

PHILADELPHIA ELECTRIC COMPANY
PHILADELPHIA

PEACH BOTTOM ATOMIC POWER STATION

UNIT NO. 2 & 3

DOCKET NOS.: 50-277 & 50-278

CHLORINE MINIMIZATION STUDY

JANUARY - DECEMBER, 1978

SUBMITTED TO

THE UNITED STATES NUCLEAR REGULATORY COMMISSION

PERSUANT TO

FACILITY OPERATING LICENSE NO. DPR-44 & 56

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PEACH BOTTOM ATOMIC POWER STATION

CHLORINE MINIMIZATION STUDY

OBJECTIVE

To evaluate the effectiveness of low chlorine feed rates in minimizing chlorine impact on the environment.

REFERENCE

Peach Bottom Atomic Power Station Environmental Technical Specification 6.2.a.

METHOD

A test apparatus which simulated the conditions of the Peach Bottom Atomic Power Station condensers was assembled on site. This apparatus showed biological growth rate by weight difference with variable chlorination schedules. Because of the growth characteristics of biological material, any slime formation was considered unacceptable.

The test apparatus was positioned at the outboard screen house and drew water from the intake basin, the source of water for the condensers. The basin water was pumped and split into two (2) streams at 1.6 gpm (7 fps); one stream was unchlorinated (#1) and the other was chlorinated (#2). The flow was delayed 55 seconds by passing through coils to simulate intake piping travel time, heated during delay to 20°F above river temperature to simulate condenser temperature rise, and then passed through two-foot sections of 3/8" Admiralty tubing. The Admiralty tubing was immersed in a constant temperature bath of approximately 110°F to simulate the steam space of the condenser.

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Chlorine was introduced to the test apparatus in the form of a sodium hypochlorite solution with a variable stroke pump. River water samples were taken to determine the chlorine demand of the river water and an appropriate concentrated chlorine solution was prepared. Chlorination schedules were maintained by controlling frequency of chlorination, concentration of free chlorine, and time length in minutes of chlorination to the test apparatus. Chlorine residuals were determined using an amphoteric titration method.

The test apparatus was operated on a monthly cycle. At the beginning of a cycle, the Admiralty tube specimens were cleaned and weighed. During the month, a chlorination schedule was maintained. At the end of the cycle, the specimen tubes were removed, visually inspected and re-weighed. If the weight differential was appreciable, the slime material was removed with a plunger and collected for analysis. Chlorination schedules were re-evaluated each month based on sample tube observations.

The following data were taken daily and are listed in the following sheets.

1. Raw river water turbidity, pH and temperature (Tr_1).
2. Temperature of time-delay effluent for both streams (Tph_1 , Tph_2).
3. Temperature of sample tube inlet for both streams (Tsi_1 , Tsi_2).
4. Temperature of sample tube effluent for both streams (Tso_1 , Tso_2).

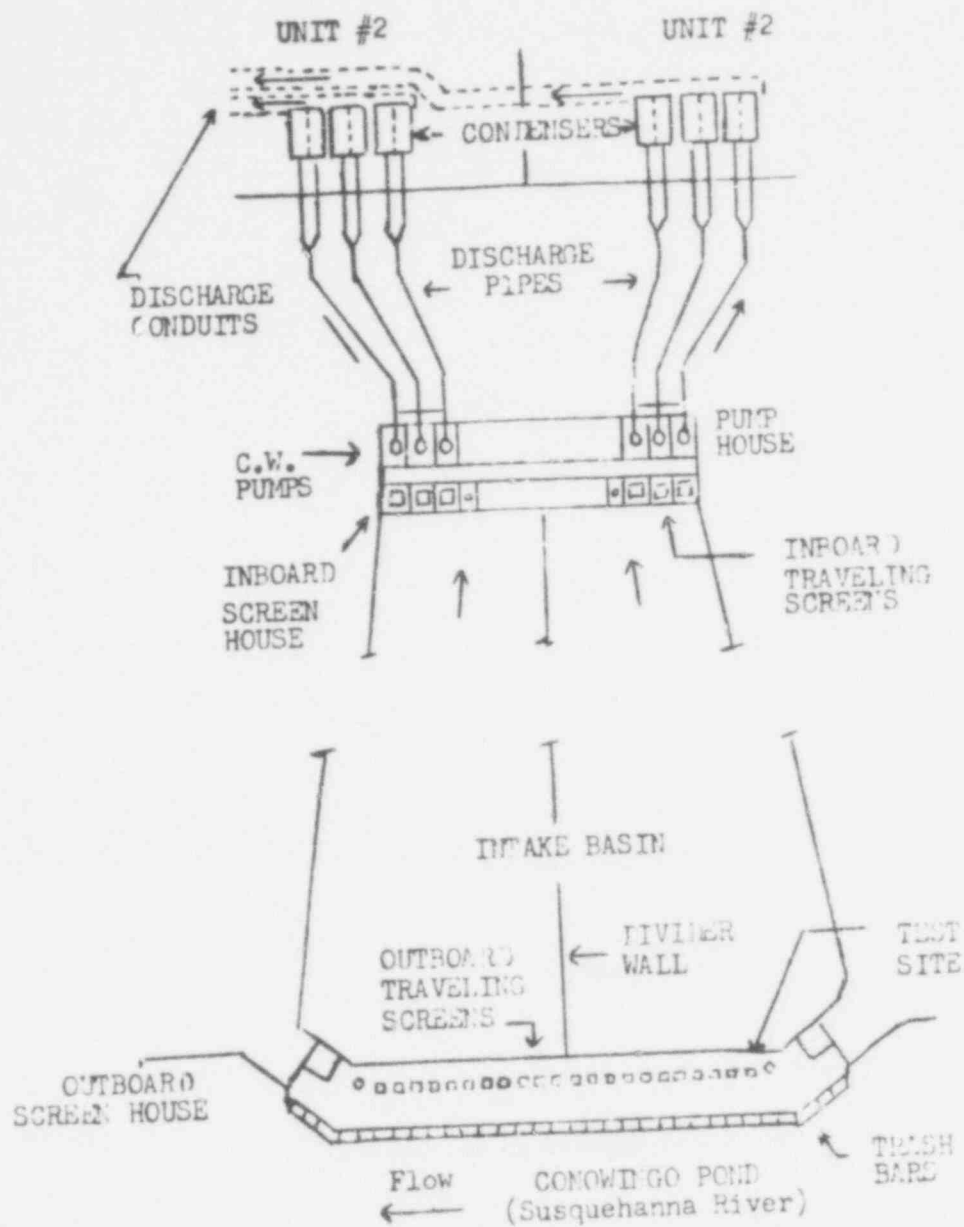
5. Closed loop heating bath temperature (T_{hb}).
6. Constant temperature bath temperature (T_{ctb}).
7. Sample pump discharge pressure (P).
8. Flow rate of both streams (q_1, q_2).
9. Canal basin level in feet.

