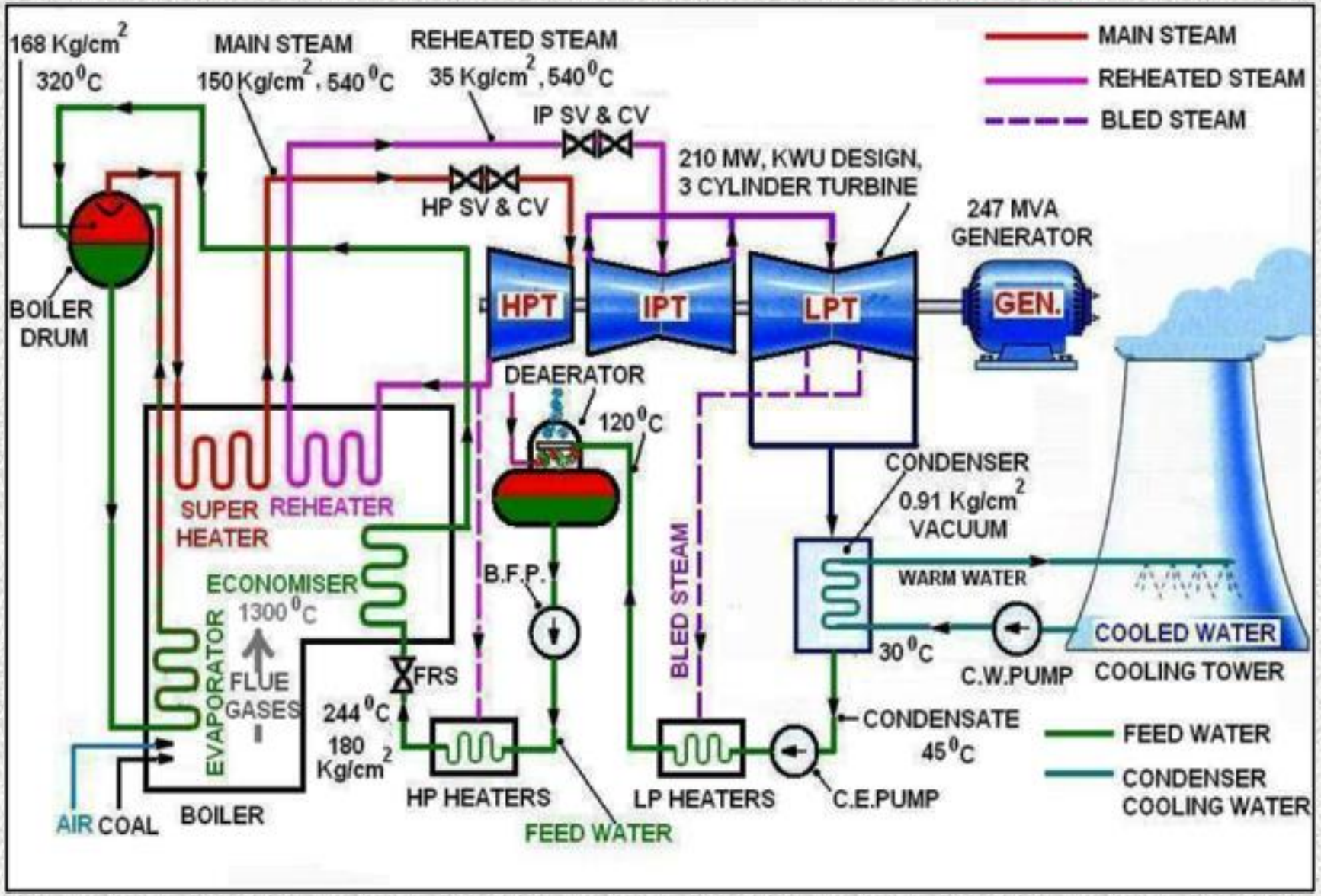
FUNCTIONING & ROLE OF A COOLING TOWER IN POWER PLANTS



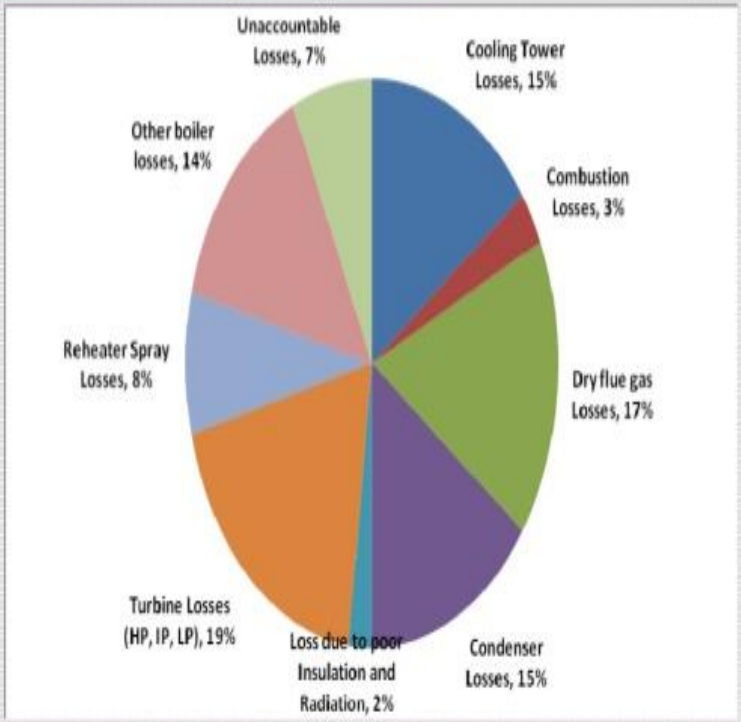
U.N. BHUPAL
Cooldeck

FACTORS AFFECTING HEAT RATE

Major Reasons for Higher Gross Heat Rate in India

- 1. Low combustion efficiency lead to high carbon loss.
- 2. High force outages due to failure of boiler tubes.
- 3. Poor performance of milling system.
- 4. Lack of Maintenance planning and spare planning
- 5. Low turbine cylinder efficiency
- 6. High dry gas losses due to high unwanted excess air
- 7. Poor sealing and heat transfer in air pre-heaters
- 8. Low condenser vacuum.
- 9. High air ingress in the boiler and high heat loss due to poor insulation
- 10. Poor Performance of ESP lead to failure of ID fan and low availability.
- 11. High cooling water inlet temperature due to poor performance of Cooling Tower.
- 12. Non availability of quantity and quality coal.
- 13. High auxiliary power consumption .
- 14. Obsolete C&I system .
- 15. Poor quality critical valves lead to passing and poor control

