



**REDUCE  
EMISSIONS  
INCREASE  
EFFICIENCY  
RESTORE  
CAPACITY**

[www.therma-chem.com](http://www.therma-chem.com)



Therma-Chem is a globally operating Scottish company specialised in the production and application of a unique chemical technology product, FS12. Used for online fireside cleaning of boilers and process heaters within power plants and refineries, FS12 improves efficiency, increases capacity, reduces emissions and allows for a high return-on-investment.

## What is FS12?

FS12 is a mildly alkaline solution containing nitrates that is designed specifically to clean boilers and process heaters online. Using Therma-Chem's proprietary injection system, the liquid is injected directly into the combustion chamber, vaporises and is carried by the flue gas through the unit, encountering all heat transfer surfaces including the combustion chamber, superheaters, economiser, air pre-heater and ESPs.

FS12 reacts with existing hard deposits and fouling on tubes by increasing their melting point and reduces them to soft powdery ash. This allows units to maintain high thermal efficiencies or recover capacity, if this was limited by fouling. FS12 also neutralises sulphur deposits on the cold end of the flue gas path preventing cold end corrosion and eases man entry during a maintenance or inspection shutdown.

In addition, FS12 will reduce NO<sub>x</sub>, SO<sub>x</sub> and Carbon emissions by up to 20%.

Using FS12 ultimately results in improved heat transfer, prevention of both high and low temperature corrosion, improved operating efficiency and reduced emissions.

## Problems & Solutions

### Slagging and fouling

FS12 removes slagging and fouling converting it to a dry friable powder which is carried away in the flue gas

### High and low temperature corrosion

FS12 eliminates vanadium corrosion and sulphur deposits are converted to non-corrosive sulphites and sulphates

### NO<sub>x</sub>, SO<sub>x</sub> and Carbon emissions

FS12 is a UNFCCC approved technology for JI and CDM projects with proven results in reducing NO<sub>x</sub>, SO<sub>x</sub> and Carbon emissions

### Loss of efficiency

By removing fouling and slagging from the heat exchange surfaces, operating efficiencies will increase and fuel consumption will reduce

### High flue gas exit temperature

FS12 removes fouling and slagging thereby allow the heat exchange surfaces to absorb more heat which will lead to a reduction in the flue gas exit temperature.

## Sectors



### Coal Fired Plants

Increase boiler efficiency by preventing fouling and ash deposits



### Oil Fired Plants

Reduce emissions and burn low quality heavy fuel oil



### Shipping

Prevent slagging and fouling on marine boilers



### Biomass

Eliminate slagging and fouling and improve capacity



### Expanders

Remove and prevent formation of catalyst deposits on expander components



### Gas Turbines

Prevent deposit build-up on gas turbine blades and vanes and eliminate corrosion

## What is FS12?

FS12 is a mildly alkaline solution containing nitrates which is injected into the combustion chamber, gasifies and is carried by the flue gases throughout the boiler encountering all heat transfer surfaces.

Our unique blend of alkali nitrates is specifically formulated to remove and prevent slagging and ash fouling.

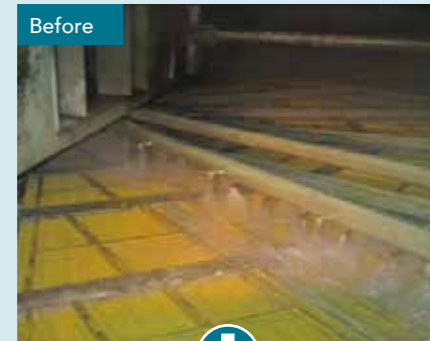
## How does it work?

FS12 increases the melting point of various elements causing semi viscous deposits to dry out and become friable. Ultimately, this causes the deposits to break down and be carried away by the flue gas stream as can be seen from the superheaters before and after they were treated with FS12.



## Does it prevent corrosion?

Yes, FS12 prevents both high and low temperature corrosion by eliminating vanadium corrosion and converting sulphur deposits to non corrosive sulphites and sulphates. The photographs of the APH show corrosive sulphurous deposits before treatment and dry non-corrosive sulphites and sulphates after FS12 treatment.



## Which units can FS12 be applied to?

- FS12 can be applied to units firing
- Liquid Fuel: heavy fuel oil, vacuum tar residue, high pour blendstock and orimulsion
  - Solid fuel: coal, lignite
  - Gas: sour gases, waste gases
  - Biomass: wood, waste

## Is it a fuel additive?

No, FS12 is not a fuel additive. FS12 is a post combustion treatment of hot gases and deposits inside boilers, directly aimed at the elimination of all deposits.

## How is FS12 injected?

Using Therma-Chem's proprietary injection equipment FS12 is injected directly into the combustion chamber of the boiler.



### Superheaters Prevent high temperature corrosion

FS12 eliminates vanadium corrosion and converts sulphur deposits into non-corrosive sulphites and sulphates which are carried away in the flue gas reducing cleaning time during shutdown.

### Economiser Limit fouling and maintain flue gas velocity

FS12 oxidises carbonaceous deposits and converts sulphur into harmless substances resulting in no corrosion and improved boiler performance.

