HM-910 Sulfur Control Agent

Introduction

Introduction

HM-910 Sulfur Control Agent
for Gulf Countries

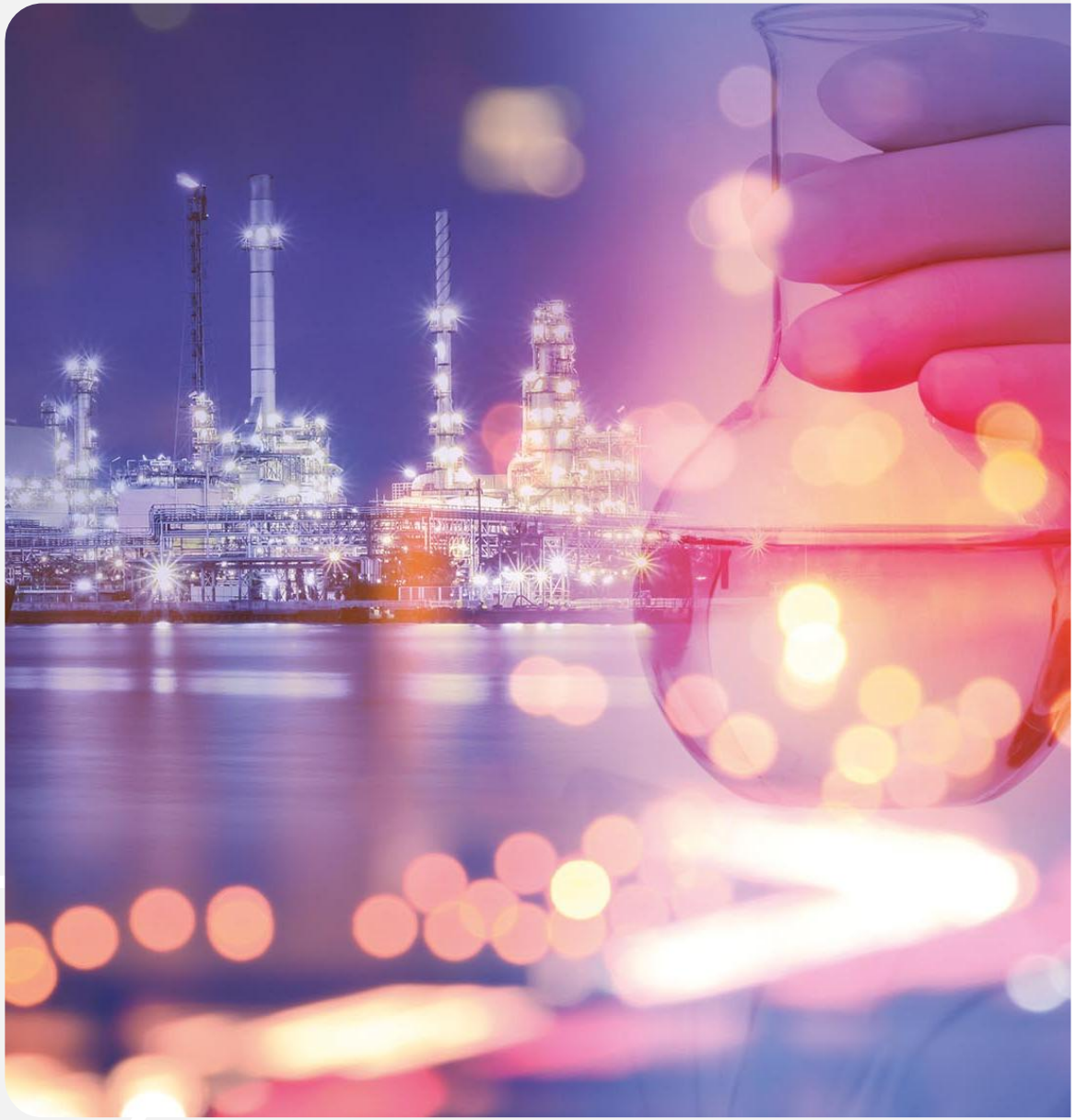
Our Promise

Our mission is to add value to your business - you get the benefits of our best-of-breed practices, our unparalleled responsiveness, and our strong technology background.

