए सभी ऐहितयात किए गए हैं और इस संबंध में स्थिति की सूचना इस अधिसूचना में संलग्न अनुबंध में संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) को दी जाएगी।

(8) प्रत्येक कोयला या लिग्नाइट आधारित तापीय विद्युत संयंत्र, संस्थापित क्षमता पर आधारित राख के कम से कम 16 घंटों के भंडारण के लिए समर्पित शुष्क फ्लाई राख साइलोस प्रतिष्ठापित करेगा, जिनके पास पृथक पहुंच मार्ग होंगे, जिससे कि राख पहुंचाने के कार्य को सुगम बनाया जा सके। इसकी सूचना संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) को उपाबंध में दी जाएगी और केन्द्रीय प्रदूषण नियंत्रण

बोर्ड (सीपीसीबी) या राज्य केन्द्रीय प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति द्वारा समय-समय पर निरीक्षण किया जाएगा।

(9) प्रत्येक कोयला या लिग्नाईट आधारित तापीय विद्युत संयंत्र (जिसके अंतर्गत कैप्टिव या सह उत्पादन केन्द्र भी है या दोनों), वास्तविक उपयोगकर्ता (उपयोगकर्ताओं) के हित के लिए केन्द्रीय प्रदूषण नियंत्रण बोर्ड के वेब पोर्टल या मोबाईल फोन एप्प का लिंक उपलब्ध कराकर ताप विद्युत संयंत्र के पास राख की उपलब्धता के वास्तविक आंकड़े प्रदान करेगा।

(10) राख के 100 प्रतिशत उपयोग का वैधानिक दायित्व, जहां भी लागू हो, विधि में बदलाव के रूप में माना जाएगा।

ख. राख के उपयोग के प्रयोजनार्थ, उत्तरवर्ती उप पैराग्राफ लागू होंगे .-

(1) ऐसे सभी अभिकरण (सरकारी, अर्द्धसरकारी और निजी), जो सड़क बिछाने, सड़क और फ्लाई ओवर के किनारों, तटीय जिलों में तटरेखा की सुरक्षा संरचनाओं और लिग्नाईट या कोयला आधारित ताप विद्युत संयंत्र से 300 किमी के भीतर बांधों जैसे निर्माण संबंधी कार्यकलापों में लगे हुए हैं, इन कार्यकलापों में अनिवार्य रूप से राख का उपयोग करेंगे :

परंतु इसको परियोजना स्थल पर निशुल्क पहुंचाया जाए और परिवहन लागत, ऐसे कोयला या लिग्नाईट आधारित ताप विद्युत संयंत्रों द्वारा वहन की जाए।

परंतु यह और कि ताप विद्युत संयंत्र पारस्परिक सहमत हुई शर्तों के अनुसार राख की लागत और परिवहन के लिए शुल्क ले सकता है उस मामले में जहां ताप विद्युत संयंत्र अन्य माध्यम से राख का निपटान करने में समर्थ है और ये अभिकरण इसके लिए प्रर्थाना कर सकते हैं और बिना लागत और बिना परिवहन शुल्क के राख उपलब्ध कराने के प्रावधान तभी लागू होंगे यदि उसके लिए ताप विद्युत संयंत्र उस निर्माण अभिकरण को नोटिस जारी करता है।

(2) उक्त कार्यकलापों में राख का उपयोग भारतीय मानक ब्यूरो, भारतीय रोड कांग्रेस, केन्द्रीय भवन अनुसंधान संस्थान, रूड़की, केन्द्रीय सड़क अनुसंधान संस्थान, दिल्ली, केन्द्रीय लोक निर्माण विभाग, राज्य लोक निर्माण विभागों और अन्य केन्द्रीय और राज्य सरकार के अभिकरणों द्वारा निर्धारित किए गए विनिर्देशों और दिशानिर्देशों के अनुसार किया जाएगा।

(3) तापीय विद्युत संयंत्र की 300 किलोमीटर की परिधि के भीतर अवस्थित सभी खानों के लिए विस्तारित उत्पादक उत्तरदायित्व (ईपीआर) के तहत खुली आवर्त खानों में राख का पृष्ठ भंडारण करना या अधिक भार के ढेरों के साथ राख का मिश्रण करना बाध्यकारी होगा। सभी खान के स्वामी या प्रचालक (चाहे सरकारी, सार्वजनिक और निजी क्षेत्र के हो) कोयला या लिग्नाईट आधारित तापीय विद्युत संयंत्रों से तीन सौ किलोमीटर (सड़क द्वारा) के भीतर, महानिदेशक, खान सुरक्षा (डीजीएमएस) के दिशानिर्देशों के अनुसार ओवर बर्डन के बाह्य निक्षेप खान की बैकफिलिंग अथवा स्टोविंग (प्रचालित या छोड़ी गई खानों, जैसा भी मामला हो) के लिए उपयोग की गई सामग्रियों के भार-दर-भार के आधार पर कम से कम 25 प्रतिशत राख को मिश्रित करने के लिए उपाय करेंगे :

परंतु ऐसे तापीय विद्युत केन्द्र नि:शुल्क राख प्रदान करके और परिवहन की लागत को वहन करके या पारस्परिक सहमत हुई शर्तों पर लिए गए निर्णय के अनुसार लागत या परिवहन व्यवस्था करके राख की अपेक्षित मात्रा की उपलब्धता को सुकर बनायेंगे और खानों के खाली स्थानों और ढेरो में अधिकभार के साथ राख को मिश्रित करना, सृजित अधिभार के लिए इस अधिसूचना के प्रकाशन की तिथि से लागू होगा और उक्त कार्यकलापों में राख का उपयोग, केंद्रीय प्रदूषण नियंत्रण बोर्ड, महानिदेशक खान सुरक्षा और भारतीय खदान ब्यूरो द्वारा निर्धारित दिशा-निर्देशों के अनुसार किया जाएगा।

स्पष्टीकरण .- इस उप-पैरा के प्रयोजन के लिए यह भी स्पष्ट किया जाता है कि लागत मुक्त राख और नि:शुल्क परिवहन के उपबंध केवल तभी लागू होंगे यदि ताप विद्युत संयंत्र इसके लिए खान मालिक को नोटिस देते हैं और अधिभार वाले ढेर के साथ मिश्रित करने और खान में खाली स्थान को भरने के लिए राख के 25 प्रतिशत हिस्से के उपयोग का अधिदेश तब तक लागू नहीं होगा जब तक कि ताप विद्युत संयंत्र द्वारा खान मालिक को नोटिस न दिया गया हो।

(5) (i) सभी खान मालिकों को खान में खाली स्थानों में राख को समायोजित करने के लिए खान बंद योजना (प्रगामी और अंतिम) तैयार करनी होगी और खान में खाली स्थान में राख के निपटान और अधिभार वाले ढेर के साथ राख को मिश्रित करने के लिए खान योजनाओं को संबंधित प्राधिकारी अनुमोदित करेगा। पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय द्वारा ताप विद्युत संयंत्रों और कोयला खदानों की पर्यावरणीय मंजूरी की अपेक्षा से छूट देने के साथ-साथ ऐसे निपटान के लिए अपनाए जाने वाले दिशानिर्देशों के संबंध में तारीख 28 अगस्त, 2019 को दिशानिर्देश जारी किए गए।

(ii) मंत्रालय, केन्द्रीय प्रदूषण नियंत्रण बोर्ड, महानिदेशक, खान सुरक्षा (डीजीएमएस) और भारतीय खान ब्यूरो (आईबीएम) के साथ परामर्श करके, खानों में खाली स्थानों में राख के निपटान करने तथा अधिभार वाले ढेरो में इसे मिश्रित करना सुगम बनाने के लिए समय-समय पर आगे भी दिशानिर्देश जारी कर सकता है और यह खान मालिकों की जिम्मेदारी होगी कि वे ऐसी खानों को अभिज्ञात करने की तिथि से एक वर्ष के भीतर विभिन्न विनियामक प्राधिकरणों द्वारा जारी की गई अनुमतियों में आवश्यक संशोधन या परिवर्तन प्राप्त करेंगे।

(6) (i) पर्यावरणीय प्रदूषण के संदर्भ में सुरक्षा, व्यवहार्यता (आर्थिक व्यवहार्यता नहीं) और पहलुओं की जांच सहित राख से खान में खाली स्थान को वापस भरने/अधिभार वाले ढेर के साथ राख को मिश्रित करने के लिए खानों की पहचान करने के लिए पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, विद्युत मंत्रालय, खान मंत्रालय, कोयला मंत्रालय, महानिदेशक खान सुरक्षा और भारतीय खान ब्यूरो से प्रतिनिधियों को शामिल करते हुए अध्यक्ष, केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) की अध्यक्षता में एक समिति का गठन किया जाएगा और यह समिति पणधारी मंत्रालयों या विभागों के लिए अभिज्ञात खानों (भूमिगत और खुली, दोनों) के संबंध में तैयार की गई तिमाही रिपोर्टों को अद्यतन करेगी और यह समिति, इस अधिसूचना के प्रकाशन के तुरंत पश्चात उपयुक्त खानों की पहचान करना आरंभ करेगी।

(ii) ताप विद्युत संयंत्र या खानें, उपरोक्त अनुसार अधिदेशित उपयोग लक्ष्यों को पूरा करने के लिए उपर्युक्त समिति द्वारा पहचान किए जाने तक राख के निपटान हेतु प्रतीक्षा नहीं करेंगी।

