NARRATIVE

The New K-2 School in Hawkins Co., Tennessee is approximately 65,522 square feet in area. Ventilation requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) were utilized in this study.

The Base Case concepts for the heating, ventilating, and air conditioning (HVAC) system is a 4-pipe or water source heat pump system utilizing a circulating water loop, natural gas-fired boiler and closed circuit cooler for heat addition and rejection. The 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 of the heat exchange 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.

We selected high efficiency water source heat pumps as manufactured by Addison manufacturing with a C.O.P. of 3.8 and EER at 20.0 for use in the geothermal system scenario. Use of lower efficiency products would drastically affect utility cost savings.

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

Thermal Conductivity	1.6 btu/hr-ft-f
Ground Temperature	57.8 Degrees F

The above values are favorable. The computed length of bores is about 37,000 feet, requiring about 124 bores, three hundred feet deep and 20 feet on centers.

Thermal Conductivity Calculation

Project Hawkins County Elementary School
Location Rogersville, Tn

Hole depth:
Hole depth 200

Test date: 9/15/99

Ground Temp 57.8 °
OSAT: 60

Test began @ 8:30 PM 0.5625 days
Terminated @ 10:00 AM

Final Temp
To bore: 96.4
From bore: 80.5

Heater Watts: 4300
Pump Watts: 200
Flow: 3.1 GPM
t 0.5625
d 0.15 3/4" Pipe size

Kg= 1.6

Highland Drilling Company

P.O. Box 160

Kingston, Tennessee 37763

(423) 376-6533

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CUSTOMER: TVA
LOCATION: ROGERSVILLE SCHOOL, HAWKINS COUNTY
DATES: 09/01/99-09/03/99

WELL #1- 21' TO BEDROCK

ROD	DEPTH	FORMATION
1	0-25	DIRT
2	25-50	ROCK 27'
3	50-75	LIMESTONE
4	75-100	LIME & SHALE STK
5	100-125	LIME, POSSIBLE WATER 110'
6	125-150	LIME
7	150-175	LIME - WATER 165' 1-2 GPM
8	175-200	LIME - WATER 185' 10-12 GPM
		TOTAL DEPTH 200'

WELL #2- DRILLED TO 42' INSTALLED 43' TEMP. SURFACE CASING
LOST CIRCULATION 60' , CAVE 165-200'

ROD	DEPTH	FORMATION
1	0-25	DIRT
2	25-50	DIRT - ROCK 42'
3	50-75	LIMESTONE
4	75-100	LIMESTONE & SHALE STK
5	100-125	LIME ?
6	125-150	LIME & SHALE
7	150-175	CAVE 165'
8	175-200	CAVE - 198'
		TOTAL DEPTH 200'