CONCLUSION

Several chlorination rates were tested during a one-year period; none of these rates gave a sufficient amount of chlorine to maintain heat exchanger surfaces free of fouling deposits over a one-month period. Although it cannot be concluded what is the satisfactory minimum chlorine rate for Peach Bottom Atomic Power Station, fouling deposits on heat exchanger surfaces have been observed and documented during periods of chlorinator outages and of erratic chlorinator operation.

It has been observed, however, that periods with chlorine rates that give a 0.5 ppm free chlorine residual at the condenser outlet water box, have kept the unit condensers clean. Further, these periods have created no adverse environmental effect on the Susquehanna River since all tests during this period have shown the free chlorine residual to be no greater than 0.1 ppm, as measured at the point of discharge to the Conowingo Pond.

Our proposal is to operate below but no greater than that chlorine rate which will maintain the point of discharge to the Conowingo Pond at a free chlorine residual no greater than 0.1 ppm. This will allow Peach Bottom Atomic Power Station to keep heat exchanger surfaces free of fouling deposits while conforming to environmental regulations. This should relieve concern regarding the environmental effects of chlorination.



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Date	Tri °F	Tph ₁ °F	Tph ₂ °F	Tsl ₁ °F	Tsl ₂ °F	Tso ₁ °F	Tso ₂ °F	Tctb °F	Thb °F	P PSIG	q ₁ gpm	q ₂ gpm	Pond Level Feet	Cond. µmhos	Turb. JTU	pH
1/25/78	43°	50°	50°	58°	58°	58°	59°	63°	-	16	1.6	1.6	108.0	200	3.7	-
1/26/78	43°	49°	48°	59°	58°	62°	61°	68°	-	14	1.5	1.6	107.5	140	43.0	-
1/27/78	41°	47°	48°	56°	66°	66°	79°	72°	97°	52	0	1.4	108.5	170	70.0	-
1/30/78	46°	54°	52°	70°	74°	85°	69°	82°	106°	0	.8	.8	103.5	170	78.0	6.6
1/31/78	45°	56°	46°	80°	75°	76°	77°	68°	91°	0	.7	1.2	103.0	170	53.0	6.6
2/1/78	46°	56°	50°	73°	74°	71°	76°	64°	90°	0	.2	1.0	101.5	185	65.0	6.9
2/2/78	44°	47°	44°	68°	68°	70°	71°	68°	90°	2	1.4	1.4	109.5	170	48.0	6.8
2/3/78	37°	41°	41°	60°	62°	60°	62°	61°	86°	12	1.6	1.5	109.0	180	28.0	6.6
2/8/78	41°	50°	46°	70°	70°	69°	72°	-	86°	3	1.4	1.3	107.5	210	14.0	6.6
2/9/78	36°	42°	40°	54°	54°	55°	57°	106°	64°	15	1.5	1.5	109.5	210	12.0	7.1
2/10/78	36°	41°	40°	52°	52°	53°	56°	108°	64°	13	1.5	1.5	108.5	210	14.0	7.1
2/13/78	38°	43°	41°	52°	53°	53°	55°	109°	57°	13	1.4	1.5	109.0	210	12.0	-
2/14/78	37°	44°	43°	53°	54°	55°	58°	111°	61°	11	1.4	1.4	108.5	210	12.0	7.2
2/15/78	36°	44°	43°	58°	58°	60°	62°	109°	63°	12	1.4	1.4	108.5	220	8.0	7.3
2/16/78	36°	43°	42°	55°	56°	56°	59°	111°	60°	13	1.5	1.5	109.5	130	10.0	7.1
2/17/78	36°	45°	44°	60°	60°	61°	64°	111°	68°	12	1.5	1.4	109.5	265	19.0	7.3
2/22/78	36°	40°	40°	52°	53°	54°	57°	106°	59°	15	1.6	1.6	109.0	265	16.0	7.3
2/23/78	36°	40°	40°	52°	53°	53°	56°	102°	63°	15	1.6	1.6	108.5	255	14.0	7.3
2/24/78	36°	42°	41°	54°	54°	55°	55°	108°	63°	14	1.6	1.6	108.0	240	12.0	7.3
2/27/78	36°	40°	40°	52°	51°	54°	56°	111°	64°	14	1.5	1.5	109.5	245	10.0	7.4
2/28/78	36°	40°	40°	50°	50°	51°	54°	108°	57°	14	1.6	1.6	109.5	230	12.0	7.3
3/1/78	36°	41°	40°	51°	52°	52°	55°	109°	57°	14	1.6	1.5	109.5	230	11.0	-
3/2/78	37°	41°	40°	52°	52°	53°	55°	107°	58°	14	1.6	1.6	110.0	277	7.4	7.4
3/3/78	36°	42°	42°	56°	56°	57°	60°	107°	63°	14	1.6	1.6	109.5	210	9.8	7.3
3/6/78	36°	40°	40°	52°	53°	54°	57°	108°	64°	14	1.5	1.5	108.5	290	9.0	7.2
3/7/78	36°	41°	41°	51°	52°	52°	55°	106°	49°	14	1.5	1.6	108.5	250	12.0	7.5
3/8/78	36°	42°	41°	52°	52°	53°	55°	100°	56°	14	1.5	1.5	108.0	250	8.7	7.5
3/9/78	36°	43°	42°	56°	56°	57°	60°	108°	63°	14	1.5	1.5	108.5	250	7.5	6.6
3/10/78	36°	41°	40°	53°	53°	53°	56°	105°	57°	14	1.6	1.5	108.5	250	8.9	7.5
3/13/78	37°	43°	42°	54°	54°	54°	57°	106°	59°	14	1.5	1.5	109.5	250	9.4	7.5
3/14/78	37°	43°	42°	53°	53°	53°	55°	108°	55°	14	1.5	1.5	109.0	290	17.0	7.6
3/15/78	38°	45°	44°	54°	54°	55°	57°	108°	58°	13	1.4	1.4	105.5	220	94.0	7.0
3/16/78	37°	45°	44°	56°	57°	57°	60°	109°	64°	10	1.5	1.5	108.0	225	55.0	7.0
3/17/78	37°	44°	43°	52°	52°	54°	56°	109°	59°	7	1.4	1.4	108.0	173	67.0	7.0
3/20/78	43°	52°	48°	66°	62°	70°	66°	111°	68°	7	1.3	1.3	110.0	161	55.0	7.1
3/21/78	45°	54°	49°	66°	63°	69°	66°	107°	70°	7	1.3	1.3	109.5	160	39.0	7.2