Section wise losses in a particular thermal power plant



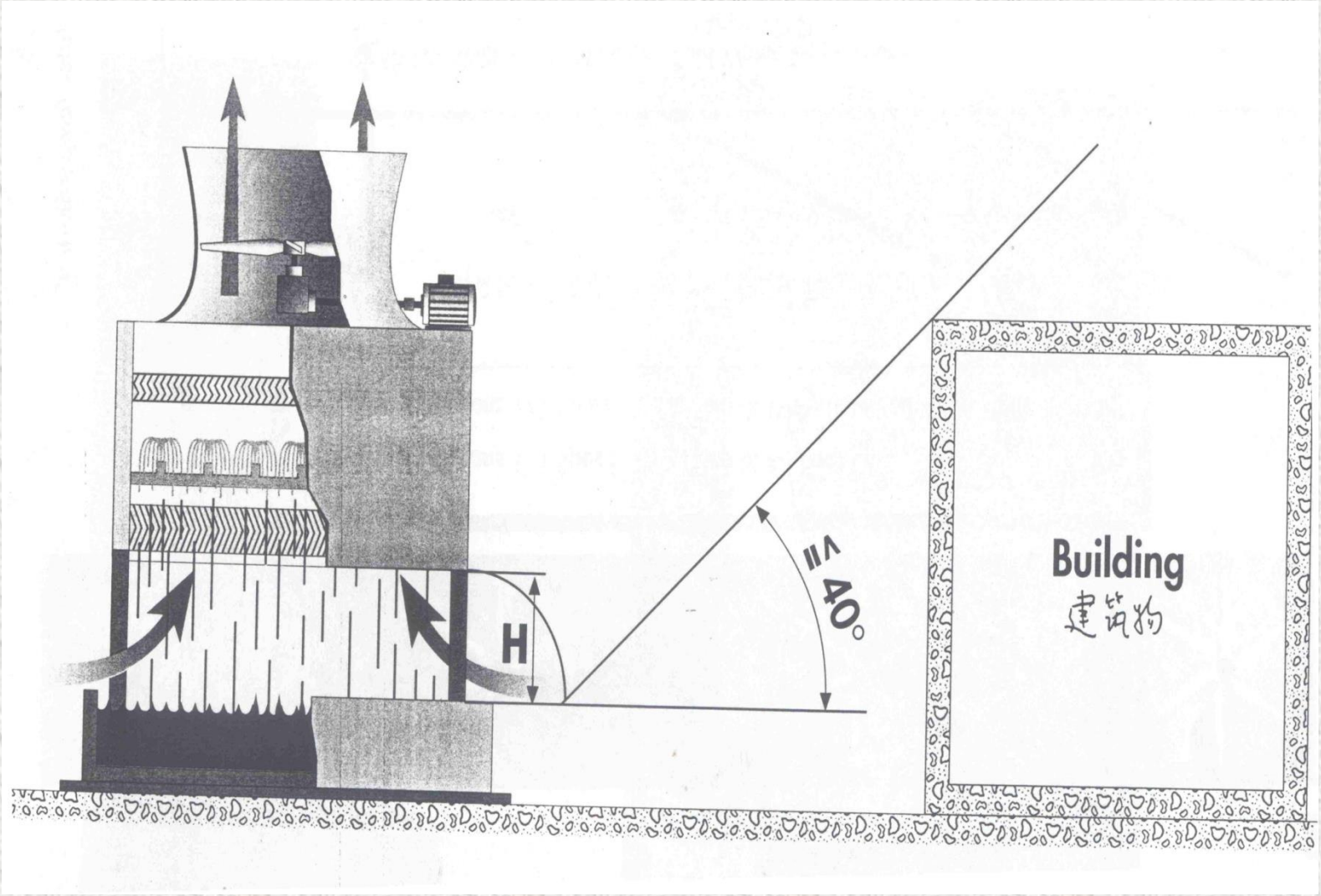
REASONS FOR COOLING TOWER PERFORMANCE SHORTFALL

- Original design shortfall/under-sizing
- Erroneous specification of thermal duty parameters, especially WBT and RH (RH consideration applies only for NDCTs)
- Erroneous specification of recirculation allowance
- Unknown/Unproven fill characteristics
- Improper tower design/pressure drop estimates
- Wrong choice of Fill
- Improper design of distribution system
- Poor Fan Performance
- Obstructions around air inlet
- High % obstructions inside the cooling tower
- Interference from nearby cooling towers
- Absence of a water treatment program
- Fouling/Scaling/Bio-growth/Choking of Fill & Distribution System