(7) राख से निचले क्षेत्र को भरने का कार्य, अनुमोदित परियोजनाओं के लिए राज्य प्रदूषण नियंत्रण बोर्ड की पूर्व अनुमति से और केन्द्रीय प्रदूषण नियंत्रण बोर्ड द्वारा निर्धारित दिशा-निर्देशों के अनुसार किया जाएगा और राज्य प्रदूषण नियंत्रण बोर्ड या प्रदूषण नियंत्रण समिति द्वारा अनुमोदित स्थलों, अवस्थान, क्षेत्र और अनुमत मात्रा को अपनी वेबसाइट पर प्रतिवर्ष प्रकाशित किया जाएगा।

(8) केन्द्रीय प्रदूषण नियंत्रण बोर्ड, संगत पणधारी के साथ मिलकर, राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) द्वारा अनुमति प्रदान करने के लिए समयबद्ध ऑनलाइन आवेदन प्रक्रिया प्रस्तुत करने के साथ-साथ इस अधिसूचना के अधीन परिकल्पित सभी प्रकार के कार्यकलापों के लिए एक वर्ष के भीतर दिशानिर्देश प्रस्तुत करेगा।

(9) कोयला या लिग्नाइट आधारित तापीय ऊर्जा संयंत्र से तीन सौ किलोमीटर के दायरे में स्थित सभी भवन निर्माण परियोजनाएं (केंद्रीय, राज्य और स्थानीय प्राथिकरणों सरकारी उपक्रमों, अन्य सरकारी अभिकरणों तथा सभी निजी अभिकरणों) राख की ईटों, टाईल्स, धातुमल राख अथवा अन्य राख आधारित उत्पादों का उपयोग करेंगी बशर्ते कि वे वैकल्पिक उत्पादों की कीमत से अधिक कीमत पर उपलब्ध न हो।

(10) राख आधारित उत्पादों के विनिर्माण और ऐसे उत्पादों में राख के उपयोग में भारतीय मानक ब्यूरो, भारतीय सड़क कांग्रेस और केंद्रीय प्रदूषण नियंत्रण बोर्ड द्वारा निर्धारित विनिर्देशों और दिशानिर्देशों की अनुपालना होगी।

ग. गैर-अनुपालन के लिए पर्यावरणीय प्रतिकर .-

(1) तीन वर्ष के चक्र के प्रथम दो वर्षों में, यदि कोयला या लिग्नाइट आधारित तापीय ऊर्जा संयंत्र (कैप्टिव और/ या सह-उत्पादक स्टेशनों या दोनों सहित) ने कम-से-कम 80 प्रतिशत राख (फ्लाई-राख और बॉटम-राख) उपयोग नहीं की है तो ऐसे गैर-अनुपालन ताप विद्युत संयंत्रों पर प्रस्तुत की गई वार्षिक रिपोर्टों के आधार पर वित्तीय वर्ष के

अंत में अप्रयुक्त राख पर 1000 रुपए प्रति टन की दर से पर्यावरणीय प्रतिकर लगाया जाएगा और यदि यह तीन वर्ष के चक्र के तीसरे वर्ष में 100 प्रतिशत राख का उपयोग करने में असमर्थ रहता है, तो वह अप्रयुक्त मात्रा पर 1000 रुपए प्रति टन की दर से पर्यावरणीय प्रतिकर के भुगतान का पात्र होगा, जिस पर पहले पर्यावरणीय प्रतिकर नहीं लगायी गयी है।

परंतु पर्यावरणीय प्रतिकर को पैरा क के उप-पैरा (4) में उल्लिखित विभिन्न उपयोगी श्रेणियों के अनुसार प्रथम अनुपालन चक्र के अंतिम वर्ष के अंत में अनुमान लगाया जाएगा और अधिरोपित किया जाएगा।

(2) अधिकारियों द्वारा एकत्रित पर्यावरणीय प्रतिकर को केन्द्रीय प्रदूषण नियंत्रण बोर्ड के निर्दिष्ट खाते में जमा किया जाएगा।

(3) लैगेसी राख के मामले में, यदि कोयला या लिग्नाइट आधारित तापीय ऊर्जा संयंत्र (कैप्टिव या सह-उत्पादक स्टेशनों या दोनों सहित) ने स्थापित क्षमता पर आधारित उत्पन्न राख का कम-से-कम 20 प्रतिशत (प्रथम वर्ष के लिए), 35 प्रतिशत (द्वितीय वर्ष के लिए), 50 प्रतिशत (तीसरे से दसवें वर्ष तक) उपयोग के बराबर लक्ष्य प्राप्त नहीं किया है तो उस वित्तीय वर्ष के दौरान अप्रयुक्त लैगेसी राख पर 1000 रुपए प्रति टन की दर से पर्यावरणीय प्रतिकर लगाया जाएगा और यदि 10 वर्ष के अंत में लैगेसी राख का उपयोग नहीं किया जाता है तो 1000 रुपए प्रति टन की दर से शेष अप्रयुक्त मात्रा पर पर्यावरणीय प्रतिकर लगाया जाएगा जिस पर पहले पर्यावरणीय प्रतिकर नहीं लगाया गया है।

(4) अधिकृत खरीददारों या उपभोक्ता अभिकरणों तक राख भेजने की जिम्मेदारी परिवाहकों या वाहन मालिक की जिम्मेदारी है और यदि इसका अनुपालन नहीं किया जाता है, तो अनधिकृत उपयोगकर्ताओं अथवा गैर-अधिकृत उपयोगर्ताओं को ऐसी मात्रा गलत तरीके से वितरित करने पर 1500 रूपए प्रति टन की दर से पर्यावरणीय प्रतिकर लगायी, इसके अतिरिक्त राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) द्वारा गैर अनुपालनकर्ता परिवाहकों पर अभियोजन लागू होगा।

(5) इस अधिसूचना के पैरा ख में विहित पर्यावरण अनुकूल तरीके में राख के उपयोग की जिम्मेदारी खरीददार या उपभोगकर्ता एजेंसियों की है और ऐसा नहीं करने पर केन्द्रीय प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) द्वारा 1500 रूपए प्रति टन की दर से पर्यावरणीय प्रतिकर लगाया जाएगा।

(6) यदि उपयोगकर्ता अधिकरण पैरा ख के अधीन निर्धारित सीमा तक अथवा पैरा घ के उप-पैरा (1) के अधीन, दिए गए नोटिस के माध्यम से सूचित की गई सीमा, इनमें से जो भी कम हो, तक राख का उपयोग नहीं करती है, वे अतिरिक्त राख की मात्रा का 1500 रूपए प्रति टन की दर से भुगतान करने के लिए उत्तरदायी होंगी।

परंतु भवन निर्माण के संबंध में पर्यावरणीय प्रतिकर निर्मित क्षेत्र के 75 रूपये प्रति वर्ग फीट की दर से वसूल किया जाएगा।

(7) (i) ताप विद्युत संयंत्रों अन्य बकायादारों से केन्द्रीय प्रदूषण नियंत्रण बोर्ड द्वारा लगायी गई का पर्यावरणीय प्रतिकर उपयोग अप्रयुक्त राख के सुरक्षित निपटान हेतु किया जाएगा और राख आधारित उत्पादों सहित राख के उपयोग के संबंध में और अधिक अनुसंधान करने के लिए भी निधि का उपयोग किया जा सकता है।

(ii) अप्रयुक्त मात्रा पर लगाए गए पर्यावरणीय प्रतिकर के पश्चात भी राख के उपयोग का उत्तरदायित्व ताप विद्युत संयंत्रों की होगी और यदि पश्चातवती चक्रों में पर्यावरणीय प्रतिकर लगाने के पश्चात ताप विद्युत संयंत्र, किसी विशेष चक्र की राख के उपयोग के लक्ष्य को प्राप्त करता है तो अगले चक्र के दौरान अप्रयुक्त मात्रा पर एकत्र की गई पर्यावरणीय प्रतिकर में 10 प्रतिशत कटौती के पश्चात उक्त रकम ताप विद्युत संयंत्र को वापस कर दी जाएगी और पश्चातवती चक्रों में राख के उपयोग के मामले में एकत्र की गई पर्यावरणीय प्रतिकर की 20 प्रतिशत, 30 प्रतिशत और उसी क्रम में कटौती की जानी है।

घ. राख या राख आधारित उत्पादों की आपूर्ति हेतु प्रक्रिया ._

(1) ताप विद्युत संयंत्रों के स्वामी अथवा राख की ईटों या टाईल्स या धातुमल आधारित राख के विनिर्माता उन व्यक्तियों या अभिकरणों को लिखित सूचना देंगे जो बिक्री या परिवहन या दोनों के लिए प्रस्तुत राख या राख आधारित उत्पादों के उपयोग के लिए उत्तरदायी हैं।

(2) ऐसे व्यक्ति या उपयोगकर्ता अभिकरणों जिन्हें ताप विद्युत संयंत्रों के स्वामी द्वारा या राख की ईंटों या टाईल्स या धातुमल आधारित राख के उत्पादकों द्वारा सूचना दी गई है, यदि वे पहले ही राख या राख उत्पादों के उपयोग के प्रयोजन से अन्य अभिकरणों के साथ जुड़े हुए हैं, यदि वे किसी भी राख/राख उत्पादों का उपयोग नहीं कर सकते हैं अथवा कम मात्रा का उपयोग कर सकते हैं, तदनुसार ताप विद्युत संयंत्र को सूचित करेंगे।

ड. प्रवर्तन, निगरानी, लेखा परीक्षा और प्रतिवेदन करना

(1) केंद्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी), उपबंधों के अनुपालना सुनिश्चित करने के लिए प्रवर्तन और निगरानी प्राधिकरण होंगे। सीपीसीबी या एसपीसीबी या पीसीसी तिमाही आधार पर राख के उपयोग की निगरानी करेंगे और सीपीसीबी इस प्रयोजन के लिए अधिसूचना की प्रकाशन की तारीख से छ: माह के भीतर एक पोर्टल विकसित करेगा। संबंधित जिला अधिकारी के पास इस अधिसूचना के उपबंधों को लागू करने और निगरानी करने के लिए समवर्ती अधिकारिता होगी।

