INDIANA MICHIGAN POWER
A unit of American Electric Power

Indiana Michigan Power
Cook Nuclear Plant
One Cook Place
Bridgman, MI 49106
AEP.com

April 27, 2005

AEP:NRC:5541
DPR-58/74 Appendix B 5.4.1

Docket Nos.: 50-315
50-316

U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2
ANNUAL ENVIRONMENTAL OPERATING REPORT

Enclosed is the Donald C. Cook Nuclear Plant Annual Environmental Operating Report. This report covers the period from January 1, 2004, through December 31, 2004, and was prepared in accordance with the requirements of Environmental Technical Specification 5.4.1.

There are no new commitments in this submittal. Should you have any questions, please contact Mr. Michael K. Scarpello, Supervisor of Nuclear Licensing, at (269) 466-2649.

Sincerely,

John A. Zwolinski
Safety Assurance Director

DB/rdw

Attachment

c: J. L. Caldwell, NRC Region III
K. D. Curry, Ft. Wayne AEP, w/o attachment
J. T. King, MPSC, w/o attachment
C. F. Lyon – NRC Washington DC
MDEQ - WHMD/HWRPS
D. Minnaar, MDEQ
NRC Resident Inspector

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ATTACHMENT TO AEP:NRC:5541

ANNUAL ENVIRONMENTAL OPERATING REPORT

Donald C. Cook Nuclear Plant Units 1 & 2

Annual Environmental Operating Report

January 1 through December 31, 2004

Indiana Michigan Power Company
Bridgman, Michigan

Docket Nos. 50-315 & 50-316
License Nos. DPR-58 & DPR-74

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I. INTRODUCTION

Technical Specifications Appendix B, Part 2, Section 5.4.1, requires that an Annual Environmental Operating Report be produced and include summaries and analyses of the results of the environmental protection activities required by Section 4.2 of the Environmental Protection Plan for the report period. The Annual Environmental Operating Report shall include a comparison with preoperational studies, operational controls (as appropriate), previous non-radiological environmental monitoring reports, and an assessment of the observed impacts of the plant operation on the environment.

This report serves to fulfill these requirements and represents the Annual Environmental Operating Report for Units 1 and 2 of the Donald C. Cook Nuclear Plant for the operating period from January 1 through December 31, 2004.

The following table summarizes the pertinent data concerning the Plant's operation during the period from January 1 to December 31, 2004.

Parameter	Unit 1	Unit 2
Gross Electrical Generation (megawatt hours)	9,134,920	8,201,538
Unit Service Factor (%)	97.8	84.3
Unit Capacity Factor – Maximum Dependable Capacity Net (%)	100.5	85.3

II. CHANGES TO THE ENVIRONMENTAL TECHNICAL SPECIFICATIONS

There were no changes to Environmental Technical Specifications in 2004.

III. NON-RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

A. Non-Routine Reports

A summary of the 2004 non-routine events is located in Appendix I of this Report. No long-term, adverse environmental effects were noted.

B. Environmental Protection Plan

There were no instances of Environmental Protection Plan noncompliance in 2004.

C. Plant Design and Operation

During 2004, there were no changes in station design, operations, tests, or experiments that involved a potentially significant unreviewed environmental issue. There were no environmental evaluations performed during the reporting period.

D. Environmental Monitoring – Herbicide Application

Herbicide applications are the activities monitored in accordance with Technical Specification Appendix B Section 4.2. There were no preoperational

herbicide studies to which comparisons could be made. Herbicide applications are managed by plant procedure PMP-2160-HER-001, Guidelines for the Application of Approved Herbicides.

A summary of the 2004 herbicide applications is contained in Appendix II of this report. Based on observations, there were no negative impacts or evidence of trends toward irreversible change to the environment as a result of the herbicide applications. Based on our review of application records and field observations, the applications conformed to EPA and State requirements for the approved use of herbicide.

E. Mollusk Biofouling Monitoring Program

Macrofouling monitoring and control activities during 2004 are discussed in Appendix III of this report.

F. Special Reports

There were no Special Reports for 2004.

APPENDIX I

NON-ROUTINE REPORTS

2004

2004 Non-Routine Events

January 10, 2004 – At 1100 hours on December 1, 2003, approximately 200 ml/min of demineralized water from the Unit One Condensate Storage Tank was found leaking past a drain valve. The drain is directed to a storm water drain leading to Outfall 001S. The leak was stopped at 2000 hours on December 1, 2003 when the valve was retightened. The quick temperature change may have caused the valve to come off its seat hence leading to the leak. Since a small amount of demineralized water was released over a short time period, and due to mixing that occurs in the sandy area of the beach before mixing with Lake Michigan, there was no threat to the environment, public health or safety.