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Date	Tr ₁ °F	Tph ₁ °F	Tph ₂ °F	Ts ₁₁ °F	Ts ₁₂ °F	Ts ₀₁ °F	Ts ₀₂ °F	Tctb °F	Thb °F	P PSIG	Q ₁ gpm	Q ₂ gpm	Pond Level Feet	Cond. µmhos	Turb. JTU	pH
NEW PUMP INSTALLED																
TEST APPARATUS PUMP FAILURE																
4/4/78	52°	55°	55°	71°	72°	73°	74°	111°	86°	18	1.6	1.6	110.5	210	7.3	14.0
4/16/78	52°	54°	55°	64°	65°	66°	67°	109°	79°	24	1.7	1.7	110.0	220	7.1	14.0
4/17/78	52°	56°	57°	71°	72°	73°	74°	110°	86°	18	1.6	1.6	110.0	220	7.2	17.0
4/18/78	52°	55°	56°	64°	64°	66°	66°	109°	72°	22	1.7	1.7	110.0	220	7.2	17.0
4/20/78	52°	56°	56°	68°	68°	72°	72°	109°	85°	19	1.6	1.6	110.0	-	7.4	-
4/21/78	53°	57°	58°	71°	71°	74°	74°	110°	86°	19	1.6	1.6	110.0	-	7.4	-
4/24/78	54°	57°	58°	69°	70°	72°	73°	110°	86°	20	1.6	1.6	110.0	-	7.4	-
4/25/78	54°	57°	58°	68°	68°	72°	73°	109°	86°	20	1.6	1.6	110.5	-	7.5	-
4/26/78	54°	57°	58°	68°	68°	72°	73°	109°	86°	20	1.6	1.6	110.0	-	7.4	-
4/27/78	53°	56°	57°	68°	69°	72°	72°	110°	86°	20	1.6	1.6	110.0	-	7.4	-
4/28/78	53°	56°	57°	68°	69°	71°	72°	104°	86°	20	1.6	1.6	110.0	-	7.4	-
5/1/78	56°	59°	60°	68°	70°	74°	75°	112°	88°	20	1.6	1.6	110.0	210	7.8	8.6
5/2/78	56°	60°	61°	70°	72°	74°	75°	109°	90°	21	1.6	1.6	110.0	190	8.2	6.0
5/3/78	57°	61°	62°	73°	74°	76°	77°	109°	91°	21	1.6	1.6	109.5	200	8.3	12.0
5/4/78	58°	62°	62°	72°	73°	76°	76°	108°	92°	23	1.6	1.6	109.5	200	7.9	7.4
5/5/78	57°	60°	61°	72°	73°	75°	76°	108°	92°	21	1.6	1.6	109.5	200	7.9	5.8
5/9/78	56°	60°	60°	76°	76°	78°	78°	110°	99°	26	1.6	1.6	108.5	230	5.8	8.1
5/10/78	57°	60°	61°	74°	74°	76°	76°	113°	9°	26	1.6	1.6	109.5	250	6.0	7.8
5/11/78	58°	61°	62°	74°	74°	76°	76°	107°	92°	25	1.6	1.6	110.0	240	5.6	7.8
5/12/78	58°	63°	64°	76°	75°	78°	77°	110°	90°	24	1.6	1.6	109.5	215	9.7	7.8
5/15/78	61°	64°	65°	73°	77°	80°	79°	110°	102°	25	1.6	1.6	108.5	170	26.5	7.5
5/16/78	56°	60°	61°	72°	71°	73°	73°	107°	90°	26	1.6	1.6	110.0	140	61.0	7.3
5/18/78	55°	59°	60°	73°	73°	75°	75°	111°	94°	24	1.6	1.6	110.0	117	30.0	7.2
5/22/78	62°	66°	67°	79°	80°	80°	81°	106°	99°	26	1.6	1.6	110.5	131	17.0	7.4
5/23/78	63°	66°	66°	75°	75°	76°	76°	105°	90°	25	1.6	1.6	111.0	135	12.5	7.3
5/24/78	63°	67°	68°	82°	83°	83°	83°	110°	107°	25	1.6	1.6	111.0	139	9.8	7.4
5/25/78	63°	68°	68°	63°	84°	84°	84°	105°	107°	26	1.6	1.6	110.0	160	10.0	7.5
5/26/78	63°	68°	69°	64°	85°	85°	86°	110°	108°	25	1.6	1.6	109.5	170	-	7.4
5/30/78	68°	73°	73°	83°	84°	85°	86°	117°	104°	24	1.6	1.6	109.5	200	-	7.0
5/31/78	70°	74°	74°	85°	86°	86°	87°	108°	106°	24	1.6	1.6	109.0	-	-	7.7
6/1/78	72°	76°	76°	67°	88°	88°	89°	108°	108°	24	1.6	1.6	109.5	100	5.1	7.8
6/2/78	73°	78°	78°	90°	90°	91°	92°	115°	110°	24	1.6	1.6	109.5	205	5.6	8.3
6/6/78	73°	78°	78°	89°	90°	90°	91°	102°	111°	22	1.5	1.5	109.5	195	7.3	7.3
6/7/78	73°	76°	76°	88°	89°	90°	90°	107°	110°	22	1.5	1.5	109.5	190	10.0	8.1

