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THERMAL WATER OF HOT SPRINGS NATIONAL PARK ARKANSAS - THEIR ORIGIN, NATURE, AND IMPLICATIONS FOR THE GEOTHERMAL DEVELOPMENT.

Lewis A. May, Eugene Stringer
and Benard Goodman

U. S. Department of Interior - National Park Service
Hot Springs National Park, AR 71901

ABSTRACT

The 47 hot springs has a combined flow of approximately 1,000,000 gallons per day at 143° fahrenheit. Source of the hot springs artesian -flow system is by infiltration of rainfall in the outcrop area of the Bigfork chert, the Arkansas Novaculite, sandstones and shales with the water emerging after 4,400 years. The radioactivity through radon gas emanation is 0.81 millimicocuric per liter. Chemical analysis milligrams per liter

Silica (SIO_2)....42.0	Sulfate (SO_4).....8.0
Calcium (Ca).....45.0	Chloride (Cl).....1.8
Sodium (Na).....4.0	Fluoride (F).....2
Potassium (K).....1.5	Oxygen (O).....3.0
Bicarbonate (HCO_3)165.0	Free Car. Di.(CO_2)10.0

Existing water usage heating restrooms, Administration Building and Therapeutic bathing as known world wide in Hot Springs, Garland County, Arkansas.

INTRODUCTION

The thermal springs of Hot Springs National Park in Arkansas has been a Natural resource of international renown for many years. The springs were known to President Thomas Jefferson who initiated the first scientific study in 1804, marking the first beginning of an era of scientific curiousity as to the origin heat sorce of the springs.

Public interest in the hot springs has been focused primarily on therapeutic values of the waters, and in serving such interest, this also has been the focus of Federal Management since the area was established as the Hot Springs Reservation in 1832 and was designated as a National Park in 1921 and is preserved and protected for present and future generations.

Geothermal energey has been utilized for many years in a minor fashion through radiators heating small structures (restrooms) on bath house row and in October, 1975 the National Park Administration Building was converted from natural gas heat to geothermal heating. With the gradual decline in bathing only about 1/3 of the thermal waters are utilized for therapeutic purpose.

SPRING DEVELOPMENT INCLUDING HISTORY AND PRESENT USE

The 47 thermal water springs including 2 exhibition springs are in a belt about one-fourth mile long and a few hundred feet wide along the southwest slop of Hot Springs Mountain.

Excavation and covering of springs to increase and concentrate flows and to protect springs from contamination, have so altered the natural spring environment that it bears no resembulance to the original conditions.

Water flow from 45 spring to a collecting line system including a 12 inch collecting line to a 300,000 gallon reservoir and pumped to high level reservoir in order to be redistributed to individual bath houses with approximately 60 pound pressure, this procees includes cooling a portion of this water from 143° to 90° for use in the bath house.

The chemical quality of water from the Hot Springs in Arkansas has been a great interest to man, probably since the hot springs were discovered.

The purpose of many investigations have been to support some therapeutic claim for the water, or to determine whether the chemical concentration of the water has been changed.

GEOTHERMAL ENERGY FOR HEATING OF THE ADMINISTRATION BUILDING-HOT SPRINGS NATIONAL PARK

With the energy crisis, it was necessary to look at all possible ways in which to conserve energy. An inhouse dialogue ensued over some months between the Superintendent, Chief of Maintenance and Utilities Foreman, leading to the conclusion that the thermal water heating should be pursued as a realistic alternative to the use of natural gas.

With the assistance of Davis & Pitts, an Engineering firm we installed a hot water coil with cleanable tubes in our existing forced air system alone with the necessary controls and devices for the new system costing approximately $3,000.00.

The average thermal water use per month for heating the 5,460 square foot building is approximately 170,895 gallons estimated cost of 7 cents

per 1,000 gallons and is required about five months each year during the winter months.

The heat reclaim for energy conservation of the administration building was put in to effect in October, 1975 replacing the need for a natural gas fired boiler.

The thermal water coil was installed in the existing 24 inch x 24 inch return air duct to heat 4,550 cubic feet per minute of air from 65° fahrenheit to 105° fahrenheit when provided with 26.0 gallons per minute of 140° fahrenheit water.

Existing installation and performance with blower moving 4,550 cubic fee per minute of air with a average of 171,000 gallons per month using 140° fahrenheit water keeps the building at a desired temperature.

Note the water use is considerable less than planned.

Controls for the System as follows:

1. The fan is the same one that existed in the previous system. It blows a given number of hours, depending on the setting on an automatic timing device. It's operation is basically no different than it was in the old system.

2. The Element is heated by the thermal water pipes into the "radiator" type unit. This is the same "HOT" water that the concessioners have available in their "hot" taps (Approximately 143° fahrenheit). The temperature of the heated air is controlled, however, by two thermostat controlled valves. These two valves control the flow of water into the unit.

3. The two thermostats operate with one having priority over the other.

A. Supply Duct Thermostat This thermostat is attached to the supply duct and measures the temperature of the heated air therein. It can open or close an electric motorized modulating valve, provided that the "building thermostat" has opened the valve on the water supply line nearest the source.

B. Building Thermostat The existing thermostat located in the administration building, has priority, in the sence that it can close the prior valve on the hot water supply line if the heated area reaches the desired temperature before the supply duct thermostat is satisfied.

Materials and Description as follows for the conversion:

The Coil shall be copper tube, aluminum fin in casing for installation in return air duct, and is of cleanable tube design with removable headers for cleaning from either end. Coil is a Bohn #5CC4A 15T x 48.

4 stand for four rows -- A stands for 8 fins

Tube wall shall be 0.035,

Tube size shall be 5/8 inch diameter

Maximum air pressure drop shall be 0.585" H_2O

Controls (Honeywell, Inc.)

1 - T991A thermostat set up for heating only

1 - M945A valve motor, 24 volts

1 - V5011A valve, 1" size, Maximum 8 psig pressure drop at 26 g. p. m.

1 - Q618A linkage

1 - Rodale switch with box and cover

1 - AT72D1477 transformer 115/24 volt

Geothermal heat will be utilized for the National Park Service Buildings (Existing Bath Houses) being renovated for use as a **Visitors** Center and a Amphitheatre and possibly using the cooled water for other therapeutic purposes.

After the use of the 143° fahrenheit waters for heating buildings has been cooled to 90° temperature; it can be utilitzed as the cool water supply for existing bath houses.