Impact of Scale on Heat Transfer Efficiency
In a boiler, fuel is burned to generate heat energy. From an efficiency standpoint, the objective is to transfer as much heat energy as possible from the hot combustion gases to the boiler water. Since scale deposits are insulating, they reduce how efficiently heat from the combustion gases is transferred through the metal boiler tubes to the water. This reduced heat transfer efficiency means that in a dirty boiler more of the heat goes out the stack instead of being converted into steam. This reduced heat transfer efficiency also means that in a dirty boiler, versus a clean one, more fuel must be burned to generate the required amount of steam.

As the graph to the right shows, some deposits are more insulating than others. For example, 1/32” of a normal scale reduces heat transfer efficiency by 2%, while 1/32” of a high iron and high silica scale reduces efficiency by 7%. To accurately estimate the excess fuel costs associated with a scaled boiler, an estimate of the average deposit thickness and what it is made of is needed.

The High Cost of Poor Scale Control
To fully appreciate the high cost of poor scale control, real cost data needs to be considered, not just percentages. As the table above shows, the excess energy cost associated with a scaled boiler is phenomenal. Often the payback in terms of reduced fuel costs will readily pay for a chemical cleaning job, better feed and control equipment, or an improved boiler treatment program.

As a Chem-Aqua water treatment professional, we can help customers evaluate and understand these cost savings or cost avoidance opportunities.