Keep corrosion under control

Femke Schaefer discusses innovative solutions to corrosion in power plants

Depending on the process conditions, the choice of materials, the structural details of the installation and the equipment, and the state of maintenance, corrosion should never be allowed to happen. When corrosion does happen, it is difficult to deal with because it affects the way the equipment operates. And it is even more difficult when some or all of the equipment needs to be replaced. In the best-case scenario, the equipment is situated in a very accessible location with plenty of space around it, and the process can be easily suspended or diverted so that the equipment can be upgraded. But this rarely happens in real life! So what would you do if you were faced with this problem?

Don't bury your head in the sand

Corrosion is the chemical degradation of materials due to a chemical reaction with their environment, particularly the degradation of metals as a result of electro-chemical reactions. The best known types of corrosion are the degradation of metal surfaces by oxygen and water in the air, as in the way iron becomes rusty and copper turns green. Corrosion can also occur in a watery environment and at high temperatures, and it can even affect ceramic materials and plastics. Corrosion causes a loss of strength because the corrosion products (oxides and salts) are much weaker than the metal. As the corroded products crumble away, the metal parts become thinner. This can even cause holes to develop in metal surfaces. An additional problem is that the corroded products occupy a greater volume than the metal. And because the materials expand, the structure can become distorted.

Corrosion causes safety risks via the failure of (supporting) structures and can ultimately cost a lot of money. To illustrate this: around the world, over five tons of steel are 'lost' through corrosion every second. The costs of these losses are estimated at 2% of Gross National Product. When corrosion occurs, it is often the result of changing process conditions, careless or unprofessional maintenance, the wrong choice of materials (design errors) or structural faults. In every case, as long as the source of the corrosion is not identified or tackled, the corrosion will continue to be a problem.

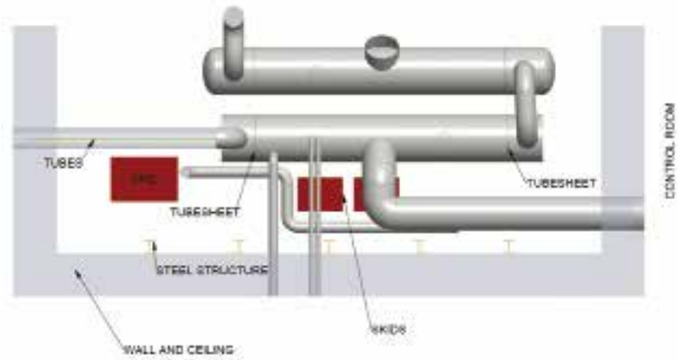
Retubing pipes in Houdini conditions

A recent real-world case study involves a district heating plant in Utrecht in the Netherlands, which keeps homes warm and comfortable during the colder days of the year. When the plant was originally built, the equipment was installed first and then the building was constructed around it, as can be seen in the photo on the left-hand page. However, possible major maintenance due to corrosion was not taken into account during that initial installation phase. And, sure enough, over the years corrosion gradually developed in the heat exchanger pipes.

Difficult maintenance conditions in the heating plant

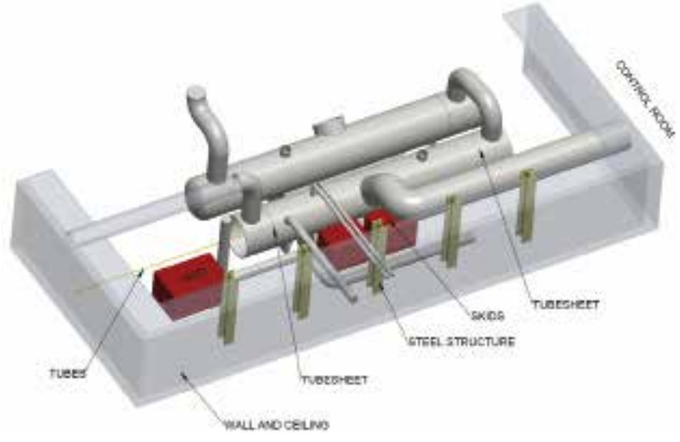
This particular system is always switched off during the summer period (when no heating is required). But some water was always left behind in the system, which also contains oxygen. So it was simply a matter of time before corrosion would set in.

The 4,600 12m pipes had to be retubed on-site. However, the heat exchanger was in a location that was difficult to reach, with limited space to work in and no way of expanding it. And the project also had an extremely short throughput time – just six weeks. The client even considered demolishing the wall in the right-hand side of Schematic 1, so that it could replace the pipes or demolish even more walls to hoist the heat exchanger out of the building and then perform the necessary maintenance there.



Schematic 1 (above): 2D drawing of the maintenance location

Schematic 2 (below): 3D drawing of the maintenance location



If the mountain won't come to Muhammad...

Bronswerk did not think it was necessary to break down the walls, so it came up with a creative solution. It chose exactly the right tools that were needed to repair the 4,600 pipes. It created special hoisting equipment to hoist the pipes in and out of the heat exchanger from above. It dismantled the skids and heat exchangers behind the target heat exchanger (on the left-hand side of Schematic 2) to create more space for the pipes. Then the old pipes were cut loose, removed from the heat exchanger and removed from the plant.

Before pulling through the pipes, the two heads were first removed from each pipe. The 4,600 pipes resulted in 9,200 pipe panel joints. On one side, the pipe panel was pulled through at the back and on the other side it was pulled with a hydraulic pipe-puller. This posed a number of challenges, such as corroded pipes breaking off while being pulled. The new pipes had to be positioned exactly in the right way, taking into account the 14 baffles through which those pipes had to be pulled. That is why the new pipes were positioned nearby the duct (at the bottom of Schematic 2.) so that they could be directly hoisted and pulled through. This was possible because of the previously mentioned additional space that was created as result of dismantling the heat exchanger and the skid. Still, a couple of pipes needed to be installed aslant because of obstruction still caused by the dismantled heat exchanger and skid. Taking into considering the short throughput time for the project, the work had to be done 24/7, in shifts.

Thanks to its creative, smart solution and perseverance as well as the decision not to demolish any walls, Bronswerk saved the district heating plant an enormous amount of civil engineering and/or construction costs. Its unique approach also minimised the system downtime, saving the plant a considerable loss of revenue. Once again, Bronswerk proved that it is a reliable partner and can be trusted to perform high-quality maintenance work. It also showed that it does not shy away from difficult and demanding working conditions, that it is always positive and flexible, and that it can finish the work in the shortest possible throughput time.

The end result? The installation was realigned with the design specifications and the integrity of the asset was restored to a reliable level. ●

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