Welcome!

Improving the Operating Efficiencies of Industrial Biomass-fueled Furnaces and Boilers

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Background

- Hard ash deposition in boilers and furnaces is a well-known problem for operators
- As fuel burns, a small portion of the ash (problem ash) is liberated, dissociated, and formed into slag/clinker
- Problem ash sticks to the next relatively cooler surface it encounters, and the process compounds itself
- Inefficiencies resulting from problem ash deposition represent a significant cost to the operator

How Ash Deposition is Typically Addressed

- Slagging and fouling are among the most common causes of maintenance headaches
- Results in higher shutdown frequency/duration, cleaning/ repairs, lost production, reduced efficiency, etc.
- Typical solutions include sootblowers, hydro-blasting, explosives, vibrator systems, etc.
- As slag can be extremely hard and difficult to remove, these methods are known to cause significant wear and/or leaks over time

What About Burning Cleaner Fuels?

- All furnaces and boilers suffer from fouling to some degree
- It can be mitigated to some extent by using more refined or clean-burning fuels
- In many cases, particularly in the wood products industry, it is often not possible to even consider changing fuels
- In cases where it is possible, it is seldom cost-effective to do so, as the use of waste is both economical and environmentally favorable

Industries Impacted

- Most facilities that contend with this problem are burning biomass, coal, or waste fuels
- This affects manufacturers of OSB, MDF, plywood, lumber, pulp & paper, etc.
- Additionally, companies operating waste disposal incinerators, dual-fueled cogeneration plants, multi-fuel combustion systems, and power stations fired with lower grade fuels

What's Missing? A Comprehensive Solution

- Good furnace/boiler operation enjoys high predictability, reliability, and availability
- Ideally, addressing problem ash should be done using a comprehensive approach
- Slagging must be kept under control, allowing the unit to operate steadily and for much greater periods of time
- Increasingly, operators are seeking a way to solve this problem in a proactive way

The Ash Modifier

- As many operators have discovered, an Ash Modifier is a tremendously effective solution to slagging
- Demonstrated reductions in fouling, with corresponding reductions in soot-blowing, and fewer/shorter shutdowns
- Specially formulated clay-based mineral compound which “sabotages” the crystalline strength of hard deposits as they form during combustion
- Results in the fracturing of slag itself, while it forms, causing detachment and ease of removal
- The cost per pound of the Ash Modifier typically includes the costs of the source selection/formulation, packaging, distribution, shipping, application equipment, and overhead

How is the Ash Modifier Applied?

- The Ash Modifier is deployable to virtually any high-pressure combustion system
- It is designed to be universally applicable (i.e. fuel-independent)
- Application method and dosage can be engineered to suit a given installation
- Variables considered include fuel(s) being burned, severity of fouling/slag, current state of cleanliness, and physical layout of the unit
- The Ash Modifier is designed to be pneumatically injected directly into the combustion zone in the furnace, and fed on a continuous 24/7 basis

What Will the Ash Modifier Do?

- Slagging/fouling can be substantially reduced, if not eliminated
- Application may be started either during operation or immediately following a cleaning
- If plugging is severe, cleaning the unit first is advised as the Ash Modifier tends to cause deposits to fall
- Quickly begins to prevent the formation of new deposits as well as the reinforcement of existing deposits
- The unit will now operate continuously in a much cleaner state, typically doubling the mean time between major outages (in many cases, much longer)

Gauging Performance of the Ash Modifier

- Indicators which tell operators that fouling/slag is developing can also serve as the key performance indicators
- Monitoring the output temperatures of the media (thermal oil, steam, water etc.) from a furnace/boiler with slagging under control shows improved temperature stability
- This results in the entire process becoming more stable and controllable
- This in turn results in improved final product quality outcomes, an easily overlooked benefit of this technology

Environmental Impact

- Improves operational efficiency and reduces other activities such as soot-blowing or concussion cleaning
- The quantity of potentially hazardous contaminants being exhausted into the environment is also reduced
- Improved combustion efficiency yields lower emissions per unit of fuel burned
- Maintenance costs of baghouses and scrubbers are reduced
- As the Ash Modifier makes fly ash slightly coarser and less resistive, ESPs and multi-cyclones will perform better, take a higher load, and also be easier to clean

Return on Investment

- For a simple production-based ROI analysis, use actual cost figures of a facility including unit production cost
- Estimate potential gains in production if the mean times between outages can be increased
- This yields the potential increase in production
- This simple ROI calculation does not include savings from improved efficiency, reduced emissions, reduced cleaning/ maintenance, and improved quality outcomes (e.g. less scrap, less downgraded/reprocessed product)

Actual Production-Based ROI Calculation (Canadian OSB Plant)

- Three GTS Furnaces with Thermal Oil Heat Exchangers
- Plant produces approx. 2 million sqft/day of OSB (3/8” basis)
- Formation of hard, glassy slag in the upper furnace and heat exchanger tubes results in premature shutdown every 9 months
- Total wood fuel consumption: 1300 tons/day
- Ash Modifier applied at approx. 1200 lbs/day
- Operating cycle without Ash Modifier: 270 days (maximum)
- Length of shutdown: 10 days

Actual Production-Based ROI Calculation (Canadian OSB Plant)

- Client wished to extend run up to 15 months (420 days)
- Primary objective: Reduce total production cost by avoiding outage
- Program was successfully extended using an Ash Modifier, eliminating intermediate shutdown for furnace cleaning
- The resulting ROI (for simplicity, based on avoided lost production alone) was calculated following a 15-month cycle

Actual Production-Based ROI Calculation (Canadian OSB Plant)

Without Ash Modifier	**270 Days**		
Production Value of Operating Cycle		$113,400,000	
Total Cost of Operating Cycle		$86,400,000	
Profit		$27,000,000	
Lost Production Due To Shutdown		$ (3,304,000)	-12.2%
With Ash Modifier	**420 Days**		
Production Value of Operating Cycle		$176,400,000	
Total Cost of Operating Cycle		$134,400,000	
Profit		$42,000,000	
Lost Production Due To Shutdown		$ (3,304,000)	-7.9%
420 Days of Ash Modifier Application		$624,078	
Return on Investment		429%	

CASE STUDY: Full Year Comparison (Mixed-Fuel Boiler)

- Bubbling Fluidized Bed Boiler (approx. 300,000 spph) in USA
- Original fuel mix: wood waste (40%), recycling wastes, pulp mill sludge, and various assorted plastic materials
- Total fuel consumption approx. 800 tons/day
- Highly alkali fuels and high operating temperature causes severe slag
- Primary bottleneck is loss of bed fluidization after 2 to 3 weeks of normal operation
- Ash Modifier applied at 700 lbs/day

CASE STUDY: Full Year Comparison (Mixed-Fuel Boiler)

- Ash Modifier recommended in conjunction with slight increase in bed medium turning
- Boiler operating cycle immediately improves, allowing operation for an entire year without slag-induced shutdowns
- In early 2015, fuel mix changed (now <20% waste wood), much more waste plastics
- To compensate, the Ash Modifier feed rate was increased to 800 lbs/day
- Boiler still operates smoothly without bed loss, and with very little agglomeration elsewhere in the boiler


Thank You!
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