Reinhold Environmental Ltd.

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EFFECTS OF POOR AIR HEATER PERFORMANCE

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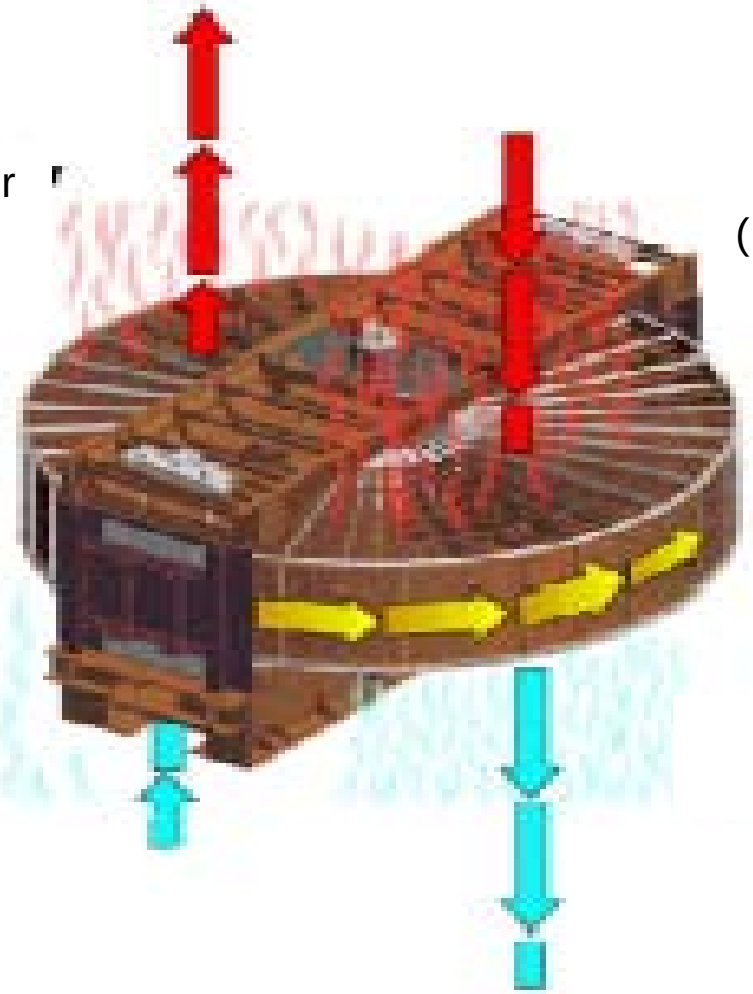
OUTLINE

- AIR HEATER 101
- WHAT AFFECTS AH PERFORMANCE?
- WHAT THE AIR HEATER AFFECTS
- AIR HEATER LEAKAGE
- ABS BUILDUP AND ITS EFFECTS
- ADDRESSING ABS PROBLEMS
- AIR HEATERS AND ESP’S

