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SWERDON,P. Pennsylvania, Commonwealth of,

SUBJECT: Submits addl info re proposed cooling water treatment program & effects on cooling tower blowdown water quality. Description of circulating & svc water sys, summary of dispersant settling studies & test results encl.

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PP&L Pennsylvania Power & Light Company
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January 30, 1985

Mr. Paul Swerdon
Chief-Facilities Section
Pennsylvania Department
of Environmental Resources
90 East Union Street, Second Floor
Wilkes-Barre, PA 18701

SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED CHEMICAL WATER TREATMENT PROGRAM
CCN 741326 FILE 012-3
PLE-6659

Dear Mr. Swerdon:

On July 19, 1984 (PLE-5362), the Pennsylvania Power and Light Company (PP&L) submitted information to the Pennsylvania Department of Environmental Resources (Pa. DER) outlining a cooling water treatment program PP&L plans to initiate at the Susquehanna Steam Electric Station (Susquehanna SES). This letter provides additional information regarding this treatment program and its anticipated effects on cooling tower blowdown water quality.

The recommended treatment program consists of the addition of a dispersant and two corrosion inhibitors to the Susquehanna SES's circulating and service water systems. The circulating water system is the plant's main cooling water system and supplies water to the main condensers. The service water system draws water from the circulating water system and supplies water to heat exchangers on various auxiliary systems and components. Raw river water is pumped from the intake structure to the cooling tower basins, treated periodically with chlorine for biological control, and then utilized in both the circulating and service water systems. For a further description of these systems, refer to Attachment 1 and to PLE-5362.

High iron levels in the makeup water from the river has resulted in iron oxide sludge filling and fouling service water heat exchangers as well as portions of the circulating water system's main condensers. This fouling reduces the heat exchanger's ability to transfer heat. Localized corrosion is also occurring under these deposits in both the service water heat exchangers and the main condensers.

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In order to reduce sludge fouling and corrosion within the service and circulating water systems PP&L plans to initiate a chemical treatment program. As stated in PLE-5362, the treatment includes the injection of a dispersant and two corrosion inhibitors into the service water pumps' discharge to maintain the levels listed below in the cooling tower basins. The range of concentrations indicated are the initial concentrations planned for the treatment program. Operating experience may dictate treatment with higher or lower levels, up to the maximum concentrations listed. Since the cooling tower blowdown discharges directly from the cooling tower basins, the concentrations listed below are those expected to be present in the blowdown (outfall 071).

Chemical	Use	Concentration in Circulating Water (cooling tower blowdown-outfall 071)	
		Range	Maximum
Sodium Polyacrylate	dispersant	4-6 ppm active acrylate	10 ppm
Sodium Toly-triazole	copper corrosion inhibitor	1.2-1.8 ppm, active Tolytriazole	2 ppm
Zinc	carbon steel corrosion inhibitor	0.5-0.8 ppm active zinc	1.0 ppm

Both the sodium polyacrylate and sodium tolytriazole are widely-used water treatment chemicals with low toxicities. The sodium polyacrylate is an acrylic acid-based, 1,000-molecular weight polymer. Forty-eight (48) hour toxicity tests on polyacrylate conducted by Betz Laboratories, Inc. showed zero mortality of Daphnia Magna and bluegills at 55 ppm and 110 ppm active acrylate, respectively. Similar toxicity tests on tolytriazole showed zero mortality of Daphnia Magna at 85 ppm after 48 hours and established a 96-hour LC_{50} for rainbow trout at 15 ppm active tolytriazole.

The addition of these chemicals to the service and circulating water systems should not impact on PP&L's ability to meet the terms and conditions of the renewed National Pollutant Discharge Elimination System (NPDES) Permit, received by PP&L on January 25, 1984. Neither the sodium polyacrylate nor the sodium tolytriazole are listed as or contain any of the 126 priority pollutants in accordance with Special Condition #1 in Part C of the Permit. Additionally, the addition of zinc, as zinc chloride or sulfate, will be controlled to assure that the cooling tower blowdown effluent limit for zinc of 1.0 ppm will be met.

