

Integrated Test & Measurement

MITIGATING RECOVERY BOILER DAMAGE AND INCREASING SOOTBLOWING EFFICIENCY WITH CLINKER DETECTION SYSTEM

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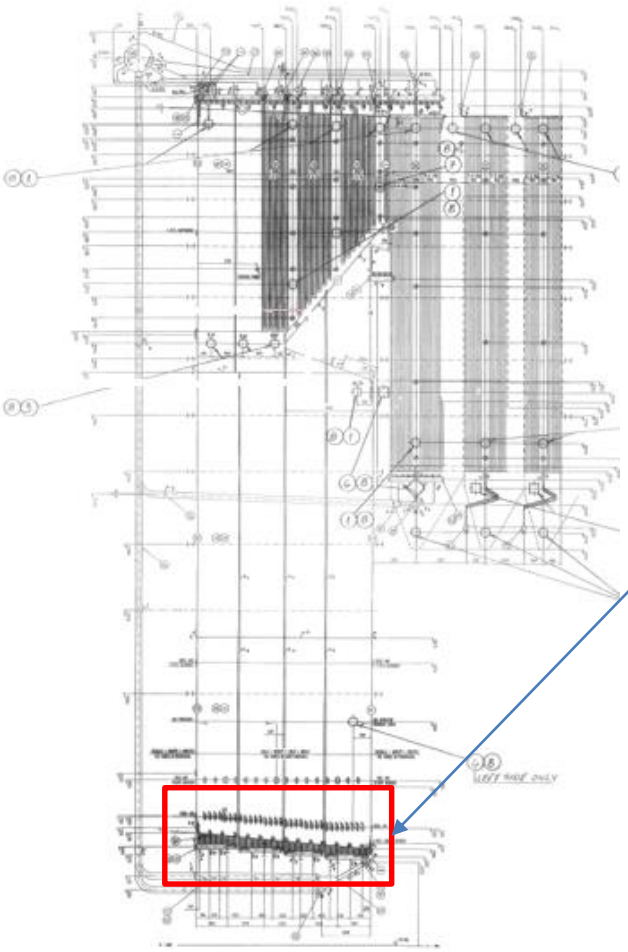
International Paper

Overview

- We started with a problem: Deposits falling from the upper furnace damaging the floor tubes of a recovery boiler.
- We arrived at a system that measures fouling remediation performance:
  - System for the detection of clinker Impacting the floor
  - Sootblower Effectiveness
  - Thermal Shedding Event Optimization