Combustion Air
(to boiler)
620°F

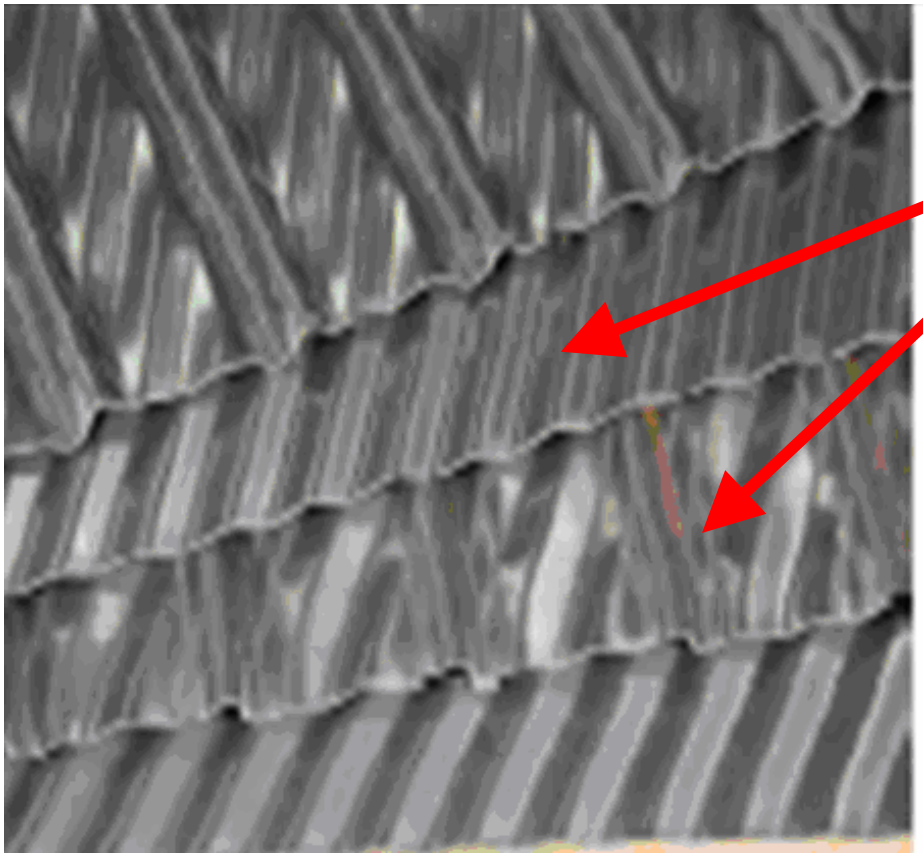


Flue Gas
(from boiler)
700°F

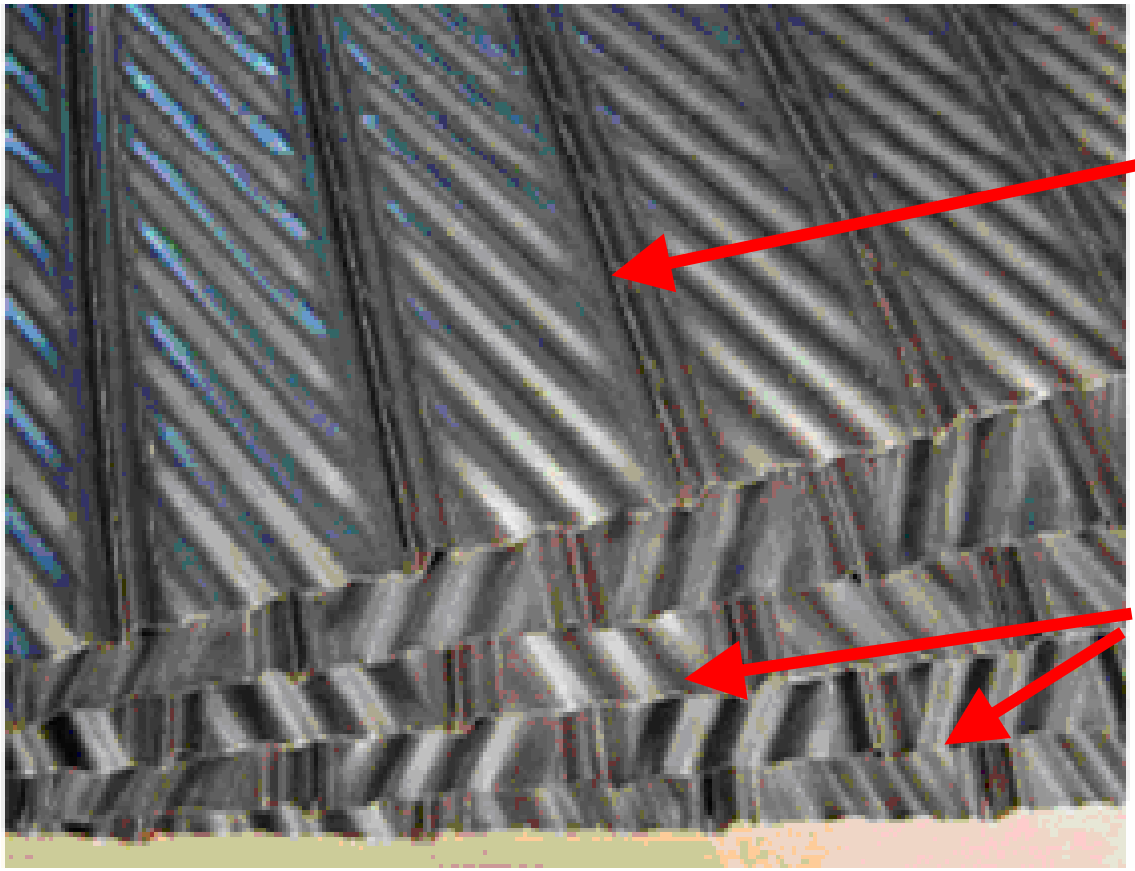
Inlet Air
100°F

to Stack
290°F

Original DU Element

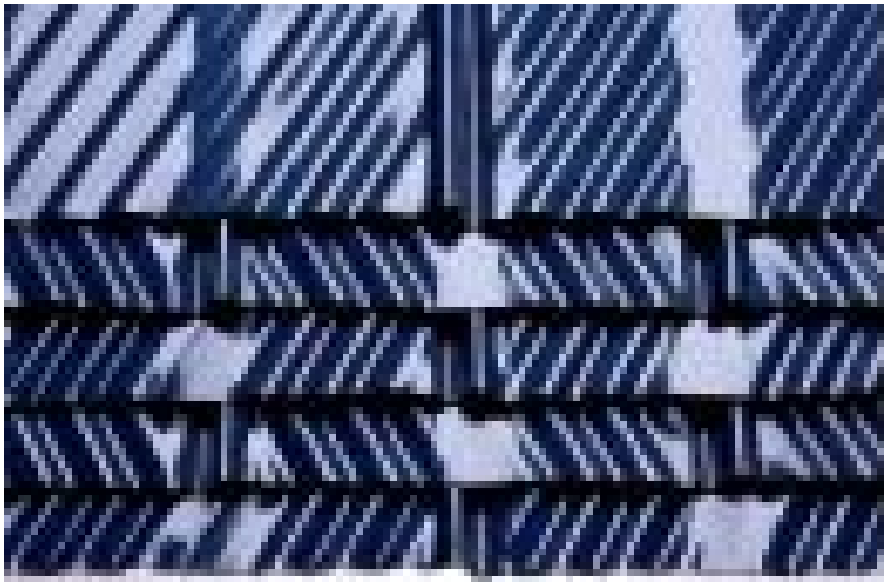


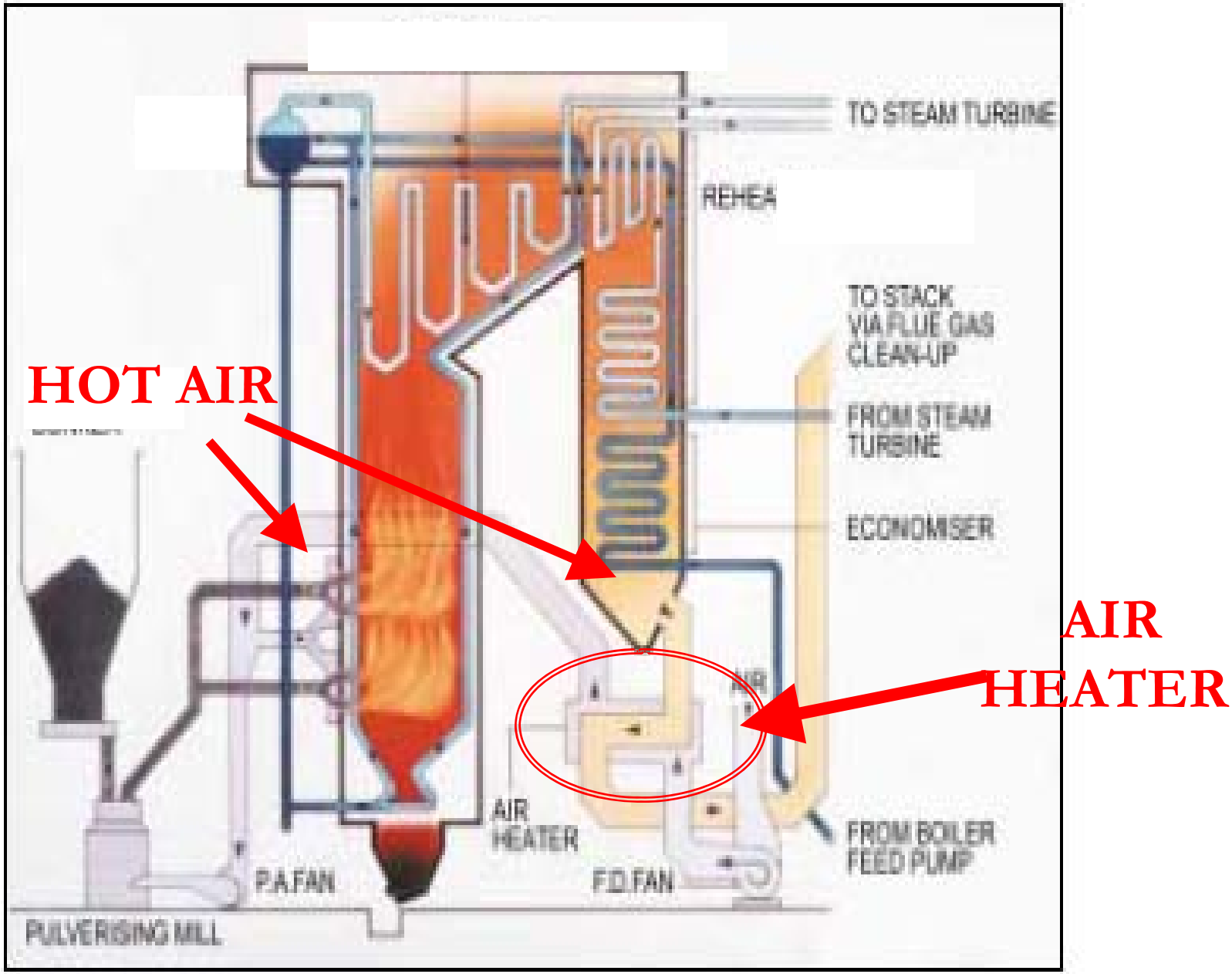
New DU 7 Element Substitute for DL



STANDARD

ABS STYLE




TO STEAM TURBINE
REHEA
TO STACK
VIA FLUE GAS
CLEAN-UP
FROM STEAM
TURBINE
ECONOMISER
HOT AIR
AIR
HEATER
FROM BOILER
FEED PUMP
AIR
HEATER
P.A.FAN
F.D.FAN
PULVERISING MILL