Our leadership team has a several decades of living and working experience in the West; this ensures customer empathy and a strong understanding of customer needs.

We pride on our good corporate culture and governing practices. Governed by an independent board of directors and a consultancy body consisting of the top-notch professionals, we create, formulate and strategize every decision, ensuring the needs of our valued clients are catered to. We are financially strong and we invest heavily in recruiting key executives, project managers and staff.

We always believed in being a dependable partner rather than just a vendor. Our business model described above has given us the opportunity to offer our domain expertise to our customers and thus build a two-way partnership. We can now help build your revenue, while you outsource your work to us.



Product Introduction

HM-910

Sulfur Control Agent

Patented & A Product of

AJ GLOBAL
YOUR GLOBAL PARTNER

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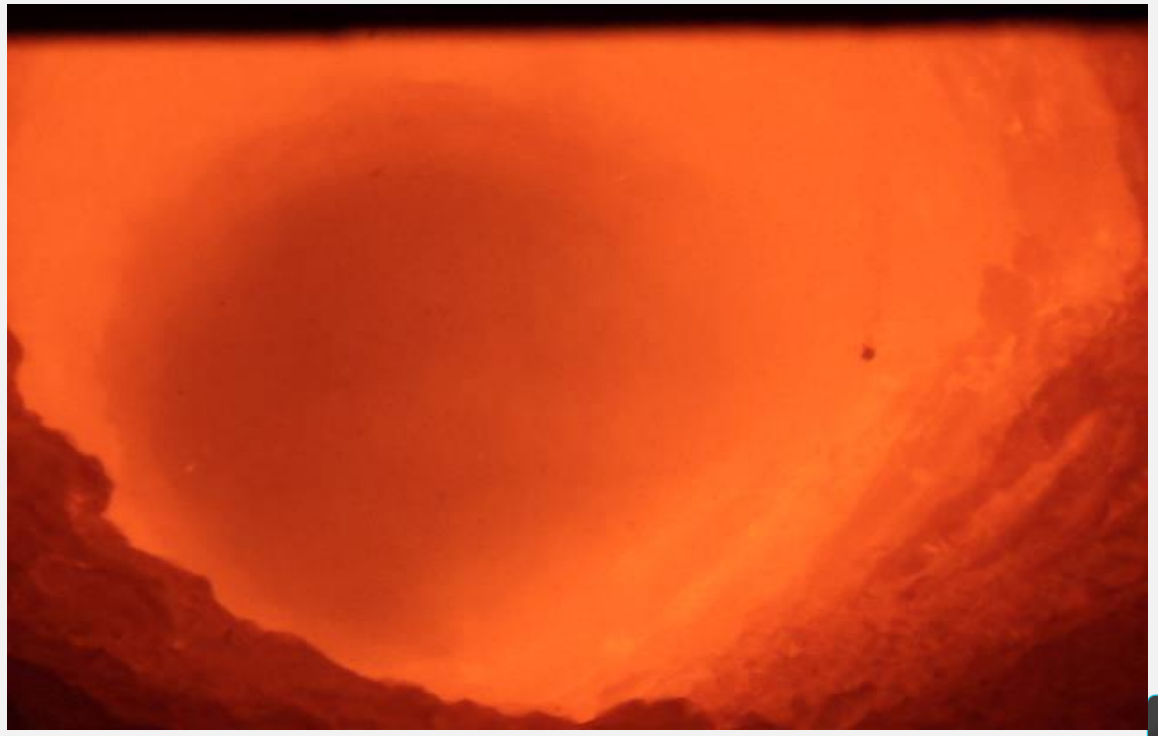
Introduction Background Story

HM-910 Sulfur Control Agent
Application Story – Cement Factories

- Many cement rotary kilns are plagued by rings in the inlet or preheating section. The effects of rings are well known

- The flow of the kiln feed is restricted; with sufficient height, hot meal is retained until the kiln inlet and flows out through the kiln inlet seal, posing a serious safety risk and damaging the kiln inlet seal.
- Increase of the pressure drop, augmenting thus the energy consumption of the induced draft (ID) fan.
- Increase of gas velocities in the ring area, entraining thus more dust into the kiln gas.
- These effects destabilize the clinker burning process. The ultimate consequence may be an unplanned kiln stop and the subsequent cleaning of the kiln.