July 19, 2004 – Groundwater monitoring for dissolved iron exceeded the limit of 300 ug/l in monitoring wells #13 and #19. The dissolved iron concentration in Well #13 was 4,900 ug/l and the dissolved iron concentration in Well #19 was 1,710 ug/l. In a letter dated April 11, 2001 to Mr. Tim Unseld, the high concentrations of iron were suspected to be the result of natural, mineral reactions and have no correlation with the discharge from Cook Nuclear Plant. It was also indicated that the plant was working with the MDEQ to revise its groundwater permit to resolve this issue. This may be resolved with the reissue of the plant's groundwater permit in 2005.

January 21, 2005 – Beginning on December 22, 2004, wild ducks were entrained into the intake cribs of the Donald C. Cook Plant. The species are believed to be primarily lesser scaup, with some bufflehead, common goldeneye, and common merganser. Plant personnel observations have determined that approximately 100 to 1,000 ducks have been rafting in the proximity of the plant intake cribs. It is believed that these ducks have congregated in the area due to the open water and abundant food supply of zebra mussels on the limestone riprap covering our intake pipes. In past years, cleaning zebra mussels from the intake cribs each fall had proven effective for minimizing wild duck entrainment. The intake cribs were cleaned of zebra mussels in the fall of 2004. A spring 2005 diving inspection of the intake cribs is planned per the work control process to determine if any other factors may have contributed to the entrainment of these animals.

Plant employees worked with the U. S. Department of Agriculture-Wildlife Service and the U. S Fish and Wildlife Service in January of 2005 to test laser equipment to attempt to reduce the number of ducks rafting in the vicinity of the plant intake structures. The results of the testing showed that the effects were only temporary in scaring the ducks away during periods of low light and was not effective during daylight hours.

APPENDIX II

HERBICIDE APPLICATION REPORT

2004

Date March 25, 2005

Subject 2004 Herbicide Spray Report - Cook Nuclear Plant

From C. A. Wohlgamuth

To J. P. Carlson

The following herbicides were applied per manufacturers' direction by certified Michigan licensed applicators on Cook Nuclear Plant property during 2004:

Via Contractor	Via AEP Personnel
Oust, Du Pont	Lebanon ProScape with Confront
Diuron, Dow	Round–Up Pro
Glyphosite, Du Pont	Scotts Halts with Crabgrass Preventer
Garlon 3A, Dow	Plateau, BASF
Garlon 4, Dow	Glypro Plus, Dow
2-4D, Riverdale	

DeAngelo Brothers Applications:
DeAngelo Brothers; a Michigan licensed herbicide applicator on contract to the AEP Energy Delivery and Customer Relations performed the applications (Bill Rahm, Mike Piergala, and Donnie Pierce).

On the dates of April 20, 22, and 23 a mixture of Diuron, Oust, and Glyphosite was used for total plant control in the 69 KV, 345 KV and 765 KV switch yards; around the Fire Protection Tanks, Paint and Oil Storage buildings, Environmental Waste Pole building, Kelly Buildings, Steam Generator Mausoleum, Mechanics Garage, Sewage Plant, Sewage Lagoons, Warehouses 4, 5 and 6; and in the Dumpster Yard, Fire Training and Laydown Area, CESA Yard, W-Yard, railroad right-of-ways, parking lots, and the plant's Protected Area. A total of 233.3 pounds of Diuron, 49.0 ounces of Oust, and 30.7 quarts of Glyphosite were used for the application and spread over 29.7 acres in accordance with the manufacturers' labels.

On May 5, a mixture of Diuron, Glyphosite, Oust, Garlon 3A, and 2-4D was applied to the Railroad "Right-of-Way" across Red Arrow Highway. A total of 29.2 pounds of Diuron, 6.1 ounces of Oust, 4.1 quarts of Glyphosite, 7 quarts of Garlon 3A, and 3.5 quarts of 2-4D were used for the application and spread over 3.5 acres in accordance with the manufacturers' labels.

On October 1, a mixture of Oust, Glyphosite, and 2-4D was applied to regrowth areas in the 765 KV switchyard. A total of 2.0 ounces of Oust, 2.0 quarts of Glyphosite, and 1.0 quart of 2-4D were used for the application and spread over 1.3 acres in accordance with the manufacturers' labels. This application was not included in the site-wide herbicide inspection but was supervised by AEP personnel. No overspray conditions were noted.

Asplundh Application:
Asplundh; a Michigan licensed herbicide applicator on contract to AEP Fort Wayne Forestry performed an application to regrowth areas under existing 69 kV lines. On September 7, 5.7 gallons of Garlon 4 was applied to 3.42 acres. This was a cut-stump treatment in accordance with the manufacturer's label. This application was not included in the site-wide herbicide inspection but was supervised by AEP personnel. No overspray conditions were noted.

The following table details the application rates used compared to the allowable application rates.