(2) (i) ताप विद्युत संयंत्र, राख उत्सर्जन और उपयोग से संबंधित मासिक सूचना वेब पोर्टल पर अगले महीने की 5 तारीख तक अपलोड करेगा। कोयला या लिग्नाइट आधारित ताप ऊर्जा संयंत्रों द्वारा केंद्रीय प्रदूषण नियंत्रण बोर्ड, संबंधित राज्य प्रदूषण नियंत्रण बोर्ड या प्रदूषण नियंत्रण समिति (पीसीसी), केंद्रीय विद्युत प्राधिकरण (सीईए) और पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय के संबंधित एकीकृत क्षेत्रीय कार्यालयों को इस अधिसूचना के उपबंधों के अनुपालन संबंधी सूचना उपलब्ध कराते हुए वार्षिक कार्यान्वयन रिपोर्ट प्रत्येक वर्ष (1 अप्रैल से 31 मार्च तक की अवधि के लिए) अप्रैल माह के 30वें दिन तक प्रस्तुत की जाएगी। सीपीसीबी और सीईए द्वारा सभी ताप विद्युत संयंत्रों द्वारा प्रस्तुत वार्षिक रिपोर्टों का समेकन किया जाएगा और उसे पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय को 31 मई तक प्रस्तुत किया जाएगा।

(ii) सभी अन्य उपयोगकर्ता अधिकरण पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय या राज्य स्तरीय पर्यावरण प्रभाव आकलन प्राधिकरण (एसईआईएए) द्वारा जारी पर्यावरणीय मंजूरी (ईसी) अथवा राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) द्वारा जारी संचालन की सहमति (सीटीओ), जो भी लागू हो, की अनुपालना रिपोर्ट में इस अधिसूचना में आज्ञापकता के अनुसार राख के उपभोग या उपयोग या निस्तारण तथा राख आधारित उत्पादों के उपयोग संबंधी सूचना प्रस्तुत करेंगे। केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) या राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) अधिसूचना के उपबंधों के प्रभावी कार्यान्वयन की समीक्षा करने हेतु ताप विद्युत संयंत्रों के अतिरिक्त अन्य सभी अधिकरणों की राख उपयोग की वार्षिक रिपोर्ट प्रकाशित करेंगे।

(3) इस अधिसूचना के उपबंधों की निगरानी और कार्यान्वयन के प्रयोजन के लिए केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) की अध्यक्षता में एक समिति का गठन किया जाएगा जिसके सदस्य विद्युत मंत्रालय, कोयला मंत्रालय, खनन मंत्रालय, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, सड़क परिवहन और राजमार्ग मंत्रालय और भारी उद्यम विभाग से होने के साथ-साथ समिति के अध्यक्ष द्वारा नामित किए जाने वाले कोई संबंधित पणधारी होंगे। यह समिति संगत पणधारी को आमंत्रित कर सकती है। यह समिति इस अधिसूचना के उपबंधों के प्रभावी और दक्ष कार्यान्वयन के लिए सिफारिशें कर सकती है। यह समिति छ: माह में कम से कम एक बार एक बैठक करेगी और वार्षिक कार्यान्वयन रिपोर्टों की समीक्षा करेगी और यह समिति, इस अधिसूचना द्वारा आजापक किए गए अनुसार छ: महीनों में कम से कम एक बार संगत पणधारी (को) को आमंत्रित करके राख के उपयोग की निगरानी करने के लिए पणधारी से साथ परामर्शदात्री बैठकें आयोजित करेगी। यह समिति पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय (एमओईएफसीसी) को छ: मासिक रिपोर्ट प्रस्तुत करेगी।

(4) ताप विद्युत संयंत्रों और राख के उपयोगकर्ताओं या राख आधारित उत्पादों के विनिर्माताओं के बीच के विवाद का समाधान करने के प्रयोजन से राज्य सरकारें या संघ राज्यक्षेत्र की सरकारें इस अधिसूचना के प्रकाशन की तारीख से तीन माह के भीतर राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) की अध्यक्षता में एक समिति का गठन करेंगी जिसमें विद्युत विभाग के प्रतिनिधि और एक प्रतिनिधि उस विभाग का होगा, जो विवाद वाले संबंधित अभिकरण का कार्य देख रहे हैं।

(5) केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) द्वारा प्राधिकृत लेखा परीक्षकों द्वारा ताप विद्युत संयंत्रों और उपयोगकर्ता अभिकरणों द्वारा किए गए राख के निपटान की अनुपालन लेखा परीक्षा संचालित की जाएगी और लेखा परीक्षा की रिपोर्ट प्रत्येक वर्ष 30 नवम्बर तक केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) को प्रस्तुत की जाएगी। केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी) या प्रदूषण नियंत्रण समिति (पीसीसी) लेखा परीक्षा की रिपोर्ट प्राप्त होने के पंद्रह दिनों के भीतर अनुपालन न करने वाले ताप विद्युत संयंत्रों के विरूद्ध कार्रवाई प्रारंभ करेगें।

[फा. सं. एचएसएम-9/1/2019-एचएसएम]

नरेश पाल गंगवार, संयुक्त सचिव

उपाबंध

31 मई तक अथवा उससे पहले प्रस्तुत की जाने वाली राख संबंधी उपबंधों की अनुपालन रिपोर्ट (01 अप्रैल से 31 मार्च की अवधि के लिए)।

क्र.सं.	**ब्यौरा**	
1.	विद्युत संयंत्र का नाम	
2.	कंपनी का नाम	
3.	जिला	
4.	राज्य	
5.	पत्राचार के लिए डाक का पता :	
6.	ई-मेल :	
7.	विद्युत संयंत्र की संस्थापित क्षमता (मेगा वॉट) :	
8.	संयंत्र लोड फैक्टर (पीएलएफ) :	
9.	उत्पादित यूनिटों की संख्या (एमडब्ल्यूएच) :	
10.	विद्युत संयंत्र के अंतर्गत कुल क्षेत्र (हेक्टेयर) (राख कुंडों के अधीन क्षेत्र सहित) :	
11.	रिपोर्टिंग की अवधि के दौरान कोयला खपत की मात्रा (प्रति वर्ष मीट्रिक टन) :	
12.	औसत राख सामग्री प्रतिशतता में (%) :	
13.	रिपोर्टिंग की अवधि के दौरान वर्तमान में उत्पादित राख की मात्रा (प्रति वर्ष मीट्रिक टन) : फ्लाई राख (प्रति वर्ष मीट्रिक टन) : बॉटम राख (प्रति वर्ष मीट्रिक टन) :	
14.	ड्राई फ्लाई राख भंडारण गड्ढा (गड्ढों) की क्षमता (मीट्रिक टन) :	
15.	**रिपोर्टिंग की अवधि के दौरान वर्तमान में उत्पादित राख के उपयोग का ब्यौरा:** (क) रिपोर्टिंग की अवधि के दौरान वर्तमान में उपयोग की गई राख की	

	कुल मात्रा (एमटीपीए) : (ख) उपयोग की गई फ्लाई राख की मात्रा (एमटीपीए) : i. फ्लाई-एश आधारित उत्पाद (ईंट या ब्लॉक या टाइल्स या फाइबर सीमेंट शीट या पाइप या बोर्ड/पैनल) : ii. सीमेंट विनिर्माण : iii. रेडी मिक्स कंक्रीट : iv. राख और जीओ-पॉलिमर आधारित निर्माण सामग्री : v. सिंटर्ड या कोल्ड बॉन्डेड राख एग्रीगेट का निर्माण : vi. सड़कों, सड़क और फ्लाई ओवर के पुश्तों का निर्माण : vii. बांधों का निर्माण : viii. निम्न भू-क्षेत्र का भराव : ix. खनिज क्षेत्रों का भराव : x. अधिभार वाले डम्पों में उपयोग : xi. कृषि : xii. तटीय जिलों में तटरेखा सुरक्षा संरचनाओं का निर्माण : xiii. अन्य देशों को राख का निर्यात : xiv. अन्य (कृपया विनिर्दिष्ट करें) : (ग) उपयोग किए गए तल के राख की मात्रा (एमटीपीए) : i. फ्लाई-एश आधारित उत्पाद (ईंट या ब्लॉक या टाइल्स या फाइबर सीमेंट शीट या पाइप या बोर्ड या पैनल) : ii. सीमेंट विनिर्माण : iii. रेडी मिक्स कंक्रीट : iv. राख और जीओ-पॉलिमर आधारित निर्माण सामग्री : v. सिंटर्ड या कोल्ड बॉन्डेड राख एग्रीगेट का निर्माण : vi. सड़कों, सड़क और फ्लाईओवर के पुश्तों का निर्माण : vii. बांधों का निर्माण : viii. निम्न भू-क्षेत्र का भराव : ix. खनिज क्षेत्रों का भराव : x. अधिभार वाले डम्पों में उपयोग : xi. कृषि : xii. तटीय जिलों में तटरेखा सुरक्षा संरचनाओं का निर्माण : xiii. अन्य देशों को राख का निर्यात : xiv. अन्य (कृपया विनिर्दिष्ट करें) : रिपोर्टिंग की अवधि के दौरान वर्तमान में अप्रयुक्त राख की कुल मात्रा (एमटीपीए :	
16.	रिपोर्टिंग की अवधि के दौरान वर्तमान में उत्पादित राख का प्रतिशतता उपयोग (%) :	
17.	**राख कुंडों में राख के निपटान का ब्यौरा** क) तारीख 31 मार्च तक (रिपोर्टिंग की अवधि को छोड़कर) राख कुण्ड (कुण्डों) में निपटान किए गए राख की कुल मात्रा (मीट्रिक टन):	