OBSTRUCTION TO THE AIR INLET

OBSTRUCTION TO THE AIR INLET

FREE SPACE AROUND COOLING TOWER AIR INLETS



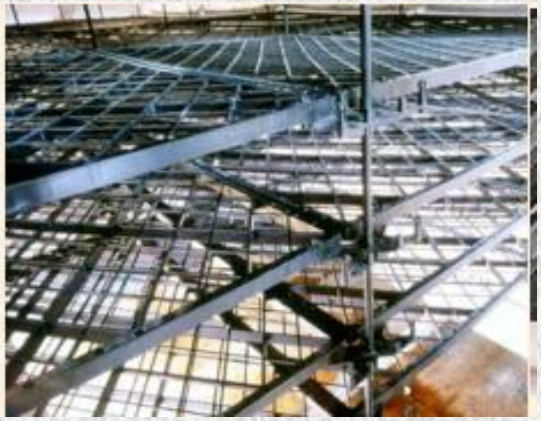
COMMONLY USED COOLING TOWER FILLS

Cross-Fluted Film Fill

Straight-Fluted Film Fill

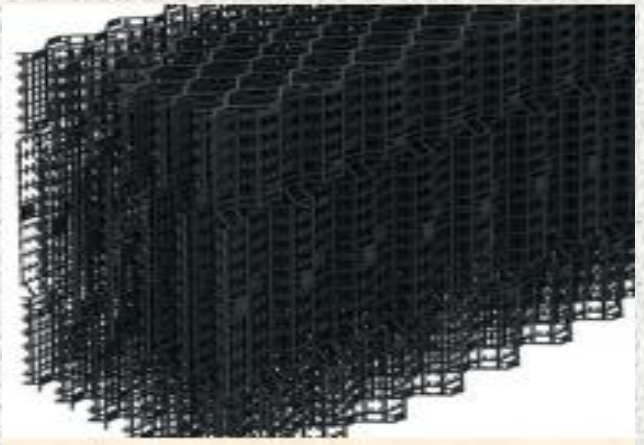
Offset-Fluted Film Fill

Splash Grid



V Bar

Cross-Fluted Trickle Grid

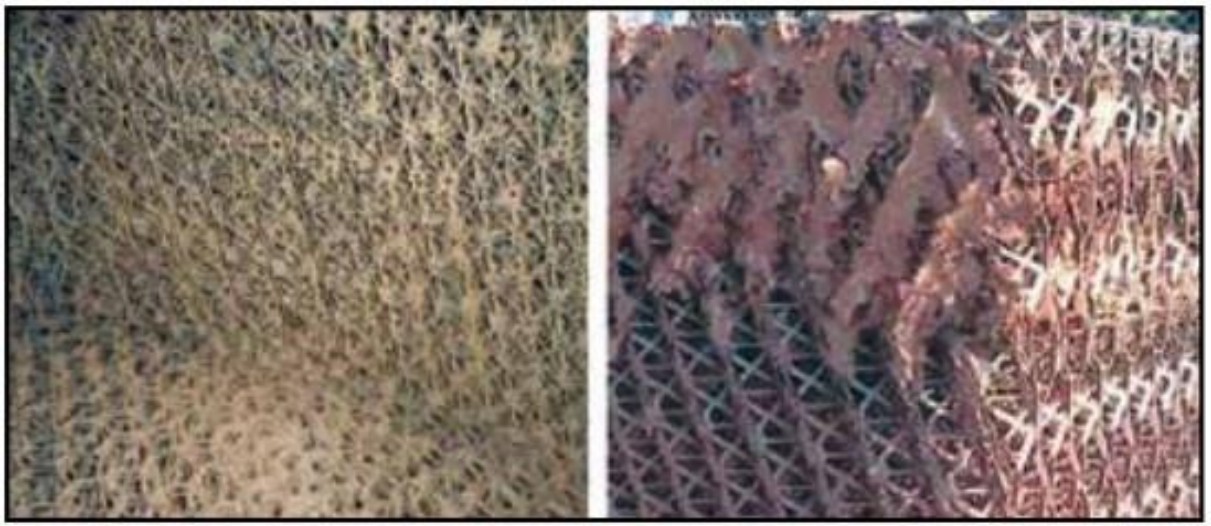


Offset-Fluted Trickle Grid

CHOKED V BAR FILLS

CHOKED SPLASH GRID FILLS

CHOKED TRICKLE GRID & FILM FILLS



OIL IN COOLING TOWER BASIN

CHOKED ADAPTER AND NOZZLE

STORED OIL CANS AND OIL SPILL ON ROOF DECK

AIR BYPASS FROM ACCESS DOOR

Poor workmanship in fixing the access door

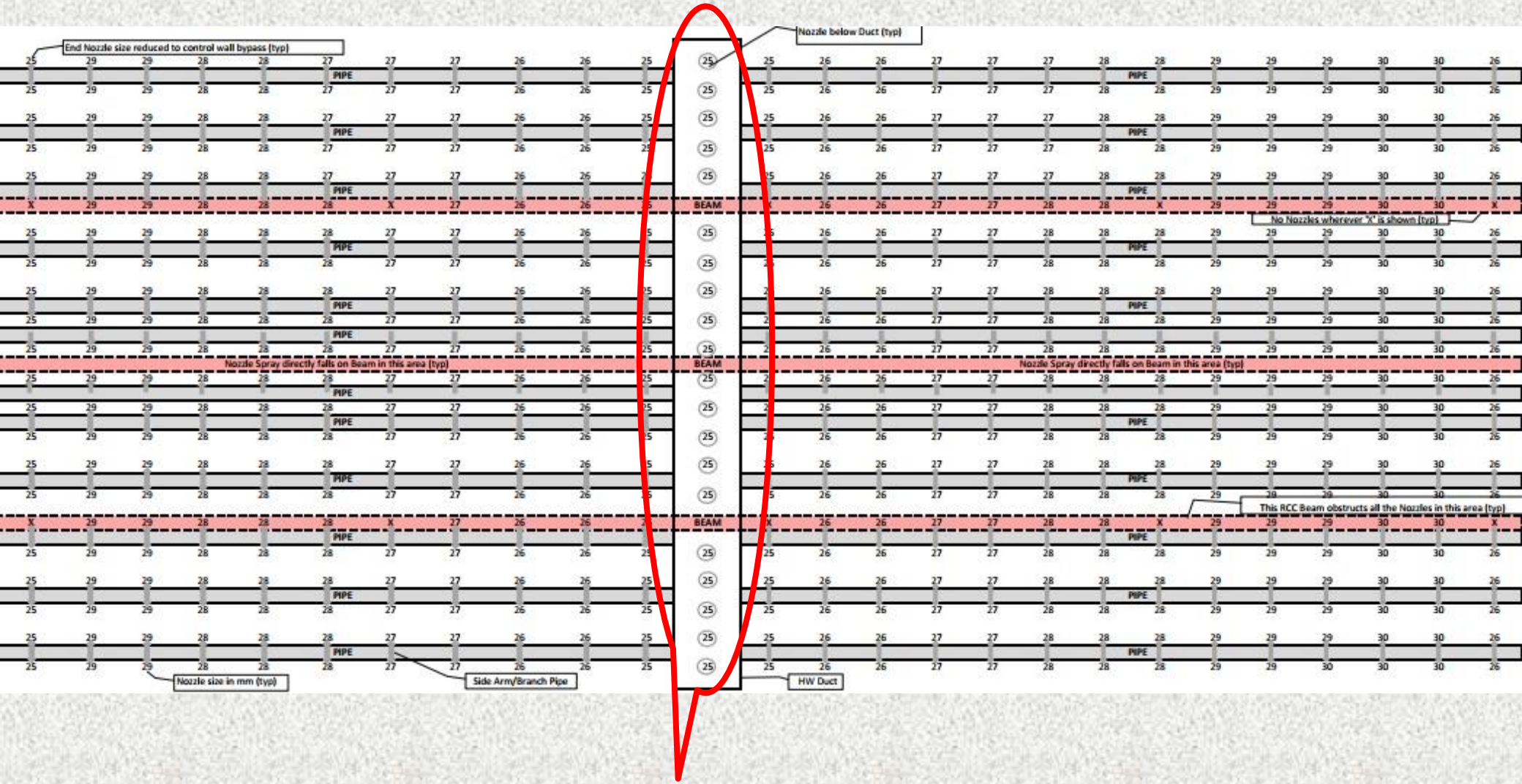
DISCOLORATION DUE TO OIL IN WATER

FOULED/CHOKED DRIFT ELIMINATORS

IMPROPER DESIGN OF DISTRIBUTION SYSTEM

Complete Fouling of Nozzles with Support Beam

MODIFIED DISTRIBUTION SYSTEM



Off-center Duct (unequal pipe lengths on either side)

PERFORMANCE IMPROVEMENT POSSIBILITIES

- **For New Towers**

a. Specify the ambient duty conditions after performing a statistical analysis of the Indian Met data as per ASHRAE or other standard industry guidelines

b. Finalize the layout of the cooling towers and the recirculation & interference allowances as per CTI bulletin PFM-110 recommendations

c. Specify design requirements/procedure as per the thermic design guidelines of BIS sub-committee CED 38.1.2 for IDCTs and NDCTs

d. Specify the right fill based on circulating water quality after engaging with fill manufacturers on water quality guidelines

e. Ensure that the fill performance characteristics being proposed by bidders/contractors are based on laboratory/pilot tests

f. Rain zone and Spray zone heat transfer should preferably be ignored in IDCT designs, which means that the KaV/L demand from the thermal duty must be met entirely by the fill