Product Name	Quantity Used		Quantity Used/Acre		Quantity Allowed/Acre	
Diuron	262.5	lbs	7.9	lbs	60.0	lbs
Oust	57.1	oz	1.7	oz	8.0	oz
Glyphosite	36.8	qt	1.1	qt	6.4	qt
Garlon 3A	7.0	qt	2.0	qt	8.0	qt
Garlon 4	5.7	gal	1.7	gal	8.0	gal
2-4D	4.5	qt	0.9	qt	8.0	qt

Mortality Inspection:
On September 2, 2004, the mortality of these herbicide applications was assessed to be greater than 85-90% by environmental technician Mr. Dean Warlin. There were no instances of overspray. As a result of the inspection, the following areas require applications in 2005, as 2004's application was not fully effective:

- some small rose bushes along railroad track areas where our sidings merged with the CSX tracks at the North end of our siding
- the North end of the track crossing over I-94
- the area of the tracks west of Warehouse #4
- weeds along the fence east of the Kelly buildings and the old aux. boiler fuel oil tank by the W-Yard
- weeds and grass on the east side of Warehouse #5 and between the dumpsters in the Dumpster/Scaffolding Yard east of Thornton Creek
- weeds along the north fence of the Laydown Area west of Thornton Creek
- spotty grasses in the 69kV Yard

Maintenance Building and Grounds:
Round-Up Pro mixed with water in a backpack sprayer was used to spot spray weeds in the landscaped stone areas around the plant site, around the fire protection water storage tanks, around the sewage ponds, around the Training Center AC units, under the racks in the PM&IS steel yard, along the railroad tracks, and on cracked asphalt/sidewalk areas. A total of 178 ounces of Round-Up Pro was used for spot spraying in 2004. The applications were performed by a licensed applicator (Rennard Williams) from the Maintenance ANR Buildings and Grounds crew. Product usage rates per acre are not reported for these applications as they were spot sprayed rather than broadcasted in accordance with the manufacturer's labels.

Lebanon ProScape fertilizer with Confront herbicide was applied on April 14 and 16 to all grassy areas in the Protected Area and along the main plant road near the plant entrance. Ten (10), forty pound bags (400 lbs) were applied to approximately 10 acres via the #14 setting on an Earthway Rotary Spreader as recommended on the manufacturer's label. The herbicide was applied by a licensed applicator (Rennard Williams) from the Maintenance ANR Buildings and Grounds crew.

Two separate herbicide applications were performed in 2004. On April 14 a batch of Plateau was broadcast sprayed over approximately 2 acres of bare soil. The batch contained 5 oz. of Plateau and 40 gallons of water. A second batch containing 7 oz of Plateau, 1.5 gallons of Glypro Plus, and 75 gallons of water was broadcast sprayed over roughly 4 acres of terrain under power lines. The batches were applied by licensed applicator, Ryan Allison, of JFNew in accordance with the manufacturer's labels.

The following table details the application rates used for weed control in the grass and garden beds compared to the allowable application rates.

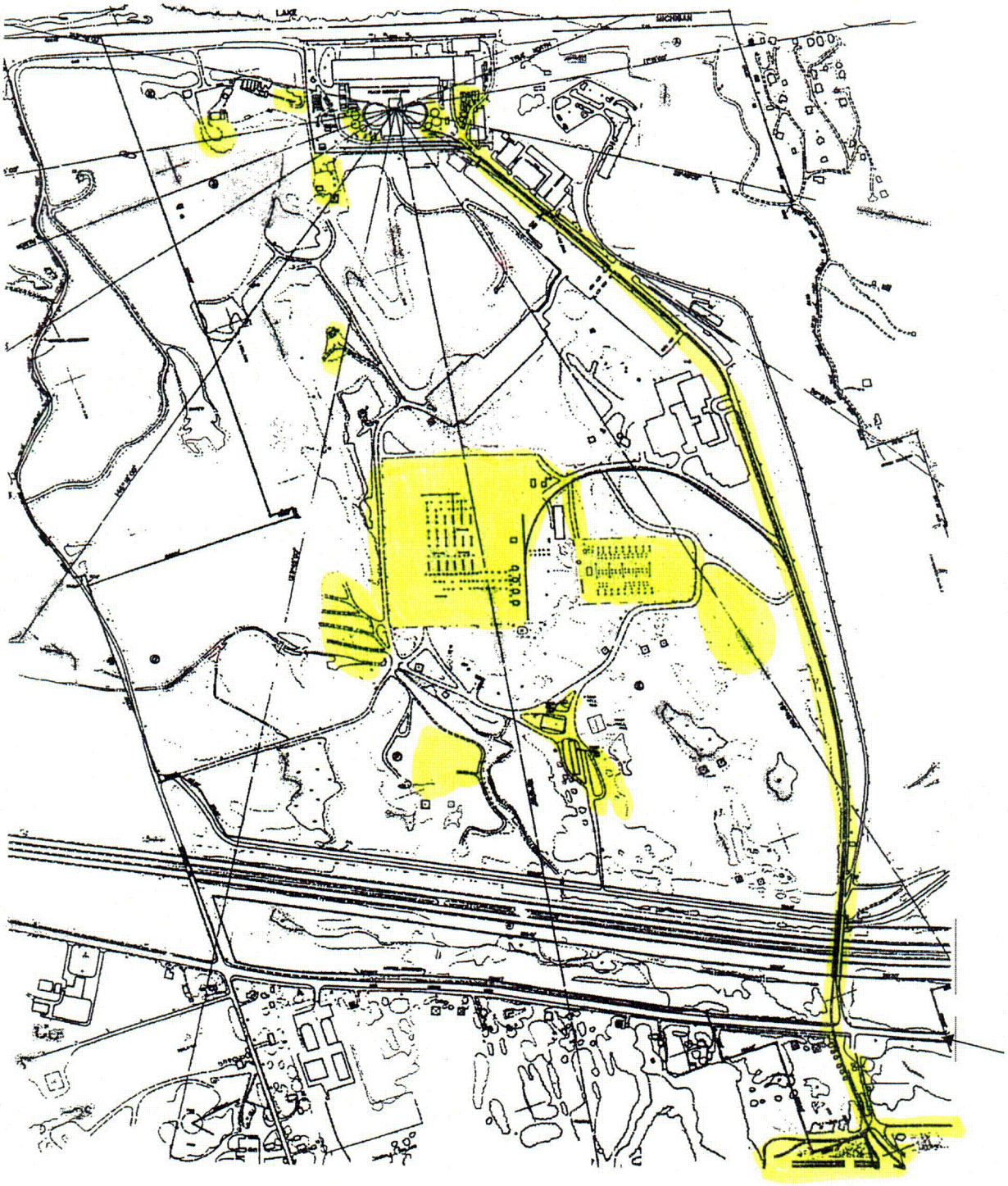
Product Name	Quantity Used	Concentration Used	Concentration Allowed
Round-Up Pro	178.0 oz.	Spot sprayed at 8.0 to 8.3 oz/gal	13.0 oz/gal for spot spraying
Lebanon ProScape with Confront	400 lbs.	10 bags/3 acres applied by #14 setting on Earthway Rotary Spreader	3.6 lbs/1000 ft^2 = 157 lbs/acre
Plateau	12 oz.	2 oz/acre spot sprayed	12 oz/acre
Glypro Plus	1.5 gal.	2 qt/acre spot sprayed	10.6 qt/acre

