



## **Deely Information**

- 2 CE 400 MWe Units
- Fuel PRB (Cordero Rojo)
- Air Preheater single Size 33½ VIT:
  - Single retractable sootblower
- Economizer
  - 1st bank 18 rows deep (staggered)
  - 2<sup>nd</sup> bank 16 rows deep (staggered)
  - 6 Copes Vulcan T30 Retracts above 1<sup>st</sup> bank
  - 6 Copes Vulcan Half-Tracks in Cavity

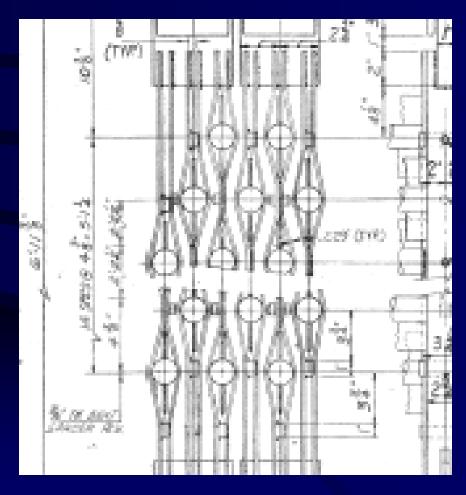


#### Air Preheater / Staggered Economizer "Cleaning Challenges"

- Sootblowers cannot maintain cleanliness:
  - can t reach intermediate and hot layers or inside tube banks
  - not all ash gets removed
- Trapped ash gets hydrated during water wash and outages (cement)
- Water wash does not remove cement and is only partially effective in removing all ash
- Results in:
  - shorter element life
  - increased differentials (ID/FD fan hp)



### Staggered Tube Arrangement







#### Low Temperature Fouling of PRB Coals

Cause: CaO / MgO + NaO / K<sub>2</sub>O

#### Results:

- Increases low temp. fouling
- NaO / K<sub>2</sub>O cause sintering

### Where:

- Non-radiant convection tube banks
- Air Heaters
- SCR s





### Solution to Pluggage Problem

- Each air preheater has a single acoustic cleaner on the gas outlet
- The economizer has two acoustic cleaners
- Operating frequency 30-40 Hz
- At this frequency the sound is:
  - most effective in keeping particles in suspension and remove existing deposits
  - in partial acoustic resonance
  - more uniform in coverage/penetration throughout economizer / air preheater





### Acoustic Cleaning Hardware

#### 2003 Unit 2:

- 2 ea on Economizer

#### 2005 Unit 1:

- 2 ea on Economizer
- 1 ea on Air Preheater

### 2006 Unit 2:

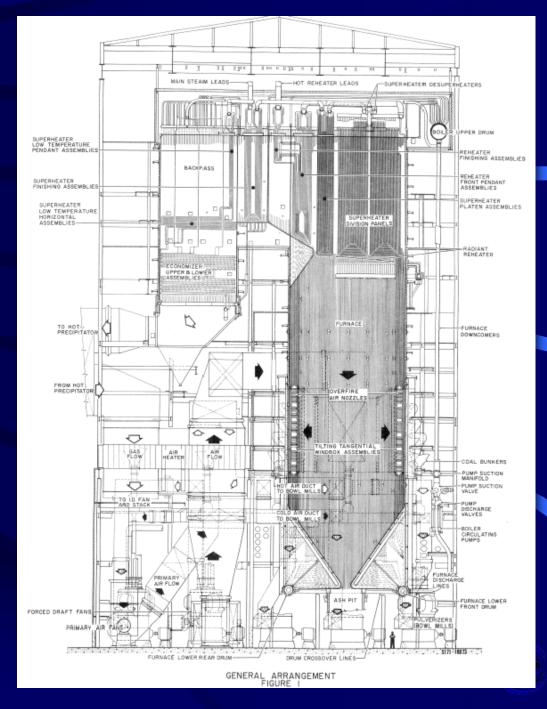
1 ea on Air Preheater



Location and Frequency of acoustic cleaners were determined by 3D finite element modeling