Problems due to high Sulfur fuel consumption

Application Story – Cement Factories

- The formation of crust rings in pre-heaters and rotary kilns is a common situation that causes operative problems in process stability.

- This situation is aggravated when residual fuels are used, as they are rich in sulfur and vanadium. This elements speed up the formation of crust and rings, and makes them hard and therefore more difficult to clean.

- Unscheduled shutdowns due to obstructions in kiln.
- Instability in the operation.
- Extra air entering the kiln due to cleanup operations
- (false air).
- Decreased combustion efficiency.
- Less chance for using alternative fuels.

Introducing HM-910 Sulfur Control Agent

HM-910

- HM-910 Sulfur Control Agent is a Magnesium based (Mg) chemical additive that modifies the vanadium (V) compounds generated, inhibiting the catalytic action of vanadium pentoxide V2O5, therefore avoiding the generation of SO3 (gaseous) by oxidation of SO2 in combustion gases:

$$SO_2 + \tfrac{1}{2} O_2 \xrightarrow[\text{Catalyst}]{V_2O_5} SO_3$$

Mechanism of Action

HM-910

1) The HM-910 additive reacts with the vanadium compounds present in residual fuels in such way that it inhibits their catalytic effect for the oxidation of SO2 into SO3 in combustion gases.

2) Therefore allowing a higher O2 availability in the process.

3) The HM-910 additive increases the melting point of the vanadium compounds generated and the chemical structure of the crust and rings making them more fragile and more friable.

4) The new vanadium compounds with high melting point, they will be shifted to the inlet instead of the pre-heaters.

5) This leaves free oxygen available for the process.

Mechanism of Action

HM-910

With the use of petcoke, compounds with low melting points are generated. This compounds are the material of which the crust and rings are made of.

Compounds Generated	Melting Point
Potassium Sulfate (K_2SO_4)	1067 C
Sodium Sulfate (Na_2SO_4)	888 C
Sodium Chloride (NaCl)	801 C
Potassium Chloride (KCl)	775.85 C
Nickel Orthovanadate ($3NiV_2O_3$)	890 C
Sodium Orthovanadate ($3Na_2V_2O_3$)	865 C
Nickel Sulfate($NiSO_4$)	840 C
Vanadium Pentoxide(V_2O_5)	690 C
Sodium Pyrovanadate ($2Na_2V_2O_3$)	654 C
Sodium Methavanate ($Na_2OV_2O_3$)	629 C
Sodium Vanadyl Vanadate ($Na_2V_2O_35V_2O_3$)	623 C
Sodium and Iron Trisulfate ($2NasFes(SO_4)_2$)	621 C

Because the HM-910 additive inhibits the formation of the above mentioned compounds, the remaining free sulfur and alkalis drain to the clinker.

HM-910 Sulfur Control Agent inhibits the generation of low melting point compounds and generates new Vanadium compounds with high melting points.

$MgO.V_2O_5$	704° C
$2MgO.V_2O_5$	1073° C
$3MgO.V_2O_5$	1243° C

These high melting point compounds do not form any ring or crust in the process.

Treatment Benefits

HM-910

- Due to the modification of the properties of the crust and ring, it will be easier to remove from the surface it is attached to (precalciner, preheater and kiln).
- Maintain and/or increase the maximum feed capacity per hour.
- An atmosphere richer in O2 allows for an increased use of alternative fuels.
- Longer production runs by reducing unscheduled shutdowns.
- Better operation stability and so longer equipment useful life.