	ख) रिपोर्टिंग की अवधि के दौरान राख कुण्ड (कुण्डों) में निपटान किए गए राख की मात्रा (मीट्रिक टन): ग) रिपोर्टिंग की अवधि के दौरान राख कुण्डों में गारा निस्सरण हेतु खपत हुए जल की कुल मात्रा (मी^{3}): घ) राख कुण्डों की कुल संख्या: (i) सक्रिय: (ii) खाली किए गए (पुन: भरा जाना है) (iii) पुन: भरे गए: ड.) राख कुण्डों के अधीन कुल क्षेत्र (हेक्टेयर):	
18.	**अलग-अलग राख कुण्ड का ब्यौरा** *राख कुण्ड 1,2 आदि (यदि राख कुण्डों की संख्या एक से अधिक हो, तो कृपया निम्नलिखित ब्यौरा अलग से उपलब्ध कराएं)* क) स्थिति: निर्माणाधीन या सक्रिय या खाली किया गया या पुन: भरा गया ख) राख कुण्ड में राख का निपटान शुरू करने की तारीख/महीना/वर्ष या महीना/वर्ष): ग) राख कुण्ड की क्षमता पूर्ण किए जाने के पश्चात् उसमें राख निपटान रोकने की तारीख (तारीख/महीना/वर्ष या महीना/वर्ष): (सक्रिय राख कुण्डों के लिए लागू नहीं) ग) क्षेत्र (हेक्टेयर): घ) डाइक की ऊंचाई (मी.): घ) आयतन (मी^{3}): ड.) तारीख 31 मार्च तक निपटान किए गए राख की मात्रा (मीट्रिक टन): च) उपलब्ध आयतन का प्रतिशत (%) और आगे निपटान किए जा सकने वाले राख की मात्रा (मीट्रिक टन): छ) राख कुण्ड के भरे जाने की अनुमानित अवधि (वर्षों और महीनों की संख्या): ड.) निर्देशांक (अक्षांश और देशान्तर): (कृपया न्यूनतम 4 निर्देशांकों को विनिर्दिष्ट करें) ज) राख कुण्ड में की गई लाइनिंग का प्रकार: एचडीपीई लाइनिंग या एलडीपीई लाइनिंग या क्ले लाइनिंग या कोई लाइनिंग नहीं छ) निपटान की विधि: शुष्क निपटान या नम गारा (नम गारा के मामले में कृपया विनिर्टिष्ट करें कि क्या एचसीएसडी या एमसीएसडी या एलसीएसडी है) ज) राख का अनुपात: गारा मिश्रण में जल (1:____): झ) संस्थापित और कार्यशील राख जल पुनर्चक्रण प्रणाली (एडब्ल्यूआरएस): हां या नहीं ञ) जमीन के अंदर या जल निकाय में राख कुण्ड से निस्सरित अपशिष्ट जल की मात्रा (मी^{3}): ट) डाइक की स्थिरता का अध्ययन कराए जाने की पिछली तारीख और उस संगठन का नाम जिसने अध्ययन किया: ठ) लेखा-परीक्षा किए जाने की पिछली तारीख और उस संगठन का नाम जिसने लेखा-परीक्षा की:	
19.	उपयोग किए गए पुराने राख की मात्रा (एमटीपीए): i. फ्लाई-एश आधारित उत्पाद (ईंट या ब्लॉक या टाइल्स या फाइबर	

	सीमेंट शीट या पाइप या बोर्ड या पैनल): ii. सीमेंट विनिर्माण: iii. रेडी मिक्स कंक्रीट: iv. राख और जीओ-पॉलिमर आधारित निर्माण सामग्री: v. सिंटर्ड या कोल्ड बॉन्डेड राख एग्रीगेट का निर्माण: vi. सड़कों, सड़क और फ्लाई ओवर के पुश्तों का निर्माण: vii. बांधों का निर्माण: viii. निम्न भू-क्षेत्र का भराव: ix. खनिज क्षेत्रों का भराव: x. अधिभार वाले डम्पों में उपयोग: xi. कृषि: xii. तटीय जिलों में तटरेखा सुरक्षा संरचनाओं का निर्माण: xiii. अन्य देशों को राख का निर्यात xiv. अन्य (कृपया विनिर्दिष्ट करें):			
20.	**सार :**			
	ब्यौरा	सृजित मात्रा (एमटीपी)	उपयोग की गई मात्रा (एमटीपी) और (%)	शेष मात्रा (एमटीपी)
	रिपोर्टिंग की अवधि के दौरान राख			
	पुरानी राख			
	कुल			
21.	कोई अन्य सूचना : वार्षिक अनुपालन रिपोर्ट, और विद्युत संयंत्रों और राख कुण्डों की शेष फाइलों की सॉफ्ट कॉपी ई-मेल:- moefcc-coalash@gov.in पर भेजी जाए।			
22.	प्राधिकृत हस्ताक्षरकर्ता के हस्ताक्षर			

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 31st December, 2021

S.O. 5481(E).—Whereas by notification of the Government of India in the erstwhile Ministry of Environment and Forests *vide* S.O.763 (E), dated the 14th September, 1999, as amended from time to time, the Central Government, issued directions for restricting the excavation of top soil for manufacturing of bricks and promoting the utilisation of fly ash in the manufacturing of building materials and in construction activity within a specified radius of three hundred kilometres from the coal or lignite based thermal power plants;

And whereas, to implement the aforesaid notification more effectively based on the polluter pays principle (PPP) thereby ensuring 100 per cent utilisation of fly ash by the coal or lignite based thermal power plants and for the sustainability of the fly ash management system, the Central Government reviewed the existing notification; and whereas environmental compensation needs to be introduced based on the polluter pays principle;

And whereas, there is a need to conserve top soil by promoting manufacture and mandating use of ash based products and building materials in the construction sector;

And whereas, there is a need to conserve top soil and natural resources by promoting utilisation of ash in road laying, road and flyover embankments, shoreline protection measures, low lying areas of approved projects, backfilling of mines, as an alternative for filling of earthen materials;

And whereas, it is necessary to protect the environment and prevent the dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land;

And whereas, in the said notification the phrase 'ash', has been used which includes both fly ash as well as bottom ash generated from the Coal or Lignite based thermal power plants;

And whereas, the Central Government intends to bring out a comprehensive framework for ash utilisation including system of environmental compensation based on polluter pays principle;

And whereas, a draft notification on ash utilisation by coal or lignite thermal power plants in supersession of the notification of the Government of India, Ministry of Environment and Forests published in the Gazette of India, Extra Ordinary part II, section 3, sub-section (i) *vide* S.O.763 (E), dated the 14th September, 1999, by notification in exercise of the powers conferred under sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with clause (d) of sub-rule (3) of rule (5) of the Environment (Protection) Rules, 1986, was published in the Gazette of India, Extraordinary, Part II, section 3, sub-section (i), *vide* G.S.R. 285(E), dated the 22nd April, 2021 inviting objections and suggestions from all persons likely to be affected thereby before the expiry of sixty days from the date on which copies of the Gazette containing the said draft provisions were made available to the public;

And, whereas all the objections and suggestions received from all persons likely to be affected thereby in respect of the said draft notification have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with clause (d) of sub-rule (3) of rule (5) of the Environment (Protection) Rules, 1986, and in supersession of the Notification S.O.763 (E), dated the 14th September, 1999 except as respect things done or omitted to be done before such supersession, the Central Government hereby issues the following notification on ash utilisation from coal or lignite thermal power plants which shall come into force on the date of the publication of this notification, namely:-

A. Responsibilities of thermal power plants to dispose fly ash and bottom ash.—

(1) Every coal or lignite based thermal power plant (including captive or co-generating stations or both) shall be primarily responsible to ensure 100 per cent utilisation of ash (fly ash, and bottom ash) generated by it in an eco-friendly manner as given in sub-paragraph (2);

(2) The ash generated from coal or lignite based thermal power plants shall be utilised only for the following eco-friendly purposes, namely:-

(i) Fly ash based products viz. bricks, blocks, tiles, fibre cement sheets, pipes, boards, panels;

(ii) Cement manufacturing, ready mix concrete;

(iii) Construction of road and fly over embankment, Ash and Geo-polymer based construction material;

(iv) Construction of dam;

(v) Filling up of low lying area;

(vi) Filling of mine voids;

(vii) Manufacturing of sintered or cold bonded ash aggregate;

(viii) Agriculture in a controlled manner based on soil testing;

(ix) Construction of shoreline protection structures in coastal districts;

(x) Export of ash to other countries;

(xi) Any other eco-friendly purpose as notified from time to time.

(3) A committee shall be constituted under the chairmanship of Chairman, Central Pollution Control Board (CPCB) and having representatives from Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Power, Ministry of Mines, Ministry of Coal, Ministry of Road Transport and Highways, Department of Agricultural Research and Education, Institute of Road Congress, National Council for Cement and Building Materials, to examine and review and recommend the eco-friendly ways of utilisation of ash and make inclusion or exclusion or modification in the list of such ways as mentioned in Sub-paragraph (2) based on technological developments and requests received from stakeholders. The committee may invite State Pollution Control Board or Pollution Control Committee, operators of thermal power plants and mines, cement plants and other stakeholders as and when required for this purpose. Based on the recommendations of the Committee, Ministry of Environment, Forest and Climate Change (MoEFCC) may publish such eco-friendly purpose.