Effects of Leakage

- Degrades APC Performance
- Poor Coal Drying - PRB Coal
- Mill Fires, Explosions
- Low Fan Capacity –Load Limits
- Added Station Load for Fans

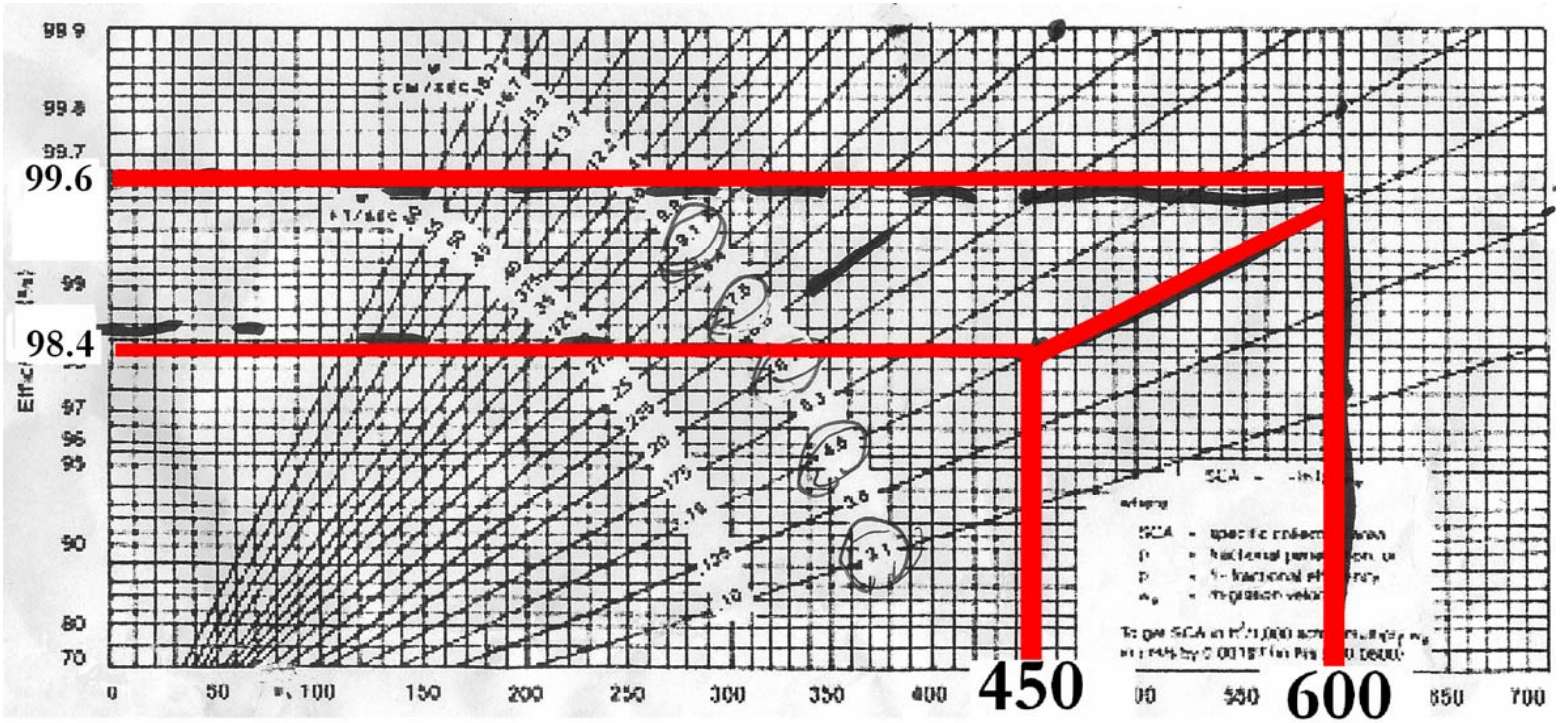
Effects of Air Heater Fouling

- Increased NOX Production
- Increased Desuperheater Spray
- Poor Flame Stability
- Increased Heat Rate
- Increased LOI

Effects of Air Heater Fouling

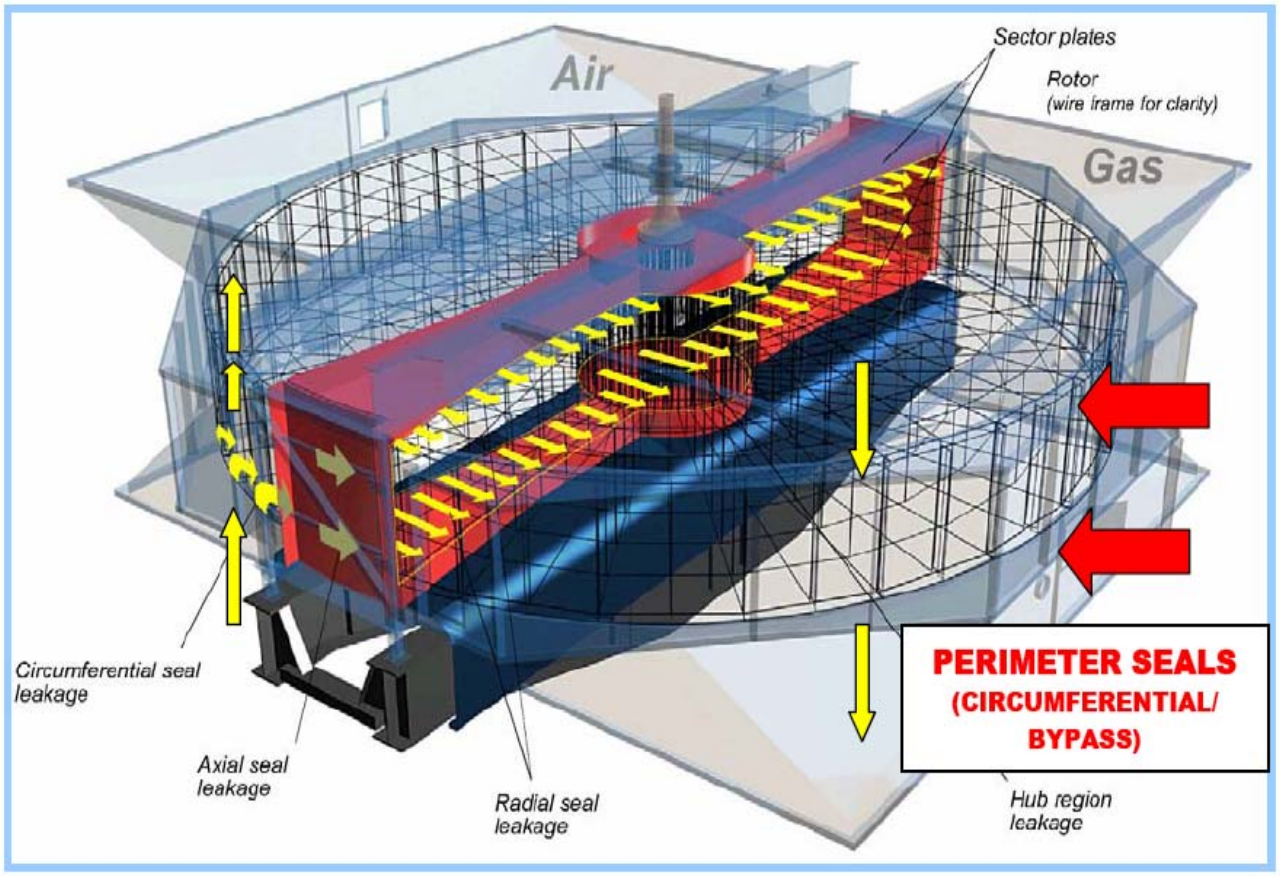
- Poor Coal Drying - PRB Coal
- Mill Fires, Explosions
- Low Fan Capacity –Load Limits
- Added Station Load for Fans

Effects of Leakage on ESP Performance



ABS Build-up at Precipitator Inlet

What is leakage ?