Amount of additive used

HM-910

The HM-910 additive is added at a rate of 1 L per ton of fuel, this means:

- **The amount of HM-910 respect to the fuel is approximately 1500 ppm.**
- **The amount of HM-910 respect to a 300 ton/h kiln is approximately 100 ppm or 0.0001% respect to the feed.**

Due to the minute amount of magnesium added to the process there is no affectation to the process or any quality specification of the produced clinker

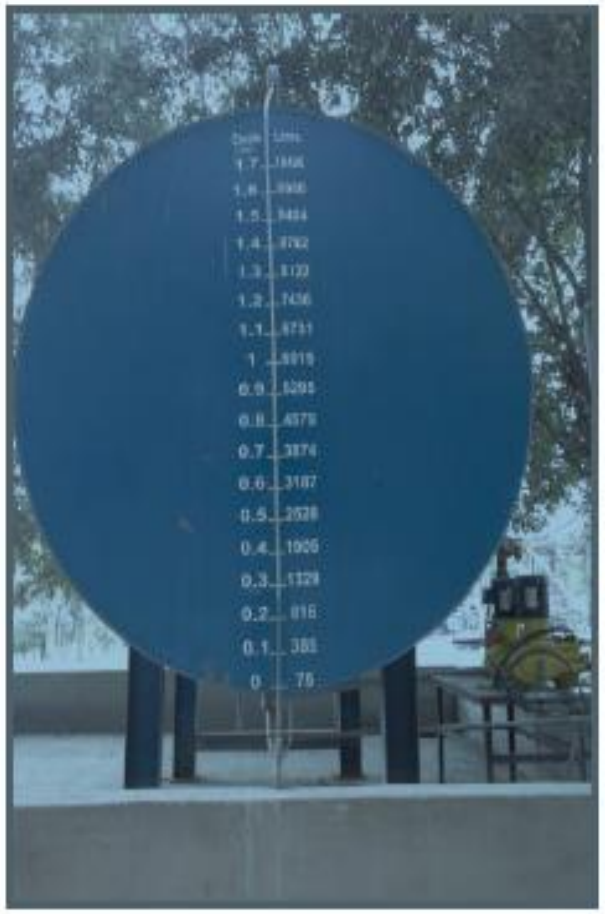
Such as:

- Cement color and quality.
- SOx emissions.
- Clinker early resistance.
- No effect on refractories.
- No effect on clinker calcining duration

Injection equipment for industrial trial

HM-910 additive is injected over petcoke conveyor band, before the milling operation. In this place the dosage is verified.

Injection equipment permanent



Injection System Facilities (Long Term)

Case Study and Successful Tests

Holcim Cement Plant – Tabasco, México

BEFORE HM-910	AFTER HM-910
Petcoke 4.0% / 6.5% Sulfur + Gas	Petcoke 6.5% Sulfur
2.5 to 3.0 % O_2	5.0 to 6.0 % O_2
175 ton/hr Raw Meal Feed	195 ton/hr Raw Meal Feed
1.5 ton/hr Alternative Fuel (tyres)	3.0 ton/hr Alternative Fuel (tyres)
0.98 a 1.2 % SO_3 in Clinker	2.5 a 3.0 % SO_3 in Clinker
40 to 60 min/shift Cleaning related activities HydroJet pump at 6,000 psi	20 min/day Cleaning related activities HydroJet pump at 1,500 psi

Pre-calciner crust composition, before and after HM-910 application:

Parameter	After	Before
PI	3.75	8.64
SiO2	16.62	6.39
Al2O3	5.03	2.02
Fe2O3	2.63	2.07
CaO	60.66	38.12
MgO	1.47	0.7
SO3	**5.05**	**15.76**
K2O	**2.24**	**14.54**
Na2O	**0.5**	**1.2**
BaO	0.42	0.23
SrO	0.33	0.19
TiO2	0.22	0.12
P2O5	0.1	
MnO	0.09	0.03
V2O5	0.04	0.05
Cr2O3	0.03	0.01
ZnO	0.02	0.009
PbO	0.02	0.04

Case Study and Successful Tests

Cement Cruz Azul Plant Hidalgo, MX

1 Month testing HM-910 Sulfur Control Agent:

Month	Oven Feeding tons/hour	O2	Alternative fuel usage /Tons
December 2016	249.39	2.52	4.151
December 2017	265.81	4.55	5.7304
Difference	**16.41**	**2.03**	**1.58**

Results benefits:

- Increase in oven feeding: Increment of production of clinker by 10.07 ton/hour (average).
- More oxygen providing a rich flame.
- As a result of a rich flame, the usage of alternatives fuels (tires, carboard, etc.) increased ending in an economic benefit since alternative fuels are low cost.

