TIFI®

Targeted In-Furnace Injection™ Technology

Superior boiler performance, corrosion control, and acid plume elimination

Fuel Tech's TIFI® Targeted In-Furnace Injection™ technology is an innovative approach to fireside treatment. The design of the process is individualized to each combustion unit.

TIFI programs can help a combustion unit maintain Maximum Combustion Rating (MCR), control derates and unscheduled outages due to slagging and fouling. TIFI programs can decrease the risks associated with fuel switching, allowing greater operating reliability while burning lower cost opportunity fuels. This is done by reducing slag and fouling while providing a host of related benefits. The amount of chemical injected is optimized by targeting all the heat exchangers in the furnace where slag or fouling can be a problem.

Benefits of TIFI programs:

- Increase Fuel Flexibility
- Improve Boiler Efficiency
- Slag Reduction
- Heat Rate Improvement
- Reduced Sootblower O&M
- SO_3 Mitigation
- Significant Return on Investment
- GHG Reduction
- Reduces Large Particle Ash Formation SCR Fouling

How Does TIFI Work?

Fuel Tech creates a customized TIFI injection strategy for your unit to provide high chemical reactivity throughout all the targeted zones. By using two different modeling programs and proprietary visualization software, we simulate the operating characteristics of your furnace. Using injection overlays and dosage maps, we track exactly where the programs should be injected - ensuring nearly 100% coverage of the target zones.

Unusually clean tubes, results occurred after use of the TIFI program for a 5-month period

- Maximize boiler performance by inhibiting slag and fouling formation in the superheat, reheat and furnace wall sections
- Minimize pressure drops across the convection passes
- Improve boiler reliability with a customized chemical and equipment program
- All programs include Fuel Tech's on-site Service Technicians with field-proven experience and top performance

FUEL TECH
Technologies for clean air & pure water

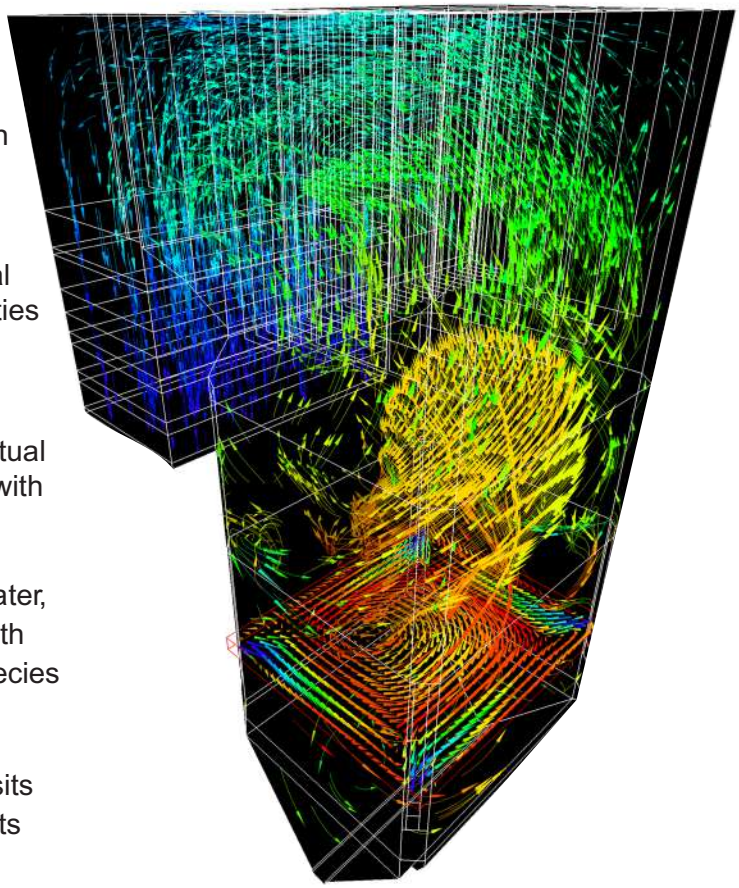
Unique Insight Into the Furnace is Key

Design process engineering is key to program effectiveness. Our computer models take into account the difference in droplet sizes - sending progressively larger droplets deeper into the furnace before evaporating, releasing and activating the chemical where needed. The process iterations converge into a dosage map that shows how much chemical has been delivered to specific areas of the furnace.

Field experience shows that the injection methods used in TIFI programs work because the correct amount of chemical reagent is directed to the right location. Fuel Tech's capabilities in Computational Fluid Dynamics (CFD) and heat transfer modeling are highly sophisticated. Using commercial and proprietary CFD modeling tools along with our own unique virtual reality design space, we recreate your boiler as a "virtual combustion unit" designing injection and dosage strategies with a goal of reaching 100% of your furnace's problem zones.

