

**LARA SUPER THERMAL POWER PROJECT  
LOCAL MANAGEMENT INSTRUCTION**

**"Optimization of Water Consumption in Ash Handling  
System"**

***LMI 20/R0/OPN/COS-ISO-00-OGN/OPS/SYST/004***



All locations are required to comply with this Directive

Approved for Implementation by .....  
HOP(LARA)

Date : ..... 26/6/18

Enquiries to : HOD(Operation)

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|    |                        |                                                                            |                                                                    |
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# **"OPTIMIZATION OF WATER CONSUMPTION IN ASH HANDLING SYSTEM"**

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## 1.0 Introduction

Bottom Ash is being evacuated by conventional hydro ejectors method during operation of power stations. The bottom ash from boiler and economiser ash collected in Economiser hopper is evacuated by employing clinker grinder. The fly ash from ESP hoppers (which constitutes about 80% of total Ash generated) is evacuated by using Vacuum Pumps in Dry Ash evacuation. The dry ash evacuated can be sent to either Dry ash silos or to HCSD silo, from which ash is discharged to Ash Dyke in Highly Concentrated Slurry form.

All the above systems, except Dry Ash collection, require mixing of water with ash for conveying it to Ash Dyke.

## 2.0 Documents :

Superseded documents: Nil

Reference documents: COS-ISO-00-OGN/OPS/SYST/004 Rev. No. : 0 January 2001

## 3.0 Need for optimisation of water consumption

3.1 The concentrations at which bottom ash and fly ash are being transported vary between 10 to 65 % by weight. This can become uneconomical due to increase in the cost of water & hydraulic transportation. Hence consumption of water in ash slurry has direct impact on pump power, therefore, optimum use of water will definitely reduce the O&M cost.

3.2 Large variations in designed and actual values of ash water ratio are observed in NTPC generating stations.

## 4.0 Methods for minimising water consumption

During evacuation and disposal of bottom/fly ash, excess quantity of water is used in making ash slurry thus exceeding the designed value of ash water ratio. Efforts must be made to minimise water consumption as far as possible. Even 10-15% reduction in water consumption will save lot of money by stopping either of ash water pumps or ash slurry pumping series.

In NTPC, Lara the free falling ash from boiler furnace is collected and stored in a '3 V' shaped water impounded bottom ash hopper provided (with water jet provided for disposal of ash crushed by clinker grinder) below the boiler furnace for its periodic removal twice in a shift of eight (8) hours per Unit. Bottom ash will be removed twice in a shift of eight (8) hours in approx. 90 min. per Unit including 5 (5) minutes for starting, stopping, sequential changeover from one unit to second unit and water flushing of the line.

Two outlet of each HCSD Silo is provided with independent High concentration slurry disposal system. The HCSD System shall take fly ash input from HCSD Silos and dispose it continuously as high concentrated slurry to ash disposal area with 55-65% ash concentration. Water is added in mixing tank with moist ash in

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a controlled manner through continuous automatic "Instrument Based" monitoring system to ensure that the basic slurry parameters remain constant during the transportation of slurry through the pipe line.

The pump speed shall be varied through VFD drive over the range of 10% to 100% of maximum flow rate. Necessary remote and manual speed control provision is there. There are six nos. of dedicated transformer to feed the power supply to VFD and after VFD to HCSD motor for six nos. HCSD pump.

Responsibility: UCE/SCE

The sources of excess water consumption and method to control water consumption are described as below:

- 4.1 After completion of emptying Bottom ash hopper and flushing of Bottom ash lines action must be taken to stop BAHF whenever possible to avoid extra water going to Ash slurry pump house.

Responsibility: UCE/SCE

- 4.2 Optimisation of water just after filling the bottom ash Hopper reduces wastage of water & pumping power. Optimizing of water consumption in bottom ash seal trough area by control of water flow through make up. Stop bottom ash hopper filling after ensuring hopper overflow.

Responsibility: UCE/SCE

- 4.3 The designed maximum concentration of B.A. and HCSD ash slurries when being handled independently should be as under:

- a) Bottom Ash {B.A.) 12.5% {w/w)
- b) Fly Ash {HCSD) 55% to 65% {w/w)

Responsibility: UCE/SCE

## 5.0 Measurement of ash water consumption

The measurement of water consumed for making ash slurry is ash/water ratio weight/volume{w/m<sup>3</sup>). Ash water sample to be collected from HCSD pump discharge/Ash mixing tank for fly ash & Ash slurry sump /ash slurry discharge line for bottom ash on weekly basis.

Responsibility: AGM (CHEM)/AGM (EEMG)

## 6.0 Saving of pumping power

### 6.1 Slurry Disposal Pumps

By minimising water consumption in making ash slurry, one pumping series can be stopped for certain duration by operating the pump series with increased speed. The first stage of slurry disposal pumps is provided with hydraulic coupling

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for setting the optimum operating speed of the pumps based on actual site requirements.