My previous letter (PLE-5362) suggested that PP&L anticipated difficulties in meeting the previous cooling tower blowdown effluent limitations for iron due

to the addition of the dispersants. However, recent developments indicate that this will not be the case. As you are aware, the newly-issued NPDES permit contains less restrictive effluent limitations for iron than existed in the previous permit. Additionally, studies conducted by PP&L indicate that the increase in cooling tower blowdown iron concentrations due to the dispersant additions will not be as great as estimated in PLE-5362.

When the treatment program is initiated, blowdown iron concentrations may increase due to the resuspension and "flushing" of iron which has settled and accumulated throughout the service and circulating water systems. PP&L may dose the polyacrylate at 15-20 ppm initially in order to aid in the removal of some of this accumulated sediment from these systems. However, the somewhat less restrictive effluent limitations on iron minimizes the possibility of permit violations during these initial stages of the treatment program.

After this initial "flushing" of the system, blowdown iron concentrations are expected to decline. However, long-term blowdown iron concentrations may remain higher than those observed prior to initiating the treatment program. Currently, some settling of suspended solids in the intake water occurs in the cooling tower basins which contributes to lower blowdown iron concentrations. The addition of dispersants may reduce this settling rate; thus, a long-term increase in iron levels in outfall 071 may occur.

PP&L conducted a series of settling studies in an attempt to quantify the effects the dispersant additions will have on settling of solids in the cooling tower basins. A description of these studies and their results are presented in Attachment 2. Based on these studies, it is anticipated that blowdown iron levels may increase by approximately 20% after the proposed treatment program is initiated.

Attachment 3 presents a plot of total iron levels (weekly grab samples) observed in the cooling tower blowdown since June 1983 (Unit 1 commercial operation). These values are compared to the previous NPDES daily maximum limit of 7.0 mg/l for total iron. Also plotted are resulting iron levels, assuming a 20% increase in blowdown iron concentrations.

Attachment 4 presents a plot of the monthly average cooling tower blowdown total iron levels (averaged from Attachment 3) as compared to the newly-issued NPDES monthly average limit of 6.8 mg/l total iron. A 20% increase in total iron concentrations should not cause unfounded violations of the monthly average limit. Those violations of this limit which would have occurred can be correlated to high individual values shown on Attachment 3, which were due to periodically high total iron concentrations in the river. These increases and fluctuations in ambient river water quality may continue to cause periodic permit violations whether or not the dispersant is used.

Overall, the treatment program should not create difficulties for PP&L in meeting the proposed effluent limitations for outfall 071. The treatment program is currently scheduled to begin during the second quarter of 1985.

If you have any questions or comments regarding this treatment program, please contact me at (215) 770-7889.