Date	Tr ₁ °F	Tph ₁ °F	Tph ₂ °F	Tsi ₁ °F	Tsi ₂ °F	Tso ₁ °F	Tso ₂ °F	Tctb °F	Thb °F	P PSIG	q ₁ gpm	q ₂ gpm	Pond Level Feet	Cond. μmhos	Turb. JTU	pH
8/3/78	80°	87°	85°	109°	102°	109°	102°	113°	125°	20	1.3	1.5	107.0	325	20.0	7.4
8/4/78	80°	84°	83°	99°	94°	100°	95°	110°	113°	20	1.3	1.5	108.0	330	25.0	7.3
8/7/78	80°	86°	84°	107°	100°	107°	100°	110°	122°	20	1.3	1.5	108.5	330	25.0	7.4
8/8/78	80°	83°	83°	96°	96°	98°	97°	110°	117°	18	1.3	1.3	108.5	295	23.0	7.5
8/9/78	81°	84°	84°	98°	98°	98°	98°	108°	118°	18	1.3	1.3	108.5	325	22.0	7.5
8/10/78	81°	85°	85°	98°	98°	99°	99°	108°	120°	18	1.3	1.3	108.0	280	15.0	7.3
8/11/78	81°	85°	85°	103°	102°	103°	102°	110°	127°	18	1.3	1.3	108.0	275	14.0	7.4
8/14/78	80°	84°	84°	98°	98°	98°	98°	108°	120°	18	1.3	1.3	109.0	265	23.0	7.3
8/15/78	81°	84°	84°	102°	102°	103°	102°	109°	126°	18	1.2	1.3	109.0	250	21.0	7.4
8/16/78	81°	85°	85°	102°	102°	103°	102°	110°	126°	18	1.2	1.3	108.5	235	14.0	7.2
8/17/78	83°	86°	86°	101°	100°	102°	101°	109°	122°	18	1.2	1.3	108.0	225	22.0	7.4
8/18/78	81°	85°	85°	101°	100°	102°	101°	113°	124°	18	1.2	1.3	108.5	225	26.0	7.2
8/21/78	80°	85°	85°	102°	101°	103°	102°	109°	126°	18	1.2	1.3	108.5	220	18.0	7.5
8/22/78	81°	85°	84°	104°	102°	105°	102°	110°	126°	17	1.2	1.3	109.0	215	13.0	7.5
8/23/78	81°	85°	84°	104°	102°	105°	102°	110°	126°	17	1.2	1.3	108.5	225	12.0	7.2
8/24/78	85°	89°	89°	105°	104°	106°	104°	111°	126°	17	1.2	1.3	108.0	240	19.0	7.5
8/25/78	82°	86°	86°	103°	101°	104°	101°	110°	122°	17	1.2	1.3	108.5	240	10.0	7.3
8/28/78	81°	86°	85°	105°	101°	105°	102°	108°	124°	17	1.2	1.3	109.0	235	24.0	7.4
8/29/78	81°	87°	86°	105°	101°	106°	102°	110°	124°	16	1.2	1.3	108.5	255	18.0	7.6
8/30/78	82°	86°	85°	105°	102°	106°	102°	115°	124°	16	1.2	1.3	108.5	255	16.0	7.2
8/31/78	81°	85°	85°	100°	99°	101°	100°	107°	122°	16	1.2	1.3	108.5	265	18.0	7.2
9/1/78	79°	83°	83°	98°	97°	99°	97°	113°	118°	16	1.2	1.3	108.5	265	17.0	7.4
9/11/78	76°	79°	79°	95°	95°	96°	95°	110°	117°	15	1.2	1.3	108.5	300	16.0	7.2
9/12/78	77°	81°	81°	96°	96°	97°	96°	111°	115°	15	1.2	1.3	108.5	320	7.1	7.4
9/13/78	76°	80°	80°	94°	94°	95°	94°	110°	115°	15	1.2	1.3	108.5	310	13.0	7.4
9/14/78	75°	79°	79°	94°	94°	95°	94°	108°	115°	15	1.2	1.3	108.5	310	12.0	7.2
9/15/78	73°	78°	77°	92°	92°	93°	93°	108°	114°	15	1.2	1.3	109.0	325	13.0	7.3
9/18/78	76°	80°	79°	96°	95°	96°	95°	109°	117°	15	1.2	1.3	108.0	315	13.0	7.2
9/19/78	77°	81°	80°	97°	96°	98°	96°	109°	118°	15	1.2	1.3	108.0	315	9.4	7.4
9/20/78	74°	78°	78°	94°	93°	95°	94°	109°	115°	15	1.2	1.3	108.0	330	17.0	7.3
9/21/78	74°	78°	78°	95°	94°	96°	94°	110°	115°	15	1.2	1.3	108.0	335	15.0	7.2
9/22/78	75°	79°	78°	96°	94°	97°	95°	111°	117°	15	1.2	1.3	108.0	335	17.0	7.5
9/25/78	71°	77°	76°	96°	92°	96°	93°	110°	117°	15	1.2	1.3	109.0	335	20.0	7.3
9/26/78	70°	75°	74°	93°	90°	94°	91°	110°	113°	15	1.2	1.3	109.0	330	15.0	7.4
9/27/78	69°	75°	74°	93°	90°	94°	91°	110°	113°	15	1.2	1.3	108.5	325	17.0	7.3
9/28/78	70°	76°	75°	95°	91°	96°	92°	110°	113°	15	1.2	1.3	109.0	305	15.0	7.3
9/29/78	66°	72°	72°	90°	88°	92°	83°	110°	111°	15	1.2	1.3	108.5	300	22.0	7.4