(4) Every coal or lignite based thermal power plant shall be responsible to utilise 100 per cent ash (fly ash and bottom ash) generated during that year, however, in no case shall utilisation fall below 80 per cent in any year, and the thermal power plant shall achieve average ash utilisation of 100 per cent in a three years cycle:

Provided that the three years cycle applicable for the first time is extendable by one year for the thermal power plants where ash utilisation is in the range of 60-80 per cent, and two years where ash utilisation is below 60 per cent and for the purpose of calculation of percentage of ash utilisation, the percentage quantity of utilisation in the year 2021- 2022 shall be taken into account as per the table below:

Utilisation percentages of thermal power plants	First compliance Cycle to meet 100 per cent utilisation	Second compliance cycle onwards, to meet 100 per cent utilisation
>80 per cent	3 years	3 years
60-80 per cent	4 years	3 years
<60 per cent	5 years	3 years

Provided further that the minimum utilisation percentage of 80 per cent shall not be applicable to the first year and first two years of the first compliance cycle for the thermal power plants under the utilisation category of 60-80 per cent and <60 per cent, respectively.

Provided also that 20per cent of ash generated in the final year of compliance cycle may be carried forward to the next cycle which shall be utilised in the next three years cycle along with the ash generated during that cycle.

(5) The unutilised accumulated ash i.e. legacy ash, which is stored before the publication of this notification, shall be utilised progressively by the thermal power plants in such a manner that the utilization of legacy ash shall be completed fully within ten years from the date of publication of this notification and this will be over and above the utilisation targets prescribed for ash generation through current operations of that particular year:

Provided that the minimum quantity of legacy ash in percentages as mentioned below shall be utilised during the corresponding year and the minimum quantity of legacy ash is to be calculated based on the annual ash generation as per installed capacity of thermal power plant.

Year from date of publication	1st	2nd	3rd -10th
Utilisation of legacy ash (in percentage of Annual ash)	At least 20 per cent	At least 35 per cent	At least 50 per cent

Provided further that the legacy ash utilisation shall not be required where ash pond or dyke has stabilised and the reclamation has taken place with greenbelt or plantation and the concerned State Pollution Control Board shall certify in this regard. Stabilisation and reclamation of an ash pond or dyke including certification by the Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall be carried out within a year from the date of publication of this notification. The ash remaining in all other ash ponds or dykes shall be utilised in progressive manner as per the above mentioned timelines.

Note: The obligations under sub-paragraph (4) and (5) above for achieving the ash utilisation targets shall be applicable from 1st April, 2022.

(6) Any new as well as operational thermal power plant may be permitted an emergency or temporary ash pond with an area of 0.1 hectare per Mega Watt (MW). Technical specifications of ash ponds or dykes shall be as per the guidelines of Central Pollution Control Board (CPCB) made in consultation with Central Electricity Authority (CEA) and these guidelines shall also lay down a procedure for annual certification of the ash pond or dyke on its safety, environmental pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and greenbelt, etc., and shall be put in place within three months from the date of publication of this notification.

(7) Every coal or lignite based thermal power plant shall ensure that loading, unloading, transport, storage and disposal of ash is done in an environmentally sound manner and that all precautions to prevent air and water pollution are taken and status in this regard shall be reported to the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) in Annexure attached to this notification.

(8) Every coal or lignite based thermal power plant shall install dedicated silos for storage of dry fly ash silos for at least sixteen hours of ash based on installed capacity and it shall be reported upon to the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) in the Annexure and shall be inspected by Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) from time to time.

(9) Every coal or lignite based thermal power plant (including captive or co-generating stations or both) shall provide real time data on daily basis of availability of ash with Thermal Power Plant (TPP), by providing link to Central Pollution Control Board's web portal or mobile phone App for the benefit of actual user(s).

(10) Statutory obligation of 100 per cent utilisation of ash shall be treated as a change in law, wherever applicable.

B. **For the purpose of utilisation of ash, the subsequent sub-paras shall apply**.—

(1) All agencies (Government, Semi-government and Private) engaged in construction activities such as road laying, road and flyover embankments, shoreline protection structures in coastal districts and dams within 300 kms from the lignite or coal based thermal power plants shall mandatorily utilise ash in these activities:

Provided that it is delivered at the project site free of cost and transportation cost is borne by such coal or lignite based thermal power plants.

Provided further that thermal power plant may charge for ash cost and transportation as per mutually agreed terms, in case thermal power plant is able to dispose the ash through other means and those agencies makes a request for it and the provisions of ash free of cost and free transportation shall be applicable, if thermal power plant serves a notice on the construction agency for the same.

(2) The utilisation of ash in the said activities shall be carried out in accordance with specifications and guidelines laid down by the Bureau of Indian Standards, Indian Road Congress, Central Building Research Institute, Roorkee, Central Road Research Institute, Delhi, Central Public Works Department, State Public Works Departments and other Central and State Government Agencies.

(3) It shall be obligatory on all mines located within 300 kilometres radius of thermal power plant, to undertake backfilling of ash in mine voids or mixing of ash with external Overburden dumps, under Extended Producer Responsibility (EPR). All mine owners or operators (Government, Public and Private Sector) within three hundred kilometres (by road) from coal or lignite based thermal power plants, shall undertake measures to mix at least 25 per cent of ash on weight to weight basis of the materials used for external dump of overburden, backfilling or stowing of mine (running or abandoned as the case may be) as per the guidelines of the Director General of Mines Safety (DGMS):

Provided that such thermal power stations shall facilitate the availability of required quantity of ash by delivering ash free of cost and bearing the cost of transportation or cost or transportation arrangement decided on mutually agreed terms and mixing of ash with overburden in mine voids and dumps shall be applicable for the overburden generated from the date of publication of this notification and the utilisation of ash in the said activities shall be carried out in accordance with guidelines laid down by the Central Pollution Control Board, Director General of Mines Safety and Indian Bureau of Mines.

Explanation.- For the purpose of this sub-paragraph, it is also clarified that the provisions of ash free of cost and free transportation shall be applicable, if thermal power plants serve a notice on the mine owner for the same and the mandate of using 25 per cent of ash for mixing with overburden dump and filling up of mine voids shall not be applicable unless a notice is served on the mine owner by thermal power plant.

(4) (i) All mine owners shall get mine closure plans (progressive and final) to accommodate ash in the mine voids and the concerned authority shall approve mine plans for disposal of ash in mine voids and mixing of ash with overburden dumps. The Ministry of Environment, Forest and Climate Change (MoEFCC) has issued guidelines on 28th August, 2019 regarding exemption of requirement of Environmental Clearance of thermal power plants and coal mines along with the guidelines to be followed for such disposal.

(ii) The Ministry in consultation with Central Pollution Control Board (CPCB), Director General of Mine Safety (DGMS) and Indian Bureau of Mines (IBM) may issue further guidelines time to time to facilitate ash disposal in mine voids and mixing with overburden dumps and it shall be the responsibility of mine owners to get the necessary amendments or modifications in the permissions issued by various regulatory authorities within one year from the date of identification of such mines.

(5) (i) There shall be a committee headed by Chairperson, Central Pollution Control Board (CPCB) with representatives from Ministry of Environment, Forest and Climate Change, Ministry of Power, Ministry of Mines, Ministry of Coal, Director General of Mine Safety and Indian Bureau of Mines for identification of mines for backfilling of mine voids with ash or mixing of ash with overburden dump including examination of safety, feasibility (not economic feasibility) and aspects of environmental contamination and the committee shall get updated quarterly reports prepared regarding identified mines (both underground and opencast) for the stakeholder Ministries or Departments and the committee shall start identifying the suitable mines immediately after the publication of this notification.

(ii) Thermal power plants or mines shall not wait for disposal of ash till the identification is done by the above mentioned committee, to meet the utilisation targets mandated as above.

(6) Filling of low lying areas with ash shall be carried out with prior permission of the State Pollution Control Board or Pollution Control Committee for approved projects, and in accordance with guidelines laid down by Central Pollution Control Board (CPCB) and the State Pollution Control Board or Pollution Control Committee (PCC) shall publish approved sites, location, area and permitted quantity annually on its website.

(7) Central Pollution Control Board after engaging relevant stakeholders, shall put in place the guidelines within one year for all types of activities envisaged under this notification including putting in place time bound online application process for the grant permission by State Pollution Control Boards (SPCBs) or Pollution Control Committees (PCCs).

(8) All building construction projects (Central, State and Local authorities, Govt. undertakings, other Govt. agencies and all private agencies) located within a radius of three hundred kilometres from a coal or lignite based thermal power plant shall use ash bricks, tiles, sintered ash aggregate or other ash based products, provided these are made available at prices not higher than the price of alternative products.

(9) Manufacturing of ash based products and use of ash in such products shall be in accordance with specifications and guidelines laid down by the Bureau of Indian Standards, Indian Road Congress, and Central Pollution Control Board.

C. Environmental compensation for non-compliance.—

(1) In the first two years of a three years cycle, if the coal or lignite based thermal power plant (including captive or co-generating stations or both) has not achieved at least 80 per cent ash (fly ash and bottom ash) utilisation, then such non-compliant thermal power plants shall be imposed with an environmental compensation of Rs. 1000 per ton on unutilised ash during the end of financial year based on the annual reports submitted and if it is unable to utilise 100 per cent of ash in the third year of the three years cycle, it shall be liable to pay an environmental compensation of Rs. 1000 per ton on the unutilised quantity on which environmental compensation has not been imposed earlier:

Provided that the environmental compensation shall be estimated and imposed at the end of last year of the first compliance cycle as per the various utilisation categories as mentioned in sub-paragraph (4) of Para A.

(2) Environmental compensation collected by the authorities shall be deposited in the designated account of Central Pollution Control Board.

