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Reducing Thermal Pollution in Environmental Systems

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CHAPTER-I

INTRODUCTION

1. INTRODUCTION

1.1 LANCO INDIA POWER LTD., PANDANALLUR.

1.1.1 Profile

LANCO India power ltd is operating its power production business spanning three generations. Since its establishment in august 2005 with a wet process thermal power plant at pandanallur near kumbakonam, LANCO power India ltd has been expanding and making itself versatile in the field of power products.

Major supplier of tamilnadu needs, lanco power supplies the "glue" upon which many residential, commercial and engineering projects are used. Lanco power India ltd has established its position in the north tamilnadu by innovatively aligning its supply and services to the needs of power users.

Lanco India power ltd modern, flexible manufacturing plant produces a wide range of power which can be delivered in bulk using reliable transmission line. For over four decades, the lanco India power ltd have produced in the range of 100MW -120 MW without any deviation.

In this company provides combine cycle power plant, which contains both gas and thermal power plants. We can re use gas power plant exhaust by using cascading effort. The gas power plant produced 80 MW power and thermal power plant produced 40 MW powers.

India currently has an installed capacity of 302 GW OF power and achieved about 97 % of the target capacity addition during 12 th five year plants (2012 -2017).The current (FY 16) Energy deficit stands at 2.1 percent and the peak deficit at 3.2 percent.

Coal is projected to remain the dominant fuel for power generation in the country. The market offers an immense potential with the independent power producers (IPP) share in capacity addition of likely to cross 60 % in the near future.

Lanco power division operates with in the lanco groups integrated power value chain .this eco system incorporates (EPC) ,Development, operation and maintenance (O& M),Trading ,transmission and distribution (T&D) and coal mines
.the division contributes 61 % to the groups revenues and 72 % to the EPC order book .

Lanco is one of the very few organisations that offers specialised O & M of thermal power plants ,and has get several bench marks in the area .though the initial goal is to operate group assets ,lanco aims to become the leading O& M specialist with in India and internationally.

Production and maintained international standards. The company has won many laurels for its cement production and has ISO 9001/2008, ISO 14001/2004 and IS 18001/2007 certifications. It has grown steadily from time to time through itsconsistent quality and customer service.

1.2 SPECIALITY OF PRODUCTS & SERVICE

1.2.1 FUEL SOURCES GAIL GAS (GAS AUTHORITY OF INDIA LTD)

The Gail India ltd gas supplied from kuttam. The gas long term contract the power plant .the gas distributed to underground tunnel kuttlam to pandanallur .The gas directly passing the combustion chamber .After that burning gas passing through turbine.

1.2.2 WATER SOURCES TAMILNADU WATER AND DRAINAGE BOARD (TWAD)

Tamilnadu water drainage board to supply the water from kollidam. The TWAD water supplied the power plant. The power plant required full amount of water from kollidam river project. First using the water boiler, condenser, and cooling tower after that exhaust water stored in pond. The water heat and dust partials sediment in the pond, next recycling the water again and again.

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1.2.3 DISTRIBUTION

Production of power combine cycle power plant. The power plant 120 MW power produced the gas and thermal power plant, gas power plant 80 MW power and thermal power plant 40 MW power produced. The power distributed in kattumannar kovil ,Chidambaram, mayiladudthuri ,vaitheeswaran kovil distributed In rural Area.

1.3 FINANCIAL HIGHLIGHTS

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Turn Over - Nett. Including Other Income (Rs. In Lacs)	182184	235605	283188	256556	281431

Table1.1Financial Highlights

1.4 ENVIRONMENTAL POLICY

- To reduce overall emissions and contamination.
- To achieve continual improvement in the prevention of Environmental pollution by adopting suitable technology and Practices.
- To promote Greenery in and around power plant.
- To minimise waste, to promote recovery, and to conserve Natural and energyresources.
- To create awareness among the employees and surrounding Community as to the importance and need for protecting the Environment.
- To reduce loss time by ensuring safe work practices.
- To reduce noise of around plant.

1.5 OBJECTIVES OF THE STUDY

The following are the objectives of this study.

- To study the risk obtained in power plant.
- To study the effectiveness of health and safety measures adopted by LANCO power India ltd ,karuppur ,pandanallur.
- To find out the employees' satisfaction on the safety measures and work environment in LANCO power India ltd, karuppur, pandanallur.
- Suggestion to improve safety according to the technology obtained.

1.6 SCOPE OF THE MODULE

This training Module aims to present the main hazards that are embedded in the power Production processes as well as the risk assessment including the management of the Corresponding risk. The basic principles and the risk assessment methodology are described in training module within which the risk assessment form used in this module, is provided. For every production process a representative Risk Assessment Table has been prepared, while for all the supporting processes there is a description of the hazards as well as an indicative Check List for managing the identified hazards.

1.7 PURPOSE OF THE TRAINING MODULE

The goal of the module is for the participants to have by the end of the course to have Basic realisation of all the main hazards in the power plant .Basic knowledge and experience of the ways in which accidents can be prevented .Basic knowledge for managing risk.

1.8 POWER GENERATION PROCESSS

Almost two third of electricity requirement of the world is fulfilled by **thermal power plants** (or **thermal power stations**). In these power stations, steam is produced by burning some fossil fuel (e.g. coal) and then used to run a steam turbine. Thus, a thermal power station may sometimes is called as a **Steam Power Station**. After the steam passes through the steam turbine, it is condensed in a condenser and again fed back into the boiler to become steam. This is known as ranking cycle. This article explains how Electricity is generated in thermal power plants. As majority of thermal power plants use coal as their primary fuel, this article is focused on a **coal fired thermal power plant**.