In summary, based upon our review of the application records, manufacturer specifications, material safety data sheets (MSDSs) and observations of the treated areas, the herbicides were applied according to the manufacturer's labeled instructions and/or according to Federal and State requirements. As required by the State of Michigan, all personnel performing herbicide applications were licensed. A map has been included with this report indicating areas of herbicide application. Detailed maps and application records are filed in PMP-2160-HER-001, Guidelines for the Application of Approved Herbicides. No signs of over spray or spillage were observed. No adverse environmental effects occurred.

Donald C. Cook Nuclear Plant

Lake Michigan

North→



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APPENDIX III

MOLLUSK BIOFOULING MONITORING PROGRAM REPORT

2004

Mollusc Biofouling Monitoring Program 2004

Performed at Donald C. Cook Nuclear Plant

Performed and Submitted
By
Cook Plant Environmental

Prepared for:

American Electric Power
Donald C. Cook Nuclear Plant
One Cook Place
Bridgman, Michigan

MOLLUSC BIOFOULING MONITORING PROGRAM
2004

March 2005

Cook Nuclear Plant
Environmental Section

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List of Tables and Figures

Executive Summary

Biofouling studies have been conducted at the Donald C. Cook Nuclear Plant since 1983. In 1991, monitoring of zebra mussels in the circulating water, essential service water (ESW), and nonessential service water (NESW) systems was added to the program. The objectives of this monitoring program are to detect the presence and determine the density of zebra mussel veligers in the Circulating Water System and postveliger settlement and growth rate in the forebay and service water systems, and to determine the effectiveness of oxidizing and non-oxidizing biocides in the plant systems by comparing densities and sizes of settled zebra mussels when applicable.

Veligers were present in the forebay from 29 April through 8 December 2004. Peak densities occurred on 15 July, 5 August, and 9 September with the major peak occurring on 9 September (212,500 veligers per cubic meter). Past years' studies have determined that zebra mussel density is independent of the volume of water entering the plant, as the concentration of veligers in the water remains the same regardless of the flow rate through the plant. The past fourteen years data suggests that the zebra mussel population is highly variable and difficult to accurately predict future populations of zebra mussels.

Cumulative settlement was monitored in the forebay using a six-inch PVC pipe. The PVC pipe was deployed on 26 June of 2003 and was retrieved on 17 June 2004. The settlement density and average size of postveligers for this one-year period was 206,925 individuals/m^2 and 3253*u* (3.3mm). The mussel density on the PVC sampler pulled in June 2004 was slightly lower than the sampler pulled in June 2003 (223,200 ind./m^2) but the average individual size was less than half that of the 2003 sampler (8.3mm). In spite

of a record high abundance of whole-water veligers in 2003, the individuals that settled and were measured in 2004 were slightly less numerous than those counted in June of 2003 and much smaller in size. This could be attributed to the daily preventive zebra mussel treatments to the intake tunnels performed in 2003.

