



PRB COAL USERS' GROUP

Prepared for the:

PRB COAL USERS' GROUP

at the

**ELECTRIC POWER 2008
Conference**

May 6-8, 2008

**Baltimore, Maryland at the
Baltimore Convention Center.**





Oxistop was formed to market and install a proven coating material in the power industry. ***Oxistop*** coating materials have a proven track record of reducing slag and residue buildup, resisting corrosion, erosion and oxidation of boiler tubes and improving fuel efficiency.





***Oxistop Coatings provide
a Protective Layer, through
Complete Chemical and Mechanical
Bonding to the Tube's Surface.***



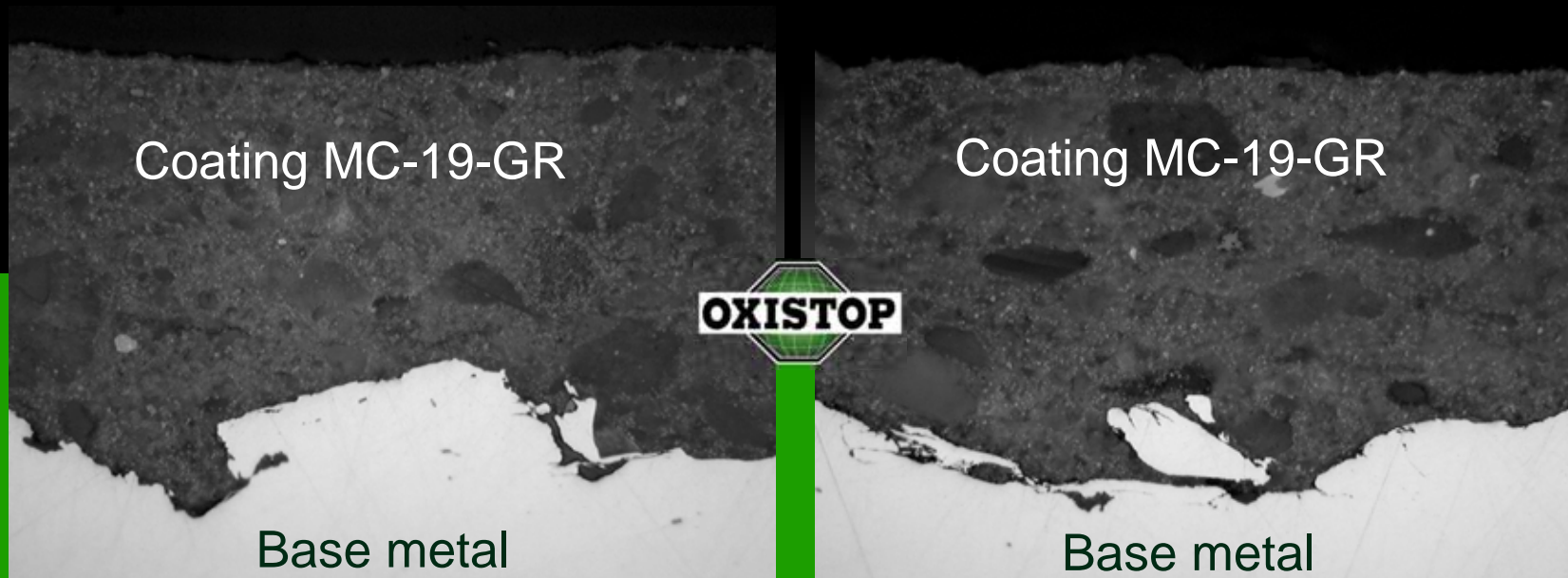
Oxistop Coatings are Non-Toxic and Non-Catalytic

High Magnification Shots of OXISTOP Coating

and Carbon Steel Interface



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500X 10µm
As polished

OAK RIDGE NATIONAL LABORATORY U. S. DEPARTMENT OF ENERGY



Oxistop Coatings

INCREASE ENERGY
PRODUCTION WHILE:



- Reducing Maintenance Costs
- Extending Boiler Tube Life
- Increasing Boiler Efficiency

Full Resume and Pictures are available at www.oxistop.com



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*Oxistop
Coating
Shedding
Slag*