Respectfully yours,

Jerome S. Fields
Sr. Environmental Scientist-Nuclear

DAS/dml

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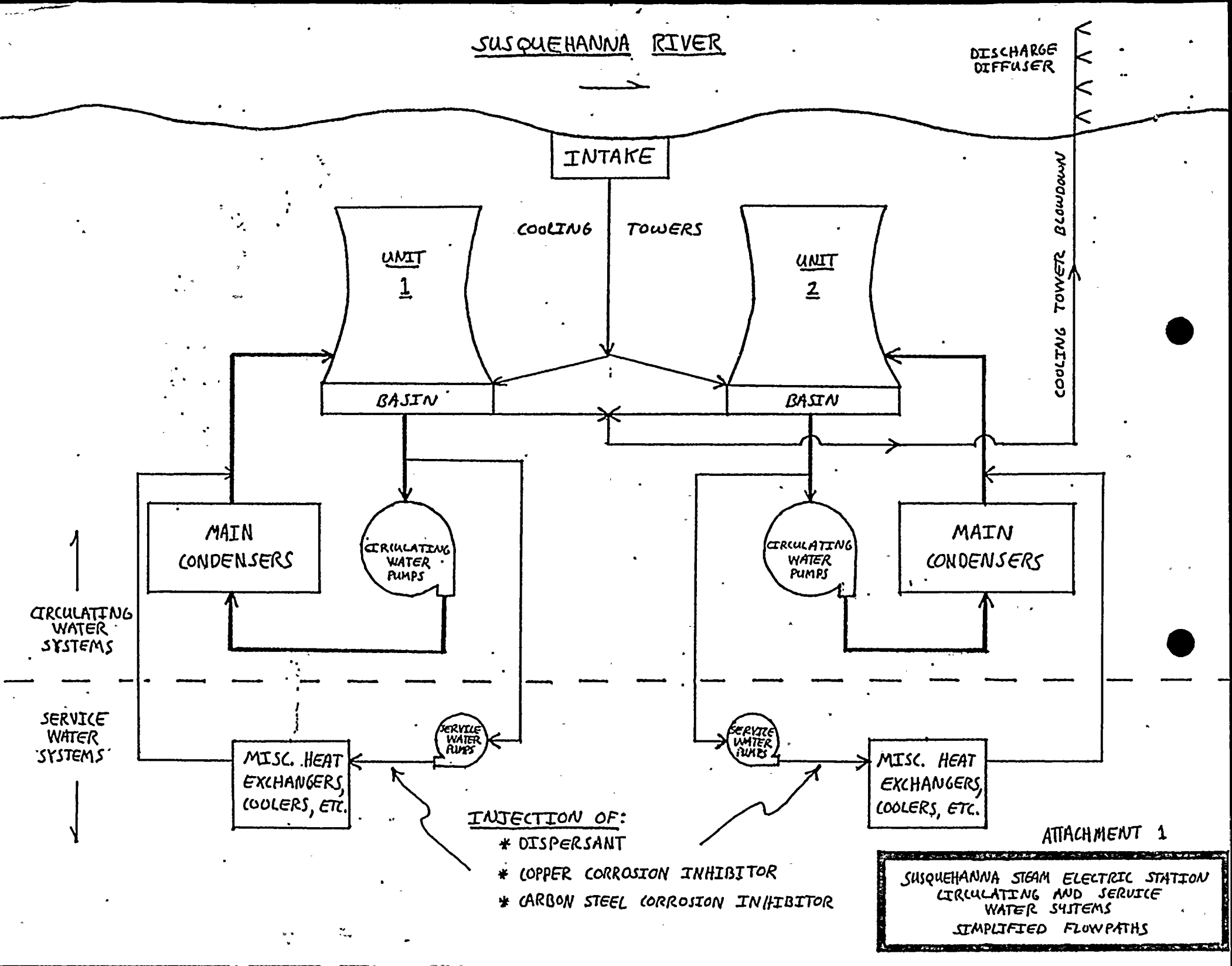
cc: A. Schwencer NRC D. Augustini Pa. DER



ATTACHMENT 1

SUSQUEHANNA STEAM ELECTRIC STATION
CIRCULATING AND SERVICE
WATER SYSTEMS
SIMPLIFIED FLOWPATHS

ATTACHMENT 2

DISPERSANT SETTLING STUDIES

PP&L performed a series of settling tests in order to compare the settling rates of solids with and without the addition of dispersants. Cooling tower basin water was dosed with sediment from the cooling tower basin to artificially create water of varying total suspended solids (TSS) and total iron (Fe) concentrations for the tests. Two 100-liter containers were used, one of which was dosed with the dispersant. The containers were mixed thoroughly, and samples were taken periodically to observe the amounts of solids and Fe remaining in suspension.

Tables 1, 2, and 3 present the results of three settling tests conducted at initial TSS of approximately 30, 300, and 500 mg/l, respectively. Concentrations of TSS and Fe in suspension were converted to percent of initial in suspension to allow comparison of the different containers. Also, the percent increase in TSS and Fe in suspension due to the addition of the dispersant was calculated as shown in Table 1.