Service Water Systems and Miscellaneous Sealing and Cooling Water

The return sides (after systems' use) of the ESW and NESW systems and the MSCW system were monitored in the 2004 Mollusc Biofouling Monitoring Program. The results indicate that the chlorination system was effective in preventing growth and prolonged settlement of postveligers in the service water systems. Settlement on bio-box artificial substrates was elevated in July due to the chlorination system operating below its target band (0.2-0.5 ppm TRC) in NESW and in the lower range of its target band for the remaining systems in the face of increasing whole-water veliger densities. This was remedied by raising the chlorine concentration to within its target band. As expected, postveliger densities rose slightly in October when the chlorination system was secured for the Unit 2 C15 Refueling Outage. This was remedied when chlorination was resumed in early November with the start-up of Unit 2. The impact was minimal as whole-water veliger densities were low in October.

Biocide Treatment

There were no biocide treatments in 2004.

Chapter 1

Introduction

1.1 Past History

American Electric Power Company (AEP) has been conducting zebra mussel monitoring studies at the Donald C. Cook Nuclear Plant since 1991. The purpose of these studies is to monitor zebra mussel veliger and postveliger settlement densities in the Circulating Water, Essential Service Water (ESW), Nonessential Service Water (NESW), and Miscellaneous Sealing and Cooling Water (MSCW) systems to help determine the effectiveness of the zebra mussel control program.

Since 1999, Grand Analysis conducted the monitoring program, designed to detect the timing of spawning and settling of zebra mussels at the Cook Nuclear Plant. In 2004 the program was taken "in house" by the Plant's Environmental staff. The program also determines densities for: 1) whole water samples for planktonic veligers; and 2) artificial substrates set within the ESW, NESW, and MSCW systems for cumulative postveliger settlement. In the Circulating Water System, a section of PVC piping was used to determine the cumulative settlement for a one-year period in the intake forebay.

There were no biocide treatments performed in 2004.

1.2 Objectives

Specific objectives for the 2004 Mollusc Biofouling Monitoring Program were as follows:

- Conduct whole-water sampling of the Circulating Water System weekly (July-November), three times in June, bimonthly (May), and monthly (April and December) to determine the presence and density of larval zebra mussels.

- Deploy artificial substrates (microscope slides in test tube racks) in the service water systems to determine cumulative settlement of postveligers. Collect samples monthly from May through December.

- Deploy a PVC piping section, also as an artificial substrate, in the intake forebay to determine cumulative settlement for approximately one year.

Chapter 2

Methods

2.1 Whole-Water Sampling

Whole-water sampling of the Circulating Water System was conducted from 29 April to 8 December 2004 (Table 2-1). Samples were collected from mid-depth in the intake forebay by pumping lake water through an in-line flowmeter into a plankton net. The sampling location was consistent with that of previous studies. Two replicates (2,000 liters each) were collected during each sampling date.

A Myers Model 2JF-51-8 pump or equivalent was connected to an in-line flowmeter assembly (Signet Model #P58640) and pumped water into a plankton net for approximately one hour. To minimize organism abrasion, measured flow was directed into a No. 20 plankton net that was suspended in a partially filled 55-gallon plastic barrel.

Samples were gently washed into the cod-end bucket of the plankton net using filtered Circulating Water System water and then transferred to a one-liter plastic container. Filtered water was added to the container to ensure that a full liter was analyzed. The two samples were analyzed immediately in an on-site laboratory.

Samples were initially mixed thoroughly for three minutes using a magnetic stir plate. Then, using a calibrated Pasteur pipette, a 1-milliliter aliquot of mixed sample was placed into a Sedgewick-Rafter cell for counting. An Olympus SZ-1145 binocular microscope (18-110x) equipped with cross-polarizing filters was used. Ten aliquots

TABLE 2-1

SAMPLING SCHEDULE FOR ZEBRA MUSSEL MONITORING AT THE D.C. COOK NUCLEAR PLANT IN 2004			
Date		**Whole Water**	**Artificial Substrates**
April	29	X(1)	
May	6	X	
	20	X	X
June	10	X	
	17	X	X(2)
	24	X	
July	1	X	
	8	X	
	15	X	X
	22	X	
	29	X	
August	5	X	
	12	X	
	19	X	X
	26	X	
September	2	X	
	9	X	
	16	X	
	23	X	X
	30	X	
October	7	X	
	14	X	
	21	X	X
	28	X	
November	4	X	
	11	X	X
	18	X	
	24	X	
December	8	X	X

1. Deploy slide racks.
2. Retrieve PVC pipe section. Read, clean & re-deploy.

were counted and the average was extrapolated to determine the number of individuals per cubic meter. The density was calculated as follows:

Density (#/m3)=(average #*DF)/0.001L*1L/2000L*1000L/m3

DF- Dilution Factor

This process was repeated for the second replicate and the mean of the two values was calculated to yield a final density value. Size measurements were recorded for up to 50 organisms from each sample. Veliger size was measured using an ocular micrometer that was calibrated to a stage micrometer.