Starting with Why



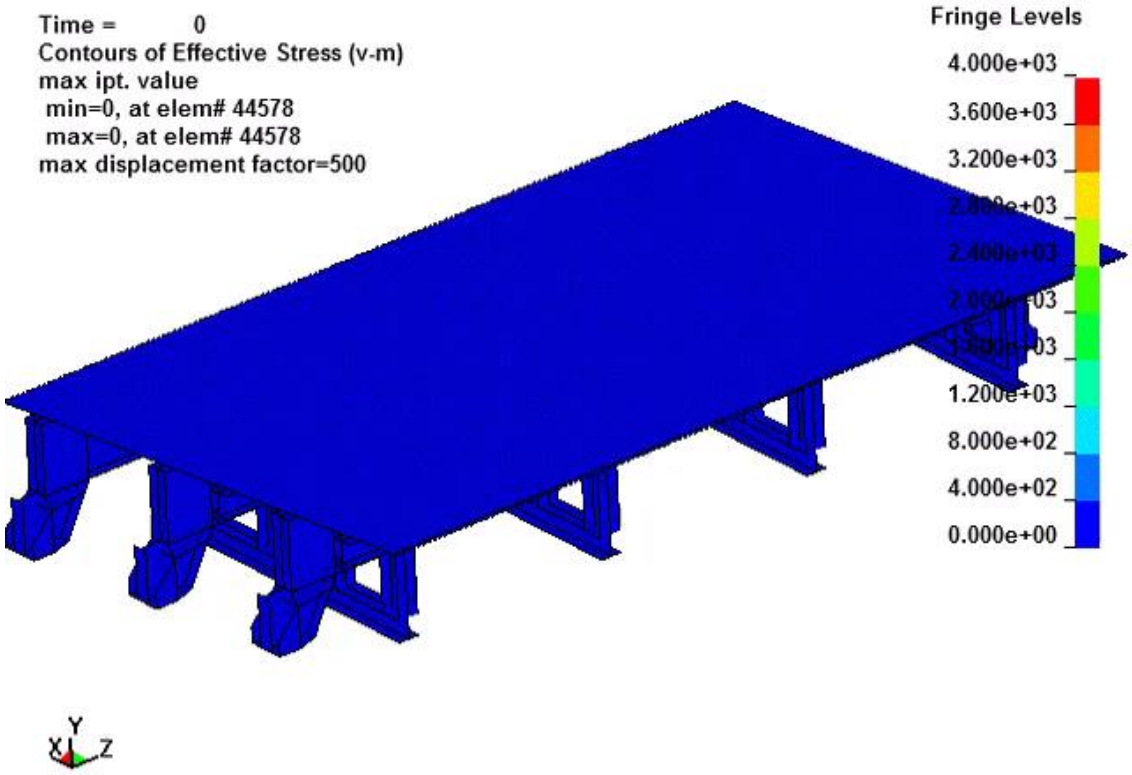
Questions

- How big are these clinkers anyway?
- When and Where are these clinkers impacting the floor?
- OK – even if we know when and where these clinkers form, what can we do to prevent them from forming in the first place?

The Solution

- Use computer modeling Finite Element Analysis (FEA) of the floor tubes to better understand the relationship between the floor damage and the clinker size.
- Monitor the magnitude and location of the clinker impacts using vibration measuring devices (accelerometers).
- Optimize fouling remediation (sootblowing and thermal shedding).

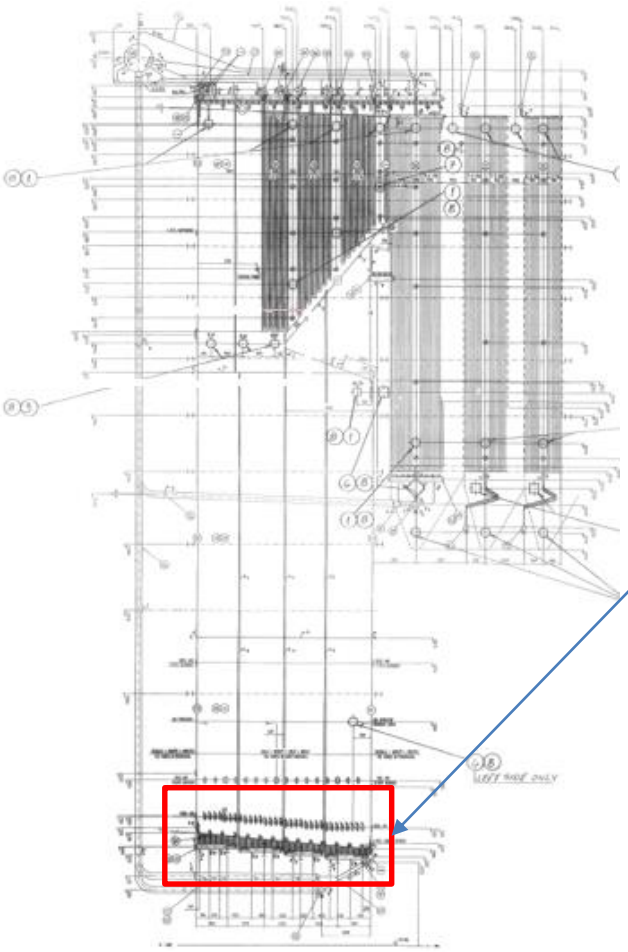
FEA Results


Time = 0
Contours of Effective Stress (v-m)
max ipt. value
min=0, at elem# 44578
max=0, at elem# 44578
max displacement factor=500
Fringe Levels
4.000e+03
3.600e+03
3.200e+03
2.800e+03
2.400e+03
2.000e+03
1.600e+03
1.200e+03
8.000e+02
4.000e+02
0.000e+00
Y
X
Z