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Date	Tri °F	Tph1 °F	Tph2 °F	Tsi1 °F	Tsi2 °F	Tso1 °F	Tso2 °F	Tctb °F	Thb °F	P PSIG	q1 gpm	q2 gpm	Pond Level Feet	Cond. µmhos	Turb. JTU	pH
6/8/78	73°	78°	78°	90°	90°	91°	92°	115°	110°	22	1.5	1.5	110.0	215	8.0	7.9
6/9/78	73°	77°	77°	90°	90°	91°	91°	105°	108°	22	1.5	1.5	109.5	195	10.0	7.8
6/12/78	74°	78°	78°	92°	92°	93°	93°	117°	108°	22	1.4	1.6	109.0	225	8.3	7.1
6/13/78	74°	79°	79°	92°	92°	98°	93°	110°	108°	22	1.4	1.5	109.0	200	11.0	-
6/14/78	70°	76°	75°	90°	90°	90°	90°	110°	106°	22	1.5	1.6	108.5	200	12.0	-
6/15/78	70°	76°	76°	92°	86°	92°	92°	110°	116°	22	1.5	1.5	109.0	195	11.0	-
6/16/78	72°	76°	77°	93°	90°	94°	92°	110°	108°	22	1.5	1.5	109.0	180	11.0	-
6/19/78	73°	79°	77°	94°	94°	96°	94°	115°	105°	22	1.5	1.6	108.0	170	12.0	-
6/20/78	77°	82°	80°	99°	96°	100°	97°	120°	109°	22	1.5	1.5	108.5	210	11.0	-
6/21/78	76°	81°	80°	99°	96°	100°	96°	111°	121°	20	1.4	1.5	108.0	200	11.0	-
6/22/78	76°	80°	-	100°	98°	100°	98°	118°	120°	20	1.5	1.5	108.5	245	13.0	7.5
6/23/78	75°	80°	80°	95°	95°	96°	95°	109°	111°	21	1.4	1.5	109.0	235	18.0	-
6/26/78	79°	83°	82°	100°	98°	100°	99°	115°	117°	20	1.4	1.5	110.0	260	7.6	7.0
6/27/78	78°	83°	82°	100°	99°	100°	100°	109°	118°	20	1.4	1.5	108.5	255	8.2	7.5
6/28/78	79°	84°	83°	101°	100°	102°	101°	113°	120°	20	1.4	1.5	109.0	255	8.4	7.6
7/3/78	75°	79°	79°	91°	91°	92°	92°	110°	111°	20	1.5	1.5	108.0	240	16.0	6.9
7/5/78	75°	79°	79°	95°	96°	96°	96°	113°	116°	20	1.5	1.6	109.5	220	16.0	7.2
7/6/78	76°	79°	79°	92°	93°	93°	94°	110°	111°	20	1.5	1.6	109.0	265	13.0	7.1
7/7/78	75°	77°	77°	91°	91°	92°	92°	112°	113°	20	1.5	1.5	108.5	265	12.0	7.1
7/10/78	76°	79°	79°	92°	92°	93°	93°	109°	113°	20	1.5	1.5	109.0	270	8.5	7.7
7/11/78	75°	79°	79°	91°	92°	92°	92°	111°	111°	20	1.5	1.5	109.0	255	7.7	7.7
7/12/78	76°	79°	79°	94°	94°	94°	94°	109°	115°	20	1.5	1.5	108.5	260	11.0	7.2
7/13/78	77°	80°	80°	92°	92°	93°	93°	113°	113°	20	1.5	1.5	108.5	270	9.2	7.2
7/14/78	77°	80°	80°	94°	94°	94°	94°	113°	113°	20	1.5	1.5	108.0	255	15.0	7.2
7/17/78	78°	81°	81°	94°	94°	95°	95°	111°	115°	20	1.5	1.5	109.5	290	18.0	7.1
7/18/78	78°	81°	81°	96°	96°	96°	96°	115°	115°	20	1.5	1.5	109.0	305	15.0	7.1
7/19/78	78°	82°	82°	101°	100°	101°	100°	110°	124°	20	1.5	1.5	108.0	300	18.0	6.8
7/20/78	80°	84°	84°	102°	101°	103°	101°	110°	125°	20	1.4	1.5	108.5	295	22.0	7.0
7/24/78	86°	88°	87°	105°	102°	106°	102°	110°	125°	20	1.4	1.5	108.0	290	24.0	8.2
7/25/78	82°	86°	85°	103°	100°	103°	100°	110°	122°	20	1.4	1.5	107.5	290	15.0	7.7
7/26/78	82°	86°	85°	104°	100°	105°	101°	109°	122°	20	1.4	1.5	108.0	285	25.0	7.6
7/27/78	81°	85°	84°	104°	100°	105°	100°	110°	122°	20	1.4	1.5	108.0	290	24.0	7.6
7/28/78	81°	86°	85°	105°	100°	106°	101°	110°	122°	20	1.4	1.5	108.5	290	26.0	7.4
7/31/78	81°	88°	86°	108°	102°	108°	103°	110°	124°	20	1.3	1.5	109.0	295	27.0	7.5
8/1/78	81°	87°	85°	107°	101°	108°	101°	110°	124°	20	1.3	1.5	109.5	300	22.0	7.4
8/2/78	81°	86°	84°	107°	101°	108°	102°	112°	124°	20	1.3	1.5	108.5	310	22.0	7.3

