In – Situ SCR Catalyst Replacement

Mark L. Schirmer
CORMETECH, Inc., 5000 International Drive, Durham, NC 27712
E-mail: schirmerml@cormetech.com; Telephone (919) 287-7241; Fax (919) 595-8701

Mark Hill
TVA , 1101 Market Street, Chattanooga, TN 37402
E-mail: mkhill2@tva.gov ; Telephone (423) 751- 7488; Fax (423) 751-8819

Summary

There are several options available for the management of SCR catalyst including operational changes, addition, replacement, regeneration, and a novel process of In –Situ replacement. A detailed study is typically conducted to evaluate each option for its applicability and related economics. The study evaluates cost, schedule, outage schedules, site conditions, and catalyst designs. The In – Situ replacement process is a patent pending process developed by CORMETECH, Inc. and has been demonstrated at several sites including the Tennessee Valley Authority (TVA) Allen Fossil Plant.

This process does not require the removal of the steel frames (modules) or the dust shields from the reactor. The module steel is reused in place. Removal and replacement of the catalyst elements is done inside the reactor. The In – Situ replacement process can be used to replace honeycomb, plate, or corrugated SCR catalyst. The process described herein for the TVA Allen site was performed on an entire catalyst layer however the process has also been executed on a partial layer basis at several other facilities.

The TVA Allen site consists of 3 X 330 MW cyclone fired boilers firing western fuels. Site conditions restricted the possibility of adding an additional layer of catalyst. The Units do not have SCR bypasses so the work needed to be done during a short scheduled boiler outage. TVA evaluated the options of regeneration of the existing top layer of catalyst, replacement with similar design (pitch and composition) catalyst, and the In- Situ replacement with a smaller pitched honeycomb catalyst. All three 330 MW Units had the top layer of catalyst replaced using the In- Situ process with a smaller pitch product.

The boiler outages at Allen were scheduled for 21 days. The replacement of the catalyst took an average of 9 days to complete (90 modules per layer in each Unit), not including cool down and vacuuming of the reactor. Once the Unit was brought down, it was allowed to cool. After cooling, vacuuming of the SCR began. Both layers of catalyst and the inlet duct were vacuumed. After vacuuming, a protective covering of plastic was installed on the second layer of catalyst to protect it during the removal and replacement of the first layer.

The catalyst module screens and grids were removed from the top layer of catalyst. Once removed, the catalyst elements in the module were removed. Three elements on each side of a partition plate within the module were removed by pushing up from the bottom of the module using specialized tools. This allowed the remaining elements to be removed from above. Roller conveyors were placed within the reactor to expedite the movement of the catalyst elements. Once out of the reactor, the catalyst elements were sent down a chute into a dumpster for disposal. The removal process can be modified to allow for the re-use (regeneration) of the elements being removed. However, in this case that was not deemed or considered an economical option.

Once the module has been emptied of catalyst elements (or plated), it was prepared for the new elements to be inserted. The elements were shipped in specialized crates that contain 36 elements (1/2 module) in a designed sequence to allow for installation. The elements were inserted in this order until the ½ module was completed. Specialized tools were used to establish and maintain the proper compression of the packing material surrounding each catalyst element within the module.

The grids were welded back on the completed modules, an inspection was completed and the screens placed back on the module. The lower layer was vacuumed and the plastic sheeting removed.

The top layer of 8.2 mm pitch catalyst at all 3 Allen Units was replaced with high open area 6.9mm pitch (patent pending) honeycomb catalyst. This higher efficiency catalyst allowed extension of time for the next action from 10,000 hours of operation to 26,000 hours of operation, an extension of 2 years for a year round operating Unit. A similar impact can be achieved when replacing plate or corrugated type catalyst with the Cormetech high efficiency honeycomb catalyst.

At Allen, the catalyst installed using the In –Situ replacement process has been operating successfully for over 8000 hours on all three Units demonstrating the viability of the process.

As mentioned above, an economic evaluation of catalyst management options would need to be done on a site by site basis. The In- Situ replacement process offers another proven and effective method for consideration. In general, the direct cost for this process is lower than removal and replacement method, similar to that of simply adding a layer, and slightly more than regenerating a layer and re-installing, however, when considering a modification to a more efficient product, this method can be an optimal approach as demonstrated by the TVA Allen example.