CHECKER PROBLEMS

A common inconvenience in the Glass Industry

It is widely accepted that plugging of checker packs is a very common and troublesome occurrence in regenerator furnaces as furnaces age, and one which can have very significant detrimental effects on furnace efficiency resulting in increasing production costs.

Studies suggest that in furnaces, which are between 6 and 10 (or more) years into their campaign life, the specific energy consumption can increase by between 5 and 15%.

This is especially the case in furnaces producing soda-lime glass, where sodium components vapourize from the melt surface (through reaction with water vapour in the furnace atmosphere) resulting in the formation of sodium hydroxides. Some soda particles may also be carried over (airborne) in the flue gases. At the same time, sulphur dioxide (arising from sulphur in the burner fuel and/or the decomposition of sulphates in the batch) form. Both these gases then leave the furnace in the flue gases.

As the flue gases cool as they pass down the checker pack, the two gases react and this leads to the condensation of sodium sulphates which partially stick to the surface of the checker refractory, gradually building up and reducing the "chimney" area of the checker pack.

This creates three major problems affecting the furnace performance,viz:
1. The reduction of the available "chimney" area leads to undesirable furnace pressures.
2. The deposits can cause severe damage to the checker pack refractory by corrosion or mechanical attack during sublimation.
3. The deposits have a lower heat conductivity than the checker refractory, and thus the transfer of heat to incoming combustion air on the "up" cycle is less effective, thereby requiring more specific energy from the burner to achieve the required melter operating temperature.

Some temporary relief from the "plugging" conditions may be achieved by extending the reversal cycle, and thereby melting some of the deposits, by subjecting the checker pack to a longer "soak" by the outgoing hot gases.
(the sulphates will become liquid at temperatures in excess of 850-900°C).
This is rarely fully effective however, and may also have an adverse effect on the regenerator crowns.

Hotwork's method is a tried and proven, effective process. By applying additional heat from the bottom of the checker pack, the top to bottom temperature differential is minimized, and the sulphates begin to melt and drip to the bottom of the regenerators quite quickly and copiously.

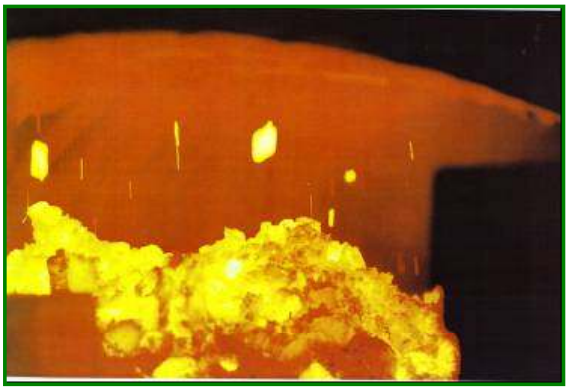

Photo: Liquid Sulphates dripping below Rider Arches

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ECONOMIC AND TECHNICAL BENEFITS OF REGENERATOR CLEANING

Based both upon Hotwork's experience, and on the conclusions of independent (general) studies on the phenomenon, the following conclusions can be reasonably drawn in connection with the build-up of depositions of solidified sulphate deposits in checker packs:-

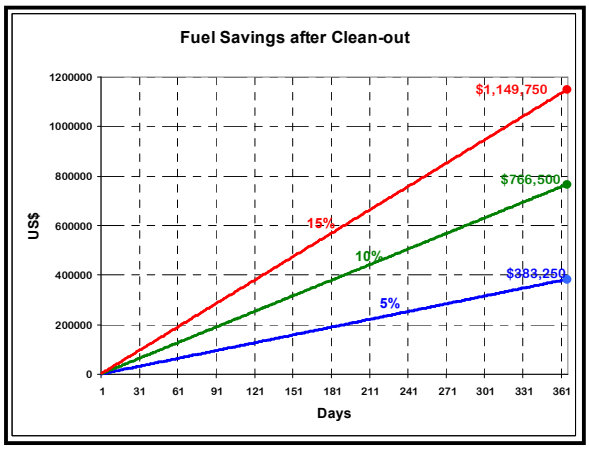
1. The situation will worsen if not addressed, the rate of deterioration will eventually accelerate. This will increas-ngly impair the furnace performance and pressure, and as the situation worsens, any solution will become difficult to effect.
2. The deposits will already be mechanically attacking and eroding the checker pack refractory. This attack will continue (and probably become more acute) as time passes, and may possibly lead to the need for a premature replacement of the checker pack.
3. The above-mentioned studies suggest that some 4 years into a furnace campaign, sulphate depositions can begin to cause an increase in specific energy requirements of anywhere between 5 and 15%. (This, because the deposits reduce the heat transfer from the checker pack to incoming combustion air, requiring additional energy input to maintain furnace operating temperature).

Therefore it is fair to say that the situation is often rather more than a "tolerable inconvenience".

The cost of Hotwork's service will vary considerably depending on the location of the glass factory, the number of affected ports, and the severity of the blockages (which in turn influences the time required to remove them). However, the potential savings will invariably far outweigh the service cost, even ignoring the potential ongoing damage to the checker pack which will ensue by failing to address the problem.

To demonstrate this, we take an example of a (say) 350TPD oil-fired flat glass furnace ,some 6-7 years into its campaign.