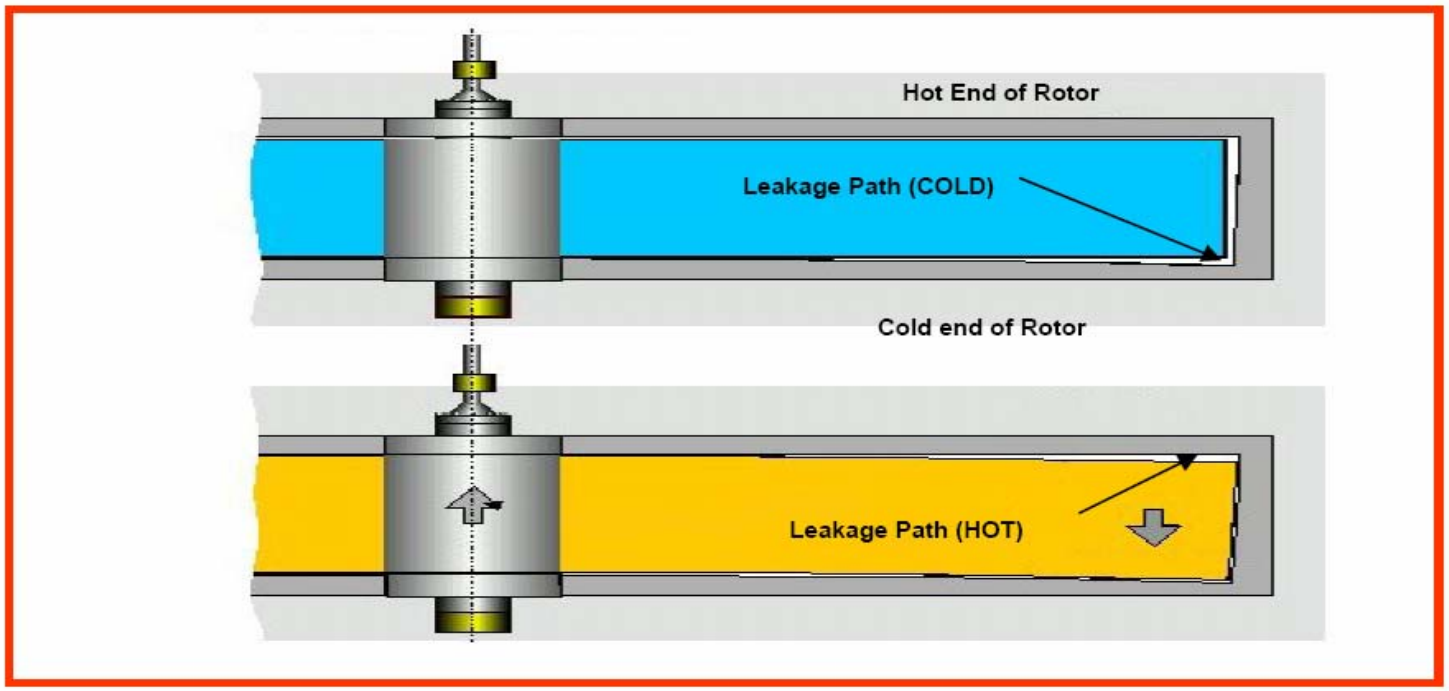


APPENDIX 1
FIGURE 1

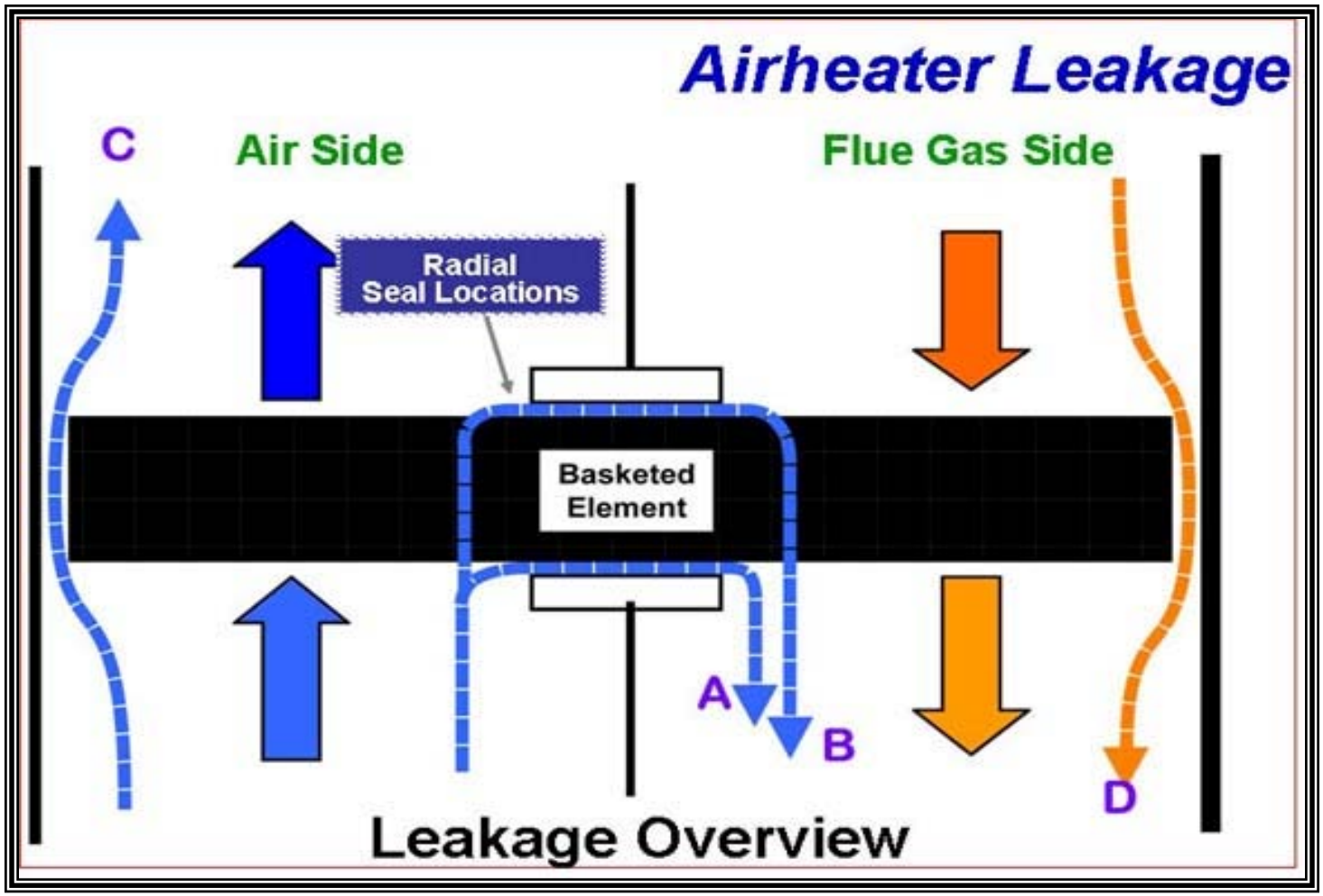
Thermal Turndown

Blue = Cold Condition of Rotor

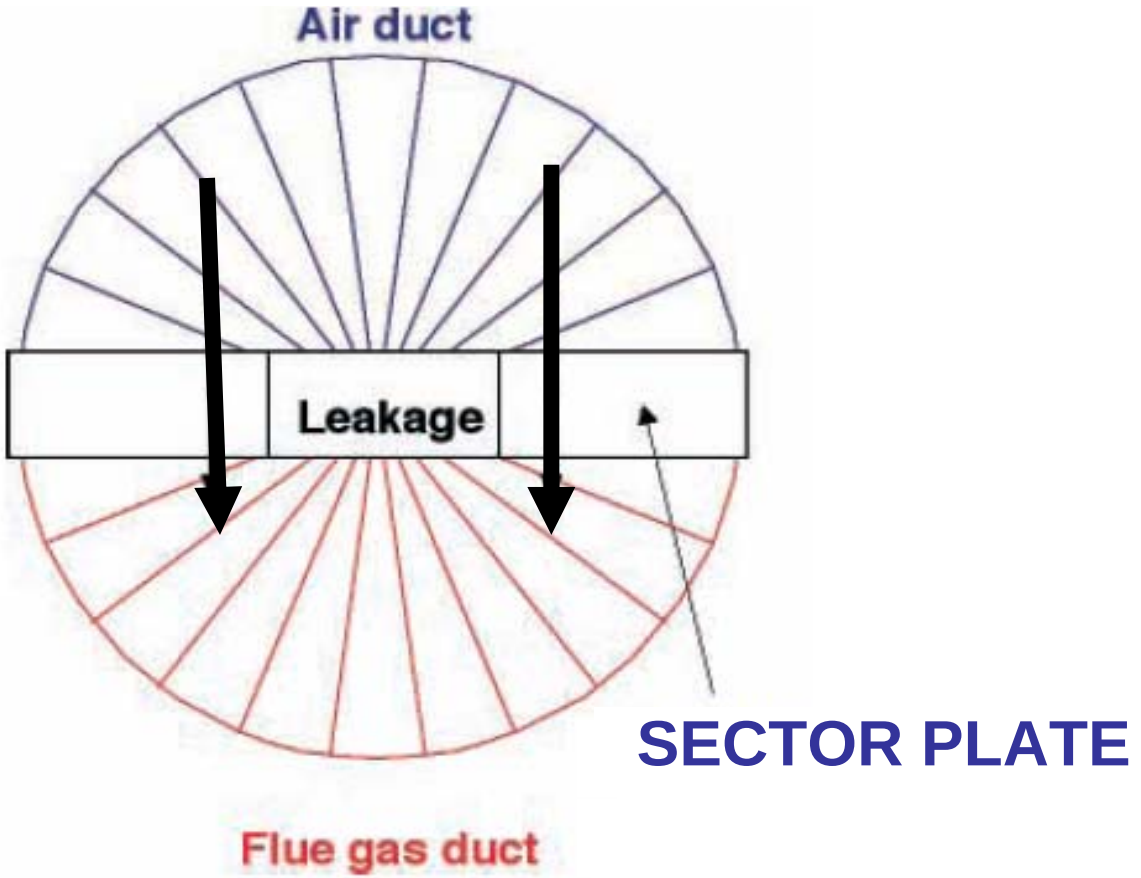
