SIMPLE PLANTS CAUSE TROUBLE, TOO

While the new plants bring new problems, there still occur problem areas in the older, operating plants

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We have looked at the newer problems which have occurred as technology has advanced. My brief presentation is a contrast to point out that we must not overlook the simple homely aspects of the plants which can cause trouble. This records the experience of the problems we had with a 150 ton/day ammonia plant.

We suffered such severe corrosion in the water jacket of the secondary reformer that after three year's service the vessel is now due for replacement. The vessel concerned was a conventionally designed secondary reformer with refractory lining and water jacketing the shell being made of ASTM A-204 Grade A firebox quality steel. The plant first started up in early 1964.

The thickness had decreased

At that time we used a once through cooling water flow using water from the water treatment plant which gave a softened water which had not been deaerated. For two years the plant operated and then in 1966 the water jacket was removed for thorough inspection of the vessel, this being a practice both of our company and the Australian government. It was found that the original thickness of the material had decreased from 1-1/16 in. to as low as ⅞ in. in places. This corrosion was of the pitting form and we had extensive pits all over the outside surface of the secondary reformer.

The next stage was to run the plant with a once through system using towns water with an addition of sodium hexa-metaphosphate (10-20 ppm) together with a dispersant. We knew this was not an ideal solution, but it was thought at the time it would be adequate. In this condition the plant ran for a further six months. In the secondary reformer jacket we also had a series of test pieces to measure corrosion and, in part, the selection of the phosphate treatment was due to the difficulties associated with the disposal of once-through water containing additives in public drains.

In the six months up to the end of 1966, the corrosion rate had decreased materially, in round figures from 3/32 in. to 0.007 in.

This is not considered satisfactory as a long term solution and at the end of 1966 the vessel was derated and its working pressure reduced from 350 lb./sq.in. to 290. At this stage the water treatment was changed on a temporary basis to a nitrite water treatment. In this system, the cooling water was allowed to boil, softened make-up water was added as needed, and a nitrite concentration of 1250 ppm maintained in the jacket. After three months further operation it was found that the corrosion rate was down to .0001 in.

Switching to a new system

We are changing to a fourth system, where recirculating cooling water in the water jacket is cooled by heat exchange with standard cooling tower water with nitrite addition to the jacket water. The reasons for this are that this enables heat release rates to be checked and gives us a better chance of assessing whether any refractory problems have arisen. Due to the design of this particular plant, if we use the boiling water system we do tend to blanket other sections with steam, particularly the control gear of the secondary reformer. This leaves us with corrosion problems in structural steel work which while not of the same importance as pressure vessel corrosion is nevertheless serious over a long term basis.

We feel now that we have a water treatment which is successful. We feel that it is worth pointing out that in the simpler aspects of chemical plant design it is easy to overlook something which is not of major importance when you are designing a plant.