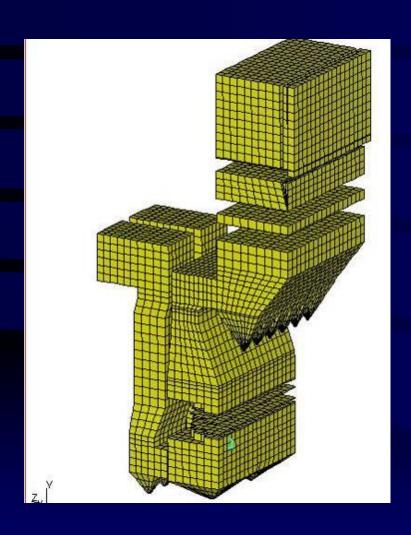


### **Boiler Side Elevation**

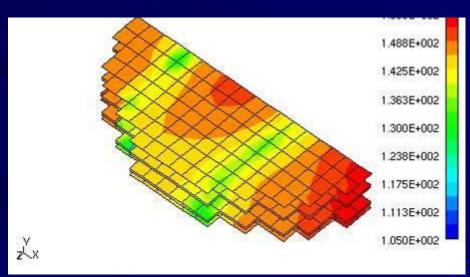




### **Acoustic Modeling**



- Cleaning Application modeled in 3D with FEanalysis
- Frequency gets selected that has the best cleaning characteristics and best response in application
- Installation location gets optimized for uniform coverage







### Experience Unit 2

- AC in service on economizer early 2004;
- APH fouled up with turning vane / economizer deposits
- AC taken out of service to preserve APH
- AC added to APH and started April 2006



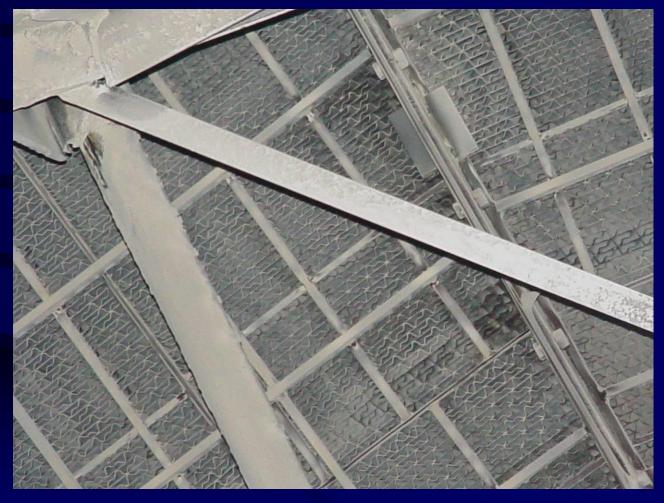


## **Experience Unit 1**

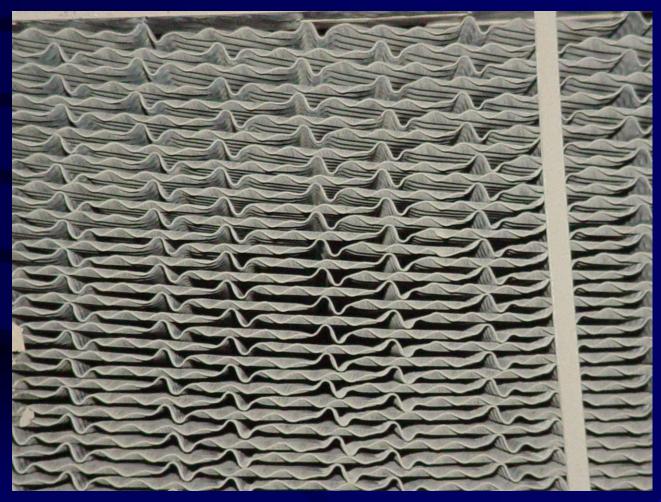
- Three AC s in service winter of 2005;
- Inspection after 5 months operation:
  - No observed areas of pluggage in the economizer
  - Hot end element looked like new
- Pressure drop was slowly falling, suggesting cleaning effect was impacting both economizer and air preheater