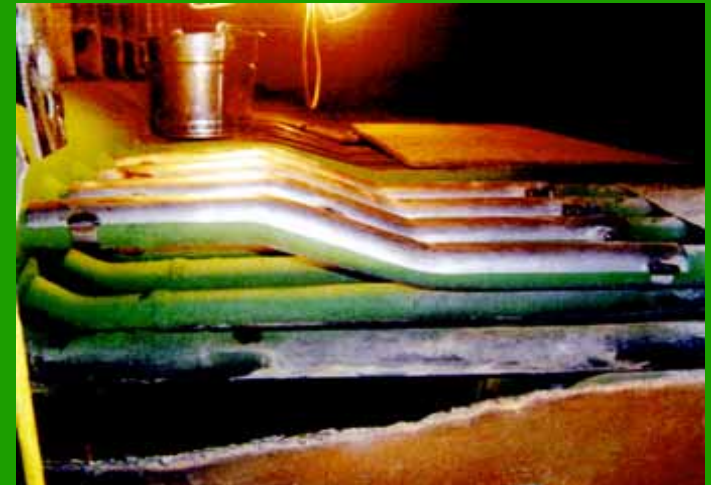
*Size of
Shedding
Slag*



*Oxistop
Coating
Overspray*



*Economizer
Tubes with
Oxistop
Coating*



First Oxistop Installation

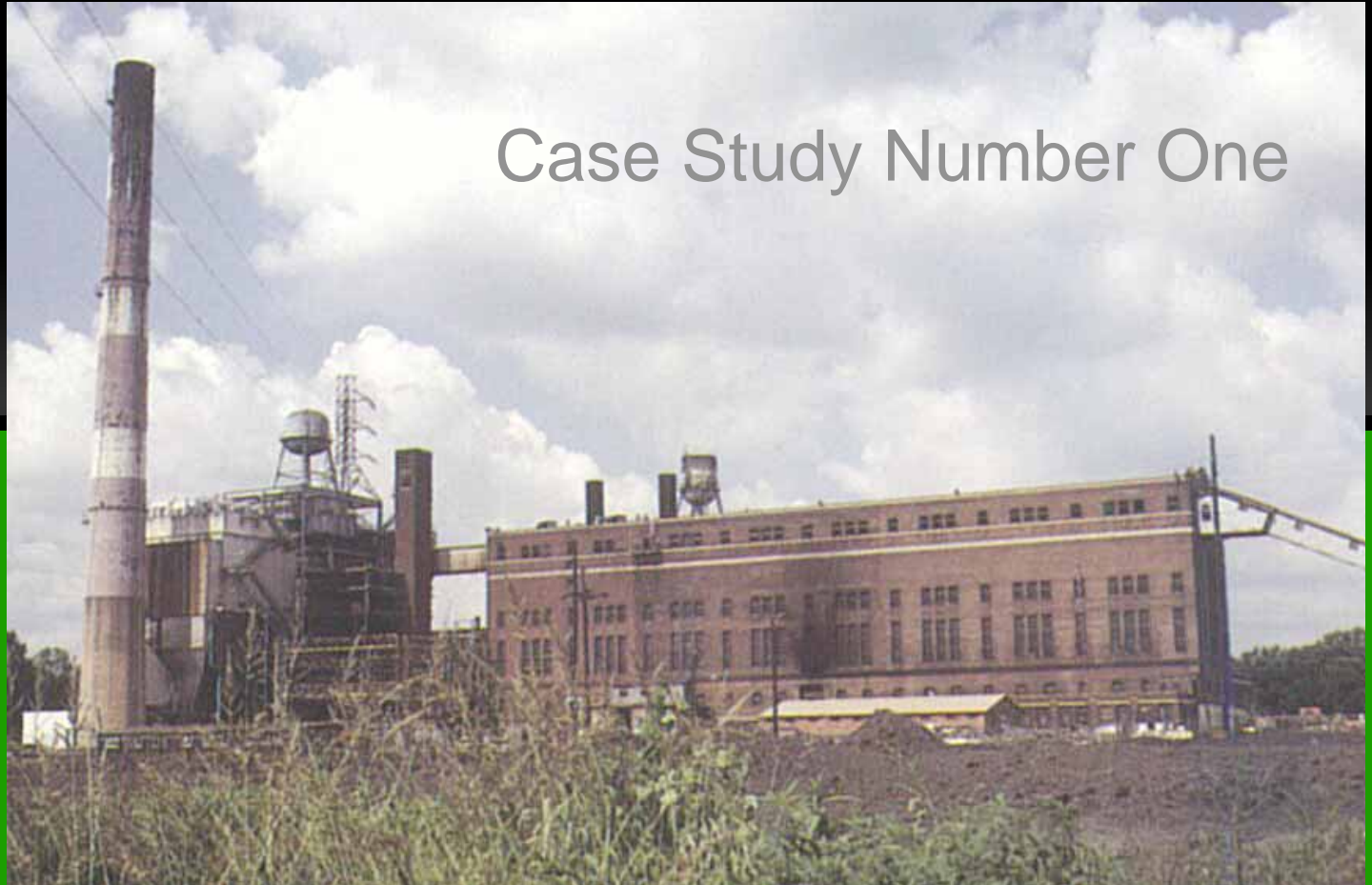
(June, 2004)



Case Study Number One



Picway





Trial burner grit blast surface preparation



Trial burners with Oxistop MC-19-GR ceramic coating applied

AEP
PICKWAY
UNCOATED



AEP
PICKWAY
COATED



2 months
online

Uncoated with eyebrow



Coated. Note excellent flame profile



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Trial areas (burners) – one year of service slag free





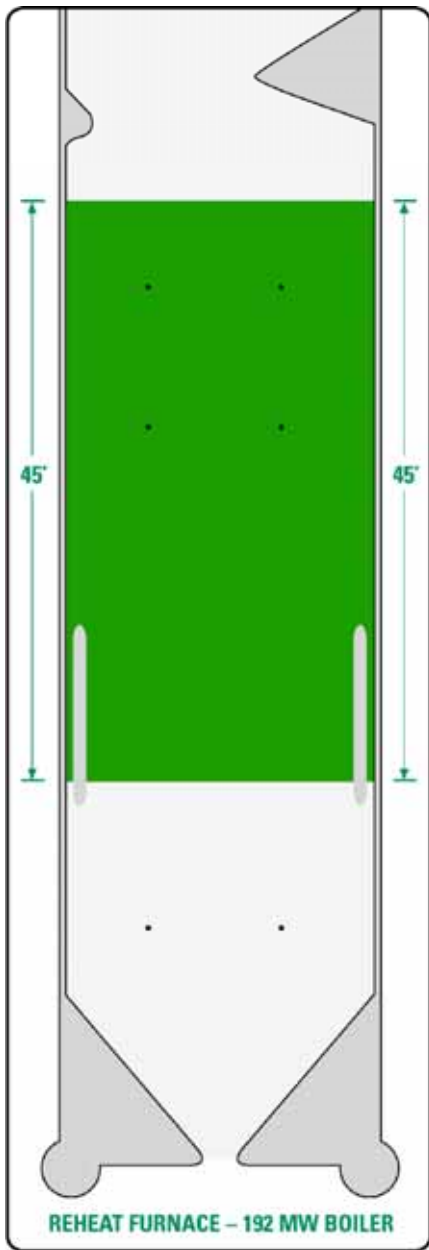
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Slag Shedding Off
Burner Wall
Coated With
Oxistop MC-19-GR



OXISTOP, CASE STUDY NUMBER TWO

In April of 2006, Oxistop installed MC-19-GR coating on a 192 MW boiler burning 100% PRB coal. Oxistop prepared by grit blast and coated less than half of the main combustion area and most of the radiant zone of the reheat furnace from below the burners to above the overfired air ports. This totaled a little over 5,500 square feet. The application was comfortably completed in the time allotted.



The Domino Effect from Conversion to PRB Fuel



The Huntley Station is located along the Niagara River in Buffalo New York



The station was purchased from Niagara Mohawk
by NRG Energy In 1999.

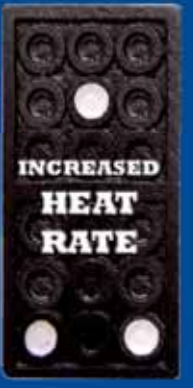
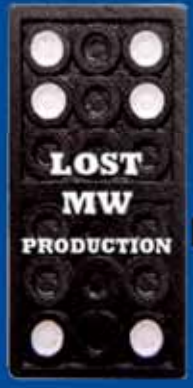
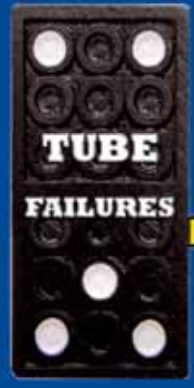
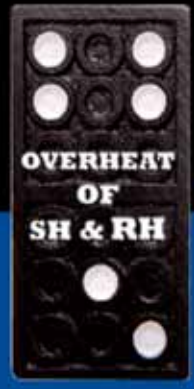
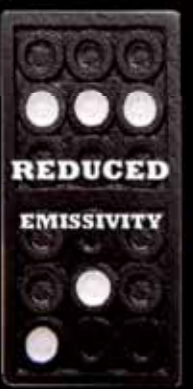
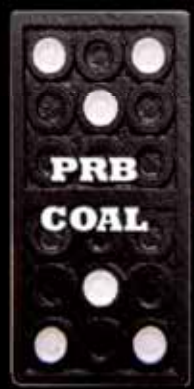
Site has been generating electric power since 1916

Two remaining units

- ✓ Combustion engineering
- ✓ Commissioned in 1957 and 58
- ✓ Twin furnace design
- ✓ 200 MW gross capacity
- ✓ 1050 °f superheat / 1000 °f reheat



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REMEDY OPTIONS

Change the Fuel?