2.2 Artificial Substrates

To determine zebra mussel settlement in the Circulating Water, a PVC section was deployed in the intake forebay, upstream of the trash racks. Bio-box side-stream samplers were installed on the return sides of both service water systems and on the Miscellaneous Sealing and Cooling Water System to determine settlement in these systems. The side-stream samplers consisted of modified test-tube racks designed to hold microscope slides and placed in bio-boxes for cumulative sampling.

2.2.1 Intake Forebay

On 17 June 2004, a PVC pipe section was analyzed that was placed in the forebay on 26 June 2003. The PVC section measured 6 inches long and had an inside diameter of 3.5 inches. It had been cut in half lengthwise, rejoined using hose clamps, attached to a rope weighted by a concrete block, and suspended at mid-depth in the intake forebay.

The PVC sampler was analyzed for densities and shell sizes by analyzing scrapings from two separate one-inch square sections of the PVC sampler. The PVC sampler was designed to provide information on zebra mussel accumulated infestation and sizes occurring over a 1-year period from June of 2003 to June of 2004.

The PVC sampler was cleaned and returned to the forebay on 17 June 2004. It was later discovered missing on 14 December (CR 04349060). The sampler was torn from its attachment point on the rope and recovered by the screenwash system. It was reported to have been seen in the Unit 1 Screenhouse dumpster during the August-September time frame by an individual who was unfamiliar with the sampler device and dismissed it as routine trash. On 5 Jan 2005, another PVC sampler was deployed in the intake forebay with a more robust attachment scheme using hose clamps.

2.2.2 Service Water Systems

Side-stream bio-boxes were placed on the return side of the service water systems (1 ESW, 2 ESW, NESW) and the Miscellaneous Sealing and Cooling (MSCW) Water System. Each bio-box contained two modified test tube racks containing a total of 80 microscope slides. The racks held the slides above the bio-box base that allowed silt and sediment to fall out before they could affect the slide settlement. The bio-boxes were covered with a plant-approved fireproof fabric to limit light exposure. Plant personnel checked the bio-boxes periodically to ensure that adequate flow was available, and flow was adjusted as necessary. Ten slides from each location were retrieved monthly and immediately analyzed for densities and shell size.

2.2.3 Artificial Substrate Cumulative Sample Analysis

An Olympus SZ-1145 binocular microscope (18-110x) equipped with cross polarizing filters was used for analyzing samples. After one side of the slide was scraped clean, the slide was placed on the microscope stage so that the attached postveligers could be counted. When slides became heavily infested, a sub-sampling technique was followed:

- The slides were sub-sampled using a straight edge that permitted either half or a quarter of the slide to be counted. Counts were then proportionally extrapolated to one square meter.

Settlement rates were computed by taking the average number of mussels from the ten slides and multiplying this value by 533.33 to obtain the density of zebra mussels per square meter. (One postveliger/microscope slide equals 533.33 postveligers per square meter.)

Shell diameters were measured for up to 50 random individuals to obtain maximum, minimum and mean sizes. Diameters were measured using an ocular micrometer calibrated to a stage micrometer.

Chapter 3

Results and Discussion

The zebra mussel monitoring system performed up to expectations in 2004. The whole-water sampling for free-swimming veligers coupled with monitoring postveliger settlement on artificial substrates provided sample results that could be compared with previous years' data.

Appendix Table 1 shows the chlorination values for the ESW and NESW systems. A 0.2-0.5 ppm total residual chlorine (TRC) is the target band for the control of zebra mussel settlement. Total residual chlorine values for the ESW and NESW systems were taken periodically. The MSCW system, which was cross-connected to the NESW system, was chlorinated on all of the dates that the NESW system was chlorinated.

3.1 Whole-Water Sampling

Sampling of planktonic veligers in the circulating water system was initiated 29 April and was completed on 8 December. Results are presented in Table 3-1 and in Figure 3-1. Veligers were present in all samples throughout the monitoring season.

Heaviest spawning activity occurred during early July through early September. The major peak density occurred on 9 September (212,500 ind./m^3). This major peak occurred three weeks later than 2003's, and is consistent in timing with the major peaks in 2002 and 2001 which also occurred during the first week of September. Overall, 2004's Whole-Water results were significantly lower than the recorded peak