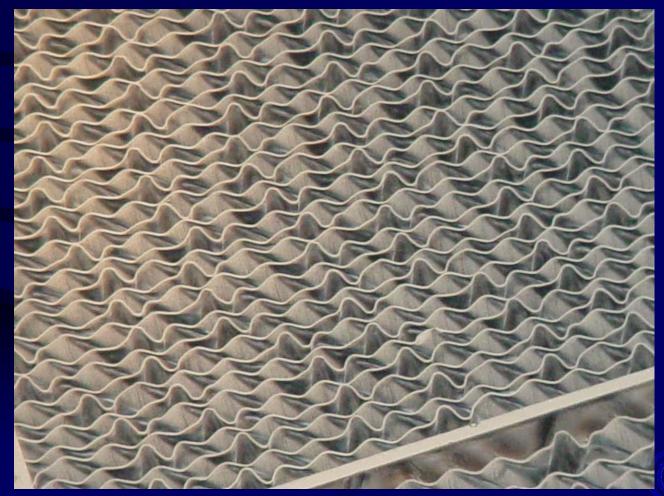




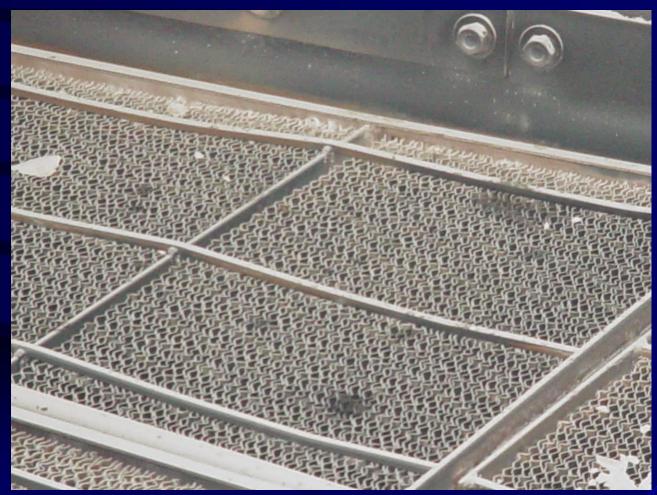














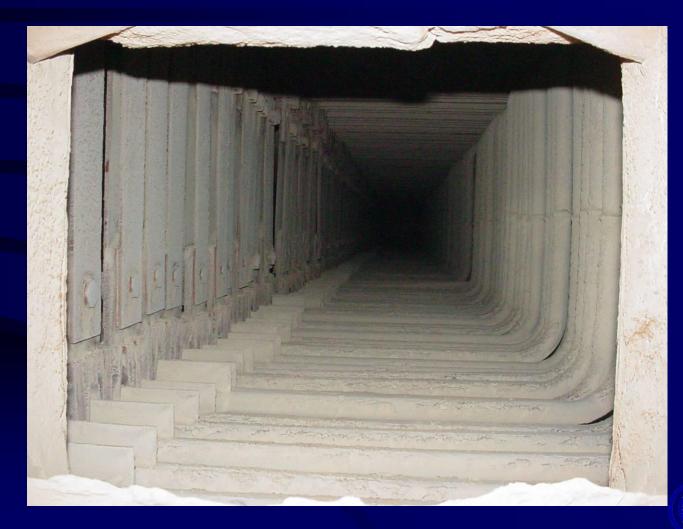
























## Outlet of Acoustic Cleaner



### Cone of Acoustic Cleaner





## WaveMaster<sup>™</sup> Acoustic Cleaner





## Detail cone /transition









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