Date	Tr ₁ °F	Tph ₁ °F	Tph ₂ °F	Tsi ₁ °F	Tsi ₂ °F	Tso ₁ °F	Tso ₂ °F	Tctb °F	Thb °F	P PSIG	Q ₁ gpm	Q ₂ gpm	Pond Level Feet	Cond. µmhos	Turb. JTU	pH
10/2/78	66°	73°	72°	93°	88°	94°	89°	110°	113°	15	1.2	1.3	108.5	315	26.0	7.3
10/3/78																
10/4/78																
10/5/78	66°	71°	71°	86°	85°	87°	86°	110°	106°	15	1.2	1.3	108.5	310	16.0	7.4
10/6/78	66°	71°	71°	86°	86°	88°	87°	110°	108°	15	1.2	1.3	109.0	310	8.0	7.4
10/9/78	62°	67°	67°	83°	82°	83°	82°	dry	105°	15	1.2	1.3	108.0	285	16.0	7.5
10/10/78	60°	66°	66°	81°	80°	83°	82°	112°	102°	15	1.2	1.3	108.5	285	12.0	7.3
10/11/78	62°	66°	66°	78°	78°	79°	79°	110°	95°	15	1.2	1.3	109.0	275	14.0	7.5
10/12/78	62°	66°	66°	82°	81°	84°	82°	111°	106°	15	1.2	1.3	108.5	275	17.0	7.6
10/13/78	63°	67°	67°	83°	82°	85°	84°	108°	106°	15	1.2	1.3	108.5	290	24.0	7.5
10/16/78	58°	65°	64°	81°	80°	83°	82°	109°	104°	15	1.2	1.3	108.0	300	28.0	7.6
10/17/78	57°	63°	63°	75°	74°	77°	75°	109°	86°	15	1.2	1.3	109.0	310	23.0	7.6
10/18/78	56°	64°	63°	80°	78°	82°	79°	109°	102°	15	1.2	1.3	109.0	325	20.0	7.6
10/19/78	58°	65°	64°	83°	80°	84°	81°	110°	104°	15	1.2	1.3	109.0	330	23.0	7.7
10/20/78	58°	64°	63°	81°	78°	83°	79°	110°	101°	15	1.2	1.3	109.0	325	15.0	7.5
10/23/78	59°	64°	63°	78°	75°	80°	76°	110°	92°	15	1.2	1.3	108.0	320	29.0	7.5
10/24/78	55°	62°	61°	74°	72°	76°	73°	110°	88°	15	1.2	1.3	109.0	330	23.0	7.5
10/25/78	55°	61°	60°	76°	73°	78°	74°	110°	90°	16	1.2	1.3	109.0	320	18.0	7.5
10/26/78	59°	63°	62°	79°	75°	81°	76°	110°	93°	16	1.2	1.3	108.0	310	16.0	7.5
10/30/78	59°	64°	62°	80°	76°	82°	77°	110°	97°	15	1.2	1.3	108.5	310	27.0	7.5
10/31/78	58°	63°	62°	79°	75°	81°	76°	110°	95°	16	1.2	1.3	108.5	305	25.0	7.6
11/1/78	57°	63°	61°	76°	72°	78°	74°	109°	88°	16	1.2	1.3	109.5	315	28.0	7.5
11/2/78	58°	62°	60°	76°	72°	78°	73°	113°	88°	16	1.2	1.3	109.5	310	20.0	7.6
11/3/78	59°	63°	61°	78°	73°	81°	75°	110°	92°	16	1.2	1.3	108.5	300	22.0	7.7
11/6/78	57°	62°	60°	76°	72°	78°	74°	108°	90°	16	1.2	1.3	109.0	305	8.0	7.6
11/7/78	57°	58°	58°	73°	72°	75°	74°	109°	92°	16	1.2	1.3	108.5	285	15.0	7.6
11/8/78	55°	57°	57°	73°	73°	75°	74°	110°	92°	15	1.2	1.3	108.0	290	10.0	7.5
11/9/78	55°	58°	58°	73°	74°	75°	75°	110°	95°	15	1.2	1.3	108.5	290	12.0	7.5
11/13/78	54°	58°	58°	75°	75°	77°	76°	110°	97°	15	1.2	1.3	107.5	300	24.0	7.6
11/14/78	54°	59°	59°	76°	76°	79°	78°	110°	97°	15	1.2	1.3	108.5	275	11.0	7.6
11/15/78	56°	59°	59°	76°	76°	78°	77°	109°	95°	15	1.2	1.3	107.5	285	13.0	7.6
11/16/78	56°	59°	59°	76°	75°	78°	77°	111°	90°	15	1.2	1.3	108.0	275	15.0	7.6
11/17/78	56°	59°	59°	76°	75°	78°	77°	111°	92°	15	1.2	1.3	107.5	275	22.0	7.5
11/20/78	53°	59°	59°	78°	76°	80°	78°	110°	93°	15	1.2	1.3	108.0	245	10.0	7.4
11/21/78	55°	58°	57°	77°	76°	80°	76°	112°	92°	15	1.2	1.3	108.5	275	12.5	7.4
11/22/78	54°	57°	56°	77°	75°	78°	76°	111°	92°	15	1.2	1.3	108.0	300	11.0	7.6
11/27/78	48°	53°	52°	74°	70°	76°	72°	110°	92°	16	1.2	1.3	108.5	305	18.0	7.6