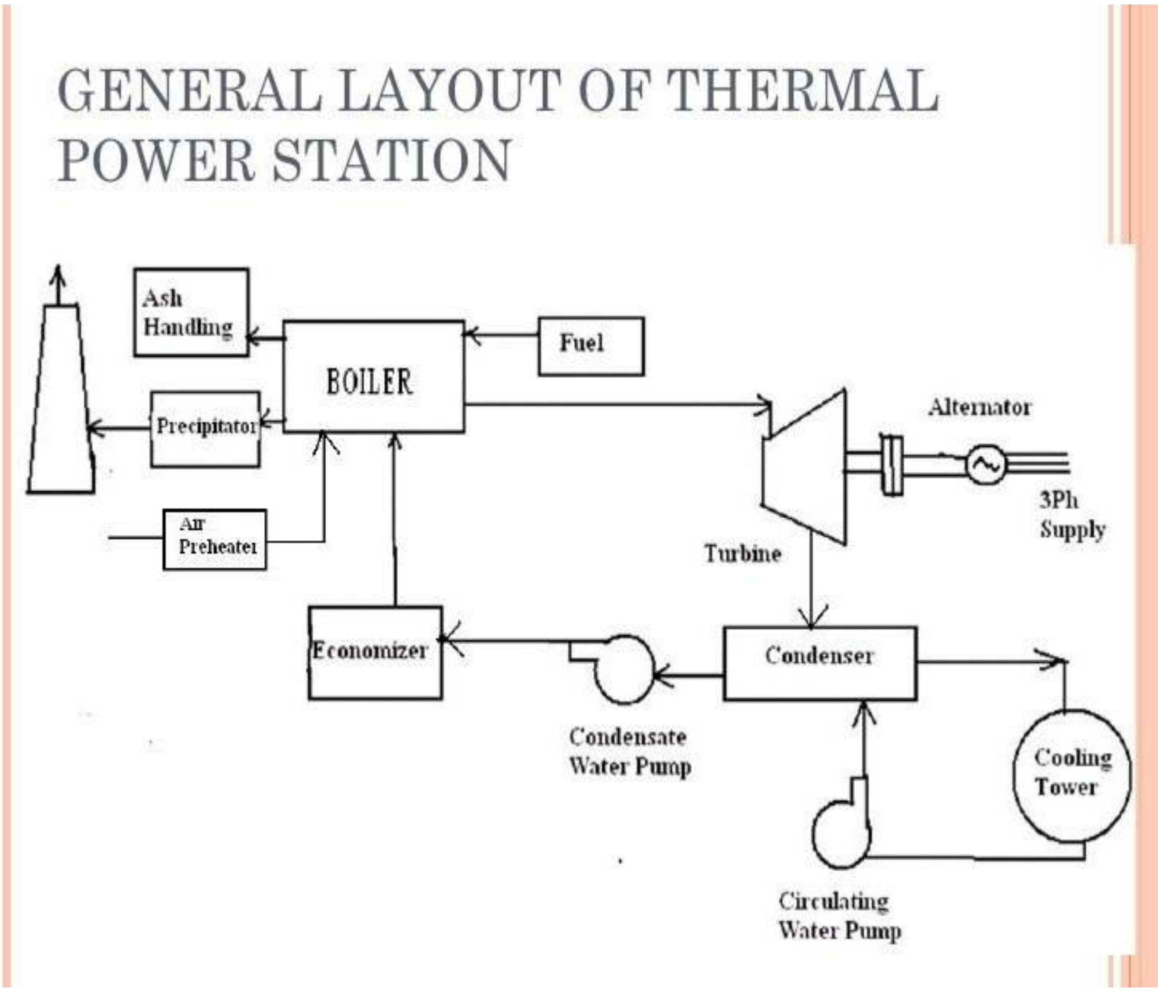

Fig 1.1 Thermal power plant lay out

1.8.1 Coal:

In a coal based thermal power plant, coal is transported from coal

mines to the generating station. Generally, bituminous coal or brown coal is used as fuel. The coal is stored in either 'dead storage' or in 'live storage'. Dead storage is generally 40 days backup coal storage which is used when coal supply is unavailable. Live storage is a raw coal bunker in boiler house. The coal is cleaned in a magnetic cleaner to filter out if any iron particles are present which may cause wear and tear in the equipment. The coal from live storage is first crushed in small particles and then taken into pulverized to make it in powdered form. Fine powdered coal undergoes complete combustion, and thus pulverized coal improves efficiency of the boiler. The ash produced after the combustion of coal is taken out of the boiler furnace and then properly disposed. Periodic removal of ash from the
boiler furnace is necessary for the proper combustion.
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1.8.2 **Boiler**:

The mixture of pulverized coal and air (usually preheated air) is taken

into boiler and then burnt in the combustion zone. On ignition of fuel a large fireball is formed at the center of the boiler and large amount of heat energy is radiated from it. The heat energy is utilized to convert the water into steam at high temperature and pressure. Steel tubes run along the boiler walls in which water is converted in steam. The flue gases from the boiler make their way through super heater, economizer, and air pre heater and finally get exhausted to the atmosphere from the chimney.

1.8.3 **Super heater**:

The super heater tubes are hanged at the hottest part of the boiler. The saturated steam produced in the boiler tubes is superheated to about 540 °C in the super heater. The superheated high pressure steam is then fed to the steam turbine.

1.8.4 **Economizer**:

An economizer is essentially a feed water heater which heats the water beforesupplying to the boiler.

1.8.5 **Air pre-heater**:

The primary air fan takes air from the atmosphere and it is then warmed in the air pre-heater. Pre-heated air is injected with coal in the boiler. The advantage ofpre-heating the air is that it improves the coal combustion.

1.8.6 **Steam turbine**:

High pressure super heated steam is fed to the steam turbine which causes turbine blades to rotate. Energy in the steam is converted into mechanical energy in the steam turbine which acts as the prime mover. The pressure and temperature of the steam falls to a lower value and it expands in volume as it passes through the turbine. The expanded low pressure steam is exhausted in the condenser.

1.8.7 **Condenser**:

The exhausted steam is condensed in the condenser by means of cold water circulation. Here, the steam loses it's pressure as well as temperature and it is converted back into water. Condensing is essential because, compressing a fluid which is in gaseous state requires a huge amount of energy with respect to the energy required in compressing liquid. Thus, condensing increases efficiency of the cycle.

1.8.8 **Alternator**:

The steam turbine is coupled to an alternator. When the turbine rotates the alternator, electrical energy is generated. This generated electrical voltage is then stepped up with the help of a transformer and then transmitted where it is to be utilized.

1.8.9 **Feed water pump**:

The condensed water is again fed to the boiler by a feed water pump. Some water may be lost during the cycle, which is suitably supplied from an externalwater source.

This was the **basic working principle of a thermal power station** and its typical components. A practical thermal plant possesses more complicated design and multiple stages of turbine such as High Pressure Turbine (HPT), Intermediate Pressure Turbine (IPT) and Low Pressure Turbine (LPT).