Yellow = Hot Condition of Rotor



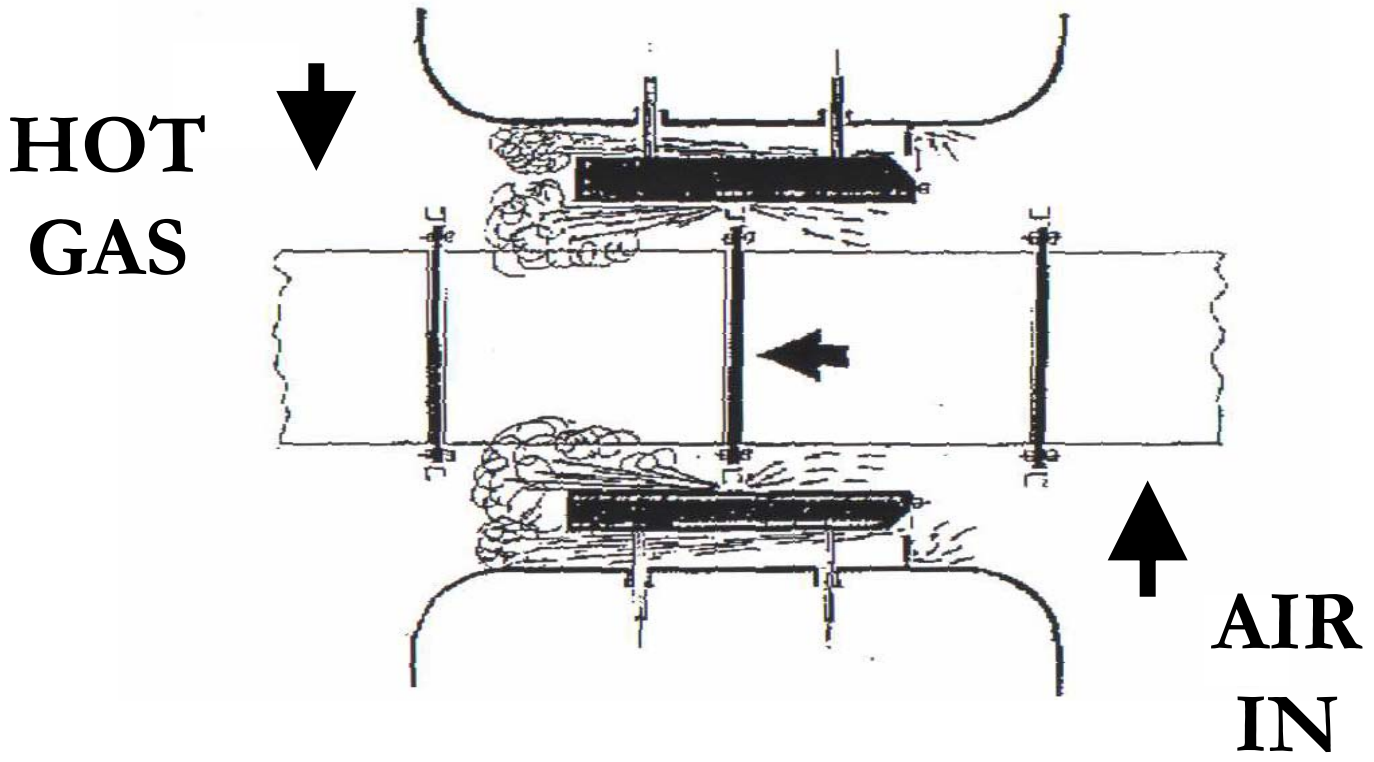
Leakage Paths in the Airheater



Leakage Path Through Radial Seals



Leakage through Radial Seals