NOT AN OPTION.

Required to maintain sulfur limits

- ✓ Low inherent sulfur

Required for making NOx limits

- ✓ High volatile content



Reduce Waterwall Ash Fowling?

Initial attempts to control by increased soot blowing

- ✓ Air blowers did not remove reflective base layer
- ✓ Limitation of compressed air

Installed water cannon to thermally shock and remove ash

- ✓ Poor cannon reliability
- ✓ Long periods between area cleanings to allow ash to build up for reduction of thermal shock to tubes

FOUND SOLUTION: Based on OXISTOP Coating Attributes

Easy to install

- ✓ Sandblast surface to white metal
- ✓ Spray coating on surface like latex paint
- ✓ Coating is water soluble until fired allowing easy clean up

Coating cures to ultra smooth ceramic surface

- ✓ Ceramics protect tubes from oxidizing atmosphere
- ✓ No adhesion to substances that come in contact with the coating

Huntley's Oxistop Thought Process

- ✓ The ceramics in the coating should protect tube from reducing atmosphere
- ✓ The coating will lessen the thermal shock and damage to tubing
- ✓ The smooth non-porous surface should inhibit ash from adhering
 - ✓ Ash should shed under its own weight
 - ✓ At any given time, clean wall surface should be randomly present over the waterwalls
 - ✓ Water cannon usage and dependence should decrease
 - ✓ Increased effectiveness of air wall blowers

Huntley's Oxistop Thought Process



- ✓ The green color will improve heat absorption of clean tubes
- ✓ The overall heat absorption in the furnace will improve
- ✓ Cost of application is below that of other corrosion coating options.



Unit 68 Oxistop Trial

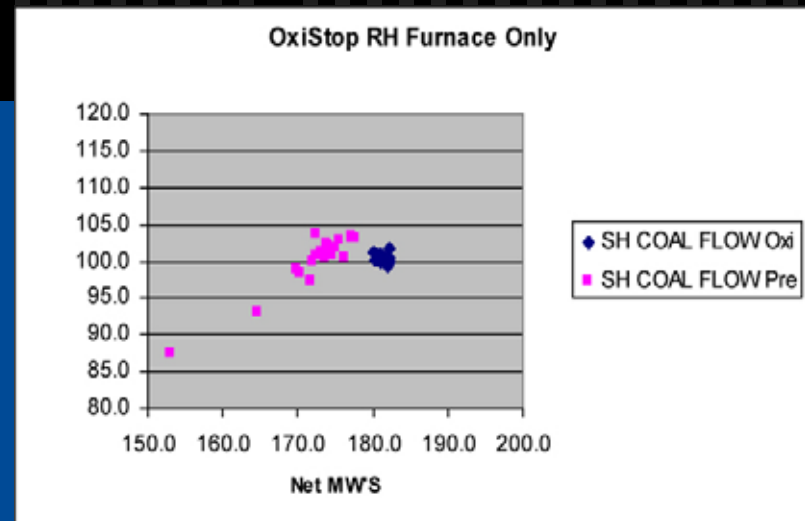
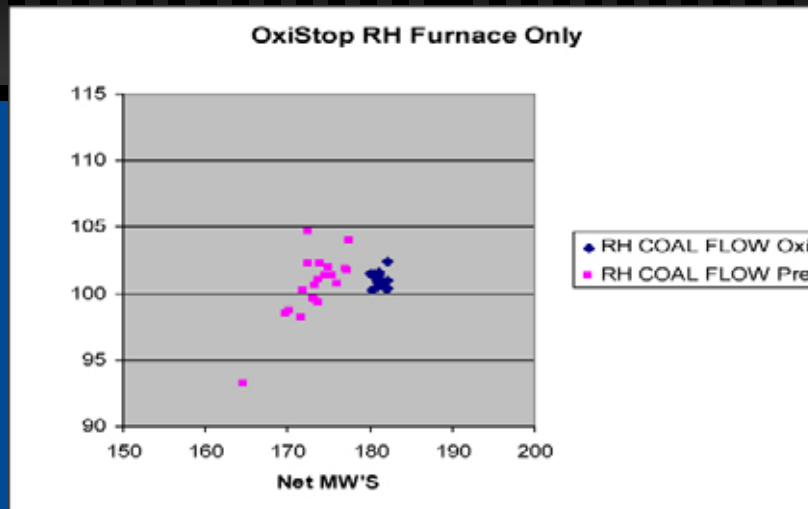


- ✓ Reheat furnace
- ✓ Approx. 5500 sq. ft. application area
- ✓ Applied during 1 week precip cleaning outage April 2006
- ✓ No other significant work performed except airheater wash

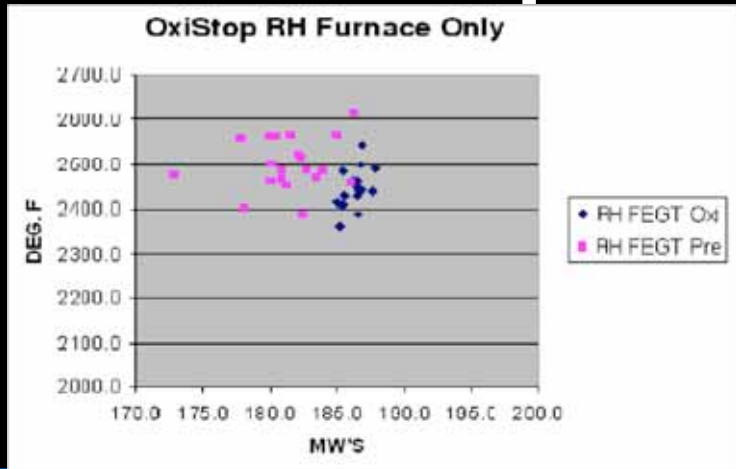
Huntley 68 Evaluation after 1 ½ Weeks of Operation Seasoning

For the same coal flow to both furnaces:

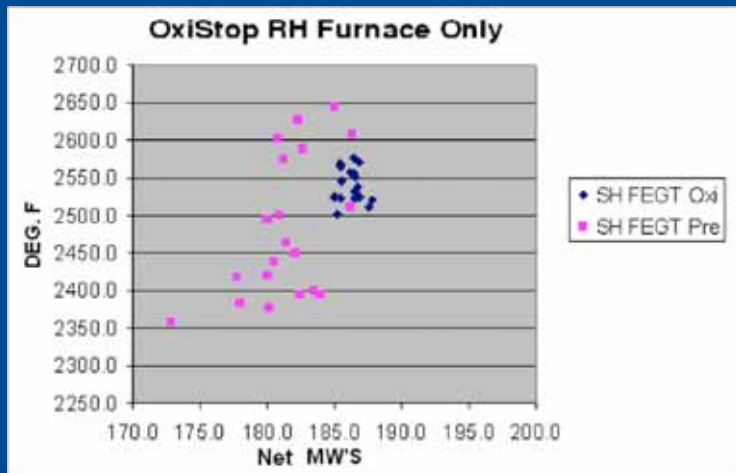
- ✓ Approx. 7 MW additional output.