Case Study and Successful Tests

Palpaiko, Turkey

Results in brief:

- Oven Production increase by 8.7 tons
- Reduction in coke fuel by 0.5 tons

1) Additional Benefits:
2) Increased oven stability during operation
3) Formation of stable rings inside the oven
4) Increased lifespan of refractory bricks
5) Longer campaigns through the elimination of clogging issues
6) A reduction in cleaning time of pre-heating unit
7) Operators have a reduced exposure to the risky high temperature of pre-heating
8) Operators can be assigned to activities that increase production value

It was observed that during testing, a gain of 0.5 t/h of thick and thin alternative fuel plus another gain of 0.5 t/h of oil substitute with only a 0.3 t/h of coke reduction, thereby increasing the ovens thermal load.

Case Study and Successful Tests

Palpaiko, Turkey

According to the information provided by Polpaico, a benefit to using the HM-910 additive is a possibility. Measurable benefits in the markers:

Oven production 8.7 t, Coke reduction 0.5 t

	Thermal Consumption	Thermal Consumption	Coke Pfister flow main burner	Higher calorific power coke	Coke flow to preheater	Higher calorific power coke	Substitute Oil CSL	Power Calorific Oil Substitute CSL	Thick Fuel Flow CSSG	Superior Calorific Power CSSG	FLow CSSF Mixed	Superior Calorific Power Mixed CSSG	Raw Powder feeding	Clinker Production
	MJ/ton	MJ/ton	T/H	KJ/ton	T/h	KJ/ton	T/h	KJ/ton	T/h	KJ/ton	T/h	Kj/ton	T/h	T/h
Before Test	3,264.80	3,264.70	6.1	34,703.80	0.8	34,699.40			0.6	19,520.50	1.1	19,790.20	133.9	82.7
During the Test	3,367.30	3,367.10	6	34,574.10	0.6	34,574.10	0.5	33,000.00	1	19,644.00	1.6	19,245.10	136	83.9
Dif.MJ/ton	**102**	**102**	**-0.1**	**-129.7**	**-0.2**	**-125.3**	**0.5**	**33,000.00**	**0.5**	**123.5**	**0.5**	**-545.1**	**2.1**	**1.3**
Adjusted Values during the test	3,367.30	3,264.30	5.6	34,574.10	0.5	34,574.10	0.5	33,000.00	1	19,644.00	1.6	19,245.10	136	83.9