FEA Conclusions

- The modeling results are dependent upon assumptions and boundary conditions:
  - Bed thickness
  - Clinker geometry and material properties
  - Location of impact
- A 50kg Clinker falling from 30 meters produce plastic deformation of 2mm. Based on this we can bucket the results in three categories:
  - Green (0-50kg@30m)
  - Yellow (50-100kg@30m)
  - Red (>100kg@30m)

The Monitoring System

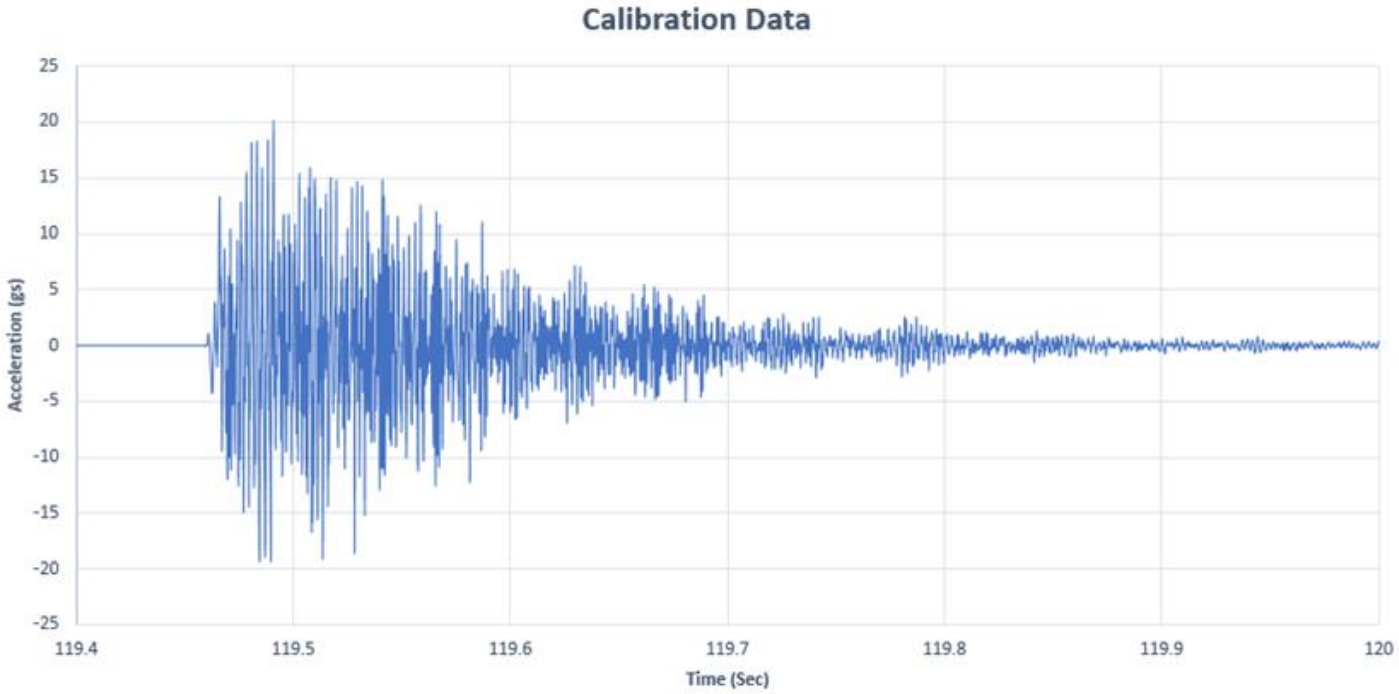


Validate/Calibrate

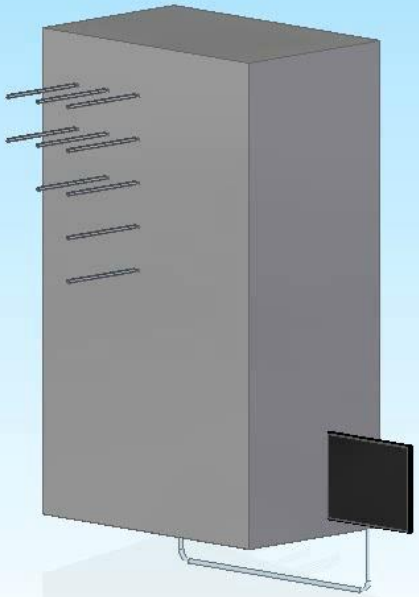
- Dropped salt bags (9-25kg and 9-12kg) from 30m above the floor
- Divided the floor into 6 zones

- Yes this works!
- Provide data to validate the FEA model
- Determine Location of Impacts
- Determine the relative size of the clinker