Huntley 68 Evaluation after 1 ½ Weeks of Operation Seasoning



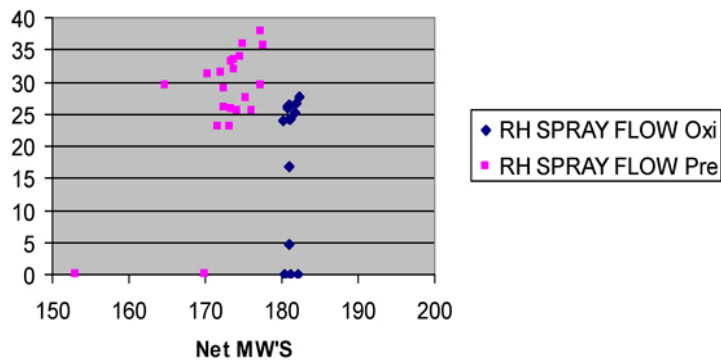
For the same coal flow to both furnaces:



- ✓ Approximately a 75°F decrease in reheat furnace exit gas temperatures (FEGT)
- ✓ No marked change in superheat FEGT

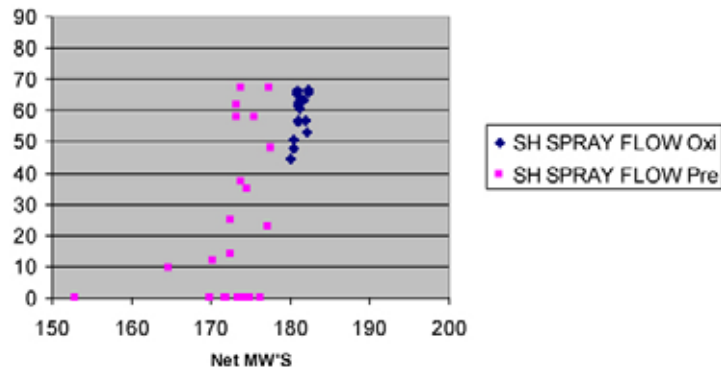
Huntley 68 Evaluation after 1 1/2 Weeks of Operation Seasoning

OxiStop RH Furnace Only



For the same coal flow to both furnaces:

OxiStop RH Furnace Only

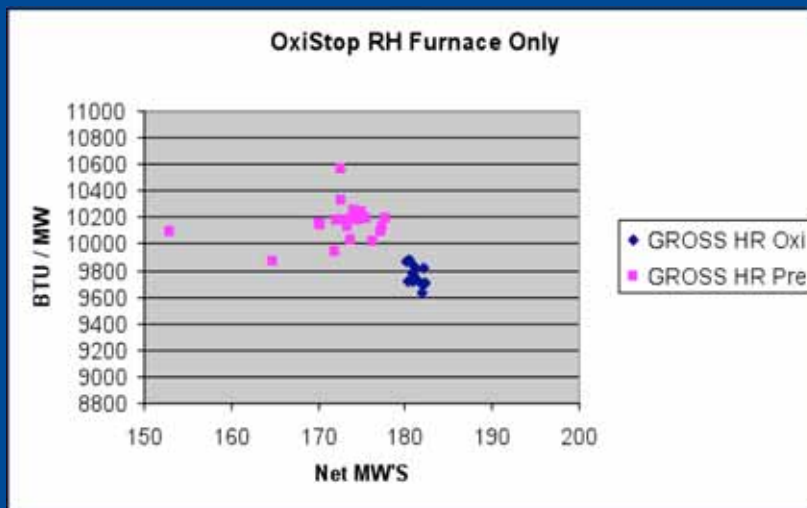


- ✓ Average 20% decrease in reheat spray flow
- ✓ No notable change in the superheat spray range



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Huntley 68 Evaluation after 1 1/2 Weeks of Operation Seasoning



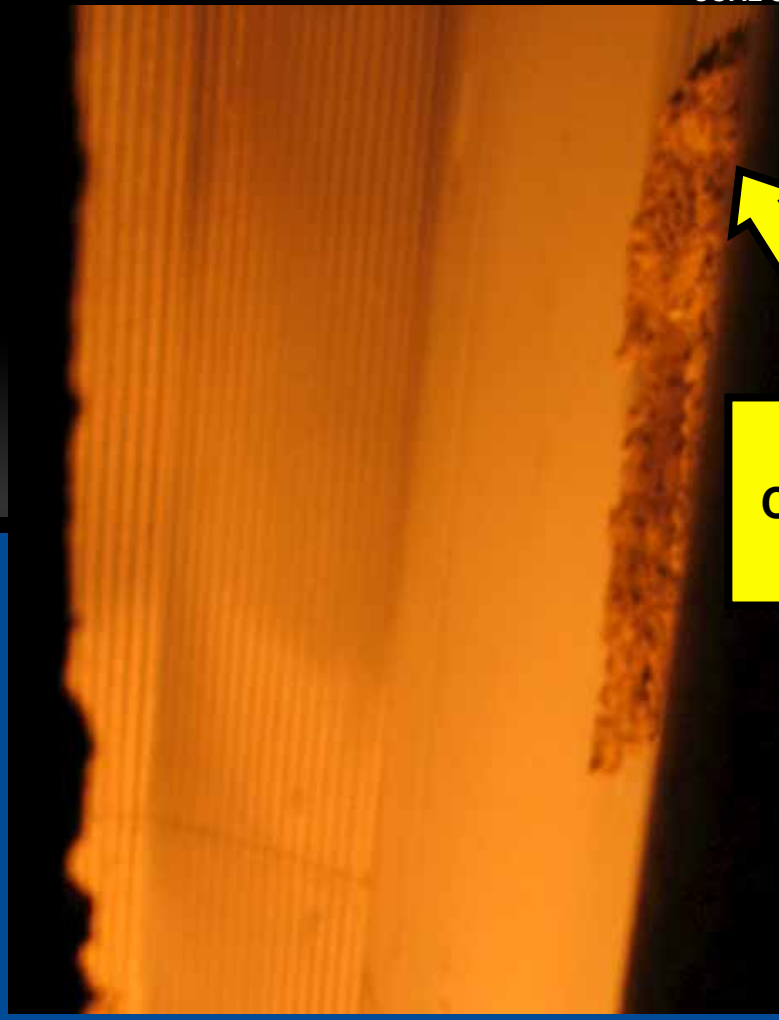
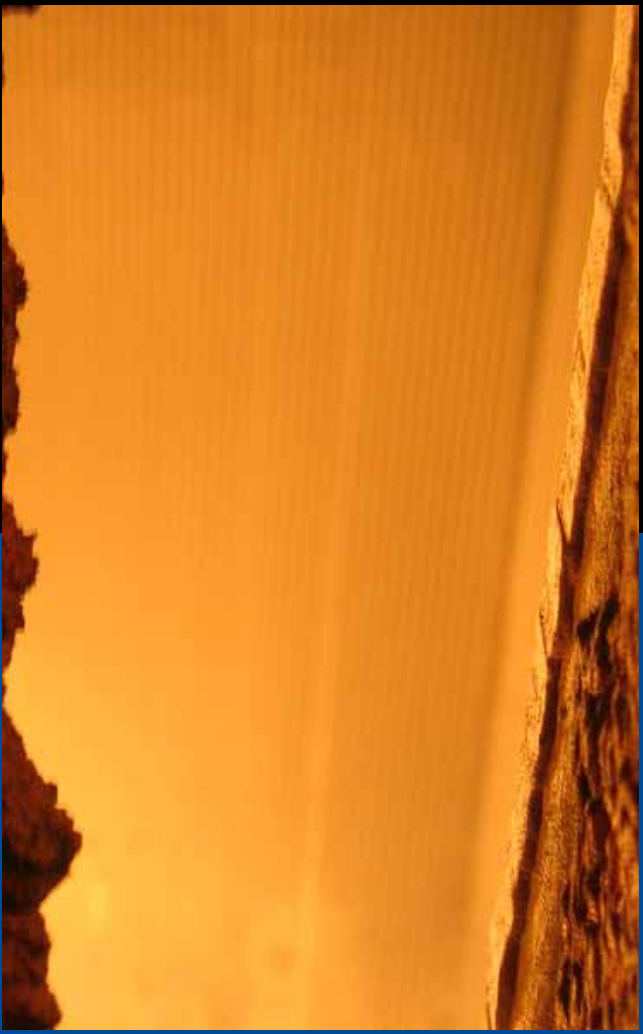
For the same coal flow
to both furnaces:

- ✓ Reduction in gross heat rate



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View in Furnace after 2 1/2 Months



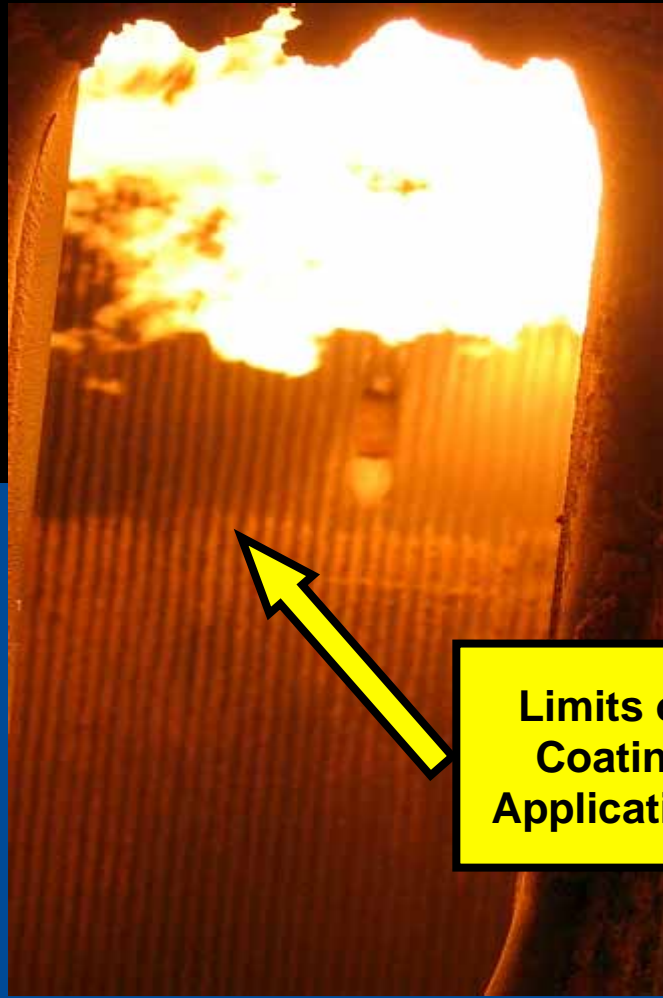
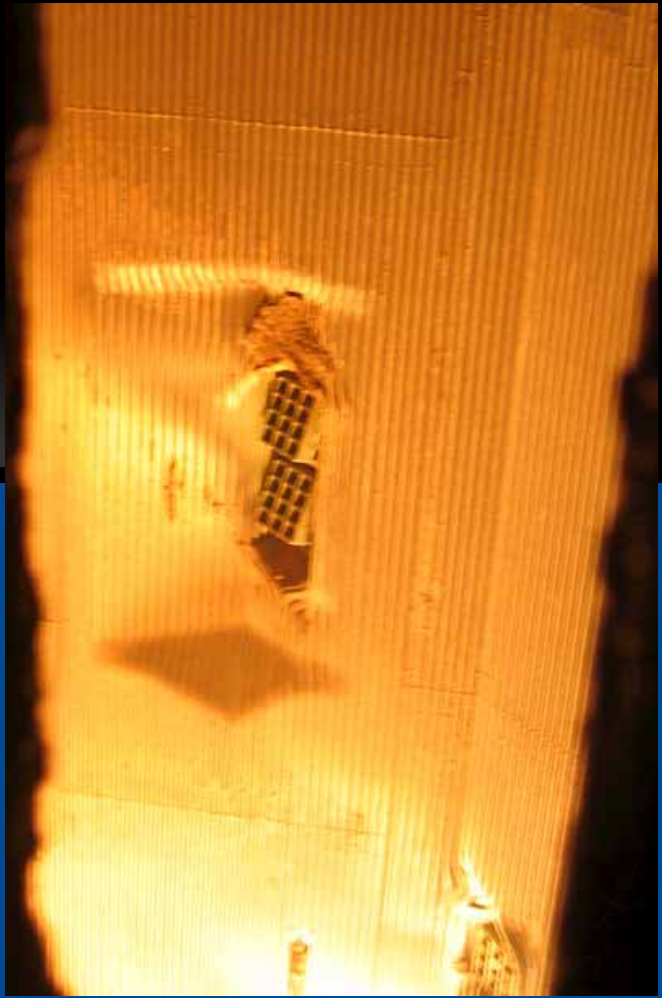
Water
Cannon
Port





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View in Furnace after 2 ½ Months