g. Spray zone heat transfer should preferably be ignored in NDCT design, which means that the entire KaV/L demand from the thermal duty must be met by the fill and rain zones

- **For Refurbishment/Upgradation of Existing Towers**

a. Get the thermic design evaluated as per BIS guidelines to begin with, as a minimum base guideline

b. Get the tower inspected thoroughly for fouling/choking/scaling/bio-growth and general condition assessment

c. Get the tower tested at site as per ATC-105 guidelines to evaluate thermal performance in its current condition

PERFORMANCE IMPROVEMENT POSSIBILITIES

e. Get the fouling/scaling/choking material tested in a lab to know its constituents so that a detailed water treatment program, as may be required can be established through either an in-house lab or a third-party water treatment company.

f. If design shortfall in thermal design is found out, determine whether it is because of design deficiency or fouling/scaling/choking.

If condition is the determinant, a custom-made water treatment program should improve tower performance.

And if original design shortfall is the main reason, consider replacing existing fills with an alternative fill of superior performance characteristics. This is especially true, if the existing fills are of V bar or Splash Grid type that can be replaced with the new age Trickle Grid or Off-set type of modular fills for substantially improved performance.

f. In certain cases, replacement of fills will warrant an increase in air inlet height that can be achieved by partially breaking the cladding wall up to the next beam level.

g. A good custom-made O&M program is a pre-requisite for continued thermal performance of cooling towers.

THANK YOU