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Date	Tr ₁ °F	Tph ₁ °F	Tph ₂ °F	Tsi ₁ °F	Tsi ₂ °F	Tso ₁ °F	Tso ₂ °F	Tctb °F	Thb °F	P PSIG	Q ₁ gpm	Q ₂ gpm	Pond Level Feet	Cond. µmhos	Turb. JTU	pH
11/28/78	46°	53°	50°	74°	70°	78°	70°	110°	90.5°	16	1.2	1.3	107.0	310	14.0	7.6
11/29/78	48°	52°	50°	75°	70°	78°	72°	110°	90.5°	16	1.2	1.3	106.5	285	16.0	7.6
11/30/78	46°	51°	49°	72°	69°	75°	70°	110°	90°	16	1.2	1.3	106.0	285	15.0	7.7
12/1/78	45°	50°	48°	70°	68°	74°	68°	109°	88°	16	1.2	1.3	106.0	260	12.0	7.6
12/4/78	45°	50°	48°	70°	66°	72°	68°	109°	88°	16	1.2	1.3	107.5	265	25.0	7.5
12/5/78	48°	48°	47°	64°	62°	68°	65°	110°	86°	16	1.2	1.3	107.5	255	20.0	7.7
12/8/78	45°	58°	58°	68°	67°	66°	66°	109°	87°	15	1.2	1.3	107.5	250	15.0	7.6
12/11/78	43°	46°	46°	62°	62°	65°	64°	110°	86°	15	1.2	1.3	107.5	235	14.0	7.6
12/12/78	45°	46°	46°	62°	62°	64°	64°	110°	86°	15	1.2	1.3	108.0	235	19.0	7.6
12/13/78	44°	45°	44°	60°	60°	63°	62°	111°	84.2°	15	1.2	1.3	108.5	215	20.0	7.6
12/14/78	44°	44°	46°	60°	60°	64°	63°	116°	82.4°	13	1.2	1.3	108.0	205	15.0	7.6
12/15/78	44°	44°	46°	61°	61°	76°	74°	124°	84.2°	12	1.2	1.3	106.5	157	16.0	7.4
12/18/78	46°	42°	42°	62°	62°	65°	66°	124°	77°	12	1.2	1.3	107.5	190	5.0	7.6
12/19/78	45°	43°	43°	61°	61°	62°	63°	99°	82°	13	1.2	1.3	108.5	140	14.0	7.4
12/20/78	47°	44°	44°	68°	70°	71°	71°	106°	81°	12	1.2	1.3	108.25	150	10.0	7.3
12/21/78	45°	44°	44°	61°	61°	64°	63°	115°	81°	12	1.2	1.3	108.75	190	14.0	7.5
12/22/78	45°	43°	43°	61°	61°	62°	63°	118°	82°	12	1.2	1.3	107.25	190	9.0	7.5
12/26/78	45°	45°	45°	62°	62°	65°	64°	109°	82°	12	1.2	1.3	107.5	210	37.0	7.5
12/27/78	44°	43°	43°	61°	60°	63°	62°	109°	81°	12	1.2	1.3	107.25	220	25.0	7.6
12/28/78	46°	41°	41°	59°	58°	62°	60°	109°	81°	12	1.2	1.3	108.25	240	30.0	7.6
1/2/79	42°	44°	44°	62°	62°	66°	66°	122°	84°	13	1.2	1.3	108.0	225	23.0	7.3
1/3/79	42°	43°	43°	60°	60°	63°	62°	108°	81°	12	1.2	1.3	107.5	215	54.0	7.2