Responsibility: UCE/SCE

## 6.2 Ash Water Pumps (HP/LP Pumps)

2 Nos HP and 3 Nos LP Pumps (including one standby) are provided for ash slurry extraction and disposal. With the reduction in water consumption in ash handling system, one or two HP/LP pumps can be stopped (continuous or intermittently) thus saving in auxiliary power consumption (during low load periods). This condition can be achieved more effectively by ensuring arresting of all the leakages (in valve glands and piping) in the system and with proper control of slurry concentration.

The operating engineers have to play a vital role in implementing the above operating modes.

Responsibility: UCE/SCE/ AGM(AHP-maint)

## 7.0 Operation and maintenance practices

7.1 System designed to operate intermittently, are being operated continuously thus defeating the O&M flexibility provided in the system.

7.2 The following are the few suggestions for saving the water consumption.

| S.N. | Existing Practice                                                                                                        | Suggested action for saving water consumption                                                                                                                                                                        | Responsibility                    |
|------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1.   | <b>Bottom Ash Handling</b>                                                                                               |                                                                                                                                                                                                                      |                                   |
| 1.1  | Use of excess number of jetting nozzles, nozzles with worn out nozzle size and improper angle of fixing in sluice trench | <ul style="list-style-type: none"> <li>Optimize number of jetting nozzles.</li> <li>Periodic replacement of nozzles irrespective of unit shut downs.</li> <li>Periodic adjustment of nozzle fixing angle.</li> </ul> | AGM(AHM)                          |
| 1.2  | Even in case of unit shutdown, water valves are kept open when there is no ash evacuation.                               | In case of unit shutdown and when ash is not being evacuated, proper exercise of control of water flow is to be done.                                                                                                | UCE/Control engr(OPN)             |
| 1.3  | Hydro-ejector valve passing observed when no ash evacuation is taking place.                                             | Valve passing to be checked in every shift and to be attended timely                                                                                                                                                 | UCE/Control engr(OPN)<br>AGM(AHM) |
| 1.4  | Make up and over flow control valves are kept fully open continuously.                                                   | Regulated water flow as per requirement.                                                                                                                                                                             | UCE/Control engr(OPN)             |

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|           |                                                                                                                                                                                                                                                |                                                                                                                         |                                           |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1.5       | Defective Hopper flushing nozzle causes unbalance flow in water                                                                                                                                                                                | Periodic replacement of hopper flushing nozzles and adjustment of nozzle fixing angle to be done as per the requirement | AGM(AHM)                                  |
| 1.6       | Water pressure in bottom ash handling is observed to be low.                                                                                                                                                                                   | High pressure water to be provided for bottom ash evacuation.                                                           | AGM(AHM)/<br>AGM(OPN)                     |
| 1.7       | Optimization of flushing nozzles size in ECO hoppers flushing apparatus.                                                                                                                                                                       | System should be operated as per design requirements.                                                                   | AGM(AHM)                                  |
| <b>2.</b> | <b>Fly Ash Handling</b>                                                                                                                                                                                                                        |                                                                                                                         |                                           |
| 2.1       | Seal water of standby vacuum pumps which are not in service also kept open                                                                                                                                                                     | Standby vacuum pump seal water line to be kept closed.                                                                  | UCE/Control<br>enr(OPN)                   |
| <b>3.</b> | <b>General</b>                                                                                                                                                                                                                                 |                                                                                                                         |                                           |
| 3.1       | Ash water ratio in Bottom Ash {B.A.}12.5% {w/w} & Fly Ash {HCSD} 55% to 65% {w/w} is measured once in a month and regular water balance check is not done.                                                                                     | Ash water ratio to be measured weekly and water balance study to be done monthly.                                       | AGM<br>(Chem/EEMG<br>)                    |
| 3.2       | Leakages are common from valve glands and in ash pipelines at some locations.                                                                                                                                                                  | All leakages to be arrested immediately without waiting for unit shutdowns wherever it is possible.                     | AGM(AHM)<br>AGM(OPN)                      |
| 3.3       | Systems designed to operate intermittently are being operated continuously. Storage capacity as envisaged in design is not fully utilized for Bottom Ash hoppers and ESP hoppers. Thus O&M flexibility provided in the system is not utilized. | System should be operated as per design requirements.                                                                   | AGM(OPN)                                  |
| 3.4       | Feed gate passing left un attended                                                                                                                                                                                                             | To be checked in every shift and any passing in feed gate to be attended immediately wherever it is possible.           | AGH(AHM)                                  |
| 3.5       | The following tanks are to be prevented from overflowing<br>1. Bottom ash over flow tank<br>2. Settling tank / surge tanks<br>3. Ash water tank<br>4. Seal water OH tank (for ASP series)                                                      | If make up valve provided with auto operation its healthiness to be ensured.                                            | UCE<br>/Control<br>enr(OPN)<br>AGM(C & I) |