Given a daily fuel consumption of 60 ton of oil at a cost of US$350/ton, the following graph indicates the potential reduced fuel costs in the first year following a Hotwork checker cleaning intervention.



It is therefore very reasonable to predict that the Hotwork service will quite easily and quickly "pay for itself"

HOW CAN YOU NOT AFFORD TO USE HOTWORK'S CHECKER CLEANING SERVICE ?

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THE PRACTICALITIES

FURNACE OPERATIONS

Normal furnace operations can continue without interruption to production, however it is better that the burn-out operation should not be timed to coincide with a period when the furnace is required to produce in excess of normal design tonnage.

TIMING

The operation should be carried out, if feasible, as soon as the checker pluggings become significant enough to impair normal furnace operations.

OBJECTIVE

Sulphates in the exhaust gases will gradually cool as they pass down from the hottest part of the setting (at the top) and begin to condense and then plug the checkerwork. As these build up and restrict the normal flows in the checker settings, the pluggings become more severe and can seriously impair the efficiency of the entire checkerwork system.

The objective of the Hotwork process is to gradually reduce the temperature differential from top to bottom of the checker settings, by preheating incoming combustion air.

In this way, and by continuing to input heat even during the down cycle, the temperatures of the settings become more uniform, bottom to top.

Consequently, on reversal, with the introduction of high temperature exhaust gases, the checker settings become even hotter, and the sulphate pluggings begin to melt, and then to "drip" down to the regenerator bottoms.

Experience has shown that it is better to start the operations on the port which has the most severe pluggings: attempting to work in any other way has caused some problems and taken much longer for the service to take effect.

Photo: View during thermal cleaning operation

HANDLING THE MELTED SULPHATES

It is impossible to predict the volume of, and speed at which, sulphates will be freed from the checker pack(s).

The molten sulphates are extremely hazardous, and if they come into contact with any cold (ambient) hard surface, they can explode and "spit", causing severe burns to human skin and creating a potential fire risk.

The plant owners must make all necessary preparations to ensure that the products of the Hotwork operation can be contained, controlled and continuously removed, including, but not necessarily restricted to, the following measures:

(1) The area below the checker settings must be fully cleared of all debris (including any solidified sulphates) and rubble or any combustible materials, IN ADVANCE of the Hotwork intervention.

(2) A suitable enclosure (typically a pit with a bed of sand) may need to be constructed to contain and entrain the molten sulphates.

(3) Any build-up of solidified sulphates must be promptly removed

The plant owners should designate specific personnel to continuously monitor the situation and conditions, on a round-the-clock basis throughout Hotwork's operations, and such personnel should be made aware of the inherent hazards and the appropriate actions necessary to safely contain the situation.

As evidenced by the photograph below, the volumes of melted deposits can be quite substantial, so appropriate precautions ARE necessary.

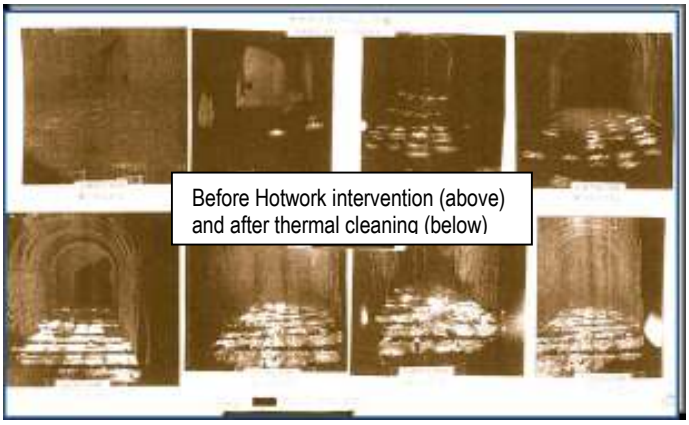
COMPOSITION OF PLUGGINGS

Every effort should be made by the operator, in advance of Hotwork's intervention, to determine that the pluggings are indeed mostly sulphates, originating from furnace fuel and/or batch fill materials, and that these are neither batch carry-over nor refractory rubble.

The temperatures necessary to melt the latter materials can not reasonably be achieved, without possibly compromising the load bearing capacity of the rider arches which feel the heat increase first.

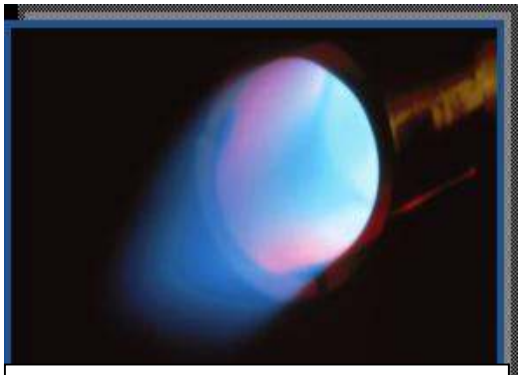
RESULTS

The photograph below shows the "shadow pattern" on the regenerator chamber floor, before and after a "melt- out" by Hotwork on a double-pass end fired regenerative furnace



Hotwork has safely and successfully carried out hundreds of checker cleaning operations worldwide on all types of regenerative glass furnaces.

LET YOUR FURNACE BREATHE FREELY AGAIN!



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TAKE THE "DEPOSITS" OUT OF YOUR CHECKERS AND START INCREASING THOSE GOING INTO YOUR BANK!

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