Our proprietary chemical reagents are mixed with air and water, targeting problem areas where slag and fouling interferes with heat transfer. These reagents react with undesirable gas species to form harmless by-products.

Our slag control reagents also penetrate existing slag deposits reducing the slag's structural integrity. As such, slag deposits become more friable and are more easily cleaned from heat transfer surfaces.



CFD modeling technologies and experience in predicting chemical reagent injection points allows for a more accurate treatment of your furnace with TIFI program technologies.

Virtual Reality Visualization takes you "inside" your boiler.

TIFI® Technologies

TIFI CORE™

Magnesium hydroxide slurry is injected into the combustion unit at locations defined by CFD modeling, to maximize coverage of slag and fouling problem areas. The slurry reacts with slag as it is forms and penetrates into existing deposits to affect the physical crystal characteristics. This technology also has also demonstrated excellent SO_3 abatement performance. This program offers the capability to co-fire high calcium or high-chloride fuels that tend to form tenacious slag deposits.

TIFI Flux™

Specifically designed for cyclone boilers, especially those burning PRB and low iron coals. TIFI Flux™ allows greater operating flexibility and lower power settings, resulting in the avoidance of the use of costly kerosene or primitive iron additives to meet the demands of cyclone units.

TIFI® Programs

TIFI Programs

- Sophisticated CFD Modeling
- Highly Reactive and Stable Reagents
- Chemical Feed Systems
- Experienced Technical Support and System Monitoring

Fuel Types

Coal

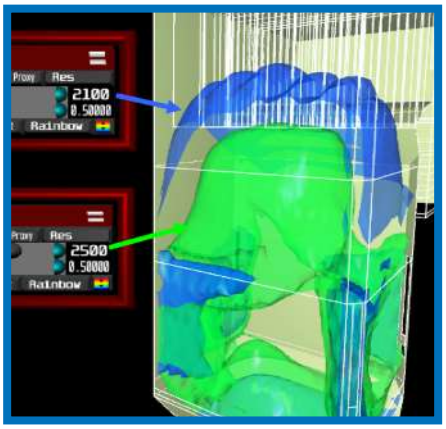
- Powder River Basin (PRB)
- Illinois Basin (ILB)
- Lignite
- Central Appalachian (CAPP)
- Challenging fuel blends

Alternative Fuels

- Biomass
- Pet Coke
- Hog Fuels
- WTE Fuels
- Liquid Waste Fuels
- Black Liquor

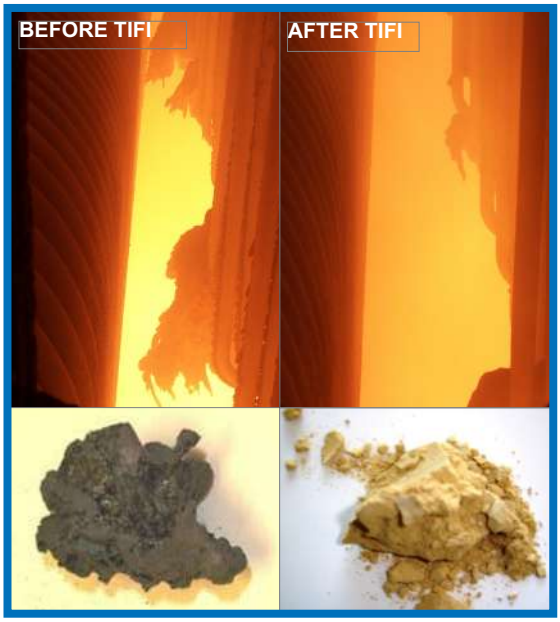
Residual Fuels

- No. 6 Oil
- Waste Oil
- Bunker C



Fuel Flexibility

This CFD model depicts the fusion zones, where molten ash starts to solidify, for high ash fusion temperatures (green areas) and those with lower ash fusion temperatures (blue). These lower fusion temperature coals can negatively impact heat transfer since their fusion zone is often the same temperature as the heat exchanger surfaces. TIFI programs with specifically designed reagent injection solutions can mitigate this problem.



Slag Control

Shown here are two images of a superheater tube bundle in a boiler. Before TIFI was started, slag deposits were bridging from the exchanger to the nose arch. Within hours of initiating TIFI program feed, the bridging started to disappear, opening the gas flow pass and allowing better heat transfer with lower pressure differentials. Also shown is the actual change in crystal morphology observed when a TIFI Program is applied. In the “before” photo slag is hard and glassy; while in the “after” photo the slag has been transformed and is crumbled and soft.

SO_3 Mitigation

TIFI technologies are also used to successfully control SO_3 and the resultant $PM_{2.5}$ acid “blue plume,” stack opacity, as well as, air heater fouling and corrosion. This allows an operator to run the combustion unit with stack temperatures below dewpoint with no degradation in air heater performance, resulting in better low load operation.

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