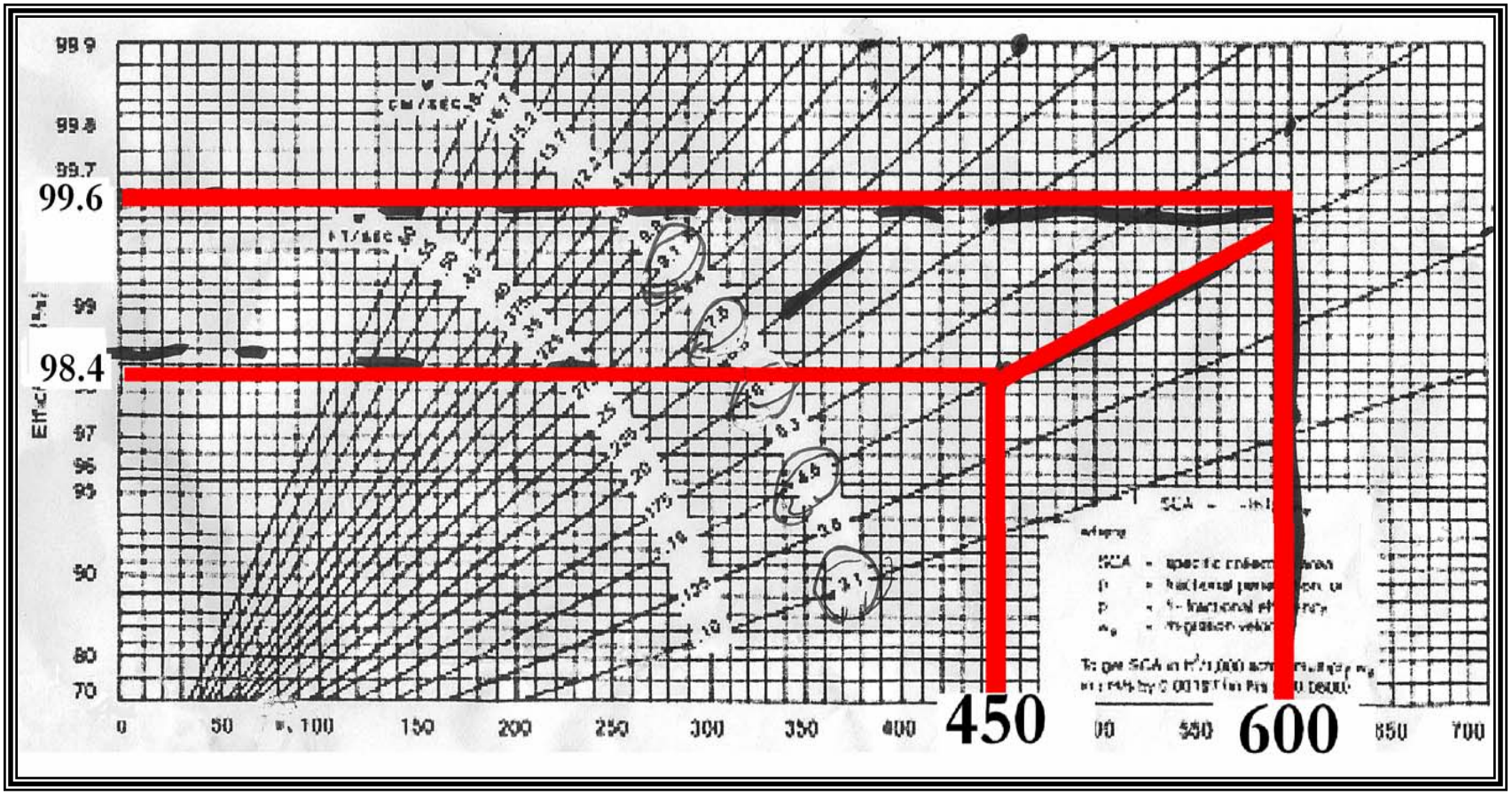
HIGH VELOCITY RADIAL SEAL LEAKAGE

Cold End Sector Plate Erosion

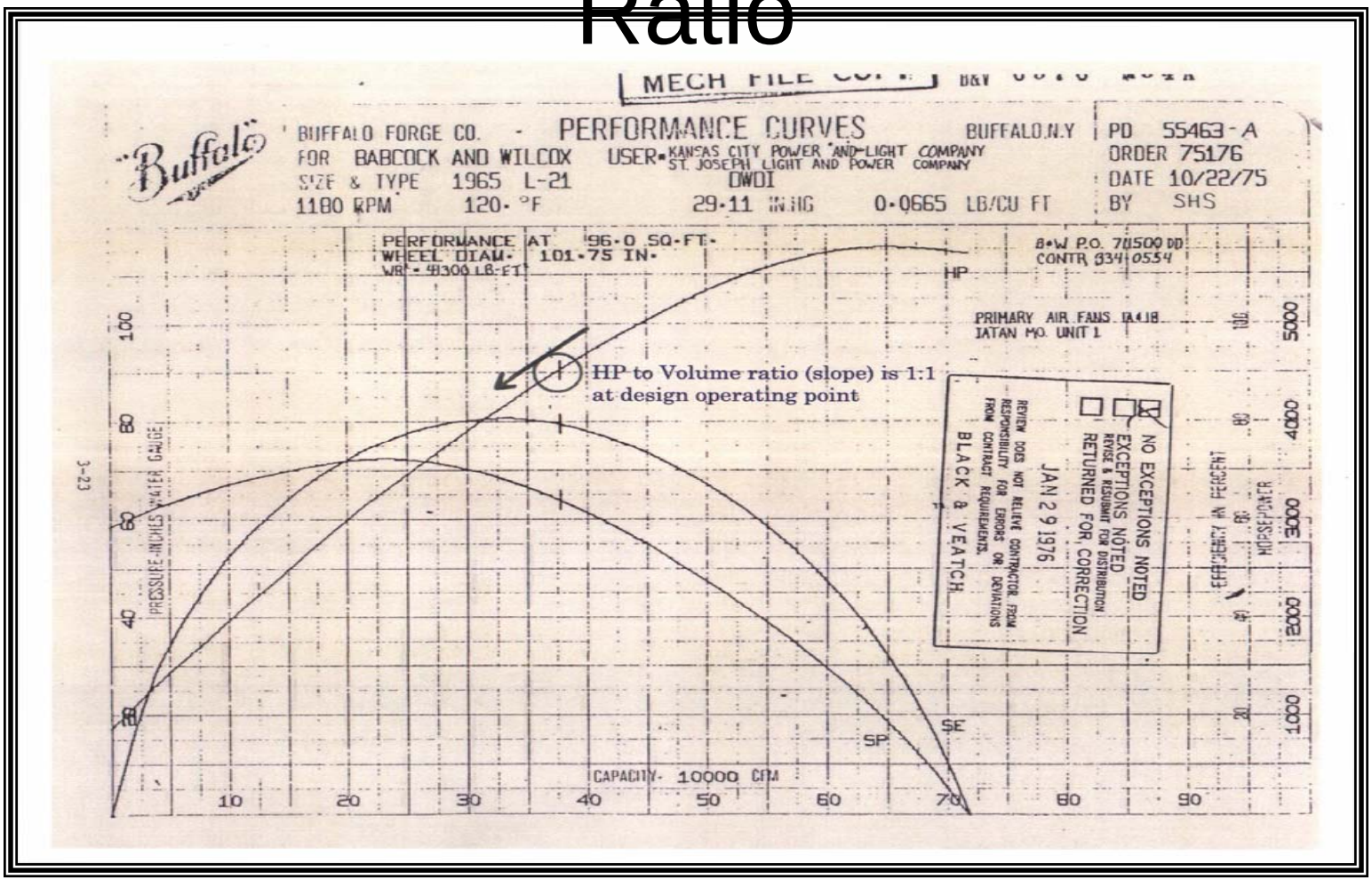
Cost Effects of Increased Radial Seal Leakage