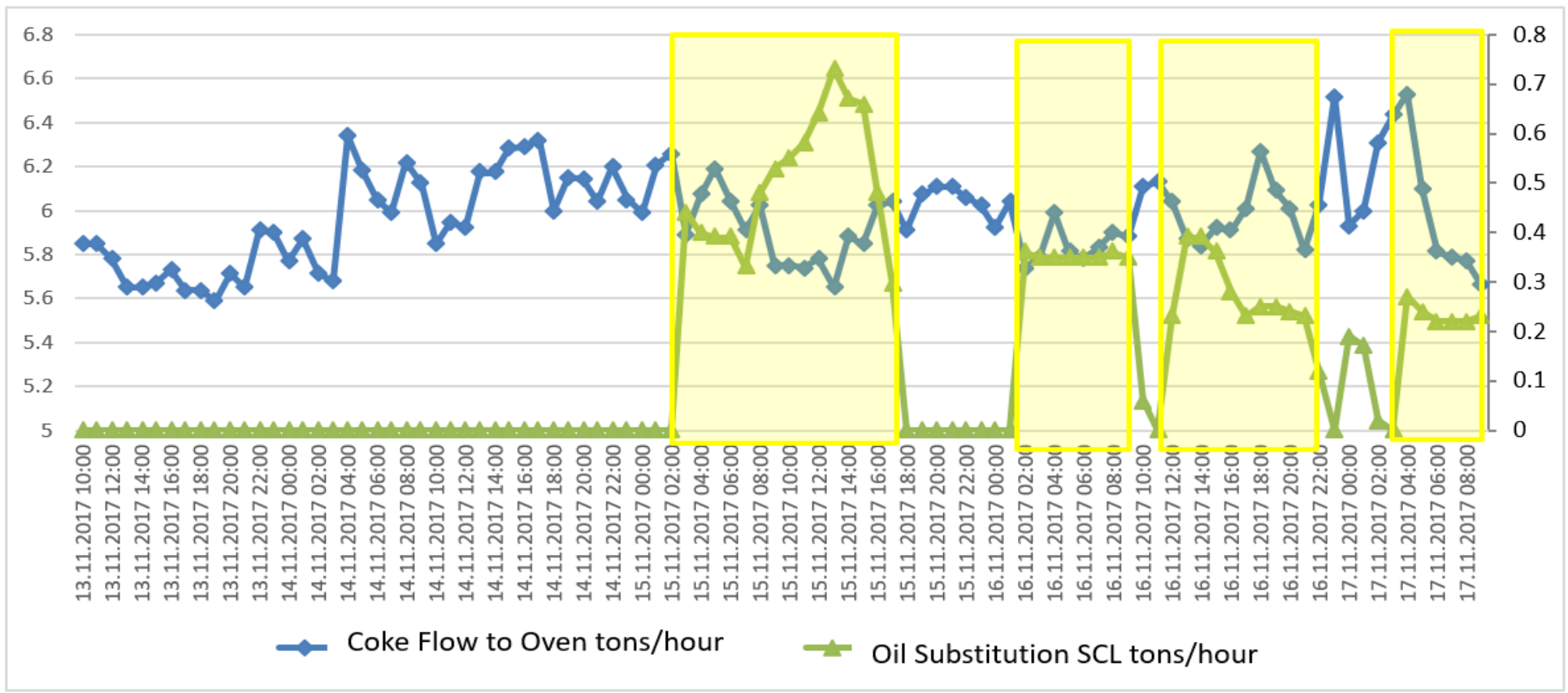
	0.4		0.1					
Mj/ton dif	**Adjust t/h COKE**	**Cost $MXP/ton**	**MXP/ton**	**MXP/day**	**MXP/Month**	**MXP/Year**	**US Dlls/Year**	
102	0.5	1,250.00	636.3	15,270.00	465,735.00	4,765,385.30	257,588.40	

Adjusted Values during the test	3,367.30	3,264.10	6	34,574.10	0.6	34,574.10	0.5	33,000.00	1	19,644.00	1.6	19,245.10	144.7	89.3

Mj/ton dif	**Ajusted t/h Clink**		**MXP/ton**	**MXP/Day**	**MXP/month**	**MXP/Year**	8.7	5.4
102	5.4	500	2,698	64,741	1,974,593	20,203,967		