### Air Pre-Heater Prevent dew point corrosion from sulphuric acid

FS12 reacts with sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) and converts it to dry, powdery non-corrosive sulphites and sulphates. FS12 also prevents further formation of sulphuric acid, thus protecting the APH from corrosion.

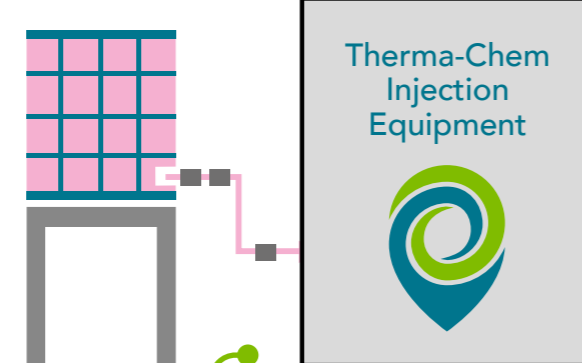
### Stack

#### Reduce NO<sub>x</sub>, SO<sub>x</sub> and Carbon emissions

FS12 is United Nations FCCC approved technology for reducing carbon emissions under Joint Implementation and CDM projects.

## How FS12 benefits boiler performance

### Therma-Chem FS12



### Therma-Chem Proprietary Injection Equipment

### Combustion Chamber

#### Eliminate slagging and improve heat transfer

FS12 removes slagging from the tube walls and converts it to a dry, friable powder. This results in increased heat transfer and restored capacity.

### Baghouse Filter

#### Improve performance and reduce maintenance

FS12 converts large, hard deposits into dry, friable powders that can be easily removed preventing damage to equipment.

### ESP

#### Improve particulate removal

FS12 converts molten ash to dry particles and these particles are attracted by the magnetic charge of the ESP thus reducing the amount of particulates emitted to the atmosphere.

### Induced Draft Fan

#### Improve performance and prevent corrosion

FS12 prevents blade corrosion on fans, reducing vibration and subsequently improving performance.



## Operational benefits

- Elimination and prevention of slagging and fireside fouling
- On-Line Boiler cleaning ability eliminating need for taking boilers offline or shutdowns
- Neutralises Acid Corrosion in the cooler unit zones
- FS12 Technology prevents High Temperature Vanadium and Sulphur corrosion
- Increased capacity c.20%
- Increased steam to fuel ratio - c.5%
- Increased efficiency c.6%
- Complete elimination of residue



## Environmental benefits

- Significant reduction in carbon emissions - c.20%
- FS-12 is an approved technology by UNFCCC for JI and CDM projects
- FS-12 is a DNV and TÜV accredited procedure
- Significant reduction in NO<sub>x</sub>, SO<sub>x</sub>, CO<sub>2</sub> particulates emissions



## Financial benefits

- Extended life expectancy of existing assets allowing for the deferral of new capital investment into new assets, while still increasing profitability and performance with your existing assets
- Profit increase stemming directly from increased capacity (recovery of capacity loss) - c.20%
- Profit increase stemming directly from reductions in fuel consumption
- Profit increase stemming directly from lower production and cleaning costs
- Profit increase stemming directly from FS12 application preventing the need for costly shut downs
- Profit increase stemming directly from increased availability due to use of FS12
- Potential increased revenues stemming from resale of CER's originated from a CDM/JI project



### Case Study 1

**Location**

Canada

**Fuel**

Coker feed and Bunker C equivalent

**Capacity**

2 x 350 T/hr  
(2 Boilers x 75,000 barrels per day)

**Problem**

Heavy fouling and high steam usage for sootblower

### After Therma-Chem Treatment

Fouling was removed resulting in a capacity increase from 550 KPPH to 730 KPPH – a recovery of 25% in boiler efficiency from 73% to 97%. This also resulted in sootblower steam savings of 720,000 lbs per day. These steam savings led to an increased extraction of bitumen equivalent to c.30,000 BPD. Additionally, savings of 2 weeks in shutdown cleaning were realised as mechanical cleaning was eliminated. This downtime saving in-turn leads to substantial gains in production from additional days in service.



### Case Study 2

**Location**

Egypt

**Fuel**

Fuel gas and heavy fuel oil

**Capacity**

2 x 350 MW  
(2 Boilers x 1,065 T/hr)

**Problem**

Fouling of superheaters and economisers

### After Therma-Chem Treatment

A TÜV inspection revealed that hard scale formations on the superheater and stringer tubes were removed by FS12. This resulted in an efficiency increase of c.2% for the limited duration of the one month trial and an emissions reduction of c.40 tonnes of CO<sub>2</sub> per day.



### Case Study 3

**Location**

Romania

**Fuel**

Coal

**Capacity**

2 x 50 MW  
(2 Boilers x 420 T/hr)

**Problem**

Slagging and fouling causing high CO<sub>2</sub> emissions

### After Therma-Chem Treatment

Slagging and fouling of the boilers was reduced improving the boiler efficiency and reducing fuel consumption. Consequently, a TÜV inspection over a period of 3 years from 2008-2010 revealed that the plant had a total emissions reduction of 78,915 tonnes of CO<sub>2</sub>. This project was a joint implementation project between the Danish and Romanian governments under the United Nations Framework Convention on Climate Change.

## Contact us

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## Clients using Therma-Chem