1.9 Classification of the Hazards in the power plant

In the power production processes there are hazards that can be classed in:

Routine and General Hazards Such As

- Safe behaviour
- Environment, work and passage areas
- Work equipment
- Safety labelling
- Personal Protective Equipment (PPE)
- Manual load handling

Special Hazards during the cement production phases such as

- Dust
- Noise
- Fire
- Emergency response
- Falling equipment
- CO
- CO_2
- NO_X
- H_2S

1.10 Air pollution

Air pollution from thermal power plants primarily comes from the emissions of harmful gases such as sulfur dioxide (SO2), nitrogen oxides (NOx), carbon dioxide (CO2), and particulate matter (PM). These emissions result from the burning of fossil fuels like coal, oil, and natural gas for energy production. Here are the major methods to reduce air pollution from thermal power plants:

1. Flue Gas Desulfurization (FGD):

This method is used to reduce sulfur dioxide emissions. It involves using limestone or other alkaline substances to remove sulfur compounds from theexhaust gases before they are released into the atmosphere.

2. Selective Catalytic Reduction (SCR):

SCR is a technology used to reduce nitrogen oxide (NOx) emissions. It involves the injection of ammonia or urea into the flue gases, which reacts with nitrogen oxides in the presence of a catalyst, converting them into harmless nitrogen and water vapor.

3. Electrostatic Precipitators (ESP):

ESPs are used to remove particulate matter from the exhaust gases. The particles are electrically charged and attracted to collection plates, preventing them from being released into the air.

4. Fabric Filters (Baghouse Filters):

These filters capture particulate matter in the flue gases by forcing them through a series of fabric bags that trap dust and particles.

5. Carbon Capture and Storage (CCS):

This method involves capturing carbon dioxide (CO2) emissions from the power plant's exhaust gases and storing them underground or using them for industrial purposes, thus preventing CO2 from entering the atmosphere.

6. Switching to Cleaner Fuels:

Replacing coal and oil with cleaner fuels such as natural gas, biomass, or renewable energy sources can significantly reduce the pollutants emitted by thermalpower plants.

7. Improved Combustion Technologies:

Upgrading combustion technologies such as fluidized bed combustion (FBC) can improve efficiency and reduce emissions of harmful gases.

8. Regular Maintenance and Monitoring:

Continuous monitoring of emissions and regular maintenance of equipment ensures that pollution control technologies are functioning optimally.

9. Energy Efficiency Improvements:

Increasing the energy efficiency of power plants reduces the amount of fuel burned, leading to a decrease in emissions.

By implementing these methods, thermal power plants can significantly reduce their environmental impact and contribute to cleaner air.

1.11 Water pollution

Water pollution from thermal power plants is primarily caused by the discharge of heated water (thermal effluents), chemicals, and other pollutants into nearby water bodies. This can harm aquatic ecosystems, affect water quality, and disturb local communities. Below are effective methods to reduce water pollution from thermal power plants:

1. Cooling Water Management

Cooling Towers: Instead of discharging heated water into water bodies, cooling towers can be used to cool down the water in a closed-loop system. This reduces thethermal discharge into nearby water bodies.
Closed-Circuit Cooling: A closed-loop system recycles water in the plant, reducing the amount of freshwater withdrawn from rivers or lakes.

2. Effluent Treatment
Effluent Treatment Plants (ETPs): These plants are designed to treat wastewater before it is released into water bodies. ETPs typically remove harmful chemicals, suspended solids, and other pollutants.
Chemical Treatment: Adding chemicals like coagulants or flocculants can help in removing suspended solids and dissolved pollutants from the wastewater.

3. Zero Liquid Discharge (ZLD) Systems
- ZLD systems aim to treat and recycle all wastewater, ensuring that no liquid effluent is discharged into the environment. This method conserves water andprevents pollution.

4. Ash Pond Management
Proper Ash Disposal: Managing the disposal of ash generated by thermal power plants is crucial for water pollution control. Ash ponds can leach pollutants like heavy metals and chemicals into groundwater and nearby water bodies. Properly lined and maintained ash ponds prevent such contamination.
Dry Ash Handling: Switching to dry ash handling systems reduces the risk of water pollution from the wet ash disposal process.

5. Use of Cleaner Fuels
Using cleaner fuels like natural gas, biomass, or renewable energy sources reduces the production of pollutants, including those that contaminate water bodies. For example, reducing the use of coal minimizes the ash content that can pollute water sources.

6. Reducing Chemical Usage
Minimizing or substituting harmful chemicals used in the plant’s operations can reduce chemical contamination in wastewater. This includes reducing the use of biocides, cooling water treatment chemicals, and corrosion inhibitors.

7. Regular Monitoring and Maintenance
Water Quality Monitoring: Regular monitoring of water quality in nearby rivers, lakes, or reservoirs helps detect and address pollution early. Ensuring that dischargemeets environmental standards is essential.
Equipment Maintenance: Proper maintenance of plant equipment ensures that there is minimal leakage of chemicals or pollutants into the water system.

8. Desalination for Water Use
In areas with limited freshwater resources, desalination of seawater for cooling purposes can reduce dependence on freshwater sources and minimize thermal and chemical discharge into local water bodies.

By adopting these methods, thermal power plants can significantly mitigate water pollution, conserve freshwater resources, and protect aquatic ecosystems.

1.12 Noise Pollution

Noise Pollution in Thermal Power Plants refers to the unwanted sound generated by various equipment and machinery in the plant, such as boilers, turbines, generators, cooling systems, and conveyors. This noise can impact the health and well-being of plant workers and nearby communities. Below are some methods to reduce noise pollution in thermal power plants:

1. Soundproofing and Acoustic Enclosures

Enclosures: Installing soundproof enclosures around noisy equipment, such as turbines, compressors, and boilers, can effectively contain the noise. Acoustic barriers can absorb and reduce sound levels before they spread into the surrounding environment.

Acoustic Insulation: Adding sound-absorbing materials to walls, ceilings, and floors of areas with high noise levels helps reduce sound transmission.

2. Vibration Isolation

Anti-Vibration Mounts: Machines like turbines and generators should be mounted on vibration isolation pads or anti-vibration mounts to reduce the transmission of vibrations that lead to noise.

Floating Floors: In areas with high vibration levels, floating floors (which are separated from the rest of the structure) can help reduce the transmission of vibrations and noise.

3. Noise Barriers and Buffers

Sound Barriers: Constructing physical barriers or walls around the plant, especially near residential or sensitive areas, can block the spread of noise.

Vegetation Buffers: Planting trees and shrubs around the plant can serve as a natural sound buffer, absorbing and deflecting noise away from nearby communities.

4. Improved Equipment Design

Low-Noise Equipment: Using newer, quieter equipment and machinery can significantly reduce noise pollution. Many modern thermal power plant componentsare designed to operate more quietly than older versions.

Maintenance: Regular maintenance and lubrication of machinery can help prevent noise caused by worn-out parts or friction.