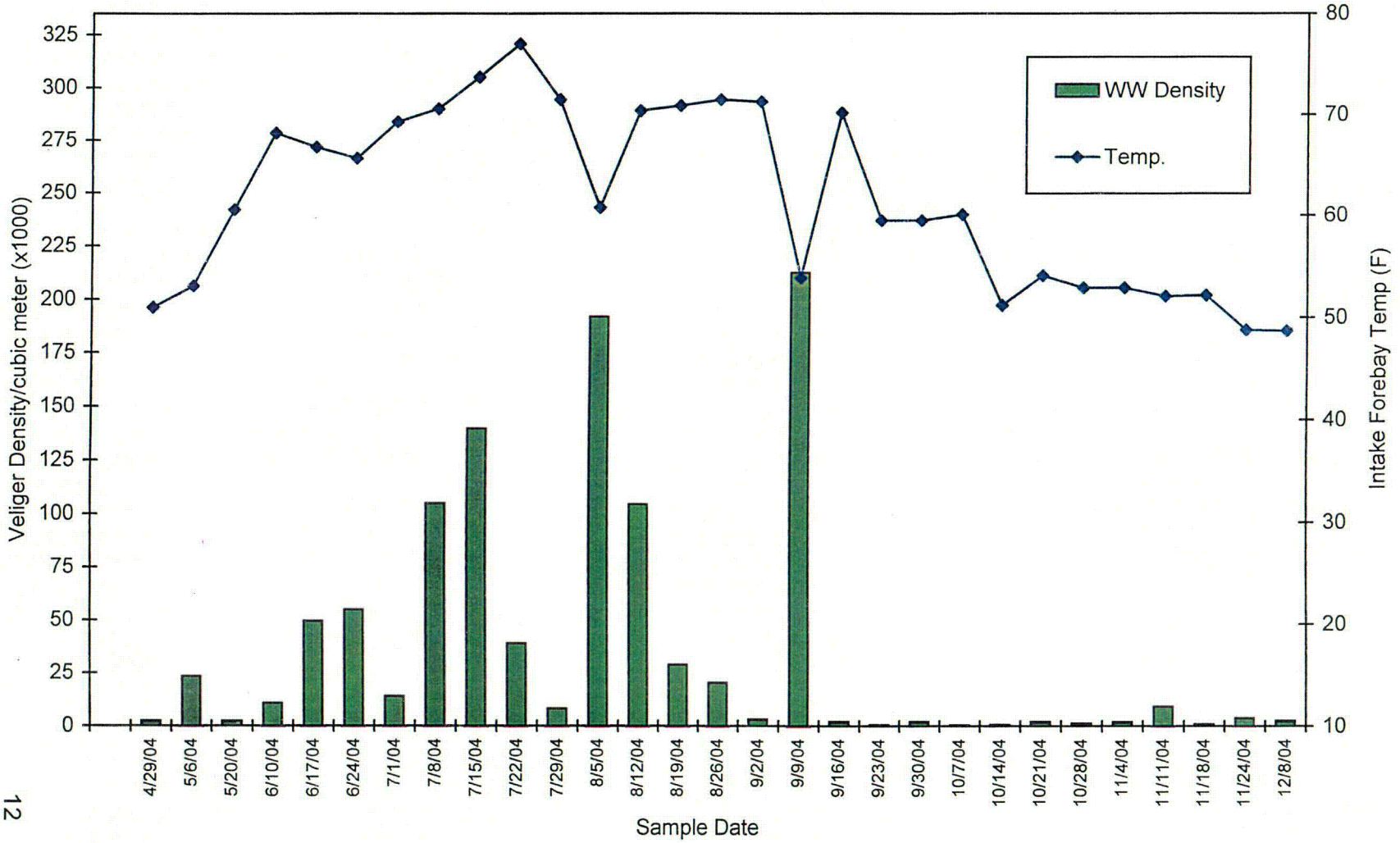
TABLE 3-1

Whole-Water Sampling Program Number of Zebra Mussel Veligers Per Cubic Meter, Veliger Size Range, and Mean Veliger Size (*um*) Collected in The D.C. Cook Nuclear Plant Forebay in 2004

Date	Density (No./m3)	Size Range (*um*)	Mean Size (*um*)
4/29/04	2300	90-130	105
5/6/04	23500	100-150	111
5/20/04	5275	100-300	137
6/10/04	10950	67-216	118
6/17/04	49600	100-250	165
6/24/04	55000	83-250	130
7/1/04	14200	100-266	154
7/8/04	105000	100-266	138
7/15/04	139750	83-250	140
7/22/04	39000	100-300	197
7/29/04	8400	100-366	201
8/5/04	192000	67-333	135
8/12/04	104500	67-333	166
8/19/04	28975	100-300	168
8/26/04	20450	100-300	152
9/2/04	3175	100-633	176
9/9/04	212500	67-300	122
9/16/04	1950	83-300	142
9/23/04	450	117-233	151
9/30/04	1925	67-300	140
10/7/04	375	100-583	216
10/14/04	575	100-266	174
10/21/04	2000	117-500	176
10/28/04	1275	100-683	166
11/4/04	1900	100-366	170
11/11/04	9400	83-500	158
11/18/04	875	133-300	220
11/24/04	3975	100-350	176
12/8/04	2475	100-466	174

FIGURE 3-1

2004 D.C. Cook Plant- Whole-Water Zebra Mussel Veliger Density and Water Column Temperature in Intake Forebay



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densities for 2001 (473,000 ind./m^3) and 2003 (450,000 ind./m^3) but higher than 2002 (107,975 ind./m^3).