(3) In case of legacy ash, if the coal or lignite based thermal power plant (including captive or co-generating stations or both) has not achieved utilisation equivalent to at least 20 per cent (for the first year), 35 per cent (for the second year), 50 per cent (for third to tenth year) of ash generated based on installed capacity, an environmental compensation of Rs. 1000 per ton of unutilised legacy ash during that financial year shall be imposed and if the utilization of legacy ash is not completed at the end of 10 years, an environmental compensation of Rs.1000 per ton shall be imposed on the remaining unutilised quantity which has not been imposed earlier.

(4) It shall be the responsibility of the transporters or vehicle owner to deliver ash to authorised purchaser or user agency and if it is not complied, then an environmental compensation of Rs. 1500 per ton on such quantity as mis-delivered to unauthorised users or non- delivered to authorised users will be imposed besides prosecution of such non-compliant transporters by State Pollution Control Board (SPCB) or Pollution Control Committee (PCC).

(5) It is the responsibility of the purchasers or user agencies to utilise ash in an eco-friendly manner as laid down at para B of this notification and if it is not complied, then an environmental compensation of Rs. 1500 or per ton shall be imposed by State Pollution Control Board (SPCB) or Pollution Control Committee (PCC).

(6) If the user agencies do not utilise ash to the extent obligated under para B or the extent to which they have been intimated through Notice(s) served under sub-paragraph (1) of para D, whichever is lower, they shall be liable to pay Rs. 1500 per ton of ash for the quantity they fall short off:

Provided that the environmental compensation on building constructions shall be levied at Rs.75/- per square feet of built up area of construction.

(7) (i) The environmental compensation collected by Central Pollution Control Board from the thermal power plants and other defaulters shall be used towards the safe disposal of the unutilised ash and the fund may also be utilised for advancing research on use of ash including ash based products.

(ii) The liability of ash utilisation shall be with thermal power plants even after imposition of environmental compensation on unutilised quantities and in case thermal power plant achieves the ash utilisation of any

particular cycle after imposition of environmental compensation in subsequent cycles, the said amount shall be returned to thermal power plant after deducting 10 per cent of the environmental compensation collected on the unutilised quantity during the next cycle and deduction of 20 per cent, 30 per cent, and so on, of the environmental compensation collected is to be made in case of utilisation of ash in subsequent cycles.

D. Procedure for supply of ash or ash based products.—

(1) The owner of thermal power plants or manufacturers of ash bricks or tiles or sintered ash aggregate shall serve written notice to persons or agencies who are liable to utilise ash or ash based products, offering for sale, or transport or both.

(2) Persons or user agencies who have been served notices by owner of thermal power plants or manufacturers of ash bricks or tiles or sintered ash aggregate, if they have already tied up with other agencies for the purpose of utilisation of ash or ash products, shall inform the thermal power plant accordingly, if they cannot use any ash or ash products or use reduced quantity.

E. Enforcement, Monitoring, Audit and Reporting.—

(1) The Central Pollution Control Board (CPCB) and the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall be the enforcing and monitoring authority for ensuring compliance of the provisions and shall monitor the utilisation of ash on quarterly basis. Central Pollution Control Board shall develop a portal for the purpose within six months of date of publication of the notification. The concerned District Magistrate shall have concurrent jurisdiction for enforcement and monitoring of the provisions of this notification.

(2) (i) Thermal power plants shall upload monthly information regarding ash generation and utilisation by 5th of the next month on the web portal. Annual implementation report (for the period 1st April to 31st March) providing information about the compliance of provisions in this notification shall be submitted by the 30th day of April, every year to the Central Pollution Control Board, concerned State Pollution Control Board or Pollution Control Committee (PCC), Central Electricity Authority (CEA), and concerned Integrated Regional Office of Ministry of Environment, Forest and Climate Change by the coal or lignite based thermal power plants. Central Pollution Control Board and Central Electricity Authority shall compile the annual reports submitted by all the thermal power plants and submit to Ministry of Environment, Forest and Climate Change by 31st May.

(ii) All other user agencies shall submit consumption or utilisation or disposal of ash and use of ash based products as mandated in this notification in the compliance report of Environmental Clearance (EC) issued by Ministry of Environment, Forest and Climate Change or State Level Environment Impact Assessment Authority (SEIAA) or Consent to Operate (CTO) issued by State Pollution Control Board (SPCB) or Pollution Control Committee (PCC), whichever is applicable. The Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall publish annual report of ash utilisation of all other agencies except thermal power plants to review the effective implementation of the provisions of the notification.

(3) For the purpose of monitoring the implementation of the provisions of this notification, a committee shall be constituted under the Chairperson, Central Pollution Control Board (CPCB), with members from Ministry of Power, Ministry of Coal, Ministry of Mines, Ministry of Environment, Forest and Climate Change, Ministry Road Transportation and Highways, Department of Heavy Industry as well as any concerned stakeholder(s), to be nominated by the Chairman of the committee. The committee may make recommendations for effective and efficient implementation of the provisions of the notification. The committee shall meet at least once in six months and review annual implementation reports and the committee shall also hold stakeholder consultations for monitoring of ash utilisation as mandated by this notification by inviting relevant stakeholder(s) at least once in six months. The committee shall submit the six monthly report to Ministry of Environment, Forest and Climate Change (MoEFCC).

(4) For the purpose of resolving disputes between thermal power plants and users of ash or manufacturer of ash based products, the State Governments or Union territory administration constitute a Committee within three months from the date of publication of this notification under the Chairman, State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) with representatives from Department of Power, and one representative from the Department which deals with the subject of concerned agency with which dispute is made.

(5) The compliance audit for ash disposal by the thermal power plants and the user agency shall be conducted by auditors, authorised by Central Pollution Control Board (CPCB) and audit report shall be submitted to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 30th November every year. Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) shall initiate action against non-compliant thermal power plants within fifteen days of receipt of audit report.

[F. No. HSM-9/1/2019-HSM]

NARESH PAL GANGWAR, Jt. Secy.

Annexure

Ash Compliance Report (for the period 1st April-31st March) to be submitted on or before 31st May.

Sl. No.	Details	
1.	Name of Power Plant	
2.	Name of the company	
3.	District	
4.	State	
5.	Postal address for communication:	
6.	E-mail:	
7.	Power Plant installed capacity (MW):	
8.	Plant Load Factor (PLF):	
9.	No. of units generated (MWh):	
10.	Total area under power plant (ha): (including area under ash ponds)	
11.	Quantity of coal consumption during reporting period (Metric Tons per Annum):	
12	Average ash content in percentage (per cent):	
13.	Quantity of current ash generation during reporting period (Metric Tons per Annum): Fly ash (Metric Tons per Annum): Bottom ash (Metric Tons per Annum):	
14.	Capacity of dry fly ash storage silo(s) (Metric Tons) :	
15	Details of utilisation of current ash generated during reporting period (a) Total quantity of current ash utilised (MTPA) during reporting period: (b) Quantity of fly ash utilised (MTPA): (i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels) (ii) Cement manufacturing:	

	(iii) Ready mix concrete: (iv) Ash and Geo-polymer based construction material: (v) Manufacturing of sintered or cold bonded ash aggregate: (vi) Construction of roads, road and fly over embankment: (vii) Construction of dams: (viii) Filling up of low lying area: (ix) Filling of mine voids: (x) Use in overburden dumps: (xi) Agriculture: (xii) Construction of shoreline protection structures in coastal districts; (xiii) Export of ash to other countries: (xiv) Others (please specify): (c) Quantity of bottom ash utilised (MTPA): (i) Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels): (ii) Cement manufacturing: (iii) Ready mix concrete: (iv) Ash and Geo-polymer based construction material: (v) Manufacturing of sintered or cold bonded ash aggregate: (vi) Construction of roads, road and flyover embankment: (vii) Construction of dams: (viii) Filling up of low lying area: (ix) Filling of mine voids: (x) Use in overburden dumps: (xi) Agriculture: (xii) Construction of shoreline protection structures in coastal districts: (xiii) Export of ash to other countries: (xiv) Others (please specify): Total quantity of current ash unutilised (MTPA) during reporting period:	
16.	Percentage utilisation of current ash generated during reporting period (per cent):	
17.	Details of disposal of ash in ash ponds (a) Total quantity of ash disposed in ash pond(s) (Metric Tons) as on 31st March (excluding reporting period): (b) Quantity of ash disposed in ash pond(s) during reporting period (Metric Tons): (c) Total quantity of water consumption for slurry discharge into ash ponds during reporting period (m^3): (d) Total number of ash ponds: (i) Active: (ii) Exhausted (yet to be reclaimed): (iii) Reclaimed: (e) total area under ash ponds (ha):	
18.	Individual ash pond details *Ash pond-1,2, etc (please provide below mentioned details separately, if number of ash ponds is more than one)* (a) Status: Under construction or Active or Exhausted or	

	Reclaimed (b) Date of start of ash disposal in ash pond (DD/MM/YYYY or MMYYYY): (c) Date of stoppage of ash disposal in ash pond after completing its capacity (DD/MM/YYYY or MM/YYYY): (Not applicable for active ash ponds) (c) area (hectares): (d) dyke height (m): (d) volume (m^3): (e) quantity of ash disposed as on 31st March (Metric Tons): (f) available volume in percentage (per cent) and quantity of ash can be further disposed (Metric Tons): (g) expected life of ash pond (number of years and months): (e) co-ordinates (Lat and Long): (please specify minimum 4 co-ordinates) (f) type of lining carried in ash pond: HDPE lining or LDPE lining or clay lining or No lining g) mode of disposal: Dry disposal or wet slurry (in case of wet slurry please specify whether HCSD or MCSD or LCSD) (h) Ratio of ash: water in slurry mix (1:___): (i) Ash water recycling system (AWRS) installed and functioning: Yes or No (j) Quantity of wastewater from ash pond discharged into land or water body (m3): (k) Last date when the dyke stability study was conducted and name of the organisation who conducted the study: (l) Last date when the audit was conducted and name of the organisation who conducted the audit:	
19.	Quantity of legacy ash utilised (MTPA): i. Fly ash based products (bricks or blocks or tiles or fibre cement sheets or pipes or boards or panels): ii. Cement manufacturing: iii. Ready mix concrete: iv. Ash and Geo-polymer based construction material: v. Manufacturing of sintered or cold bonded ash aggregate: vi. Construction of roads, road and flyover embankment: vii. Construction of dams: viii. Filling up of low lying area: ix. Filling of mine voids: x. Use in overburden dumps: xi. Agriculture: xii. Construction of shoreline protection structures in coastal districts; xiii. Export of ash to other countries: xiv. Others (please specify):	
20.	Summary:	