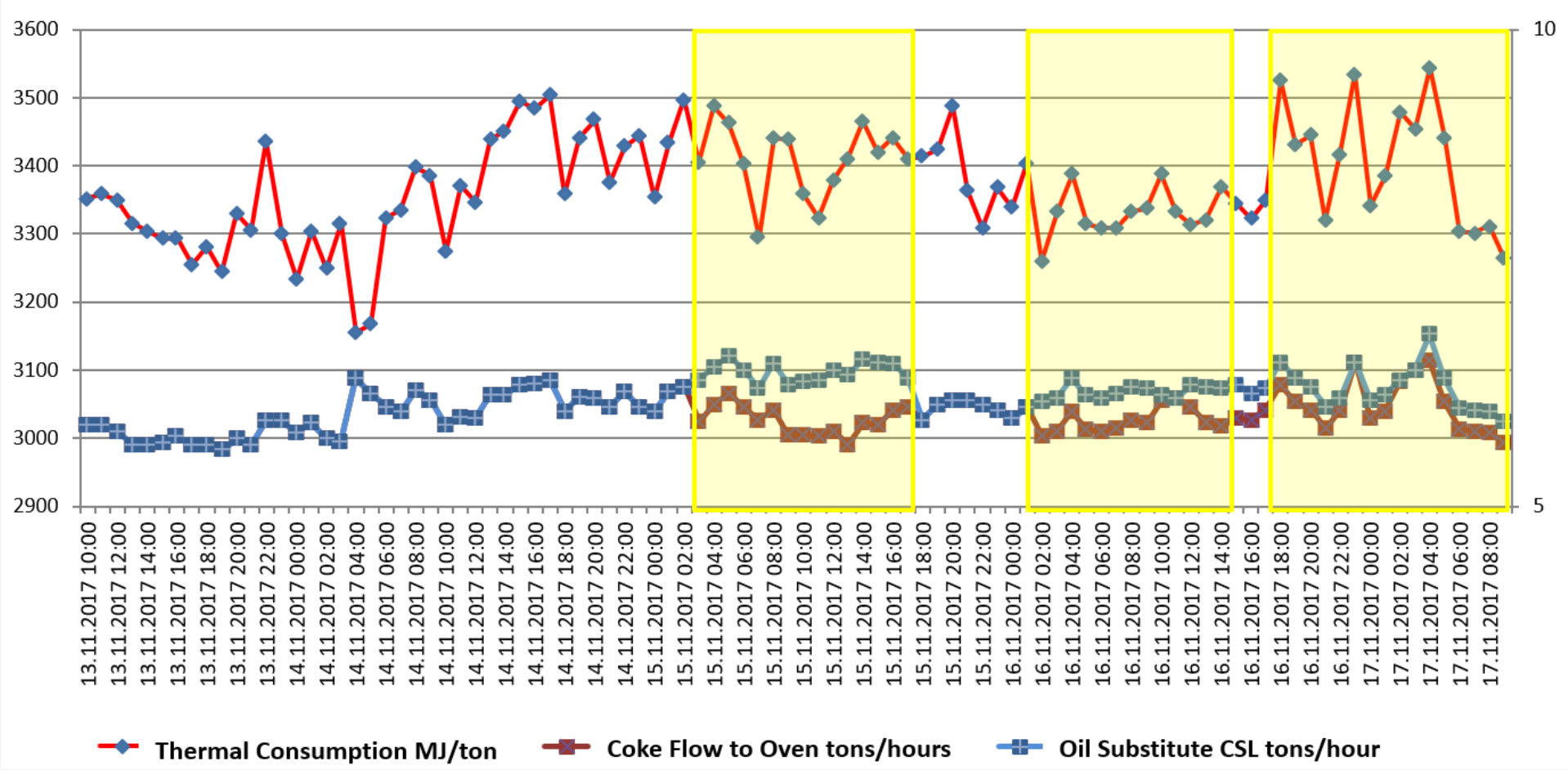
Case Study and Successful Tests

The oil substitute is fed through the coke and into the main burner without reducing the ovens thermal load.