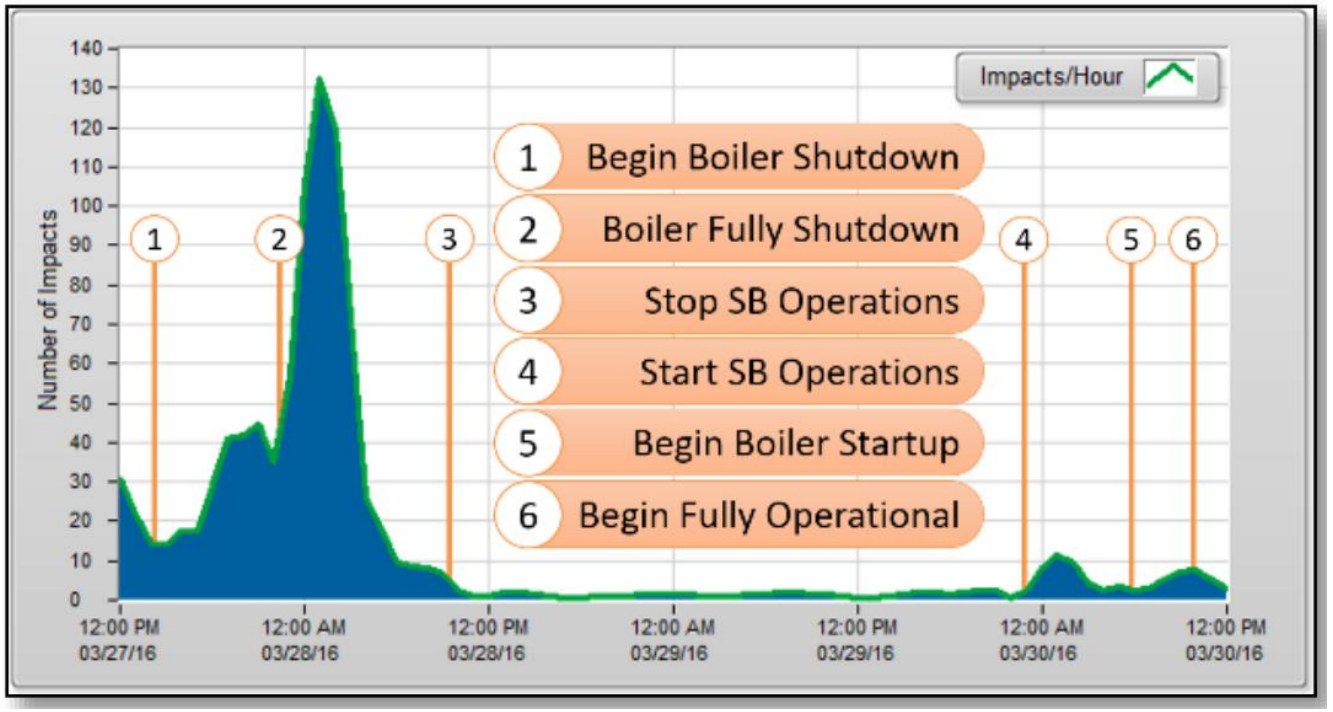
Calibration Results



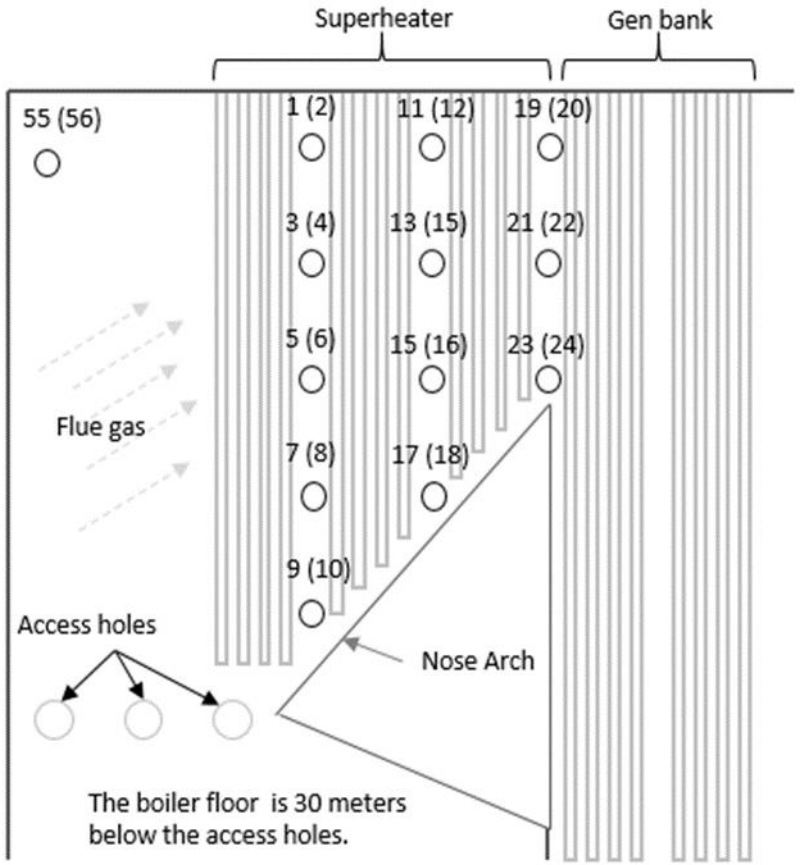
Detection System in Action

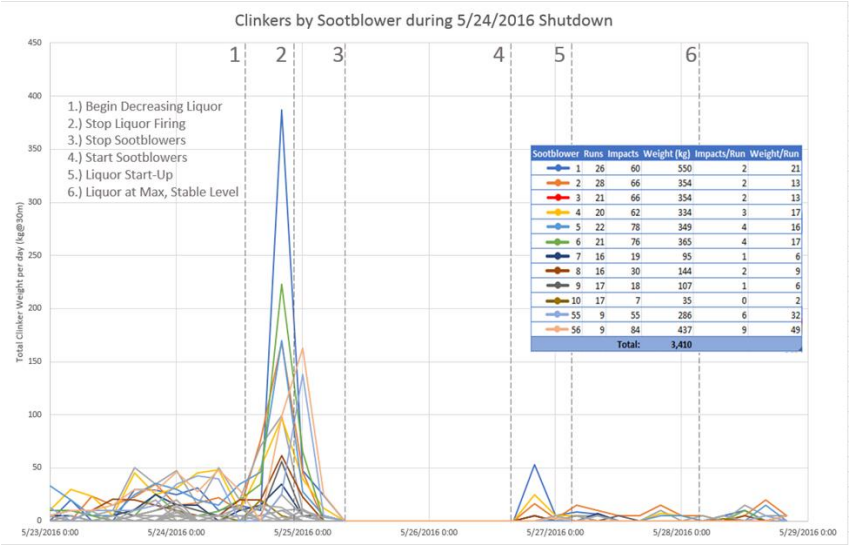


Thermal Shedding



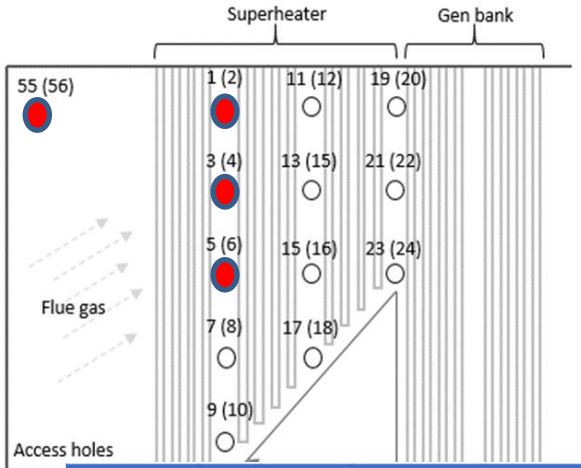
Thermal Shedding By Sootblower





Sootblower	Runs	Impacts	Weight (kg)	Impacts/Run	Weight/Run
1	26	60	550	2	21
2	28	66	354	2	13
3	21	66	354	2	13
4	20	62	334	3	17
