ENVIRONMENTAL WATER, LTD.
WATER TREATMENT SPECIALISTS

Technical Data Sheet

CONDENSER EFFICIENCY

A clean condenser performs more efficiently saving operation and maintenance expenses as well as costly downtime.

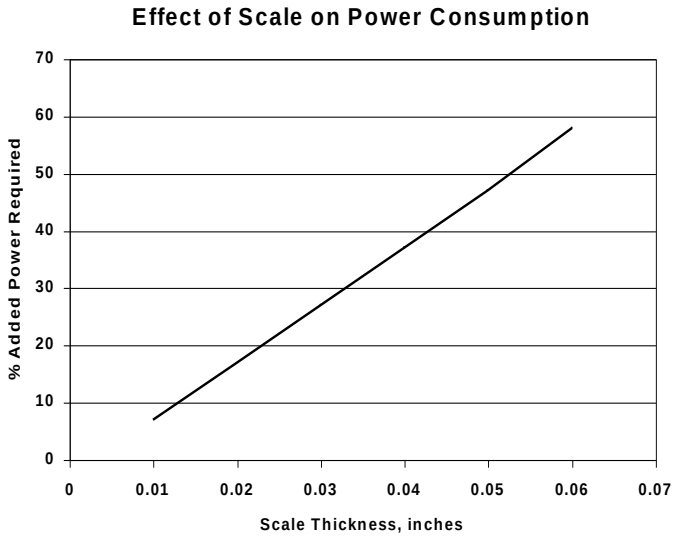
Condenser scale reduces efficiency of chiller operation by inhibiting the heat transfer from the process refrigerant. The presence of scale is like spreading a thin film of insulation across the path of heat transfer. The table below illustrates the impact scale has on heat transfer.

Percent Heat Transfer Loss Due to Condenser Scale

Tube Scale Thickness	Cooler	Condenser
Clean Tube	0	0
0.006 inch of scale	16.7%	30.0%
0.012 inch of scale	28.5%	45.9%
0.024 inch of scale	44.5%	62.9%
0.036 inch of scale	54.6%	71.8%

The impact of poor heat transfer will translate into a need for added power consumption (required to drive the compressor). In a 300-ton centrifugal chiller with an average load of 35% (run time of 3000 hours per year), a scale thickness of 1/32nd inches on the condenser tubes can cost as much as $25,000 per year in added electric consumption. The graph to the side illustrates the potential increase in power consumption based on scale thickness.

Tube deposits will impact condenser bundle reliability in addition to impacting heat transfer and system efficiency. Corrosion cells are formed beneath tube deposits which can lead to under-deposit corrosion or



promote an environment for microbiological growth – biofilm. The presence of biofilm can lead to a form of localized corrosion referred to as MIC (microbiologically induced/influenced corrosion).

There are three key requirements to maintaining condenser cleanliness: 1) proper operation of the condenser cooling loop 2) proper quality control of cooling tower water and 3) proper treatment of the cooling tower water. Good operating protocol includes maintaining adequate water flow/velocity, avoiding stagnant water conditions and adequate cooling tower performance. Maintaining proper control of cooling tower water quality is achieved with good cycles control (well-maintained conductivity controller and bleed line) and minimizing suspended solids in the water. One common method to control suspended solids is with a properly designed filtration system. Proper treatment should consider corrosion control, scale/fouling control and microbiological control. Where deposits do exist, the condenser operator should consider off-line or on-line cleaning options.