5. Operational Controls

Limiting High-Noise Operations: Minimizing the operation of high-noise equipment during nighttime or off-peak hours helps reduce the impact on nearbyresidents.

Speed and Load Control: Operating machines at optimal speeds and loads can reduce noise generation. Machines running under heavy load conditions oftengenerate more noise.

6. Personal Protective Equipment (PPE) for Workers

Ear Protection: Providing workers with earplugs or earmuffs in high-noise areas helps prevent hearing damage and reduces their exposure to harmful noise levels.

Noise Monitoring: Regular monitoring of noise levels within the plant ensures that workers are not exposed to excessive noise, helping identify areas where improvements are needed.

7. Community Engagement and Monitoring

Noise Level Monitoring: Regular monitoring of noise levels around the plant site ensures compliance with environmental regulations and helps identify any rising noise pollution trends.

Community Feedback: Engaging with local communities to gather feedback on noise pollution allows the plant to take proactive steps to address concerns and reduce disturbances.

8. Plant Layout and Design Optimization

Strategic Equipment Placement: Proper placement of noisy equipment away from residential or sensitive areas can help minimize noise impact. The design of the plant should consider sound propagation and create buffer zones.

By employing these methods, thermal power plants can reduce noise pollution, protect workers' hearing, and minimize disturbances to nearby communities, ultimately improving the overall environmental and social impact of the plant.

1.13 Thermal Pollution

Thermal Pollution in Thermal Power Plants refers to the release of heated water or air into the environment, typically caused by the cooling process in power plants. This increase in temperature can raise the temperature of nearby water bodies, leading to adverse effects on aquatic ecosystems, biodiversity, and water quality.

Causes of Thermal Pollution in Thermal Power Plants:

1. Cooling Water Discharge: Thermal power plants often use large quantities of water to cool steam produced during the generation of electricity. The heated water is then discharged back into rivers, lakes, or oceans, raising the water temperature.
2. Air Emissions: The release of hot exhaust gases from power plants can contribute to thermal pollution in the surrounding environment.
3. Evaporation Losses: Large cooling towers can cause evaporation of heated water into the air, which may also lead to local temperature increases.

Methods to Reduce Thermal Pollution:

1. Cooling Towers and Cooling Ponds

Cooling Towers: These structures allow water to cool by evaporation before being returned to the water source. This helps lower the temperature of the water discharged back into the environment.

Closed-Circuit Cooling: Using a closed-loop system in which water is continuously reused helps reduce the amount of heated water released into the environment.

2. Efficient Heat Exchangers

Heat exchangers are used to transfer heat from the plant’s exhaust or cooling systems to a secondary cooling medium without directly releasing heated water into the environment. These systems enhance cooling efficiency and reduce thermal pollution.

3. Use of Deep-Well Injection

Instead of discharging heated water into nearby surface water bodies, thermal plants can use deep-well injection systems to safely dispose of or store heated waterunderground, where the heat can dissipate naturally.

4. Cooling Water Recirculation

By implementing recirculating cooling systems, the same water can be used multiple times for cooling purposes. This reduces the overall demand for fresh cooling water and minimizes thermal discharge.

5. Relocation of Discharge Points

By carefully choosing the location of water discharge points, plants can reduce the direct impact of heated water on vulnerable ecosystems. For example, releasing water into deeper or less sensitive areas can prevent immediate harm to aquatic life.

6. Artificial Lakes or Reservoirs

Thermal plants can use artificial lakes or reservoirs to dissipate heat over a larger area. This helps to spread out the thermal load and reduce the temperature rise in a particular area.

7. Switching to Alternative Cooling Methods

Dry Cooling Systems: These systems use air instead of water for cooling, reducing water usage and thermal discharge into the environment.
Hybrid Cooling: Combining wet and dry cooling methods to optimize cooling efficiency and minimize thermal pollution.

8. Improved Power Plant Efficiency

Upgrading plants to operate more efficiently means less heat generation and, consequently, less thermal pollution. Higher efficiency reduces the amount of energy lost as heat and minimizes the thermal burden on the environment.

9. Monitoring and Regulation

Continuous monitoring of water temperatures and surrounding ecosystems helps ensure that thermal pollution remains within acceptable limits. Strict regulatory measures should be implemented to ensure that thermal discharges do not exceed safe levels for aquatic life.

10. Use of Alternative Cooling Technologies

Exploring newer technologies like air-cooled condensers or hybrid air-water cooling systems can significantly reduce water usage and thermal discharges.

By adopting these measures, thermal power plants can significantly reduce thermal pollution, contributing to healthier aquatic ecosystems and reducing negative environmental impacts.

1.14 Soil Pollution

Soil Pollution in Thermal Power Plants is caused primarily by the disposal of waste materials such as fly ash, bottom ash, slag, and other residues generated during the burning of fossil fuels. These pollutants can contaminate soil, leading to the accumulation of heavy metals (like mercury, arsenic, and lead), chemicals, and other harmful substances. Soil pollution can degrade land quality, harm plant life, and enter the food chain, affecting both humans and animals.

Reducing Soil Pollution from Thermal Power Plants:

1. Proper Ash Disposal and Management

Ash Ponds: Thermal power plants typically store fly ash and bottom ash in ash ponds. Proper management of these ponds is critical to prevent seepage of hazardous materials into the surrounding soil and groundwater. Ensuring that ash ponds are lined and well-maintained can help prevent contamination.
Dry Ash Handling: Switching from wet to dry ash handling systems minimizes the risk of leaching harmful

chemicals into the soil. Dry ash is stored and transported in sealed containers, reducing its environmental impact.

2. Use of Ash in Construction and Agriculture

Fly Ash Utilization: Instead of disposing of fly ash, thermal plants can repurpose it for various industrial applications, such as in the production of cement, bricks, or road construction. This not only reduces the volume of waste but also prevents its accumulation in soil.

Agricultural Application: Fly ash can be used in agriculture to improve soil quality and fertility, provided it is free from harmful contaminants. This reduces its environmental impact while promoting sustainable agriculture.

3. Sealing and Containing Waste Materials

Landfill and Waste Containment: If waste materials must be stored on-site, they should be securely contained in landfills with proper liners to prevent contamination. Using impermeable barriers or caps over waste storage areas can help keep harmful substances from leaching into the soil.

4. Revegetation and Land Rehabilitation

Land Reclamation: After ash or waste disposal, plants can rehabilitate the land through revegetation. This restores soil quality and prevents the spread of contaminants. Covering ash disposal areas with soil or vegetation helps reduce dust and prevents the spread of pollutants.