- As a percentage of total FD fan flow radial seal leakage can range from 7% to 30%
- Radial seal leakage affects both ID and FD fans
- Radial seal leakage degrades the performance of back end air pollution control equipment
- Increased pressure drop of 4 inH2O from ABS fouling can increase cold end leakage 2% to 6% of FD fan flow.

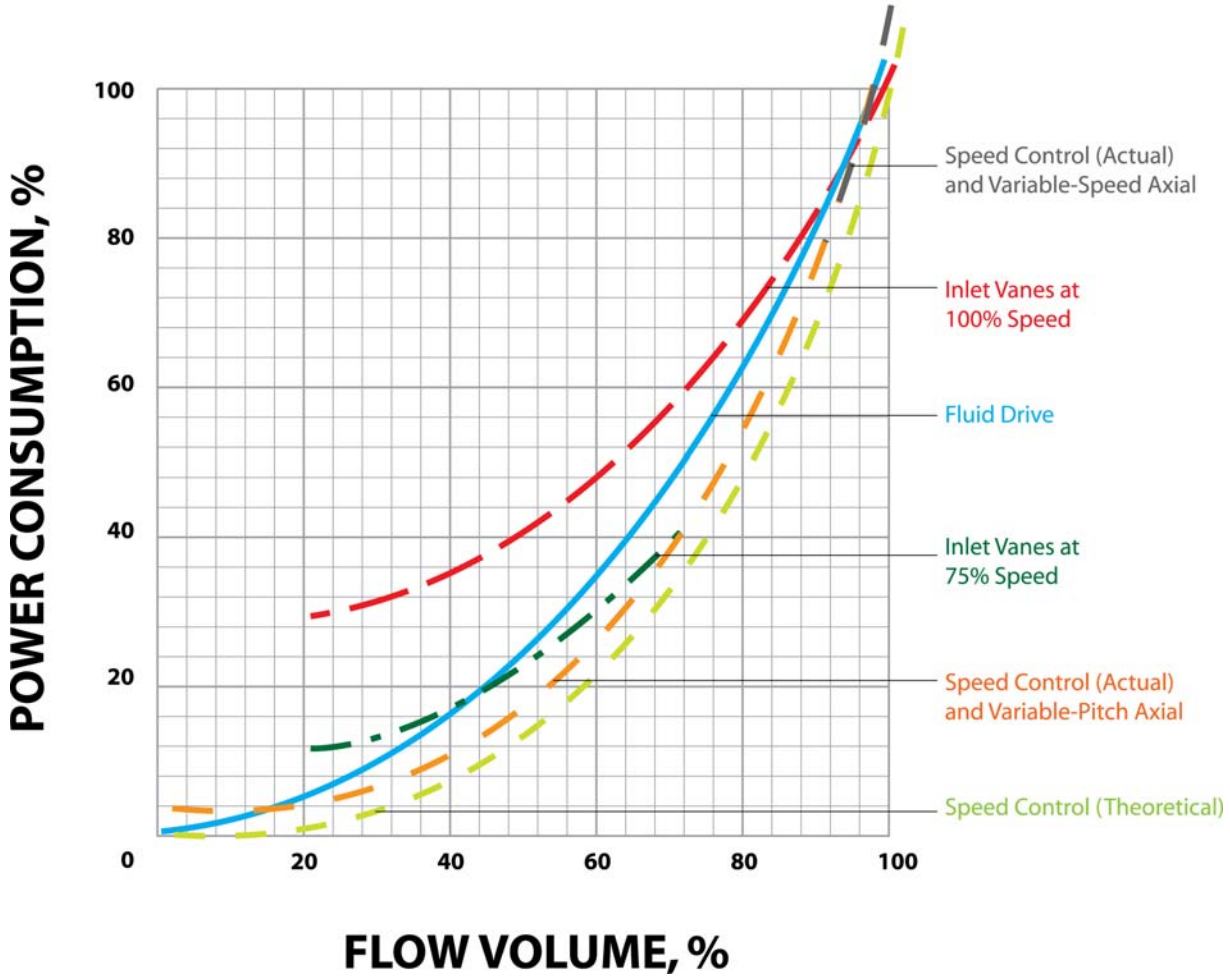
Effects of Leakage on ESP Performance



Fan Curve: Horsepower to Volume Ratio



Power Consumption vs. Volumetric Flow



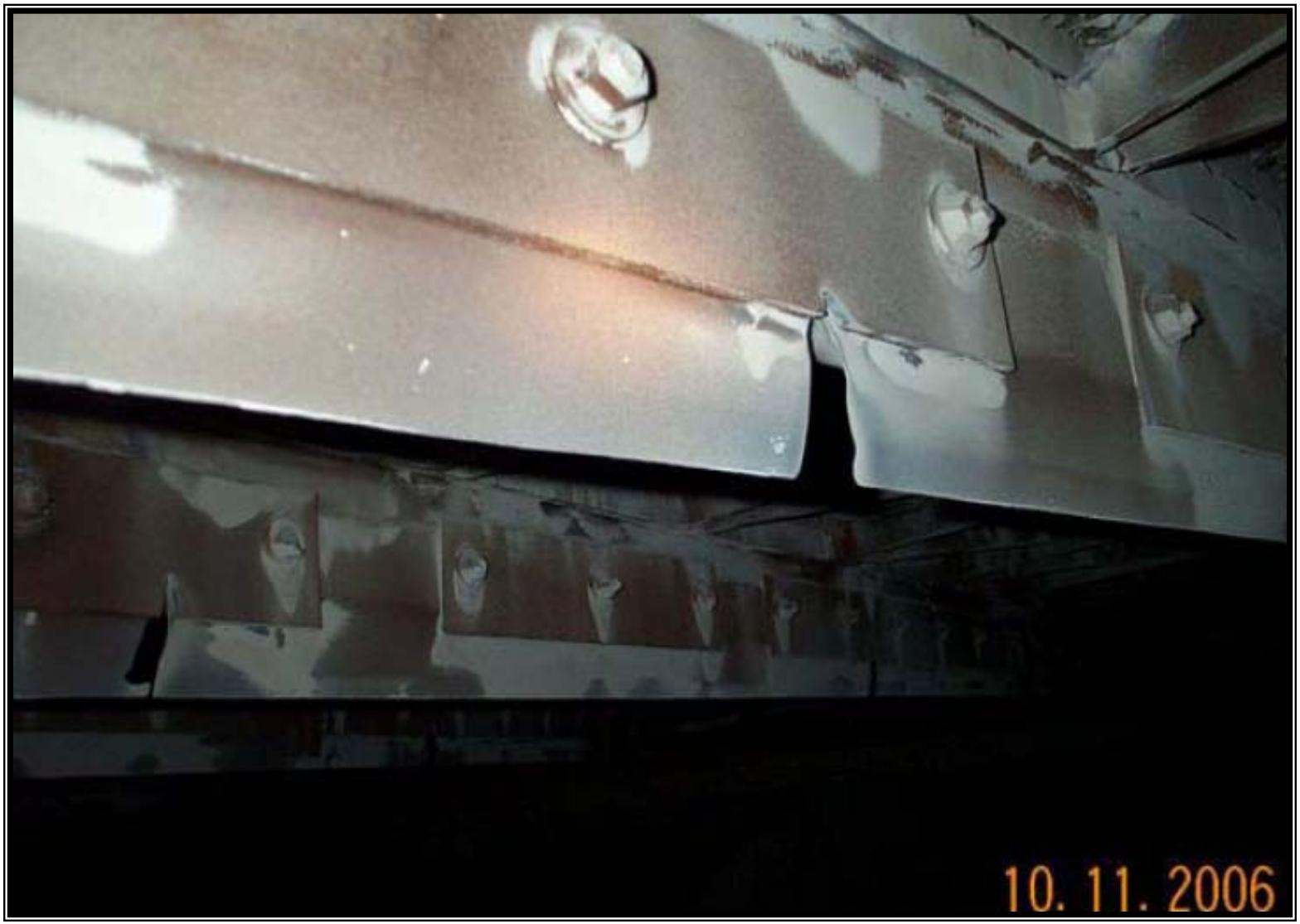

Radial Seal

DuraMax™ Radial Seal

Before Contact

Contact with Sector Plate


High Performance
Radial Seal


10. 11. 2006

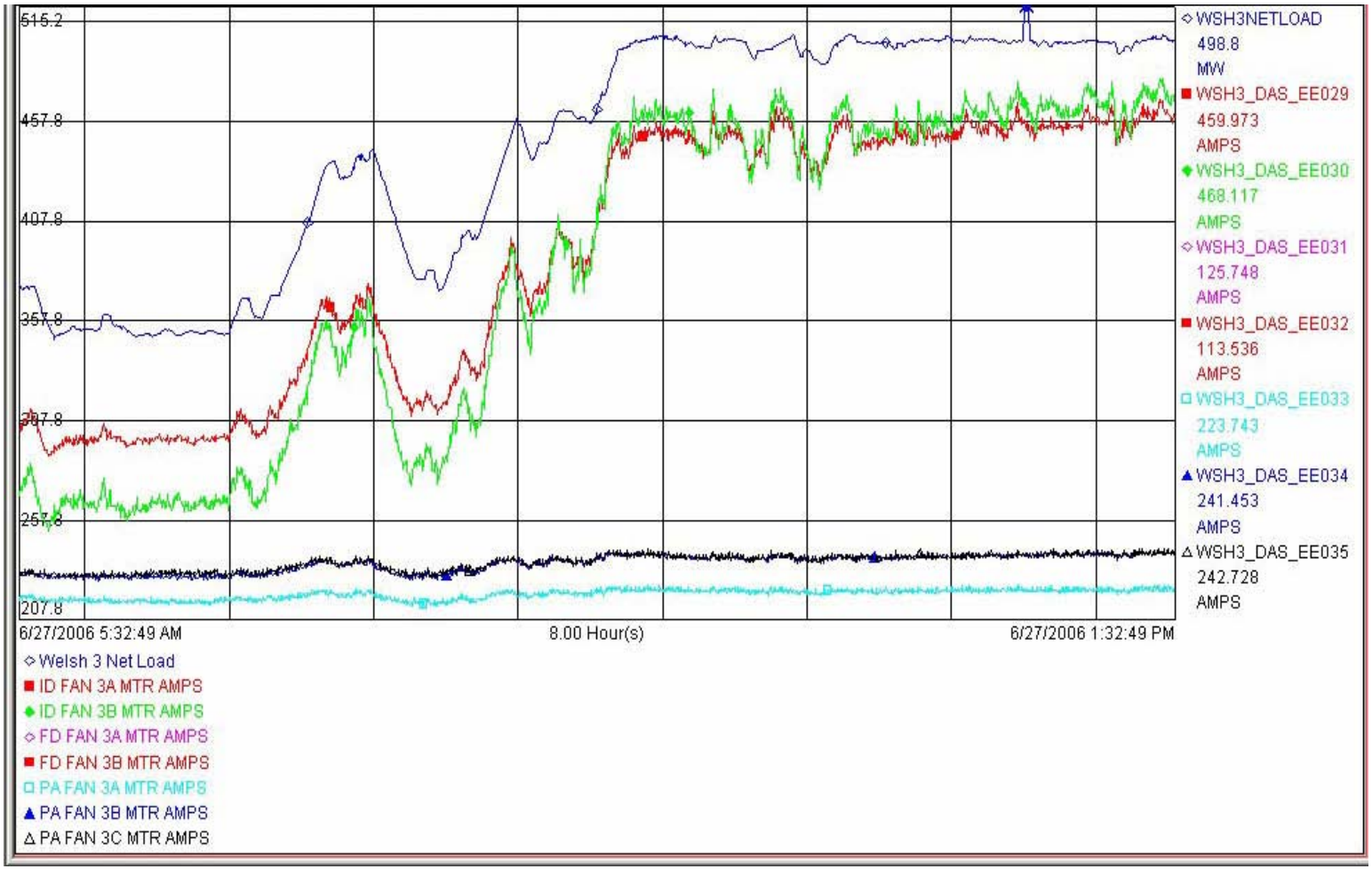
Gaps Between Worn Standard Radial Seals and Sector Plate

