Cooling Towers

2708

UNION CARBIDE

UNION CARBIDE CORPORATION

NUCLEAR DIVISION

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U. S. Atomic Energy Commission
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Attention: Mr. J. A. Lenhard, Director
Safety Division

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Gentlemen:

Available Information on Blowdown from Large Cooling Towers

Per request of J. S. Wing, we are transmitting the following information on our recirculating water practices and our present cooling tower systems at ORGDP, Paducah, and ORNL.

Basically, at all sites we use a dianodic water treatment which depends on maintaining concentrations of chromate, zinc, and phosphate in the water at about 20, 2 to 4, and 1 to 2 ppm, respectively. Blowdown water has essentially the same composition as that in the recycle loop. Typical compositions and estimated cycles of concentration presently obtained are given in table I for the Oak Ridge and Paducah gaseous diffusion plants.

Makeup water is softened toward a target of 30 ppm calcium hardness (as $CaCO_3$). The proprietary Oracol-TL (BETZ) inhibitor is added. At the diffusion plants, chlorine gas is used as an algaecide and sulfuric acid is used to maintain the pH between 6.0 and 6.5. ORNL is employing pentachlorophenol as an algaecide.

Currently, blowdown water is not treated at any site*. Based on test sampling and flow data, satisfactory dilution has been considered in the past to be available in the rivers to which these discharges flow. As you know, the problem has been under continuing study and will be discussed separately over the period of the next few months as new pollution abatement requirements are being considered.

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* ORGDP is continuing testing of the practice of resoftening part of the recirculating water flow; however, this falls under the category of blowdown avoidance.

This document has been approved for release to the public by:

David R Hamm 4/29/96
Technical Information Officer Date
ORNL Site

Available data on major cooling tower systems are given in table II. Due to the present low process load at the diffusion plants, these systems are being operated considerably below design capacity. The systems are of varying ages and, in some cases, repairs would be needed to regain design capacity. Of course required flows and makeup rates also vary substantially seasonally and for other equipment performance reasons; therefore, the numbers given must be viewed as quite approximate.

Very truly yours,

R. G. Jordan, Superintendent
Oak Ridge Gaseous Diffusion Plant

RGJ:JHP:ga

cc: Mr. F. L. Culler, Jr.
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TABLE I

BLOWDOWN WATER COMPOSITION

	ORGDP	Paducah
Dissolved Solids	1000	1500-2000
Total Hardness (as $CaCO_3$)	500	600-700
Chloride (as NaCl)	70	350-500
Sulfate (as Na_2SO_4)	600	1000-1200
Phosphate (total as PO_4)	1	2
Chromium (as chromate)	22	22
Zinc (as Zn)	2.5	4
Cycles of Concentration	3-7	9-15

TABLE II

MAJOR COOLING TOWER SYSTEMS DATA

Plant	System	Cooling Tower	Circulation, gpm	Makeup, gpm	Blowdown, gpm
ORNL	Oak Ridge Research Reactor	Marley Cross-Flow Single Flow	12,000	200	50
	Research Reactor Pool	United Cross-Flow Double Flow	900	6	2
	Bulk Shielding Reactor	Cross-Flow Single Flow	1,200	18	5
	High Flux Isotope Reactor	4-Cell Cross-Flow	22,000	750	120
	4500 Research Complex	Cross-Flow	10,000	200	50
	6000 Area	Cross-Flow	5,000	100	25
		ORNL Total	51,100	1,274	252
ORGDP	Tower A (K-25)	Marley Cross-Flow (18-cell)	10,000*		
	Tower C (K-29)	Marley Cross-Flow (14-cell)	5,500*		
	Tower E (K-31)	Marley Cross-Flow (16-cell)	23,000*		
	Tower H (K-33)	Foster-Wheeler Counterflow (11-cell)	40,000*		
		ORGDP Total	78,500	3,800	380
PADUCAH	C-31	Hudson Counterflow (16-cell)	28,000**		
	C-35	Hudson Counterflow (16-cell)	20,000**		
	C-33	Two Hudson Counterflow (16 cells each)	71,000**		

TABLE II
(Continued)

MAJOR COOLING TOWER SYSTEMS DATA

Plant	System	Cooling Tower	Circulation, gpm	Makeup, gpm	Blowdown, gpm
	C-37	Two Marley Cross-Flow (14 cells each)	89,000**		
		Paducah Total	208,000	6,900	520

* These systems are currently operated much below design because of low process loads. Usually this is done by using only some of the cells in a tower. For towers A and C, design ratings are about 4000 gpm per cell; for tower E, about 3500 gpm per cell; and for tower H, about 8000 gpm per cell. Tower B services the K-25 area but is not currently usable. Tower G is a duplicate of tower H but is not currently in use. Design ratings are only approximate because they must consider liquid flow capacity, design dry and wet bulb temperatures, temperature of feed water to tower, and approach temperature difference.

** As at ORGDP, these systems are currently operated much below design. Design ratings per cell for the Hudson counterflow towers are about 3200 gpm and for the Marley cross-flow, about 4400 gpm. Current capability may be only about 70% of these values.