Tree Planting: Planting trees and grasses in ash disposal areas can improve soil structure and prevent erosion, which in turn reduces the movement of ash and contaminants.

5. Regular Soil Monitoring

Soil Testing and Monitoring: Regularly testing the soil around thermal power plants for contamination helps identify potential risks early. By monitoring soil quality, power plants can take corrective measures to address any pollutants that may be accumulating.

Leachate Management: Monitoring and managing leachate from ash ponds and waste storage areas ensures that harmful substances are not leaching into the soil. Proper treatment of leachate helps protect surrounding land.

6. Waste Minimization

Energy Efficiency and Waste Reduction: Improving the overall efficiency of thermal power plants reduces the amount of waste generated. By using cleaner technologies and improving combustion efficiency, the production of ash and other waste materials can be minimized.

Cleaner Fuels: Switching to cleaner fuels, such as natural gas or biomass, can reduce the amount of harmful residues and pollutants in the waste.

7. Pollution Control Technologies

Flue Gas Desulfurization (FGD): Installing FGD systems to reduce sulfur emissions can help prevent the accumulation of sulfur compounds in soil. These systems can reduce the contamination caused by acid rain, which can leach into the soil and affect its quality.

Wet Scrubbing Systems: These systems are used to remove particulate matter and pollutants from flue gases. By controlling emissions effectively, these technologies help reduce the amount of ash and contaminants that are deposited in soil.

8. Comprehensive Waste Management Plans

Integrated Waste Management: Implementing a comprehensive waste management strategy that includes reducing, recycling, and reusing waste materials helps minimize soil pollution. Properly sorting, treating, and storing waste can prevent hazardous substances from contaminating the soil.

By adopting these methods, thermal power plants can significantly reduce soil pollution, leading to improved soil health, reduced environmental impacts, andsustainable land use practices.

1.15 Radioactive Pollution

Radioactive Pollution in Thermal Power Plants typically arises from the use of uranium or thorium as fuel in some types of thermal power plants, especially in nuclear power generation. While conventional thermal power plants (such as those burning coal or natural gas) do not emit significant levels of radioactivity, certain components of the plant may still contain trace amounts of naturally occurring radioactive materials (NORM). For example, coal combustion can release low levels of radioactive substances like radon and uranium. However, the primary concern for radioactive pollution is in **nuclear power plants**, where radioactive isotopes are intentionally used and managed.

Sources of Radioactive Pollution in Thermal Power Plants:

1. Nuclear Fuel Handling: In nuclear power plants, uranium or plutonium fuel rods are used to generate energy. During operation, radioactive isotopes like cesium-137,iodine-131, and strontium-90 can be released.
2. Spent Fuel: After the nuclear fuel is used, the spent fuel contains highly radioactive materials that must be managed and stored safely.
3. Cooling Systems: Nuclear reactors require cooling water systems, and sometimes small amounts of radioactive isotopes can contaminate the cooling water.
4. Leaks or Accidents: Accidental releases due to equipment failure, leaks, or mishandling of nuclear materials can result in radioactive contamination in the environment.

Methods to Reduce Radioactive Pollution in Thermal Power Plants:

1. Waste Management and Storage

Spent Fuel Storage: Proper storage of spent fuel is essential to prevent radioactive contamination. Used fuel is often stored in specially designed pools of water for cooling and radiation shielding or in dry casks after a few years of cooling.
Long-Term Disposal: Developing safe long-term disposal methods, such as deep geological disposal, is crucial for managing high-level radioactive waste generated from nuclear reactors.
Radioactive Waste Treatment: Radioactive waste, including low and intermediate- level waste, must be securely handled and processed. Safe and secure storage facilities are essential for keeping this waste isolated from the environment.

2. Reactor Safety and Containment Systems

Containment Structures: Nuclear reactors are equipped with reinforced containment buildings designed to prevent the release of radioactive materials in the event of an accident or failure. These structures contain the radiation and prevent leaks.
Redundant Safety Systems: To minimize the risk of accidental radioactive release, thermal power plants use multiple safety systems, such as backup cooling systems, redundant reactors, and pressure control systems, which can shut down a reactor safely in case of a malfunction.
Leak Detection: Continuous monitoring for leaks in reactors and cooling systems helps identify and address any issues that might lead to radioactive contamination.

3. Improved Fuel Efficiency

High Burn-Up Fuel: Using advanced fuel technology (such as high burn-up fuel) allows for greater energy

extraction from the same quantity of fuel, reducing the amount of spent fuel generated and the associated radioactive waste.
Fuel Recycling: Some nuclear reactors employ fuel recycling techniques, which involve reprocessing spent fuel to extract usable materials (such as plutonium and uranium) for reuse. This helps reduce the volume of radioactive waste and the need for new uranium extraction.

4. Environmental Monitoring
Radiation Monitoring Systems: Power plants, particularly nuclear facilities, must implement continuous environmental radiation monitoring systems to track radiation levels in the air, water, and soil around the plant. This ensures early detection of any potential radioactive leaks.
Radon Monitoring: Monitoring radon emissions is important, especially in plants that burn coal, as radon gas is a naturally occurring radioactive substance that canbe released during combustion.

5. Decommissioning and Site Cleanup
Decommissioning Nuclear Plants: When a nuclear power plant reaches the end of its operational life, careful decommissioning is necessary to prevent the release of radioactive materials. This involves dismantling the reactor, cleaning the site, and disposing of radioactive components safely.

Radiation Shielding: Proper shielding in reactors and other radiation-producing components prevents the escape of radioactive materials and protects workers and the environment.

6. Use of Alternative and Cleaner Energy Sources
Shift to Renewable Energy: Reducing reliance on nuclear energy by shifting towards renewable energy sources such as wind, solar, and hydroelectric power reduces the risk of radioactive pollution.
Advanced Nuclear Technologies: Developing newer and safer nuclear technologies, such as small modular reactors (SMRs), which are designed with enhanced safety features and less radioactive waste production, can help mitigate the risks associated with traditional nuclear power plants.

7. Public Education and Awareness
Radiation Safety Training: Educating workers and the surrounding community about radiation safety and emergency procedures can help prevent accidental exposure to radioactive materials.
Emergency Preparedness: Developing and regularly updating emergency response plans to handle radioactive releases ensures that both workers and the public are prepared for any unforeseen incidents.

By implementing these methods, thermal power plants, especially nuclear plants, can minimize the risks associated with radioactive pollution and ensure that radioactive materials are handled safely and responsibly. This helps protect the environment, workers, and the surrounding communities from potential harm.