At extremely low initial TSS and Fe levels (approximately 30 mg/l TSS) no difference in settling rates was observed between the treated and untreated jars since very little solids were present and little settling occurred. However, at higher initial TSS and Fe levels the amounts of solids and Fe remaining in suspension at any given time consistently remained 10-20% higher in the treated jars than in the untreated jars. This suggests that TSS and total Fe in the cooling tower basins may increase accordingly. Thus, it is anticipated that cooling tower blowdown iron levels may increase up to 20% after the proposed treatment program is initiated.

TABLE 1

SETTLING TEST #1

INITIAL TSS = 30 mg/l

TIME	Solids Remaining In Suspension Untreated TSS		Treated TSS		Percent* Increase
Hours	mg/l	% of initial	mg/l	% of initial	
0 (Initial)	29.3	100	30.3	100	--
1/4	27	92.2	26	88.8	- 7.2
1/2	27.3	93.1	28.3	93.4	+ 0.3
1	26	88.7	27	89.1	+ 0.5
2	24	81.9	22	72.6	-11.4
3	25	85.3	21	69.3	-18.8
4	20	68.3	17	56.0	-18.0
5-3/4	17	58.0	15	49.5	-17.2

* Percent Increase = $\frac{\text{Treated \% of initial TSS} - \text{Untreated \% of initial TSS}}{\text{Untreated \% of initial TSS}}$

TABLE 2

SETTLING TEST #2

INITIAL TSS = 300 mg/l
Fe = 14.0 mg/l

SOLIDS REMAINING IN SUSPENSION

TIME	UNTREATED				TREATED				PERCENT INCREASE	
Hours	mg/l		% of Initial		mg/l		% of Initial			
	TSS	Fe	TSS	Fe	TSS	Fe	TSS	Fe	TSS	Fe
0 (Initial)	295	14.0	100	100	312	14.5	100	100	--	--
1/2	122	7.85	41.4	56.1	150	8.79	48.1	60.6	16.2	8.0
1	100	6.91	33.9	49.4	120	7.85	38.5	54.1	13.6	9.5
2	78	5.86	26.4	41.9	98	6.75	31.4	46.6	18.9	11.2
3	64	5.36	21.7	38.3	81	6.11	26.0	42.1	19.8	9.9
4-1/2	49	4.77	16.6	34.1	64	5.52	20.5	38.1	23.5	11.7
5-1/2	46	4.31	15.6	30.8	57	5.02	18.3	34.6	17.3	12.3
					AVERAGE PERCENT INCREASE				18.2	10.4