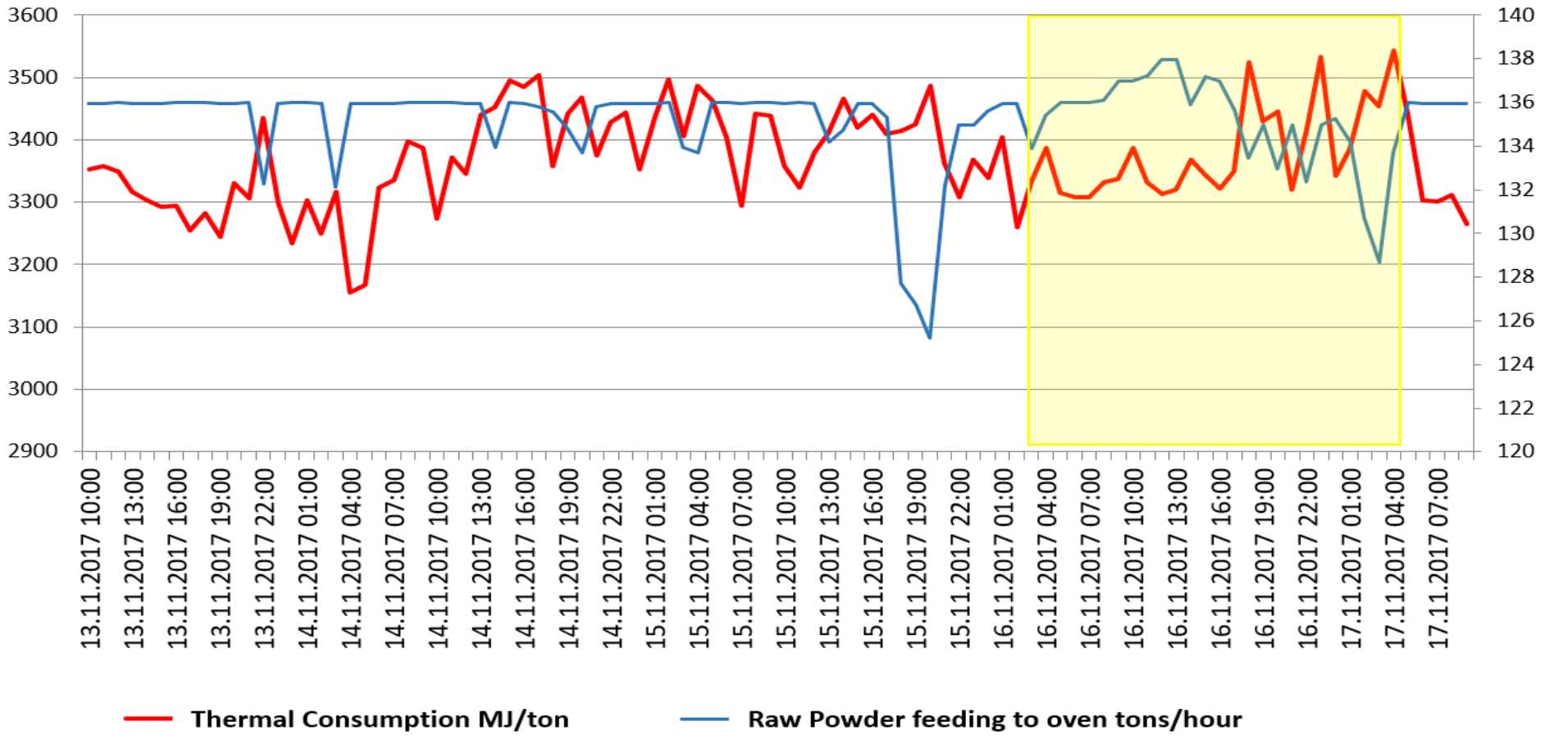
Case Study and Successful Tests

The largest influence in thermal consumption is given by the injection of coke into the main burner.



Case Study and Successful Tests

Another influence in thermal consumption is impacted by the feeding rate into the oven.



"KNOW HOW"

"KNOW HOW" in Cement applications:

The project of the application of the additive HM-910 in cement plants arises from the synergy that AJ Global and associates has with its partner companies, where the development of a high quality product and extensive experience in applications of cement additives have added value to the national and foreign markets.

The Team has successfully carried out the application of additives in various cement plants in Mexico and Venezuela for more than 10 years, working for groups such as Cementos Cruz Azul, Holcim, Cemex, Cementos Catatumbo and Cementos Andino, among others.

Industrial Trial

Information Needed

- Feed (ton/hr).
- SO3 in raw meal and clinker (%).
- Na2O and K2O in raw meal (%).
- Fuel consumption (ton/hr).
- O2 in kiln inlet (%).
- Access to cleanup area in precalciner.

Note: The information must cover the period of one month before and during the trial

Industrial Trial

Regarding the treatment of boiler fuel additive, the technical information we need to start evaluating the feasibility of application is as follows:

1. Brand and Model of Boiler.
2. Power generation capacity in MWh (mega watt per hour)
3. Vapor generation capacity in T / h.
4. Fuel consumption in T / h.
5. Type of Fuel (fuel oil, for what you said) and its quality:% Sulfur,% Vanadium,% Sodium,% Nickel,% Ash and Viscosity.
6. Type of air supply: Induced Shot or Forced Shot?
7. Heat exchange in the combustion gases: Ljstrom or Tubular type?
8. Temperature of combustion gases at the entrance and exit of the heat exchange system.
9. Data on emissions of O2, CO, CO2, Not, SO2, SO3 and PST (Total Suspended Particles).

Basically, the boiler is a candidate for treatment if it has fouling problems (obstruction of the flow of gases) and corrosion problems in the cold areas of the same (ducts to chimney). With the above information we can start a diagnosis, and know if it is necessary to make a visit or request additional information.

ThankYou

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