1.16 Light Pollution

Light Pollution in Thermal Power Plants refers to the excessive, misdirected, or obtrusive artificial light generated by the plant's infrastructure, such as its lights on towers, buildings, and other facilities. This light can interfere with the natural environment, wildlife, and the surrounding communities, leading to negative impacts on ecosystems, human health, and the night sky.

Causes of Light Pollution in Thermal Power Plants:
1. Security Lighting: Thermal power plants often use bright floodlights and security lights for the

protection of the facility during nighttime.

2. Operational Lighting: Lights are necessary for operations, maintenance, and visibility, especially during night shifts.

3. Towers and Chimneys: Tall structures in the plant, such as chimneys and cooling towers, are often equipped with powerful lights for safety and aviation warning purposes, which can scatter light into the surrounding environment.

4. Unshielded Lighting: Many lights may not be properly shielded, allowing the light to scatter in all directions, increasing the overall impact on the surrounding areas.

Methods to Reduce Light Pollution from Thermal Power Plants:

1. Use of Proper Lighting Fixtures

Shielded Lights: Install full-cutoff or shielded lighting that directs light downward rather than allowing it to scatter in all directions. This reduces light spill into the skyand surrounding areas.

LED Lighting: Use energy-efficient LED lights that are more focused and can be directed precisely where needed. LEDs also produce less light pollution than traditional incandescent or fluorescent lights.

Motion Sensors: Install motion sensors and timers on security lighting, so lights are only activated when necessary. This reduces the amount of unnecessary light during periods of low activity.

2. Minimize Over-Illumination

Lighting Control Systems: Implement automated lighting control systems that adjust the brightness or switch off lights based on the time of day or activity levels. For example, dimming lights during off-peak hours or when full illumination is notrequired.

Use of Low-Intensity Lighting: Where possible, use lower-intensity lighting in areas that do not require bright illumination. This can significantly reduce light pollution while still maintaining safety and visibility.

3. Strategic Placement of Lights

Focused Lighting: Position lights strategically to illuminate only the essential areas. For instance, direct lighting towards pathways or work areas rather than casting light into open spaces or the sky.

Avoid Overhead Lighting: Minimize the use of overhead lights, which contribute to skyglow (the brightening of the night sky over populated areas).

4. Design and Landscape Considerations

Natural Barriers: Use landscaping elements such as trees or fences to help block or diffuse light from the plant, preventing it from reaching residential or wildlife areas. Building Design: Design buildings and structures to minimize the need for excessive exterior lighting by maximizing natural light during the day and ensuring lighting is well-placed and well-shielded at night.

5. Reducing the Use of Warning Lights

Use of Modern Aircraft Warning Systems: Some plants use aviation warning lights to signal tall structures like chimneys. Modern, low-light-intensity systems can replace traditional high-intensity red lights, which are less intrusive and still meet safety standards.

LED-Based Warning Lights: These are less bright and can be directed more accurately, helping to minimize light pollution while still fulfilling safety requirements.

6. Light Pollution Monitoring

Regular Audits: Conducting periodic audits to assess the effectiveness of current lighting systems and identifying areas where light pollution is most significant. This allows for the implementation of corrective measures in problem areas.

Public Reporting Systems: Set up systems that allow the public and local communities to report any excessive light pollution from the plant. This feedback can help identify and address specific sources of light pollution.

7. Collaboration with Local Authorities

Compliance with Regulations: Adhere to local and international regulations and standards concerning light pollution. Many regions have established limits on the amount of light emissions in certain zones, especially in residential or protected areas.

Community Engagement: Collaborating with local communities to ensure that lighting systems are appropriate for both plant operations and the needs of surrounding areas can help reduce conflicts and ensure responsible lighting practices.

8. Education and Awareness

Staff Training: Train plant staff on the importance of minimizing light pollution and the best practices for using lighting efficiently and responsibly.

Public Awareness Campaigns: Educate the community and plant workers about the impacts of light pollution and encourage measures to reduce it.

By adopting these methods, thermal power plants can significantly reduce light pollution, ensuring that their operations do not negatively affect the surrounding environment, wildlife, and local communities. Reducing light pollution can also improve the quality of the night sky and support the health and well-being of residents near the plant.

1.16. INDIAN BOILER ACT

The Indian boiler act 1923 this law has the following provision

- A boiler cannot be used unless it has been registered with chief inspector of boilers

- The maximum working pressure of the boiler has to be determined by the boiler inspector. He will issue a certificate to this effect. The owner is not allowed to run the boiler at a pressure higher than this, under any circumstances.

- The registration should be renewed on the expiry of the period for which it was granted
- The registration should also be renewed in case of any accident in the boiler
- In case of any accident the boiler owner has to report giving full details of the nature and causes of accident within twenty four hours

- The rules regulations and bye laws governing the up keep and maintenance of boilers the procedure for their registration, inspection and determination of maximum pressure and safety conditions etc. are subjected to revision bya central board under the control of the government of India.

CHAPTER-II LITERATURE REVIEW
LITERATURE REVIEW

2.1 SUMMARY OF THE LITERATURE REVIEW

XIE Qiyue, Wang, Xiaoli , **(**July 27-29, 2016,**):" Pulverized Coal in Primary Air Pipe of Thermal Power Plant Boiler"** The quality of the coal fed to the boiler in thermal power plant is significant to the running efficiency and the safety of the boiler. In order to guarantee the efficiency and the safety, it is necessary to measure accurately the quality of the coal. However, the quality of the coal is not stable and cannot be measured online, which causes many problems. Therefore, a prediction model based on support vector regression (SVR) is proposed for the carbon content of pulverized coal in this paper. Firstly, main auxiliary variables are selected through correlation analysis and the data is pre processed with normalization. Secondly, the optimal kernel function is determined through comparative analysis for different kernel functions and model parameters are determined by using grid search method. Thirdly, the SVR model is constructed through 5 steps and its training results are analyzed. Finally, the obtained model is tested by using the industrial running data and the predicted results using the SVR model are compared with these obtained by using the BP-ANN model. The results show that the SVR model is more accurate, holds better performance of promotion, and can predict the carbon content of coal boiler of the duct pulverized well

Liu He, Wang Ya-jing: Publisher titile**"Evaluating the Safety of Thermal Power Plant via Grey Clustering"** —A method of employing grey clustering to evaluate the safety of thermal power plant was proposed. The safety class of thermal power plant was classified for five grades. The feature space, which represented safety characteristics of thermal power plant, was put forward. The concrete evaluation contents of feature space were provided. The feature vector value to evaluate safety of thermal power plant was got by Delphi's method.
Improved grey clustering based on triangle white negation function was used to cluster feature vector. Membership degrees belonged to each classification and grey variable weight clustering coefficients were calculated and the safety level of thermal power plant was finally confirmed. The results show that the method can effectively classify the safety level of thermal power plant and provide a way of evaluating safety of thermal power plant.

