A TALE OF TWO HEAT PUMPS

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Introduction

Over the past few years, the Geo-Heat Center has been involved in the evaluation of many groundwater source heat pump systems. Our experience has demonstrated that ground water systems can offer significant benefits to the building owner in the area of operational energy savings. In order for the owner to fully take advantage of the benefits, however, it is critical that the system be carefully designed, skillfully installed and operated according to the designers intent. Serious consequences can result when these precautions are not observed.

To illustrate this point, this paper describes the experiences of two systems. Each was installed in the last several years in newly constructed county jail facilities and shall henceforth be referred to as System #1 and System #2. System #1 is a 360 ton 2 machine installation which provides the heating and cooling needs of a 120,000 ft^2 county jail in Eastern Washington state. This system employs a 700 gpm (@72°F) Production well and injects all of the groundwater into a second well.

System #2 is a single machine 156 ton design using 56°F groundwater. This system serves a county courthouse and jail facility in Northern California. Two production wells, capable of a combined peak flow of 250 gpm, provide the heat source/sink. Effluent from this system is discharged to a nearby river.

System #1

System #1 is an excellent example of the need to carefully design the groundwater/mechanical system interface to minimize the extent to which the groundwater is exposed to the equipment.

Figure 1 provides a flow scheme fro the original system design. As indicated, the groundwater was pumped from the production well to a 6,000 gal. holding tank located in the mechanical room. Pump operation was on/off in response to a level control on the tank. From the tank, the 72°F well water was admitted directly to the heating and cooling loops to moderate temperature. Fluid flow into the loops was initiated when the chilled water loop fell below 46°F or when the heating loop rose above 108°F. A second set of valves discharged fluid from the loops as the groundwater was admitted.

The initial indications of problems with this system developed before construction was even completed. A serious corrosion condition became evident in the heating and cooling loop piping and the groundwater circuit. Large quantities of a pasty rust colored sediment were appearing in system strainers. The sediment was believed to be a result of a combination of sand produced in the well and products of corrosion.