

GE Water & Process Technologies All Volatile Treatment in Ethylene Waste Heat Boiler System Saves More Than US\$100,000/Yr

Challenge

An ethylene plant in Europe with Transfer Line Exchangers (TLE) waste heat boilers, equipped with mixed metallurgy at the condensers and low pressure heaters, was operating at 120 bar (1760 psig) at a superheat temperature of 515°C (959°F). The recovered condensate is treated with a mixed-bed polishing unit where boiler makeup water cation conductivity is consistently less than 0.15 micro-siemens/cm.

The water treatment program was based on hydrazine, ammonia and trisodiumphosphate. Since start up, the unit has experienced higher levels of iron and copper than recommended by accepted industry best practices. Moreover, the ammonia and phosphate dosage made it difficult to maintain stable pH/PO₄ control for a congruent program. Finally, corrosion of copper alloy condensers and heat exchangers has resulted in leaks that have affected the plant operations causing unscheduled shut-downs.

The challenge for a new program was:

- a) to eliminate the corrosion on copper alloy equipment, with the reduction of copper levels to < 5 ppb in boiler feedwater;
- b) to reduce the iron level in boiler feedwater to below 20 ppb;
- c) to have a stable operation in all the Waste Heat Boilers keeping the TLE critical exchangers clean

Solution

The program implemented by GE is based on the application of:

- a) CorTrol* OS5310/CorTrol OS5700, hydroxylamine technology for oxygen removal and passivation.
- b) OptiSpense* HP5160/Steamate* NA0880, amine technology for improved pH control and elimination of ammonia, which can be corrosive to copper alloys.

The CorTrol OS hydroxylamine is dosed in the deaerated feedwater, and the OptiSpense/Steamate amines after the condensate polishing system, which enables consistent pH control throughout the system.

The system was equipped with a reliable on-line pH and conductivity measurement system to control any potential leaks and is prepared to implement emergency control procedures in the event of up-sets.

Results

Following implementation of the modified treatment program, iron levels in the boiler feedwater were consistently reduced to below 20 ppb, and copper to below 5 ppb, meeting the performance goals set forth for the project. In addition, the pH in the system is now consistently controlled in the target range of 8.5 to 9.2.

Data for the program's pH and conductivity are shown in Table 1.



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Table 1

Sampling Point	pH	Conductivity
Makeup water	7.5	0.15 ¹
Boiler Feedwater	8.5-9.0	2.5 - 3.0
Boiler Water	8.8- 9-2	25 - 50
Superheated Steam	8.5-9.0	3.5 - 4.5
Turbine Condensate	8.5 - 9.0	3.5 - 4.5

¹ Cation Conductivity

In addition, since the new program has been in place, there have been no plant outages due to waterside failures.

The plant is required by local regulations to perform a complete inspection of the high pressure vessels every three years. This inspection confirmed that with the new chemistry in place:

- Corrosion in condensers has been stopped.
- The cleanliness of the TLE exchangers is significantly improved.
- The steam turbine is clean and free of corrosion.

The estimated value of the enhanced reliability in plant operation is more than US\$100,000/y in savings.

The plant has been operating with GE treatment for more than nine years with consistent results.