J.A. Hole, Mukesh Pand : In this article **"Worker Productivity, Occupational Health, Safety and Environmental Issues in Thermal Power Plant."** -The main objective of this research was to identify factors that affected worker productivity, occupational health and safety in thermal power plant in Maharashtra. Thirty production managers participated in the study. Fifty-two percent of the managers reported hot environmental conditions, 30% reported noisy environment, and 26% reported lack of resources and facilities. Managers received worker complaints of fatigue, back pain, upper body pain, hand and wrist pain and headaches. Management (85%) acknowledged not having knowledge or access to ergonomics information. Ninety percent of the companies did not carry out ergonomic assessments. A significant correlation ($p < 0{:}01$) was found among productivity indicators and health and organizational attributes. Lack of skills in ergonomics and training, communication and resources are believed to be some of the factors contributing to the poor ergonomic conditions and consequent loss of worker productivity and reduced health and safety in the Thermal Power plants.

CHAPTER-III PROBLEM DESCRIPTION

3. PROBLEM DESCRIPTION

3. 1 WATER POLUTION PROBLEMS

Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily. An estimated 580 people in India die of water pollution related illness every day. About 90 percent of the water in the cities of China is polluted.

As of 2007, half a billion Chinese had no access to safe drinking water In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems. For example, in the most recent national report on water quality in the United States, 44 percent of assessed stream miles, 64 percent of assessed lake acres, and 30 percent of assessed bays and estuarine square miles were classified as polluted.

The head of China's national development agency said in 2007 that one quarter the length of China's seven main rivers were so poisoned the water harmed the skin.

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

3.1.1 Cholera

Bacteria called 'vibrio chlorae' cause a small intestinal disease known as cholera. Symptoms of cholera include diarrheal and vomiting, as well as abdominal cramps and headache.

3.1.2 Malaria

Malaria is a disease caused by parasites, which are spread by female mosquitoes called Anopheles. Mosquitoes breed in water, and whenthey bite a person infected with malaria, they can spread the infection to other people.

Symptoms of malaria include fever, headache and shivering. In severe cases, it can even lead to complications like pneumonia, severe anaemia, coma and death.

3.1.3 Typhoid Fever

This common bacterial infection affects around 12 million people annually. It is caused by the ingestion of contaminated food and water.
Symptoms include nausea, loss of appetite, and headache.

Factious diseases caused by **pathogens** (usually microorganisms) from animal fecal origins, of which the most common occur in developing countries,including:

- Typhoid
- Giardiasis
- Amoebiasis

- Ascariasis
- Hookworm

Diseases caused by **polluted beach water**, including:

- Gastroenteritis
- Diarrhea
- Encephalitis
- Stomach cramps and aches
- Vomiting
- Hepatitis

- Liver damage and even cancer (due to DNA damage) – caused by a series of chemicals (e.g., chlorinated solvents, MTBE)
- Kidney damage caused by a series of chemicals
- Neurological problems **-** damage to the nervous system – usually due to the presence of chemicals such as pesticides (e.g. DDT)
- Reproductive and endocrine damage including interrupted sexual development, inability to breed, degraded immune function, decreased fertility and increase in some types of cancers – caused by a series of chemicals including endocrine disruptors
- Thyroid system disorders (a common cause is exposure to per chlorate, which is a chemical contaminating large water bodies such as the Colorado River)
- Increased water pollution creates breeding grounds for malaria-carrying mosquitoes, which kill 1.2-2.7 million people a year
- A series of less serious health effects could be associated to bathing in contaminated water (i.e. polluted beach water) including:
  - Rashes
  - Earaches
  - Pink eyes

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CHAPTER-I V METHODOLOGY

4.1 EFFLUENT TREATMENT PLANT

- The water is basic necessity of life used many purpose one of whichindustrial use
- Industries generally take water from rivers and lakes but they have to payheavy taxes for that
- So necessary them recycling that reduce the cost and also conserve it Considering the criteria an effluent treatment plant is also being established in Rourkela steel plant
- The main function of ETP is to clean CGP effluent and recycling and furtheruse

