NTPC JHAJJAR O&M
PRESENTATION

EXPERIENCE WITH HIGH CONCENTRATED SLURRY DISPOSAL SYSTEM

O&M CONFERENCE-IPS 2013-by
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Presentation Synopsis

- Why HCSD
- DRY ASH DISPOSAL THRU UNLOADING
- DRY ASH DISPOSAL THRU HCSD
- PROCESS FLOW OF HCSD
- ISSUES MAKING HCSD OPERATION ON AUTO
- WATER REQUIREMENT CALCULATION
- LOGIC SEQUENCE
- SITE EXPERIENCES WITH HCSD
- PRESENT DAY LIMITATIONS
- PROBLEMS EXPERIENCED WITH EQUIPMENTS
Why HCSD

Conventional Lean Slurry Disposal System and Ash Water Recovery System have limitations/disadvantages on account of higher amount of water wastage/contamination, ground water pollution, potential for ash pond collapse, vast land required for ash dykes, higher costs for ash pond construction and higher power consumption.

These limitations have led to the adoption of new environment friendly ash disposal technologies like High Concentration Slurry Disposal (HCSD) Systems.
DRY ASH DISPOSAL

- ESP / APH Hopper
- Isolation v/v.
- Cast iron pipe
- Target Box
- Buffer Hopper-08
- Bag Filter
- Feeder Vessels(2)
- Vacuum Pump (8)
- Cleared wtr.
- Transport Air Compressor (3)
- Buffer hopper fluidising air blower-02 no
- Press. Vacuum Relief Door
- Bag Filter
- Vent. Fan
- Ash Silo cap. 1000 T
- Fluidising Feeder
- Rotary Feeder
- Telescopic chute
- (Unloading into closed tanker)
- Silo Aeration Blower (6)
- Metering cut off gate
- HMDC
- Loading open trucks
- HMDC Wtr. Pump (6)
DRY ASH DISPOSAL WITH HCSD

Diagram showing the process of dry ash disposal with HCSD, including components such as Vent Filter with Fan, HCSD Silo, Ash Conditioner, Rotary Feeder, Mass Flow Meter, HCSD Silo Aeration Blower, HCSD Pump, and HCSD Pipeline to HCSD Ash Dyke.
Process Flow-chart of HCSD system

- **FLY ASH**
  - Capacity: 40-100 t/hr

- **MASS FLOW METER**

- **ROTARY UNLOADER / AIR SLIDE**
  - Capacity: 40-100 t/hr

- **AGITATED MIXING TANK**

- **WATER**
  - **Flushing Valve**
  - **Make up valve**

- **BOoster Pump**
  - Capacity: 225m³/hr, 4-6ksc

- **SUCTION STRAINER**

- **HCSD Pump**
  - Capacity: 225m³/hr
  - Max: 47ksc

- **ASH POND**
Issues involved in making HCSD on Auto

- Calibration of Mass Flow meter - Make SIEMENS
- Calibration of Rotary feeder VFD - Make DENFORCE, DENMARK
- Rotary feeder Motor - MARATHON
- Rotary feeder - DCIPS
- Calibration of Hose Pump - WMN, Netherland
- Calibration of Coriolis Density Meter
- Tuning of Slurry Control loop Unit - SIEMENS
- Tuning of GEHO PUMP control unit
Issues involved in Rotary feeder

- Vibration reduced in the structure to read the meter correctly, Cross-checked with telescopic chute unloading into the truck
- Calibration of Mass Flow meter-Make SIEMENS
- VFD calibration- rpm v/s tons/hr (table made)

Issues involved in ΔP calibration

- Delta-P is the pressure difference between two fixed points in the hose pump discharge pipe
- Timing of slurry from lean mixture to dense mixture
Issues involved in Coriolis density meter

- Sampling cross-checked with chemistry
- Slurry density range changed from 1 -1.5 to 1-1.8 (4-20mA signal)

Issues involved in Slurry control unit

- Card which was damaged during commissioning repaired
- Logic for the hardware re-arranged
- Interface between software & hardware put back
Water requirement as per slurry requirement