5	22	78	349	4	16
6	21	76	365	4	17
7	16	19	95	1	6
8	16	30	144	2	9
9	17	18	107	1	6
10	17	7	35	0	2
55	9	55	286	6	32
56	9	84	437	9	49
		Total:	3,410		

Chill and Blow Results



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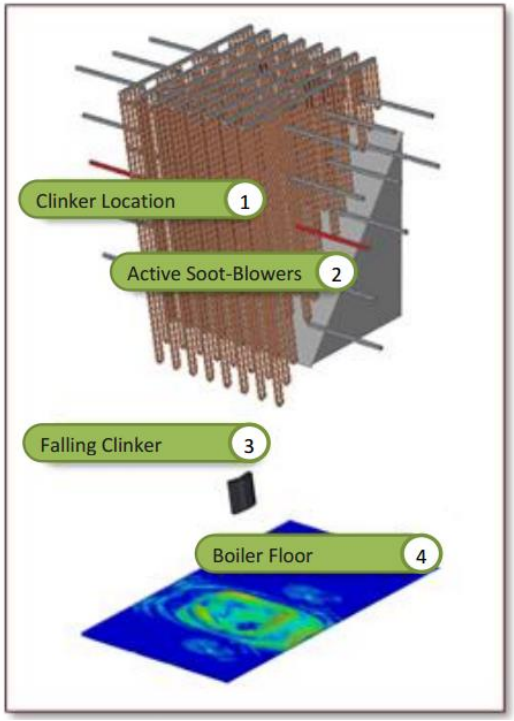
- SB's 1-6, 55, and 56 shed the greatest amount of deposit.
- SB's 55 and 56 were the top performers. Consider increasing # of runs during the next Chill and Blow.
- SB's 7-10 shed the least amount of Deposits
- Buildup was in the upper furnace.

Conclusions

System Results

- Increase operating safety by identifying damaging clinkers
- Determine location of superheater fouling
- Optimize sootblower operation to reduce the risk of floor damage
- Optimize Chill and Blow events



This system is the subject of a U.S. Patent Application