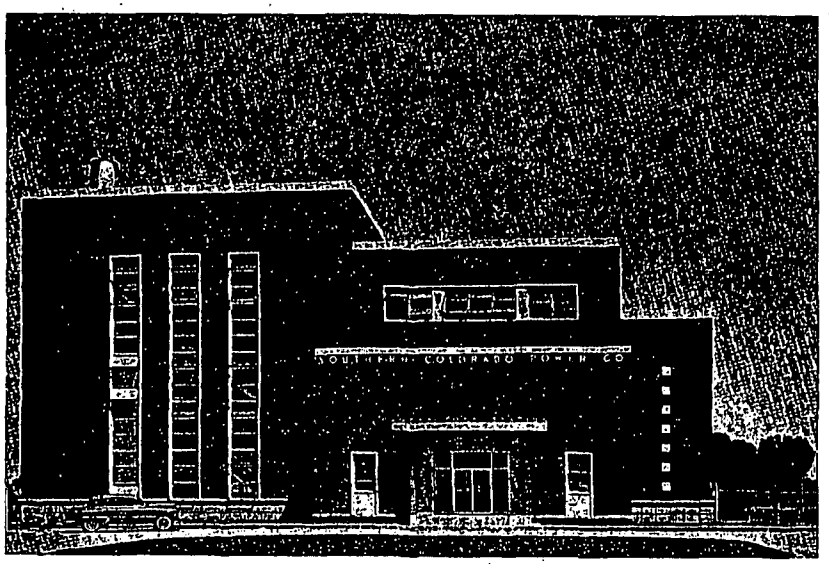


CLEAN LINES, modern look of today's power stations, even the smaller ones like this 7500-kw Rocky Ford, Colo. plant, reflect sound engineering. But here's a plea for the same attention to detail for the station's cooling-water service

Bearings, Glands Need Clean Water Too

Station cooling-water services clog up from iron and solids

By PAUL SNYDER, *Chief Engineer, Rocky Ford Plant, Southern Colorado Power Co*

► As MORE POWER PLANTS go up in semiarid regions, a rather specialized water-conditioning problem for station water service is bound to crop up unless steps are taken at the design stage. At least that was our experience in the Rocky Ford, Colo. plant of the Southern Colorado Power Co after its 1951 start.

Here, we'd put in a 100,000-lb-per-hr 600-psig 825-F-total-temperature steam generator to supply a 7500-kw steam-turbine-driven generator. Makeup water for cooling tower, boiler and all station service-cooling needs came from two 900-ft-deep wells. These wells flow freely at about 10 gpm. So we set the pumps at 250 ft, and the two wells deliver 150 gpm.

This well water shows a total hardness of 52 ppm as $CaCO_3$, a calcium hardness of 18 ppm, a magnesium hardness of 34 ppm, a zero phenolphthalein alkalinity and 208-ppm methyl-orange alkalinity, all expressed as $CaCO_3$. Chlorides, as $NaCl$, run 36 ppm; sulfates, as Na_2SO_4, 667 ppm; silica, as SiO_2, 11 ppm; phosphates show 0 ppm as PO_4. Total iron analyzes: 6.9 ppm, as Fe; carbon dioxide, 34.6 ppm; ammonia, as NH_3, 2.0 ppm; sulfide, as H_2S, 1.1 ppm; pH measures 7.0.

We started the plant off with a 4-in. standby connection to the city-water supply, which carries a total hardness of 250 ppm, as $CaCO_3$, in summer, and 600 ppm in winter.

When well water is released to atmospheric pressure much of the carbon dioxide and hydrogen sulfide escape, so dissolved iron drops out of solution. This chain of reactions takes place especially where flow is not turbulent.

Our external water-conditioning system, employing one of the new synthetic zeolites, does an excellent job of removing total hardness; iron and ammonia. One thing we did find, though: To get rid of ammonia, we had to recharge the zeolite about three times as often as we would have for hardness salts alone. But our station cooling-water supply was a different story.