Say Ash flow through rotary feeder = 170 tons/hr

In order to maintain ash : water ratio 50:50

Taking density of water as 1kg/cm³
& density of ash as 2 kg/cm³

Volume of ash for the above quantity= 85m³/hr
Volume of water requirement= 85m³/hr

Similarly, for ash:water ratio 60:40
Volume of water requirement=56 m³
Volume of ash = 85m³
Ash water slurry being non-Newtonian exhibits different phenomenon

<table>
<thead>
<tr>
<th>(\Delta P) = (PT1-PT2)</th>
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Internal slurry flow inside pipe line
SLURRY INTO THE DYKE
Auto sequence Logic during deashinging

1. GEHO pump Lubrication starts
2. Pneumatic Knife gate valve opens
3. Rotary feeder starts according to parameter setting in OWS (say 170t/hr)
4. Water control valve opens as per parameter setting in OWS) (say 65:35)
5. Mixing tank level(0-4700mm) at 10% 470 mm, agitator starts
6. At 15% level, hose pump takes start
7. Now water control valve gets control from Hose pump delta P)
8. At 70% level of AMT at 3290mm, booster pump starts
9. At Booster pump disch pr>2 ksc, GEHO pump starts
10. At 80%(3760mm) level of AMT, GEHO pump VFD increases by 10%
    (1000rpm to 1100 rpm)
11. At 60% level(2820mm)of AMT, GEHO pump comes to 900 rpm

In any case, if the AMT level (4230mm) at 90% level, Knife gate valve closes
& water control valve closes fully.
When the mass flow meter reading shows <5tph for 3 minutes, Rotary feeder
closes, KGV closes & water control valve.
Auto sequence Logic for flushing

1) Now, both GEHO & Booster pump running with no incoming ash & water
2) Now when level in AMT reaches <470 mm, First GEHO trips, then booster pump stops
3) Agitator & hose pump is still running
3) Flushing valve opens for 3 minutes
4) AMT make up valve opens
5) Again at 70% AMT, both booster pump & then GEHO pump starts for 20 minutes, at VFD speed of 1200 rpm
6) Again make valve closes after 20 minutes
7) Flushing is over & all equipments closed with AMT level at 10%.
Present Day limitations

**Designed Ash Flow**: Presently system designed at 170t/hr. We are receiving ash to the tune of 70-120 tons/hr depending on coal flow of 280-350 tons coal with ash % after blending 35.

**Flushing requirement**: With present rate of ash flow, we are able to evacuate our HCSD silo from 6 mtr (210 tons) in 1 & 1/2 hour. Then there is a requirement of flushing for half an hour.

**AMT make up & booster pump flushing valve**: Jamming in these valves results in running the system on manual mode.

**Feedback from the water control valve positioning**: Mostly ash ingress, require constant flushing.

**Rotary feeder close feedback**: Limit switch adjustment required.

**Instrument Air pressure requirement**: 5-7 ksc But even with 6 compressor against design of 3 compressor running, IAC pr remains less than 5ksc.
Problems faced with the equipment at site

Ash conditioner: Extensive damages in the roller & bearings, high vibrations. Finally replaced with the Air slide (design change required).

Mixing tank agitator: Agitator Blade got twisted (shrunk fitted) due to Dry run.

Agitator gear box: Abnormal sound due to oil leakages, new design, WMN purchased from Denmark, Indian representative could not solve the problem, finally WMN called & problem solved.

Pneumatic valve damage in flushing line from booster pump: Solenoid getting damaged (may be due to underrated actuator). Replacement required every 7th day.

Slurry Control loop card damage: Every silo SLC card is unique, while using in another silo, card getting damaged.

Problem in pulse signaling in hose pump: Pulse were getting lost in the loop.

Instrument Air pressure requirement: 5-7 ksc. But even with 6 compressor against design of 3 compressor running, IAC pr remains less than 5ksc.
For any clarification you can write to us
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sanjaykumar50@ntpc.co.in