More TECHNICAL BRIEFS

were added and three new hot zeolite units were mounted over the filters to save space.

Improved results obtained:—

(1) Alkalinity and CO_2 in steam cut in half. (2) Phosphate deposits in economizer and heaters eliminated. (3) Operating cost reduced from \$7.86 to \$4.30 per 1,000,000 lb. (4) Total solids reduced 16% and boiler blowoff reduced 25%. (5) Operating control simplified by eliminating soda ash and other chemicals by adding phosphate direct to boilers. *ASME Paper No. 52-A-96.*

Contamination of Condensate by Heat Exchanger Tube Alloys. *By J D Ristroph, Virginia Electric & Power Co and E B Powell, Stone & Webster Engrg Corp.*

The accumulation of foreign metal and metallic oxides on the internal heating surfaces of high pressure boilers has become a source of growing concern to the steam power industry in the United States. Especially over the past ten years with the advent of the 2,000 psi and higher pressure, steam generators, such deposits have been found serious hazards. These deposits all retard heat transfer and so tend to produce a high temperature in the tube walls, leading in turn to overheating or corrosion or both. Deposits of copper origin seem to have the further objectionable property of masking the evolution of hydrogen from the affected surface, which might otherwise give advance warning of the impending failure. Operating experience has pointed to corrosion and solution of metals of the steam-condensate-feed-water part of the system, external to the boiler proper, as normally the major source of the boiler heating surface metallic deposits in the so-called 100%-condensate-feed-water type plant to which the present paper directly refers.

Virginia Electric and Power Company decided to investigate heat exchanger tube alloys as potential sources of metallic contamination of condensate flowing in contact with them. The test equipment employed steam condensate as actually produced in the power plant and otherwise followed conditions of normal operation. In addition, it was used to investigate the influence of such special chemicals as might promise reduction in corrosion and solution of piping and other parts of the steam-condensate system.

Results are presented from condensate contamination studies conducted at two steam power stations to evaluate the influence of temperature of condensate, of differing dissolved gas content, and of cumulative service time upon the degree of metallic contamination to be expected in steam condensate of the general character described from flowing contact with tubing of twelve alloys commercially used in power plant heat exchangers. The influence of cyclohexylamine on the rates of contamination is also indicated. The testing procedures are briefly described. *ASME Paper No. 52-A-63.*

Protection of Heat Exchanger Channels and Covers from Salt Water Corrosion. *By Wilfred J Danziger, Olaf A Sundholm, M W Kellogg Co.*

In the usual shell-and-tube heat exchanger used as a cooler or condenser with fresh water as coolant, the channel, the channel cover, and the floating-head-cover are made of steel or cast iron.

When salt water serves as a coolant, the normal corrosion of steel and cast iron by salt water is accentuated by the galvanic cell set up by the combination of non-ferrous tubes and tube sheets with the ferrous materials under discussion. Rapid failure of the ferrous parts results. This paper describes some of the materials and methods used in petroleum refineries to obtain reasonable life for channels, channel covers, and floating heads when using salt water, together with information on performance where obtainable.

There are, unfortunately, no standard compositions of "fresh," "brackish,"

> **TO OBTAIN COMPLETE TEXT**
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> *Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.*
>
> *American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York, N. Y. Nov 30-Dec 5, 1952. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.*
>
> *American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York, N. Y. Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.*

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or "salt" waters, so that local conditions can have a considerable effect upon performance.

Within these limitations, it appears that cast iron or steel channels and floating covers in fresh water service have a probable life of four years before requiring any significant amount of maintenance, and 10 to 15 years life is not uncommon.

In salt water service, steel is unsatisfactory. One refinery reports that channels require repairs in 8 to ... months; another that they usually ... within three or four months. A third reports that "salt water attack on unprotected steel is extremely rapid, and we do not use it in these services except as a stop-gap measure." The life of cast iron also seems to vary considerably with local conditions of the water, as evidenced by these judgments at varied geography: failure inside two years; failure of channels in ... months, of floating covers in 9 months, life of 6 to 10 months, no better corrosion resistance than steel. Although cast iron appears, in some cases, to have more resistance to corrosion than steel, steel can be fairly easily repaired by welding and any corrosion is visibly evident. Corrosion of cast iron leaves a weak, porous, graphitic structure, so that extent of damage cannot be determined by visual inspection.

Brackish water is generally found near the mouth of slowly-flowing rivers. The salt content varies with the river and, for a particular river, with the varying flow resulting from rain or dry spells. With low salt concentrations and low water temperature, corrosion of steel and cast iron is slow; at higher levels corrosion approaches that of sea water. Thus, it has been reported that the cast iron channels of four condensers installed in 1926 in Harrison, N. J., and cooled with Passaic River water gave no trouble for several years. The building of Wanaque Dam in the headwaters of the river and diversion of some of the impounded water resulted in the tides encroaching further upstream. By 1930 the river water at the installation was brackish. A year later parts of the channels were found to be badly corroded, and corrosion continued until corrective measures were undertaken. The reported average salt concentration was 304 grains per gal in approximately the last 6 months of 1933; 161 grains per gal in the following 4½ month period; and 525 grains per gal in August and September of 1934. For co...

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