Hot End Sector Plate Erosion

Cold End Sector Plate Erosion

Fan Power Savings from Reduced Leakage

FAN	Before (AMPS)	After (AMPS)
3A ID FAN	**572**	**459**
3B ID FAN	**691**	**468**
3A FD FAN	**131**	**125**
3B FD FAN	**128**	**113**


515.2
457.8
407.8
357.8
307.8
257.8
207.8
6/27/2006 5:32:49 AM
8.00 Hour(s)
6/27/2006 1:32:49 PM
◇ WSH3NETLOAD
498.8
MW
■ WSH3_DAS_EE029
459.973
AMPS
◆ WSH3_DAS_EE030
468.117
AMPS
◇ WSH3_DAS_EE031
125.748
AMPS
■ WSH3_DAS_EE032
113.536
AMPS
□ WSH3_DAS_EE033
223.743
AMPS
▲ WSH3_DAS_EE034
241.453
AMPS
△ WSH3_DAS_EE035
242.728
AMPS
◇ Welsh 3 Net Load
■ ID FAN 3A MTR AMPS
◆ ID FAN 3B MTR AMPS
◇ FD FAN 3A MTR AMPS
■ FD FAN 3B MTR AMPS
□ PA FAN 3A MTR AMPS
▲ PA FAN 3B MTR AMPS
△ PA FAN 3C MTR AMPS