Details	Quantity generated (MTP)	Quantity utilised (MTP) and (per cent)	Balance quantity (MTP)

	Current ash during reporting period			
	Legacy ash			
	Total			
21.	Any other information: Soft copy of the annual compliance report, and shape files of power plant and ash ponds may be e-mailed to:- moefcc-coalash@gov.in			
22.	Signature of Authorised Signatory			

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ANNEXURE-II

रजिस्ट्री सं. डी.एल.- 33004/99 REGD. No. D. L.-33004/99

भारत का राजपत्र
The Gazette of India

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असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)

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पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 30 दिसम्बर, 2022

का.आ. 6169(अ).—पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय में भारत सरकार ने पर्यावरण (संरक्षण) नियम, 1986 के नियम (5) के उप-नियम (3) के खंड (घ) के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) और उप-धारा (2) के खंड (v) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए भारत के राजपत्र, असाधारण, भाग II, खंड 3 उप खंड (ii) का.आ. 5481(अ), तारीख 31 दिसंबर, 2021 द्वारा एक अधिसूचना जारी की थी (जिन्हें इसमें इसके पश्चात इसे राख के उपयोग से संबंधित अधिसूचना कहा गया है);

और, राख के उपयोग से संबंधित अधिसूचना के उपबंधों के कार्यान्वयन के संबंध में विद्युत मंत्रालय, ताप विद्युत संयंत्रों और विभिन्न हितधारकों से अनुरोध प्राप्त हुए हैं;

और, राख के उपयोग से संबंधित अधिसूचना के कार्यान्वयन में सुचारू परिवर्तन लाने हेतु उक्त अधिसूचना के कतिपय उपबंधों में संशोधन लाना उचित है;

अत: अब, केन्द्रीय सरकार पर्यावरण (संरक्षण) नियम, 1986 के नियम (5) के उप-नियम (1), (2) और (4) के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उप-धारा (1) और उप-धारा (2) के खंड (v) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, जारी राख के उपयोग संबंधी अधिसूचना में निम्नलिखित संशोधन करती है, अर्थात्:-

जारी राख के उपयोग से संबंधित अधिसूचना में संशोधन –

1. पैरा क में, -

(i) उप पैरा क (4) में, तीसरे परंतुक के पश्चात निम्नलिखित परन्तुक अंतर्विष्ट किया जाएगा, अर्थात् :

''परन्तु, यह भी कि इस अधिसूचना के प्रकाशन की तारीख को अथवा उसके पश्चात् स्थापित नए ताप विद्युत संयंत्र सारणी में यथा विनिर्दिष्ट 60 प्रतिशत से कम ताप विद्युत संयंत्रों के लिए विनिर्दिष्ट अनुपालन चक्र के समान प्रथम अनुपालन चक्र का अनुसरण करेंगे।

टिप्पण : लागू अनुपालन चक्र के अनुसार उपयोग के लक्ष्य 1 अप्रैल, 2022 से प्रभावी होंगे।''

(ii) उप पैरा 5 में, -

(क) आरंभिक पैरा में, "इस अधिसूचना के प्रकाशन की तारीख" शब्दों के स्थान पर "1 अप्रैल, 2022" उक्त अक्षर और शब्द रखे जाएंगे;

(ख) दूसरे परंतुक में, -

(i) ''हरित पट्टी या पौधरोपण'' के पश्चात, "या उप पैरा (6) में यथा विनिर्दिष्ट केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) द्वारा जारी मार्गदर्शी सिद्धांतों के अनुसार सौर ऊर्जा संभव या पवन ऊर्जा संयंत्र" शब्द कोष्ठकों और अक्षरों को अंत:स्थापित किए जाएंगे;

(ii) ''केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीब) या" शब्द कोष्ठक और अक्षर हटा दिया जाएंगे।

(iii) "एक वर्ष" शब्दों के स्थान पर "तीन वर्ष" शब्दों को रखा जाएगा।

(iv) "इस अधिसूचना के प्रकाशन की तारीख" शब्दों के स्थान पर "1 अप्रैल, 2022" उक्त अक्षर और शब्द रखे जाएंगे;

(ग) दूसरे परंतुक के पश्चात निम्नलिखित उपलब्ध अंत:स्थापित किया जाएगा, अर्थात् :

"परंतु कि पैरा क (6) में यथाविनिर्दिष्ट राख के अस्थायी भंडारण हेतु अभिहीत किए गए संचालित राख कुंड या डाइक के सिवाय सभी राख कुंडों या डाइक में संग्रहीत राख में पुरानी राख एकत्रित होगी और या तो इसे पुनःप्राप्त या स्थिर या उपयोग करना होगा।"

(iii) उप पैरा (6) के स्थान, उप पैरा रखा जाएगा, अर्थात्:

"(6) किसी भी नए और साथ ही चालू थर्मल पावर प्लांट को 0.1 हेक्टेयर प्रति मेगा वाट (मेगावाट) के क्षेत्र में राख के अस्थायी भंडारण के लिए परिचालन राख तालाब या डाइक की अनुमति दी जा सकती है। केन्द्रीय विद्युत प्राधिकरण के परामर्श से बनाए गए केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) के दिशा-निर्देशों के अनुसार परिचालन के साथ-साथ स्थिर और पुन: दावा किए गए राख तालाबों या बांधों की तकनीकी विशिष्टताओं के अनुसार होंगे और ये दिशानिर्देश वार्षिक प्रमाणन के लिए एक प्रक्रिया भी निर्धारित करेंगे। परिचालन के साथ-साथ राख तालाब या डाइक को उसकी सुरक्षा, पर्यावरण प्रदूषण, उपलब्ध मात्रा, निपटान के तरीके, पानी की खपत या निपटान में संरक्षण, राख जल पुनर्चक्रण और हरित पट्टी, आदि पर परिचालन के साथ-साथ स्थिर और पुन: प्राप्त किया जाएगा और इस अधिसूचना के प्रकाशन की तारीख से तीन महीने भीतर रखा जाएगा :

परंतु कि 31 दिसंबर, 2021 से पहले चालू किए गए ताप विद्युत संयंत्रों के लिए 1600 मेगावाट से कम या उसके बराबर स्थापित क्षमता वाले दो परिचालन राख तालाबों या डाइकों तक और 1600 से अधिक स्थापित क्षमता वाले ताप विद्युत संयंत्रों के लिए चार परिचालन राख तालाबों या बांधों तक MW, मौजूदा राख तालाबों या बांधों से निर्दिष्ट क्षेत्र के भीतर कई लैगून होने पर, निर्देशांक के साथ स्पष्ट सीमांकन के साथ नामित किया जा सकता है, और केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी)/प्रदूषण को सूचित करेगा। नियंत्रण समिति (पीसीसी) 31 मार्च, 2023 तक :

परंतु आगे कि नए थर्मल पावर प्लांट या मौजूदा थर्मल पावर प्लांट के विस्तार के मामले में केवल एक ऐश पोंड या डाइक की अनुमति दी जाएगी 31 दिसंबर, 2021 को या उसके बाद, जो केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) और संबंधित राज्य प्रदूषण नियंत्रण बोर्ड (एसपीसीबी)/प्रदूषण नियंत्रण समिति (पीसीसी) को कमीशन की तारीख से 3 महीने के भीतर निर्देशांक के साथ सीमांकन के विवरण की सूचना देगा। थर्मल पावर प्लांट या 31 मार्च, 2023 तक, जो भी बाद में हो :

परंतु यह और कि कोयला और लिग्नाइट आधारित तापीय विद्युत संयंत्रों को आगे किसी भी नए कार्यशील राख कुंड या डाइक को स्थापित करने या नाम निर्दिष्ट करने की अनुमति नहीं दी जाएगी।

परंतु यह और कि कार्यशील राख कुंड या डाइक की 0.1 हे./मेगावॉट (एमडब्ल्यू) का विनिर्देशन तारीख 3 नवम्बर, 2009 से पूर्व चालू तापीय विद्ययुत संयंत्रों पर लागू नहीं होंगे।"

2. पैरा ख में, -

(i) उप पैरा (1) में, "300 कि.मी. के भीतर" शब्दों कोष्ठकों और आंकड़ों के स्थान पर "300 कि.मी. के रेडियस के भीतर" शब्द कोष्ठक और आंकड़े रखें जाएंगे।

(ii) उप पैरा (8) में, उच्चतर "वैकल्पिक उत्पादों के मूल्य से अधिक" शब्दों के स्थान पर "केन्द्रीय लोक कार्य विभाग (सीपीडब्ल्यूडी) या संबंधित लोक कार्य विभाग (पीडब्ल्यूडी) द्वारा विनिर्दिष्ट दरों की अनुसूची में उल्लिखित मूल्य या दरों की अनुसूची के अधीन निर्धारित न होने परल वैकल्पिक उत्पादों का मूल्य" शब्द रखे जाएंगे।