ATTACHMENT 3

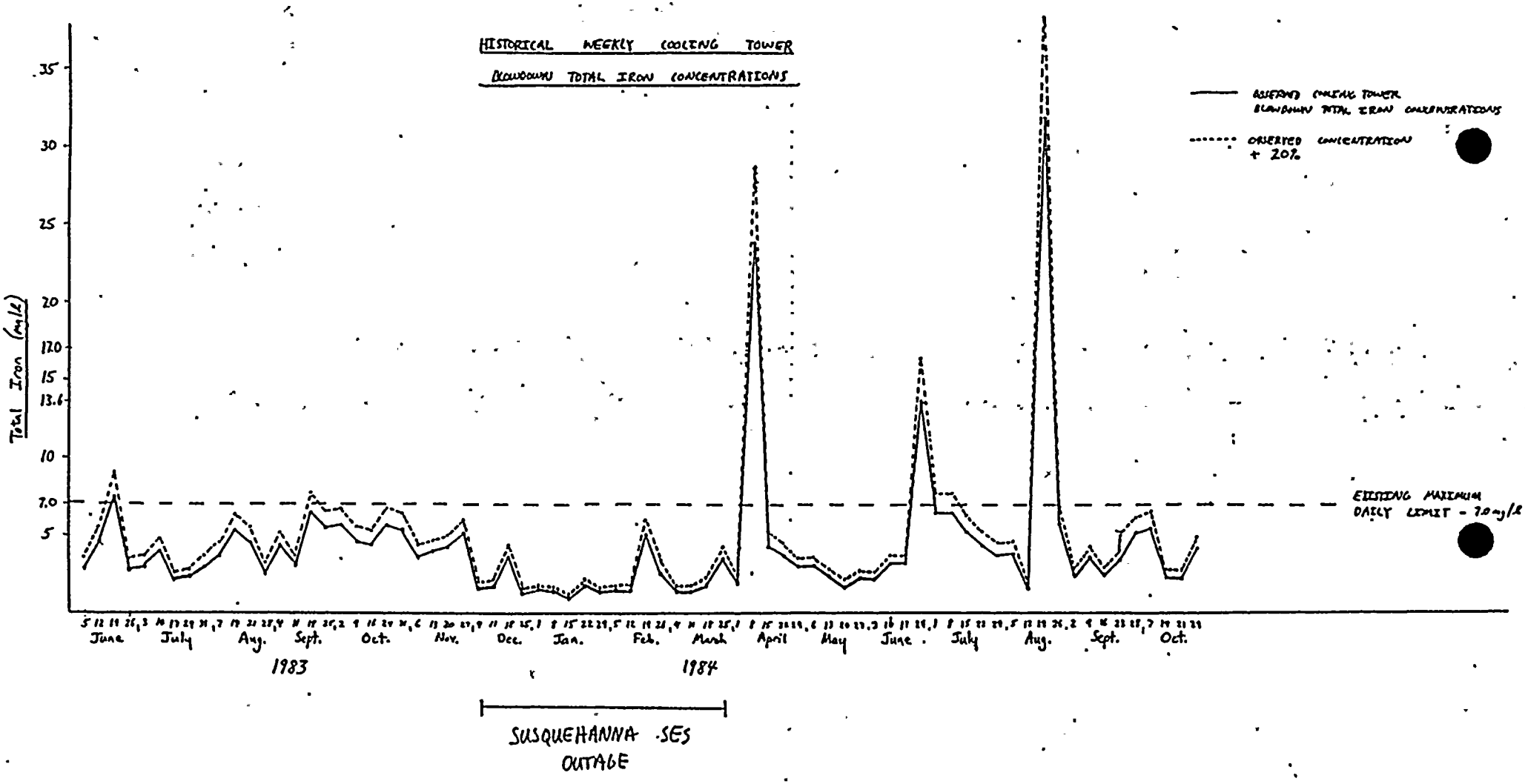


TABLE 3

SETTLING TEST #3

INITIAL TSS = 485 mg/l
Fe = 20 mg/l

SOLIDS REMAINING IN SUSPENSION

TIME	UNTREATED				TREATED				PERCENT INCREASE	
Hours	mg/l		% of Initial		mg/l		% of Initial			
	TSS	Fe	TSS	Fe	TSS	Fe	TSS	Fe	TSS	Fe
0	472	19.3	100	100	496	20.3	100	100	--	--
1/2	126	7.9	26.7	40.9	150	9.15	30.2	45.1	13.1	10.3
2/3	113	--	23.9	--	132	--	26.6	--	11.3	18.4
1	85	6.10	18.0	31.6	101	7.59	20.4	37.4	13.3	18.4
2	51	4.70	10.8	24.4	102	5.80	20.6	28.6	90.7	17.2
3	44.5	4.35	9.4	22.5	125	5.49	12.6	27.0	34.0	20.0
4	43	4.13	9.1	21.4	52	5.57	10.5	27.4	15.4	28.0
6	34	4.28	8.3	22.2	50	5.53	10.1	27.2	21.7	22.5
					AVERAGE PERCENT INCREASE				18.1*	19.3

* Excluding the 90.7 value.

ATTACHMENT 4

HISTORICAL MONTHLY AVERAGE COOLING TOWER BLOWDOWN TOTAL IRON CONCENTRATIONS