Limits of Coating Application



After 5 Months of Service

- ✓ During October outage, needed to do UT scan of waterwall tubes for hydrogen damage
- ✓ Sweeping down walls with **floor brooms** was only requirement to obtain UT readings

Expanded Oxistop Application to Huntley 68 SH Furnace

- ✓ Same application area as reheat furnace
- ✓ Applied during October 2006 scheduled outage
- ✓ Total application time of 5200 sq. ft. of coating including sand blasting was just over 24 hours

Other Changes to Unit 68 that Skew SH Furnace Application Test Data



- ✓ New and improved O₂ meters for better oxygen measurements and control resulting in lower unburn carbon levels
- ✓ Reactivation and tuning of “Connoisseur” controls improving unit performance and optimizing NOx production
- ✓ Operation of new pendant pass and airheater soot blowers
- ✓ Marked reduction in boiler setting air in-leakage
- ✓ New high pressure feedwater heaters and level controls



Oxistop Contribution



The Oxistop application did Provide
margins that allowed
“Connoisseur” to be effective

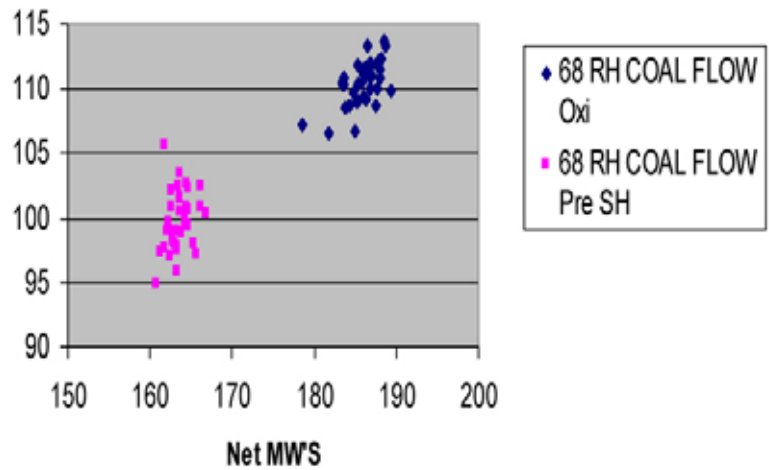




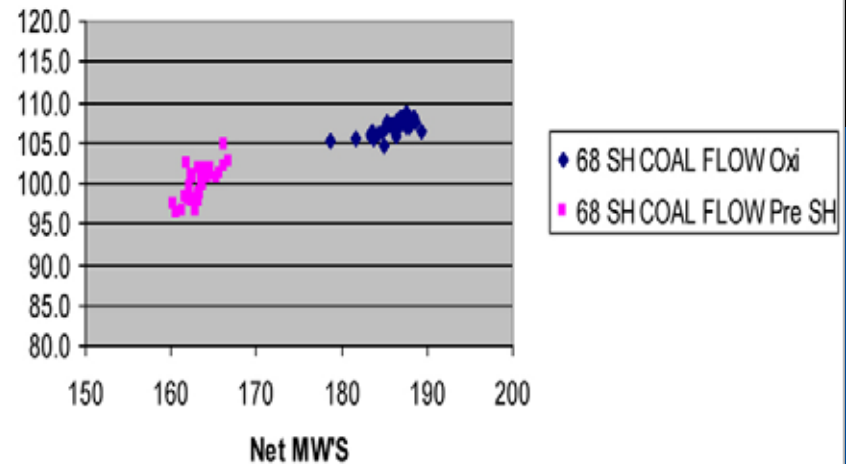
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Huntley 68 Evaluation 2 Months after SH Furnace Application

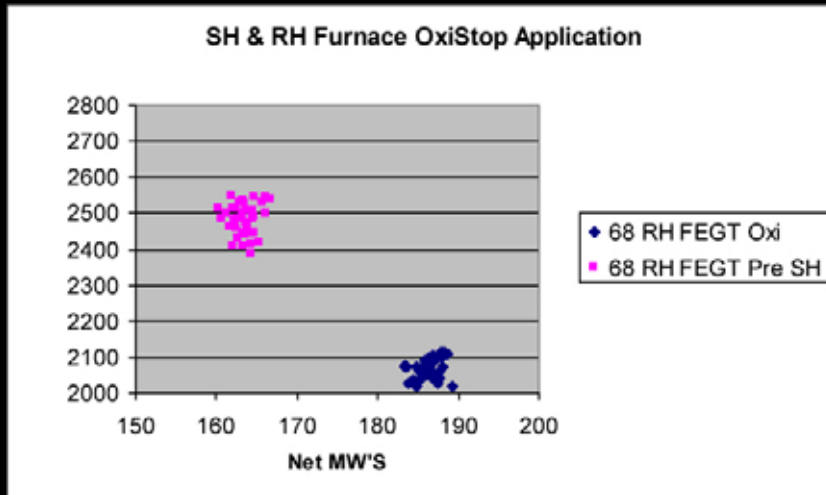
SH & RH Furnace OxiStop Application



SH & RH Furnace OxiStop Application

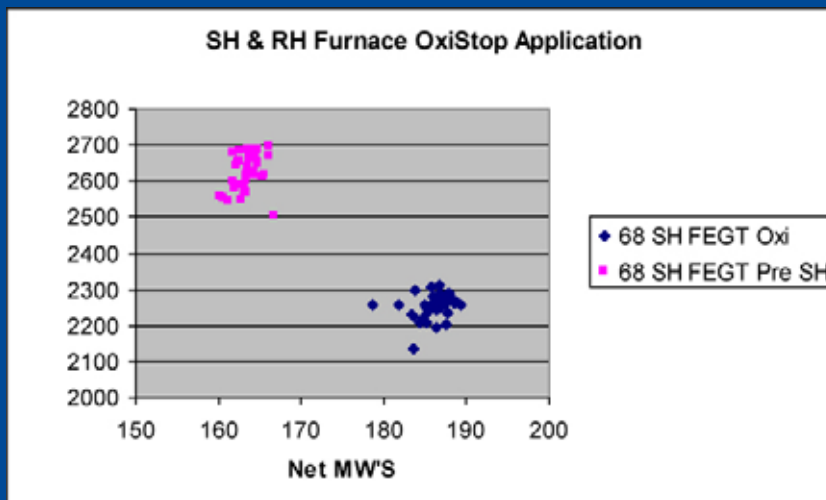


Huntley 68 Evaluation 2 Months after SH Furnace Application



Big change in reheat furnace because:

✓ SH furnace is generating more steam



✓ RH furnace is no longer being over fired to make steam for load

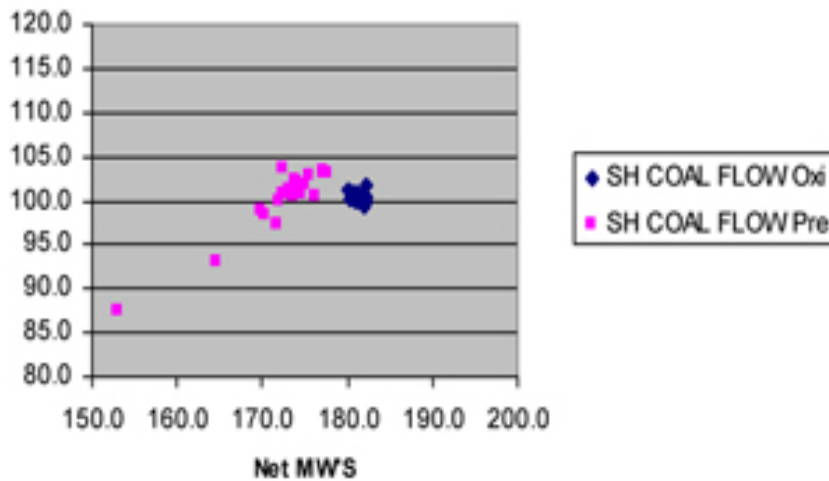
✓ RH furnace fuel input is below SH furnace



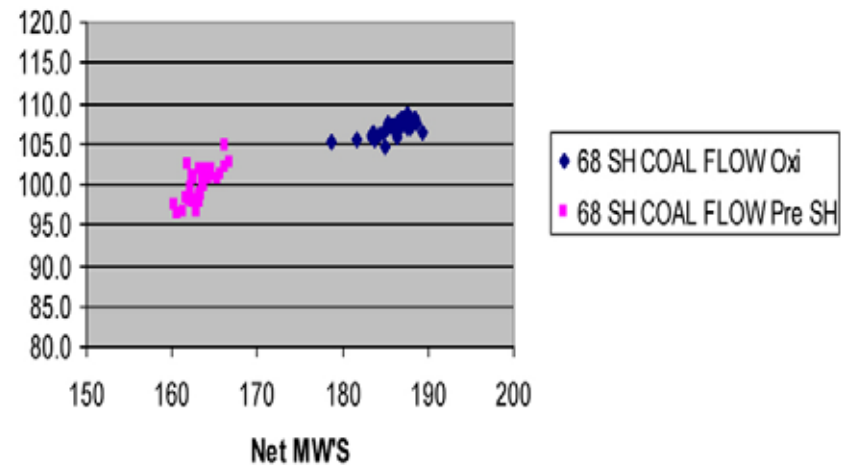
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Huntley 68 Evaluation 2 Months after SH Furnace Application