3. पैरा घ में, -

(i) उप पैरा (2) के स्थान, उप पैरा रखा जाएगा, अर्थात्:

''(2) जिन व्यक्तियों या उपयोगकर्ता या एजेंसियों को थर्मल पावर प्लांट के मालिक द्वारा नोटिस दिया गया है, अगर वे राख के उपयोग के उद्देश्य से पहले से ही अन्य एजेंसियों के साथ करार कर चुके हैं तो थर्मल पावर प्लांट को तदनुसार सूचित करेंगे और यदि वे उपयोग नहीं कर सकते हैं कोई राख या कम मात्रा का उपयोग कर सकता है।''

(ii) उप-पैरा (2) के पश्चात्, निम्नलिखित उप-पैरा अंत:स्थापित किया जाएगा, अर्थात्:

"(3) जिन व्यक्तियों या उपभोकता अभिकरणों को, यदि वे राख आधारित उत्पादों के उपयोग के उद्देश्य से अन्य अभिकरणों के साथ पहले से जुड़े हुए हैं, ऐश ब्रिक्स या टाइल्स या सिंटर्ड ऐश ऐग्रीगेट या अन्य राख आधारित उत्पादों के विनिर्माताओं के द्वारा नोटिस दिया गया है तो उन्हें ऐश ब्रिक्स या आइल्स या सिंटर्ड ऐश ऐग्रीगेट या अन्य राख आधारित उतपादों के विनिर्माताओं को सूचित करना होगा, तद्नुसार, यदि वे राख आधारित उत्पादों का उपयोग नहीं कर सकते या कम प्रमात्रा में उपयोग कर सकते हैं।"

2. यह अधिसूचना राजपत्र में प्रकाशन की तारीख से प्रवृत होगी।

[फा. सं. एचएसएम - 9/1/2019- एचएसएम]

नरेश पाल गंगवार, अपर सचिव

टिप्पण : मूल अधिसूचना भारत के राजपत्र, असाधारण, भाग-II, खंड 3, उप-खंड (ii) सं. एस 5481(अ) तारीख 31 दिसम्बर, 2021 के द्वारा में प्रकाशित की गई।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 30th December, 2022

S.O. 6169(E).—Whereas, the Government of India, Ministry of Environment, Forest and Climate Change, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with clause (d) of sub-rule (3) of rule (5) of the Environment (Protection) Rules, 1986, issued a notification published in the Gazette of India, Extraordinary, Part II, Section 3, sub-section (ii) *vide* S.O.5481(E), dated the 31st December, 2021 (herein after referred to as the ash utilisation notification);

And whereas, requests have been received from Ministry of Power, thermal power plants and various stakeholders regarding implementation of provisions of the ash utilisation notification;

And whereas, it is expedient to make amendments to certain provisions of the said notification to have smooth transitioning in implementation of the ash utilisation notification;

Now, therefore, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with of sub-rule (1), (2) and (4) of rule (5) of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following amendments in the ash utilisation notification namely:-

In the ash utilisation notification,-

(1) in paragraph A,-

(i) in sub-paragraph (4), after the third proviso, the following shall be inserted, namely,-

"Provided also that new thermal power plants commissioned on or after the date of publication of this notification shall follow the first compliance cycle similar to the compliance cycle specified for thermal power plants having utilisation per cent. less than 60 per cent. as specified in the table.

Note: The utilisation targets as per the applicable compliance cycle shall commence from 1st April, 2022.".

(ii) in sub- paragraph (5),-

(a) in the opening paragraph, for the words "the date of publication of this notification", the figures, letters and word "1st April, 2022" shall be substituted;

(b) in the second proviso, -

(i) after the words "green belt or plantation", the words, brackets, letters and figure "or solar power plant or wind power plant as per the guidelines issued by the Central Pollution Control Board (CPCB) as specified in sub-para (6)" shall be inserted,

(ii) the words, brackets and letters "Central Pollution Control Board (CPCB) or" shall be deleted,

(iii) for the words "a year", the words "three years" shall be substituted,

(iv) for the words "the date of publication of this notification", the figures, letters and word "1st April, 2022" shall be substituted.

(c) after the second proviso, the following proviso shall be inserted, namely:

"Provided that ash stored in all ash ponds or dykes other than operational ash pond or dyke designated for temporary storage of ash as specified in sub-para (6) shall constitute the legacy ash and either to be reclaimed or stabilised or utilised.".

(iii) for sub- paragraph (6), the following sub-para shall be substituted, namely,-

"(6) Any new as well as operational thermal power plant may be permitted operational ash pond or dyke for temporary storage of ash within an area of 0.1 hectare per Mega Watt (MW). Technical specifications of operational as well as stabilised and reclaimed ash ponds or dykes shall be as per the guidelines of the Central Pollution Control Board (CPCB) made in consultation with the Central Electricity Authority (CEA) and these guidelines shall also lay down a procedure for annual certification of the operational as well as stabilised and reclaimed ash pond or dyke on its safety, environment pollution, available volume, mode of disposal, water consumption or conservation in disposal, ash water recycling and green belt, etc. and shall be put in place within three months from the date of publication of this notification:

Provided that up to two operational ash ponds or dykes for thermal power plants commissioned before 31st December, 2021, having installed capacity less than or equal to 1600 MW, and up to four operational ash ponds or dykes for thermal power plants having installed capacity more than 1600 MW, having multiple lagoons, within the specified area from the existing ash ponds or dykes, may be designated with clear demarcation along with coordinates, and shall inform to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 31st March, 2023:

Provided further that one ash pond or dyke shall be permitted in case of new thermal power plants or expansion of existing thermal power plants commissioned on or after 31st December, 2021, which shall inform the details of demarcation along with coordinates to Central Pollution Control Board (CPCB) and concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) within 3 months from the date of commissioning of thermal power plant or by 31st March, 2023, whichever is later:

Provided also that coal and lignite based thermal power plants shall not be allowed to further establish or designate any new operational ash pond or dyke:

Provided also that specification of 0.1 hectare per Mega Watt (MW) of an operational ash pond or dyke shall not be applicable for the thermal power plants commissioned before 03rd November, 2009.".

(2) in paragraph B,-

(i) in sub- paragraph (1), for the words, figures and letters "within 300 kms", the words, figures and letters "within a radius of 300 kms" shall be substituted,

(ii) in sub- paragraph (8), for the words "higher than the price of alternative products", the words, brackets and letters "more than the price mentioned in the Schedule of Rates as specified by Central Public Works Department (CPWD) or concerned Public Works Department (PWD) or price of alternative products, if not mentioned in the Schedule of Rates." shall be substituted.

(3) in paragraph -D, -

(i) for sub- paragraph (2), the following sub- paragraph shall be substituted, namely,-

"(2) Persons or user agencies who have been served notice by owner of thermal power plants, if they have already tied up with other agencies for the purpose of utilisation of ash, shall inform the thermal power plant accordingly, and if they cannot use any ash or may use reduced quantity.".

(ii) after sub- paragraph (2), the following sub-para shall be inserted, namely,-

"(3) Persons or user agencies who have been served notice by manufacturers of ash bricks or tiles or sintered ash aggregate or other ash based products, if they have already tied up with other agencies for the purpose of utilisation of ash based products, shall inform the manufacturer of ash bricks or tiles or sintered ash aggregate or other ash based products, accordingly, and if they cannot use ash based products, or may use reduced quantity.".

2. This notification shall come into force on the date of its publication in the Official Gazette.

[F. No. HSM-9/1/2019-HSM]

NARESH PAL GANGWAR, Addl. Secy.

Note : The principal notification was published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii), dated the 31st December, 2021, *vide* number S.O.5481 (E), dated the 31st December, 2021.

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Annexures-III

Codes and References

1) IS 1498 - 1970 (Reaffirmed 2007): Classification and Identification of Soils for General Engineering Purposes.

2) IS 7894- 1975 (Reaffirmed 2002): Code of Practice for stability Analysis of Earth Dams.

3) IS 8237-1895 (Reaffirmed 2002): Code of Practice for Protection of Slopes for Reservoir Embankment.

4) IS 8816·1978 (Reaffirmed 2002): Guidelines for design of large Earth and Rock filled Dams.

5) IS 9429-1999: Code of Practice for drainage system for Earth and Rock fill Dams.

6) IS 12169-1987(Reaffirmed 1997): Criteria for design of small embankment dams

7) IS10635-2014(Reaffirmed2020): Freeboard requirements in embankment dams – Guidelines

8) Earth and Rock fill Dams by Bharat Singh. H.D Sharma

9) USBR: Design of Small Dams

10) USBR: Earth Manual

11) MoEF&CC- "Gazette notification, SO no.5481(E) 31st Dec.,2021 Part-II, section -3, Sub-section-ii" Ministry of Environment and Forests, Govt.of India, New Delhi.

12) MoEF&CC -Ammendment, SO no.6169(E) 3Oth Dec.,2022 Part-II, section -3, Sub-section-ii" Ministry of Environment and Forests, Govt.of India, New Delhi.

13) Naresh D.N., 2008 "Management of ash disposal", Indian Geotechnical Conference – 2010, GEO trendz December 16–18, 2010 IGS Mumbai Chapter & IIT Bombay.

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15) NTPC 2007: Guidelines for ash disposal management in NTPC stations 2005- Corporate Engineering Division, NTPC.

16) Guidelines for Management of Ash dyke- Corporate Engineering Division, NTPC Ltd.

17) Reclamation potential of ash ponds and future prospects in 2nd International conference on fly ash disposal and utilization. Organized by the Central Board of Irrigation and Power and Fly Ash Mission, Technology, Information Forecasting and Assessment Council, New Delhi, India, 2–4 February 2000.

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