

NARRATIVE

The New Elementary School in Centerville, Tennessee is approximately 51,000 square feet in area, including all alternates to the project. Ventilation requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) were utilized in this study.

The base concept for the heating, ventilating, and air conditioning (HVAC) system were a standard 4-pipe system and water source heat pump system both utilizing a circulating water loop, natural gas-fired boiler and closed circuit cooler for heat addition and rejection. Also included was an air-to-air heat pump system utilizing individual heat pump systems installed throughout the facility. Each system would be controlled by thermostats located in respective zones.

The geothermal system utilizes very similar heat pump equipment as the water source heat pump system except heat is rejected and added via heat exchangers configured vertically in the ground. Each heat exchanger is located in a vertical bore about 300 feet deep. The building interior water loop is circulated via pumps to the "borefield" located outside, underground. Each bore contains a 1-inch supply and return pipe. The extent or number of bores determines the overall capability to reject heat or absorb heat from the constant temperature ground soil. Thus, no boiler or cooler is needed for the water loop. All heat exchanger is confined to the borefield.

The geothermal units are capable of handling water loop temperature ranges lower than the usual water source heat pumps. This feature usually allows the heat pumps to operate at cooler refrigerant temperature which allow greater mechanical efficiencies and extended equipment life. Therefore, energy and maintenance costs are significantly less than other concepts. Also, the statistical service life of this equipment is twenty years.

A test bore was prepared and tested at the Centerville project site to determine the actual ground temperature and thermal conductivity. The following results were found:

Thermal Conductivity	1.9 btu/hr-ft-f
Ground Temperature	61.0 Degrees F

The above values are favorable. The computed length of bores is about 26,110 feet, requiring about 87 bores, three hundred feet deep and 20 feet on centers.

The computed data for the geothermal concept indicates an annual cost savings of \$18,300.00 to \$22,850.00 in utilities, as compared to the 4-pipe, WSHP and Air HP system. The comparison on a building basis is as follows:

Standard 4-Pipe System:	\$ 1.08 per sq. ft.
Standard Water Source Heat Pump System:	\$ 1.09 per sq. ft.
Air to Air Heat Pump System:	\$ 1.13 per sq. ft.
Geothermal System:	\$ 0.84 per sq. ft.

GEOTHERMAL W/ AIR HP

\$ 1.01 per sq. ft.

NO DRILL LOG