Flow rates to our water-cooled bearings, air-compressor jackets and boiler-feed pump's gland-jackets ran very low and quiet. As a direct result, iron, dropping out of solution from the well water, as it neared atmospheric pressure in the connecting pipings or the water-cooled parts, filled them up from one-half to two-thirds of their volume within a single year, photos above.

We knew the answer, and so started the engineering and investigation of an aerator, followed by the cold-lime softening process for complete station satisfaction. But, in the meantime, we had a major problem on our hands.

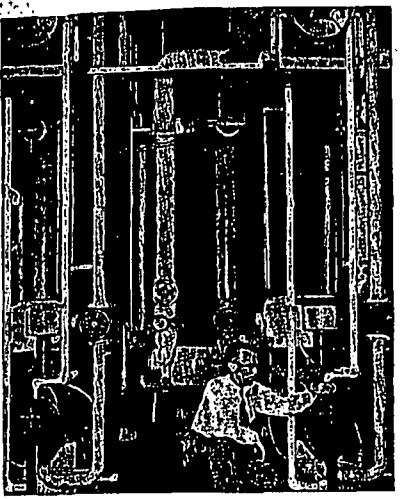
To get the induced-draft fan's bearing-water-jackets, the air compressor's water-jackets and the boiler-feed pump's gland-jackets back to their start-up conditions, we cleaned them one at a time with inhibited muriatic acid.

Then we put in special copper-core fan-cooled radiators, top right photo, 8 ft above each air compressor and induced-draft fan's bearing near the outside wall. This way, each fan has an outside-air intake. Once in place, we tied these radiators into the equipment's cooling-water connections by 1½-in. pipe and hose fittings. Piping was laid out to give maximum circulation by thermal-siphon alone. The former cooling-water supply was cut off and condensate was put in the loop with 500 cc of potassium-dichromate rust inhibitor added. Makeup is nil.

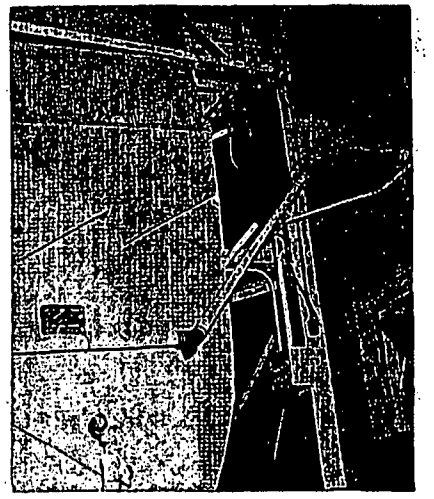
Mercoid aquastats in the top tank of each radiator switch the fans on and off as circulating-water temperature requires.

The boiler-feed pump's packing glands now draw their cooling-water supply through one-inch copper piping that taps into the condenser-hotwell pump header. Discharge goes into the condensate stream just ahead of the low-pressure extraction heater. An automatic throttling valve on the hotwell level gives enough pressure differential for circulation through the glands.

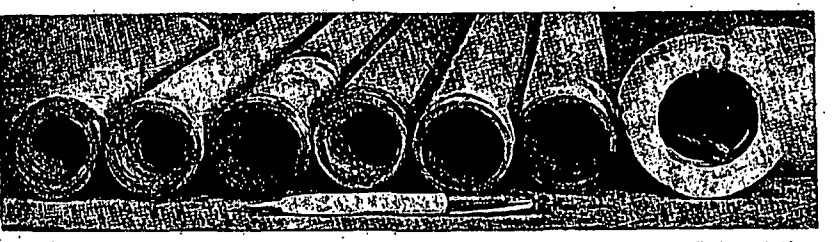
With these changes we dropped our station water-cooling needs from 26 gpm to 1½ gpm. This last 1½ gpm comes from city water, which also supplies the zeolite-softened evaporator makeup.



AIR-COMPRESSOR jackets, as well as pump gland-jackets and bearings, ran hot from badly clogged water service, *below*



SPECIAL copper-core fan-cooled radiators remove heat, picked up by cooling water in compressor jackets and fan bearings



***MUD, IRON** and insoluble scale in raw water, normally tapped for general station-service cooling needs, can become a service problem in the supply system, especially in semiarid regions where the cooling duty runs much heavier and longer*