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The following Table has been compiled to show the chlorine demand of the Susquehanna River at Peach Bottom.*

<u>Date</u>	<u>ppm Cl added</u>
2/5/78	0.21
2/27/78	1.10
3/6/78	1.45
3/15/78	3.50
3/22/78	1.10
3/29/78	0.50
4/12/78	0.21
4/19/78	0.30
4/26/78	0.25
5/3/78	0.16
5/10/78	0.26
5/18/78	0.40
5/24/78	0.30
6/8/78	0.53
6/28/78	1.00
7/13/78	0.72
7/19/78	1.20
7/26/78	0.88
8/2/78	0.91
8/9/78	1.12
8/16/78	0.80
8/23/78	0.98
8/30/78	0.97
9/11/78	0.72
9/18/78	0.60
9/21/78	1.05
9/25/78	1.12
9/28/78	0.78
10/2/78	0.72
10/11/78	0.91
10/18/78	0.78
10/25/78	0.46
11/1/78	0.72
11/8/78	0.32
11/15/78	0.50
11/22/78	0.50
11/29/78	0.42

<u>Date</u>	<u>ppm Cl added</u>
12/13/78	0.44
12/20/78	0.42
12/27/78	0.49
1/3/79	0.45
1/19/79	0.44

*Chlorine addition required before appearance of free residual.

The periods, chlorination schedule, and tube observations have been compiled in the following table.

Month	Dates	Chlorination Schedule	Line #1, Unchlorinated				Line #2, Chlorinated			
			Wt. gain, grams	% Moist.	Total % Solids	Vol. Solids	Wt. gain, grams	% Moist.	Total % Solids	Vol. Solids
1	1/25 - 2/21/78	2/1 → 0.10 ppm - 25 min.								
		2/8 → 0.20 ppm - 25 min.								
		2/25 → 0.20 ppm - 20 min.	0.527	-	-	-	0.683	-	-	-
2	2/22 - 3/21/78	3/1 → 0.20 ppm - 20 min.								
		3/8 → 0.20 ppm - 20 min.								
		3/25 → 0.30 ppm - 20 min.	1.698	82.9	17.1	1.6	0.149	23.5	76.5	11.4
3	4/17 - 5/18/78	4/19 → 0.20 ppm - 20 min.								
		4/26 → 0.20 ppm - 20 min.								
		5/3 → 0.15 ppm - 20 min.								
		5/10 → 0.20 ppm - 20 min.								
		5/18 → 0.15 ppm - 20 min.	0.894	92.4	5.7	1.9	0.151	-	-	-
4	5/22 - 6/22/78	5/24 → 0.10 ppm - 20 min.								
		5/31 → 0.10 ppm - 15 min.								
		6/8 → 0.07 ppm - 20 min.								
		6/15 → 0.10 ppm - 15 min.	5.006	-	-	-	0.893	-	-	-
5	7/7 - 8/7/78	7/13 → 0.10 ppm - 25 min.								
		7/19 → 0.10 ppm - 20 min.								
		7/26 → 0.10 ppm - 25 min.								
		8/2 → 0.10 ppm - 15 min.	3.311	88.3	11.7	1.8	0.306	94.5	5.5	1.6
6	8/7 - 9/6/78	8/9 → 0.1 ppm - 25 min.								
		8/16 → 0.1 ppm - 20 min.								
		8/24 → 0.1 ppm - 20 min.								
		8/31 → 0.1 ppm - 20 min.	3.181	88.2	11.8	1.9	0.307	93.2	6.8	1.3

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Month	Dates	Chlorination Schedule	Line #1, Unchlorinated				Line #2, Chlorinated			
			Wt. gain, grams	% Moist.	Total % Solids	% Vol. Solids	Wt. gain, grams	% Moist.	Total % Solids	% Vol. Solids
7	9/10 - 10/4/78	9/11 → 0.13 ppm - 15 min. 9/14 → 0.10 ppm - 15 min. 9/18 → 0.10 ppm - 15 min. 9/21 → 0.10 ppm - 15 min. 9/25 → 0.10 ppm - 15 min. 9/28 → 0.12 ppm - 15 min. 10/2 → 0.13 ppm - 15 min.	2.296	88.6	11.4	2.5	0.098	92.9	7.1	5.1
8	10/5 - 11/3/78	10/11 → 0.10 ppm - 20 min. 10/18 → 0.12 ppm - 20 min. 10/25 → 0.10 ppm - 20 min. 11/1 → 0.10 ppm - 20 min.	3.904	89.0	11.0	2.0	0.440	93.0	7.0	5.1
9	11/4 - 12/4/78	11/8 → 0.10 ppm - 10 min. 11/15 → 0.10 ppm - 10 min. 11/22 → 0.10 ppm - 10 min. 11/29 → 0.10 ppm - 10 min.	1.136	88.0	12.0	4.6	0.678	95.9	4.1	2.4
10	12/5/78 - 1/4/79	12/13 → 0.10 ppm - 15 min. 12/20 → 0.10 ppm - 10 min. 12/27 → 0.38 ppm - 30 min. 1/3 → 0.10 ppm - 10 min.	1.127	96.7	3.3	2.0	0.197	93.4	6.6	3.0
11	1/5/ - 1/31/79	1/19 → 0.16 ppm - 20 min.	0.018	61.1	38.9	16.7	0.448	5.4	94.6	11.4

Note: Total solids determined at 105°C; Volatile solids determined at 650°C

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