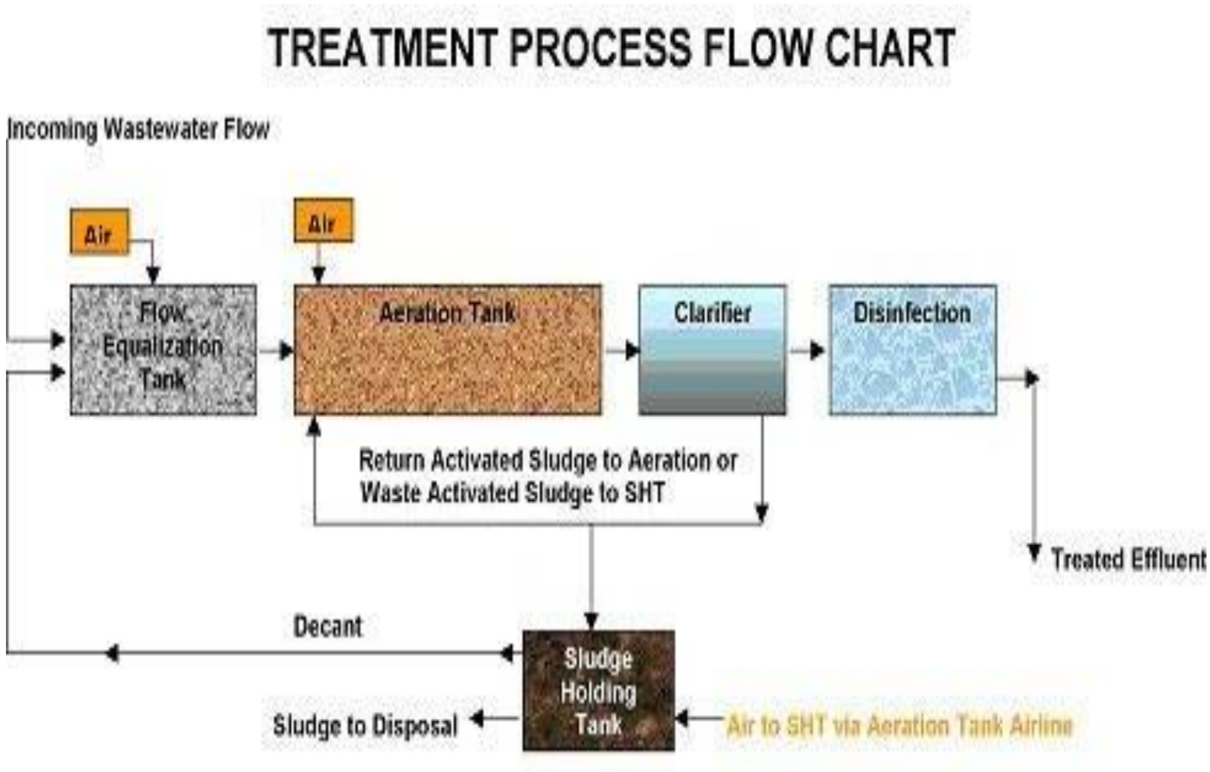

Fig 1.2 Treatment process flow chart

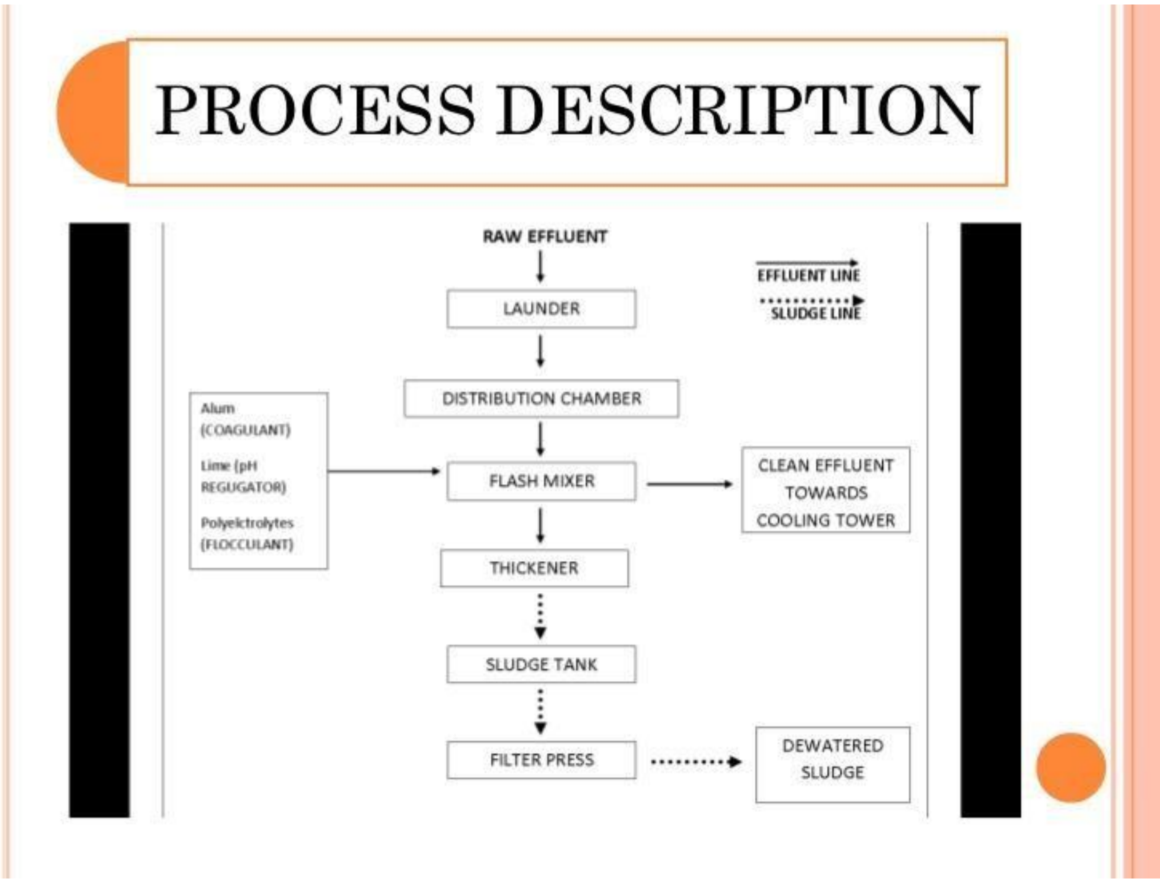

Fig 1.3 Process description

4.1 Inlet launders

- The purpose of launder is to flow the effluent of gas scrubber to distribution chamber.
- The inlet cannel designed for a surge flow of 950 m^3/hr.
- Self cleaning velocity that velocity at which is the sludge flows will not accumulated in launder.

4.2 Distribution chamber

- The purpose of distribution chamber is divided the flow in toequal.
- In case the one of the thickener is closed than would be nodistribution
- The size of gets designed such that there it is equal distributionlayer

4.3 Flash mixer

- In flash mixer alum (coagulate) acts up on sludge .so that suspended solid settle down .the addition of ph also raised by lime to required have 7-9.

4.4 Clarifier:

- The clarifier to separate the treated slurry from clean water

Slurry settled down and cleans water top flows down the cooling water where it cooled and recycles

- Finally slurry pumped in slurry tank

4.5 Sludge tank

- The main purpose of tank is to hold sludge for transfer to filterprocess
- From sludge tank sludge is pumped to filter press by filter pressFeed pump.

CHAPTER-V RESULT AND DISCUSSION

5. RESULT AND DISCUSSION

5.1 WATER POLLUTION CONTROL THE THERMAL POWER PLANT

- Reduced ash from power plant
- Reduce the exhaust water to mixed to river, lake, and pond

5.2 PERMISSIBLE STANDARED IN INDIA

S NO	PARAMETER	permissible limits (disposal to inland surface water)
1	PH	5.5
2	TSS	100 mg/l
3	OIL & GREASE	10 mg/l
4	BOD	30 mg/l
5	COD	250 mg/l

Table 1.5 Permissible standards in India

CHAPTER-VI CONCLUSION

6.1 CONCLUSION

There is more than one billion people in the world have no access to safe drinking water and more than two billion people worldwide who don’t have proper sanitation systems. Water purification is one of the solutions for water pollution
.millions of people worldwide could by saved if people used chlorination , filtration

,and solar disinfection to treat water at their homes.

Contamination of ground water was reported from nearly from nearly 90% of the clusters contamination where reported where mostly found in phreatic aquifers presence of other basic elements in excess of permissible limit like salinity may be due to geogenic causes.

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