UNCLASSIFIED **OAK RIDGE NATIONAL LABORATORY**

Operated By

UNION CARBIDE NUCLEAR COMPANY

POST OFFICE BOX P
OAK RIDGE, TENNESSEE

EXTERNAL TRANSMITTAL AUTHORIZED

ORNL
CENTRAL FILES NUMBERCF-56-6-171

DATE: June 28, 1956

SUBJECT: HRT Cooling Tower Performance Test Evaluation

TO: R. Van Winkle

FROM: R. E. Brooksbank

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission to the extent that such employee or contractor prepares, handles or distributes, or provides access to, any information pursuant to his employment or contract with the Commission.

Photostat Price \$ 1.80Microfilm Price \$ 1.80

Available from the
Office of Technical Services
Department of Commerce
Washington 25, D. C.

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use of the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report.

UNCLASSIFIED

596-1

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

HRT COOLING TOWER PERFORMANCE TEST EVALUATION

Summary

The HRT Cooling Tower has been tested and was found to exceed design performance by approximately 20 per cent.

Procedure

Approximately 40 per cent of the normal cooling tower heat load was applied to the cooling water by passing steam to the turbine condenser and the turbine-generator. In this manner, a cooling range of 17.8°F was obtained with an 8.7°F approach to the wet bulb temperature.

Temperatures of the cooling water to and from the tower were measured with mercury-in-glass thermometers taken in direct contact with the liquid. Wet bulb temperatures were taken with a sling psychrometer.

Cooling water flow rates were determined from the characteristic curves of the circulating pump, and checked against the total flow going through calibrated rotameters.

Results

The HRT Cooling Tower is designed for an 800-gpm water flow with a 45°F cooling range and a 10°F approach to a wet bulb temperature of 80°F. The design conditions and the conditions obtained during the test are compared in Table 1. Data taken during the equilibrium test period are presented in Table 2.

TABLE 1

<u>Design Conditions</u>		<u>Test Conditions (Avg.)</u>
Flow	800 gpm	810
Inlet Temperature (°F)	135	93.5
Outlet Temperature (°F)	90	75.7
Wet Bulb (°F)	80	67.0
Range (°F)	45	17.8
Approach	10°F	8.7
Drift	< 0.2 %	---
Air Flow (Inlet)	115,500 cfm	~ 114,000
Wind Velocity	< 6 mi/hr	2
KaV(1)	1.49	1.72
L		

Tower test factors and wet bulb factors were calculated and plotted in Fig. 1 for various conditions⁽²⁾ and were applied to the standard performance equation:

Design Performance = Design GPM x Tower Test Factor x Wet Bulb Factor

For HRT Tower = $800 \times 1.00 \times 1.00 = 800$

Test Performance = Actual GPM x T.F. x W.B. Factor = $810 \times 0.85 \times 1.39 =$
 $= 958$

Performance Ratio = $\frac{\text{Test Performance}}{\text{Design Performance}} = \frac{958}{800} = 1.20$

The performance ratio was also checked by comparing the design $\frac{K_a V}{L}$ ⁽¹⁾ of 1.49 with the $\frac{K_a V}{L}$ ⁽¹⁾ obtained from the test. The ratio obtained from this method was 1.16.

On the basis of these tests the cooling tower appears to meet all design requirements and is acceptable for use.

 R. E. Brooksbank

REB;be

2. Testing of HRT Cooling Tower, memorandum from H. A. McLain and M. I. Lundin to R. E. Brooksbank (Feb. 29, 1956).

4

TABLE 2

Cooling Tower Performance Data

Time	Cooling Water		Pump Pressure		GPM	Air Velocity ^(a) Ave. (Entrance)	Wet Bulb Temp. °F (Avg)	Dry Bulb Temp. °F
	On °F	Off °F	Suction psi	Discharge psi				
1005	84.2	68.2	~ 2	50.2	810	300 ft/min	66.5	84
1035	86.5	72.5	2	47.0	940	300	--	84
1105	88.3	74.3	2	47.5	920	300	69.0	84
1130	89.7	74.3	2	47.5	920	300	--	84
1215	90.4	75.4	1	47.0 ^(b)	-	300	67.0	84
1300 ^(c)	93.6	75.6	2	50.0	810	300	67.0	84
1340	93.4	75.6	2	50.0	810	300	67.0	84
1405	93.6	75.9	2	50.0	810	300	67.0	84

^a Wind velocity during test, < 2 mi/hr.

^b Flow reduced through turbine condenser.

^c Test conditions, equilibrium was reached at this point.

-385