**8.0 Records:** All activities will be recorded in UCE/AHP control engineer in log books to ensure conformity.

**9.0 Review:** The GM (O & M), will be responsible for reviewing this document on a 2 -yearly basis or as necessary.

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**10.0 Distribution list:**

| SL NO. | DATE OF ISSUE | ISSUED TO              |
|--------|---------------|------------------------|
| 1      |               | GM (O&M)               |
| 2      |               | AGM (OPERATION)        |
| 3      |               | GM(MAINT)              |
| 4      |               | AGM (CHEM)             |
| 5      |               | AGM (AHP)              |
| 6      |               | AGM ( C & I)           |
| 7      |               | AGM (EEMG)             |
| 8      |               | LARA INTRANET HOMEPAGE |

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## DOs &amp; DON'Ts

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**Do's for optimising ash water consumption wherever it is possible.**

- After completion of emptying Bottom ash hopper and flushing of Bottom ash lines stop BAHP.
- Optimize water consumption in bottom ash seal trough area by control of water flow through make up.
- Stop bottom ash hopper filling after ensuring hopper overflow.
- By minimising water consumption in making ash slurry, one pumping series can be stopped for certain duration by operating the pump series with increased speed.
- Additional HP/LP pumps can be stopped (continuous or intermittently) thus saving in auxiliary power consumption (during low load periods).
- Wherever jetting nozzles are used in ash handling, optimize number of jetting nozzles & Periodic replacement, fixing angles of nozzles to be done on opportunity basis.
- Use of service water on continuous basis to be avoided wherever it is possible, e.g. standby vacuum pump seal water line to be kept closed. If passing is observed in solenoid valves same to be attended timely.
- In case of unit shutdown and when ash is not being evacuated, proper exercise of control of water flow is to be done.
- Hydro-ejector Valve passing to be checked in every shift and to be attended timely
- Make up and over flow control valves are to be kept on auto & their passing to be checked to avoid overflow.
- High pressure water to be provided for bottom ash evacuation.
- Optimize flushing nozzles size in ECO hoppers flushing apparatus.
- Ash water ratio to be measured weekly and water balance study to be done monthly.
- All leakages to be arrested immediately without waiting for unit shutdowns wherever it is possible.
- Feed gate passing to be checked in every shift and any passing in feed gate to be attended immediately wherever it is possible.
- The following tanks are to be prevented from overflowing
  1. Bottom ash over flow tank
  2. Settling tank / surge tanks
  3. Ash water tank
  4. Seal water OH tank (for ASP series)

**Don'ts**

- Do not compromise safety & healthiness of system & equipment for ash water optimization.
- Do not operate make up valve manually wherever auto operation is available.
- Do not overlook passing in valves, Gland leakages in pump & valves, leakages in water lines.
- Do not operate ash slurry with high water make up to maintain pit level.
- Do not close manual valves of nozzles of ECO/bottom ash hopper without considering their effects.
- Do not run BAHP for extra time if line flushing is done.

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| S.NO. | Checklist                                                                                                                                                             | Department        | Remark/Status |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|
| 1     | One HP/LP pump can be stopped during low load period operation whenever possible.                                                                                     | OPN               |               |
| 2     | After completion of emptying Bottom ash hopper and flushing of Bottom ash lines Stop BAHF whenever possible                                                           | OPN               |               |
| 3     | Ash water sample to be collected from HCSD pump discharge/Ash mixing tank for fly ash & Ash slurry sump /ash slurry discharge line for bottom ash on weekly basis.    | CHEM              |               |
| 4     | Optimize number of jetting nozzles, Periodic replacement of nozzles irrespective of unit shut downs. Periodic adjustment of nozzle fixing angle.                      | AHM               |               |
| 5     | Use of service water on continuous basis to be optimized.                                                                                                             | OPN               |               |
| 6     | In case of unit shutdown and when ash is not being evacuated, proper exercise of control of water flow is to be done.                                                 | OPN               |               |
| 7     | Hydro-ejector Valve passing to be checked in every shift and to be attended timely                                                                                    | OPN/AHM           |               |
| 8     | Make up and over flow control valves are to be kept in auto and water flow to be regulated as per requirement to avoid overflow. Valve passing to be attended timely. | OPN<br>AHM /C & I |               |
| 9     | Periodic replacement of hopper flushing nozzles and adjustment of nozzle fixing angle to be done as per the requirement                                               | AHM               |               |
| 10    | High pressure water to be provided for bottom ash evacuation.                                                                                                         | AHM/OPN           |               |
| 11    | Optimization of flushing nozzles size in ECO hoppers flushing apparatus as per design requirements.                                                                   | AHM               |               |
| 12    | Seal water of standby vacuum pumps which are not in service also kept closed.                                                                                         | OPN               |               |
| 13    | Ash water ratio to be measured weekly and water balance study to be done monthly.                                                                                     | CHEM./EEMG        |               |
| 14    | Leakages are common from valve glands and in ash pipelines to be arrested immediately without waiting for unit shutdowns wherever it is possible                      | AHM/OPN           |               |
| 15    | Systems designed to operate intermittently should be operated as per design requirements.                                                                             | OPN               |               |
| 16    | Feed gate passing to be checked in every shift and any passing in feed gate to be attended immediately wherever it is possible.                                       | OPN/AHM           |               |

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