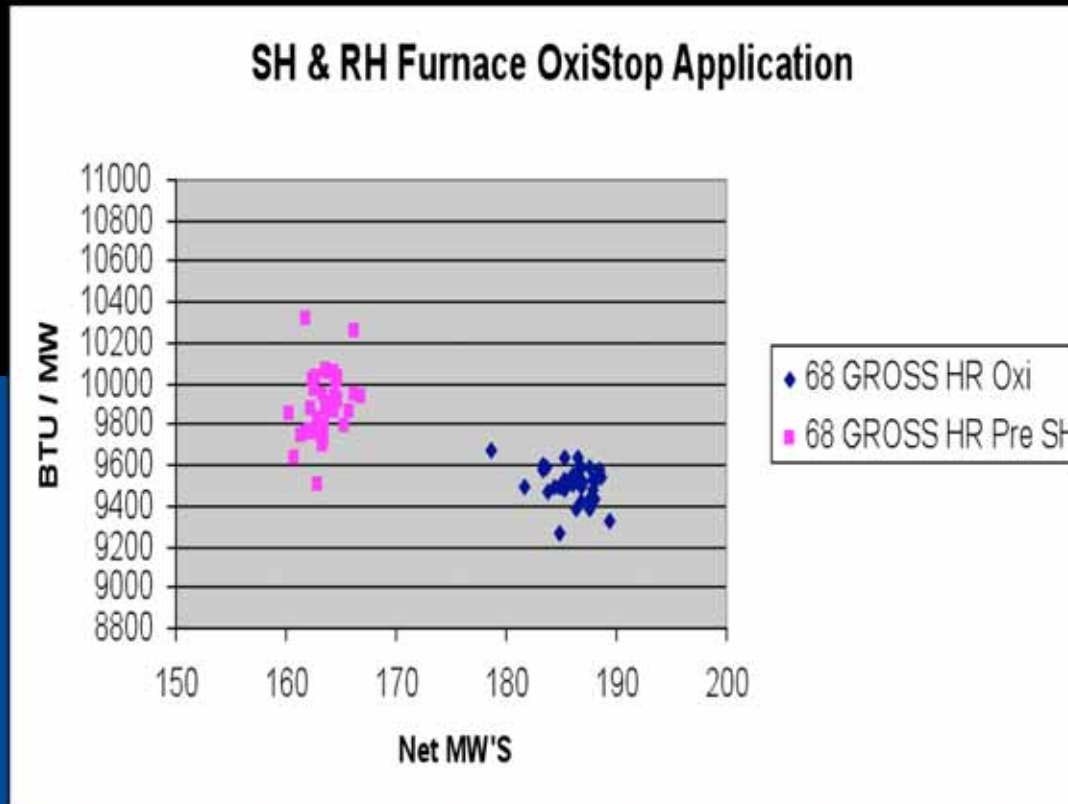
OxiStop RH Furnace Only



SH & RH Furnace OxiStop Application



Huntley 68 Evaluation 2 Months after SH Furnace Application





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Conclusion

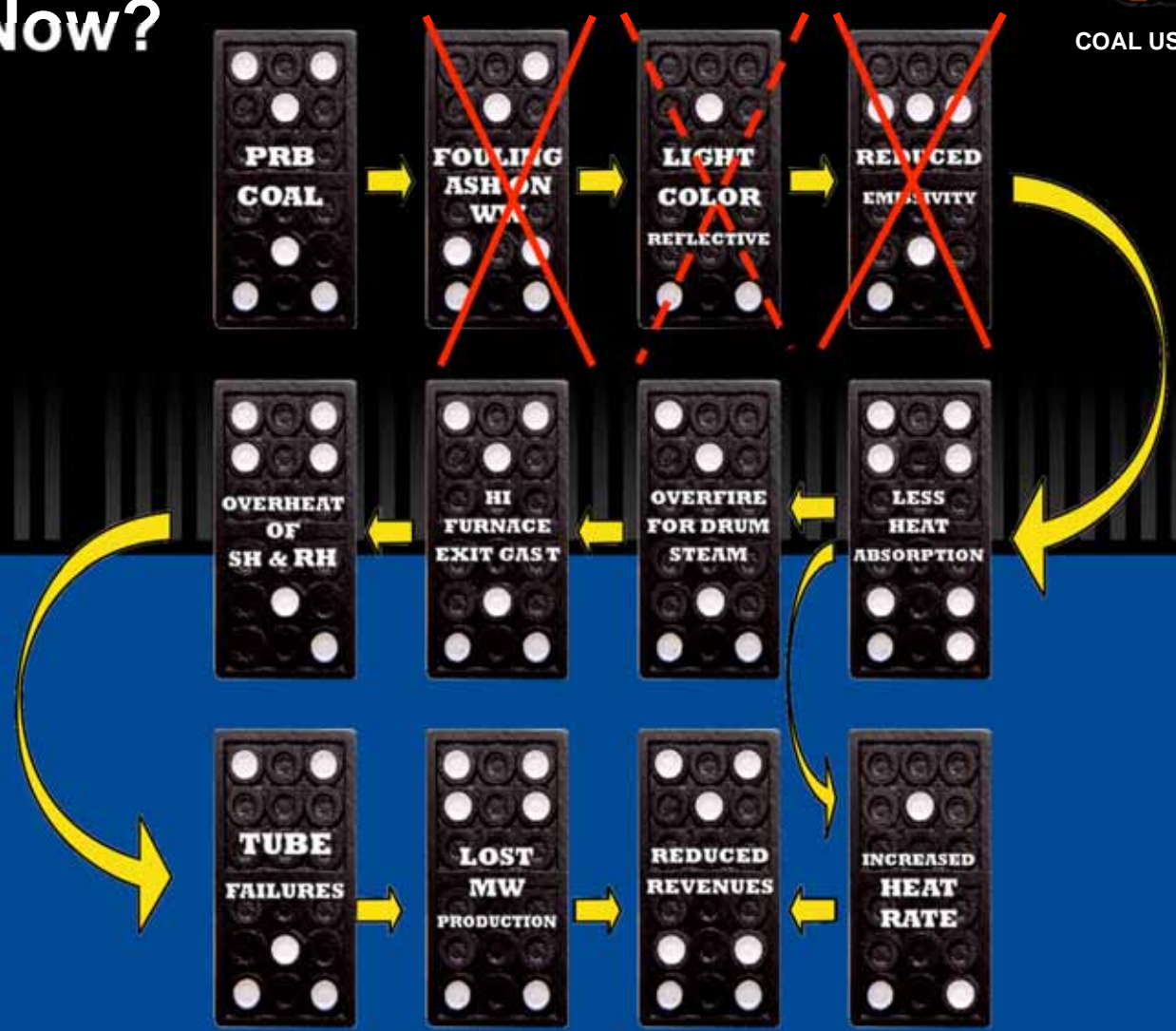
The Oxistop coating does have a positive effect on the heat absorbing ability of Huntley 68's waterwalls.



So what's the condition of our Dominoes Now?



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The Domino Effect from Conversion to PRB Fuel



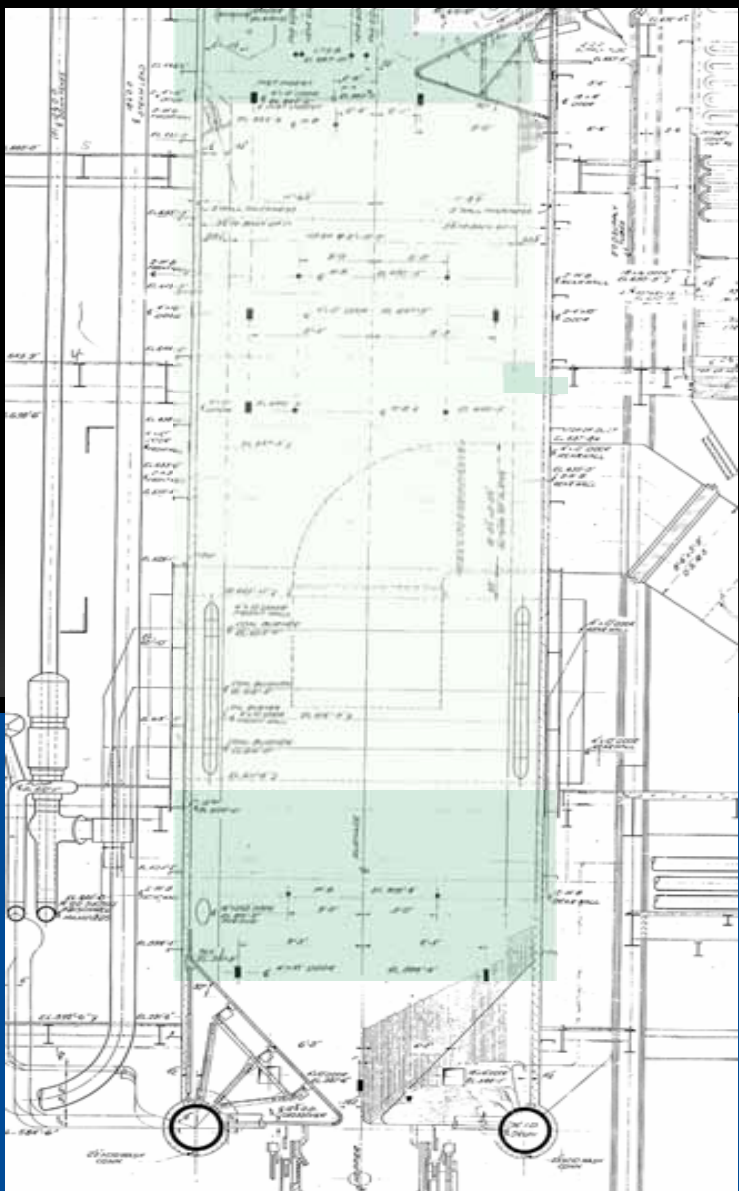
Now when the PRB block topples, the chain is broken and the other blocks do not become a problem





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Future Plans



- ✓ Applied 8500 sq. ft. Oxistop as represented by both the solid and hashed shading in each furnace of unit 67

- ✓ Obtained similar positive effects



NRG Huntley States the Following:



- The water cannon usage in this area is significantly lower.
 - The furnace exit gas temperatures (FEGT) of the reheat box are below historical data. Decrease in air heater outlet gas temperature.
- Lower fuel usage eliminating over firing to make steaming rate.
 - Maximum megawatt output is increased to 198 Megawatts, with slightly less coal burned.

Division Wall Panel coated with Oxistop MC-19-GRP



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**ONLINE INFRARED IMAGE OF
THE COATED AREAS—2.5 YEARS ONLINE
(taken approx 6 months ago)**



To Summarize Oxistop Coatings Will:

- reduce the oxidation of metals at high temperatures
 - improve the temperature uniformity of boiler waterwall tubes
 - reduce the abrasive wear of fly ash on boiler tubes
- reduce the build-up of combustion by-products in pulverized coal burning boilers
 - improve heat transfer into boiler water wall tubes having an emissivity value of .94
 - demonstrate excellent corrosion resistance at high temperatures



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