Secondary peaks were recorded in 2004 on 5 August (192,000 ind./m^3) and 15 July (139,750 ind./m^3). The 2004's secondary peak densities were generally less than half the 2003's secondary peaks.

Whole water veliger densities crashed after their peak on 9 September with falling lake temperatures after mid-September. A small blip was noted on 11 November (9,400 ind./m^3) as densities continued their downward trend into December. The whole-water densities show that there are substantial numbers of veligers in the forebay, indicating the need for effective chlorination in the service water systems. Effective chlorination is therefore critical to the safe operation of the plant due to the threat of small valves and piping becoming clogged with zebra mussels.

The 2003 report concluded that yearly results in peak abundances make it difficult to predict when the peak abundance will occur each season other than estimating some time between July and October. Continued whole-water monitoring during the veliger spawning season will detect when these peak abundances occur.

Whole-water densities recorded during 1993 through 1995 for the November and December sampling periods were less than 1,000 ind. /m^3 for sampling conducted after 3 November. During the 1996 through 2000 as well as 2002 and 2003 sampling seasons, whole-water densities recorded in November were about five times greater than those of the 1993 through 1995 period, showing that spawning occurred into the late fall due to warm fall weather. In 2001, warm fall weather was not experienced as in the previous

five years, as whole-water densities observed in November 2001 were less than 2,000 ind. /m^3. With the exception of the 11 November blip, the 2004 whole-water November densities resembled more those of 2001. However, because of the late fall spawning in previous years, there is a need for chlorination to continue into the late fall months to prevent zebra mussel settlement and growth in plant systems.

In summary, zebra mussel veligers were present in the water column on all sampling dates from 29 April through 8 December. Spawning commenced in late April and continued through the end of the sampling program. Peak veliger densities occurred during a 10-week period from early July to early September.

3.2 Artificial Substrate Sampling, Biocide Treatment, and Mechanical Cleaning

3.2.1 Circulating Water System Artificial Substrate Sampling

Cumulative settlement was monitored in the intake forebay using a six-inch PVC pipe with a 3.5 inch inside diameter. The PVC pipe was set in the forebay on 26 June of 2003 and examined on 17 June 2004 to determine the average density and size range for the 12 months. The density on the substrate was 206,925 ind./m^2. Individuals ranged from 580*u*-11,254*u* (.58mm – 11mm) and the mean size of fifty randomly selected individuals was 3,253*u* (3.3mm). This 12-month density is slightly lower than the density measured in 2003 of 223,200 ind./m^2. What is noteworthy is that the average size of the individuals measured in 2004 was less than half (3.3mm) of those measured in 2003 (8.4mm). Even in the face of a record high abundance of whole-water veligers in 2003, the individuals that settled and were measured in June of 2004 were

slightly less numerous than those counted in June of 2003 and were much smaller in size. This could have been attributed to the daily Spectrus CT1300 treatments that were performed during the 2003 veliger spawning season ("Mollusc Biofouling Monitoring Program 2003", Section 3.2.3). This possible affect was noted in the "2003 Preventive Zebra Mussel Treatment Self-Assessment SA-2003-REA-003-QH" report. Over the three years that the June to June sampling was performed, the June 2004 data showed the lowest average size and density. (See chart below.)

Circulating Water Intake Forebay PVC Artificial Substrate Zebra Mussel Density and Size Chart				
Date		Size um		
	Average	Maximum	Minimum	Density
June 2004	3,253	11,254	580	206,925
June 2003	8,400	31,000	200	223,200
June 2002	4,450	17,000	1,200	420,050

3.2.2 Service Water Systems and Miscellaneous Sealing and Cooling Water System Artificial Substrate Sampling

The return sides (after systems' use) of the ESW and NESW systems and the MSCW system were monitored in the 2004 Mollusc Biofouling Monitoring Program. Chlorine is injected beneath each ESW pump suction. The ESW trains are typically cross-tied downstream of the chlorine injection point so that both ESW trains are served. A separate chlorine injection point, which is in the suction header, serves the NESW system and subsequently the MSCW system. Cumulative settlement sampling and analysis was performed on a monthly basis in 2004.

Artificial substrate slides were installed on 29 April and ten slides per month were examined and not replaced. Results are shown in Table 3-2 and Figure 3-2. The data indicates that the chlorination system was effective in preventing growth and prolonged settlement of postveligers in the service water systems. Settlement in the NESW system rose to 6,613 ind./m^2 on 15 July and was also up slightly in the MSCW and ESW systems on this date. (See Table 3-2) Whole-water veliger densities rose into early July with the first spawning peak occurring on 15 July. Reviewing the chlorination data, Appendix Table 1 revealed that the chlorination system was operating below its target 0.2-0.5 ppm TRC band for NESW and in the lower end of the band for the remaining systems during this time period. This would account for the increase in the settled postveligers during the early to mid-July time period. Chlorination to the NESW was out of service for about a week in late July and was returned to service in early August. The next cumulative settlement sample taken on 19 August showed good control in all of the systems that were chlorinated.

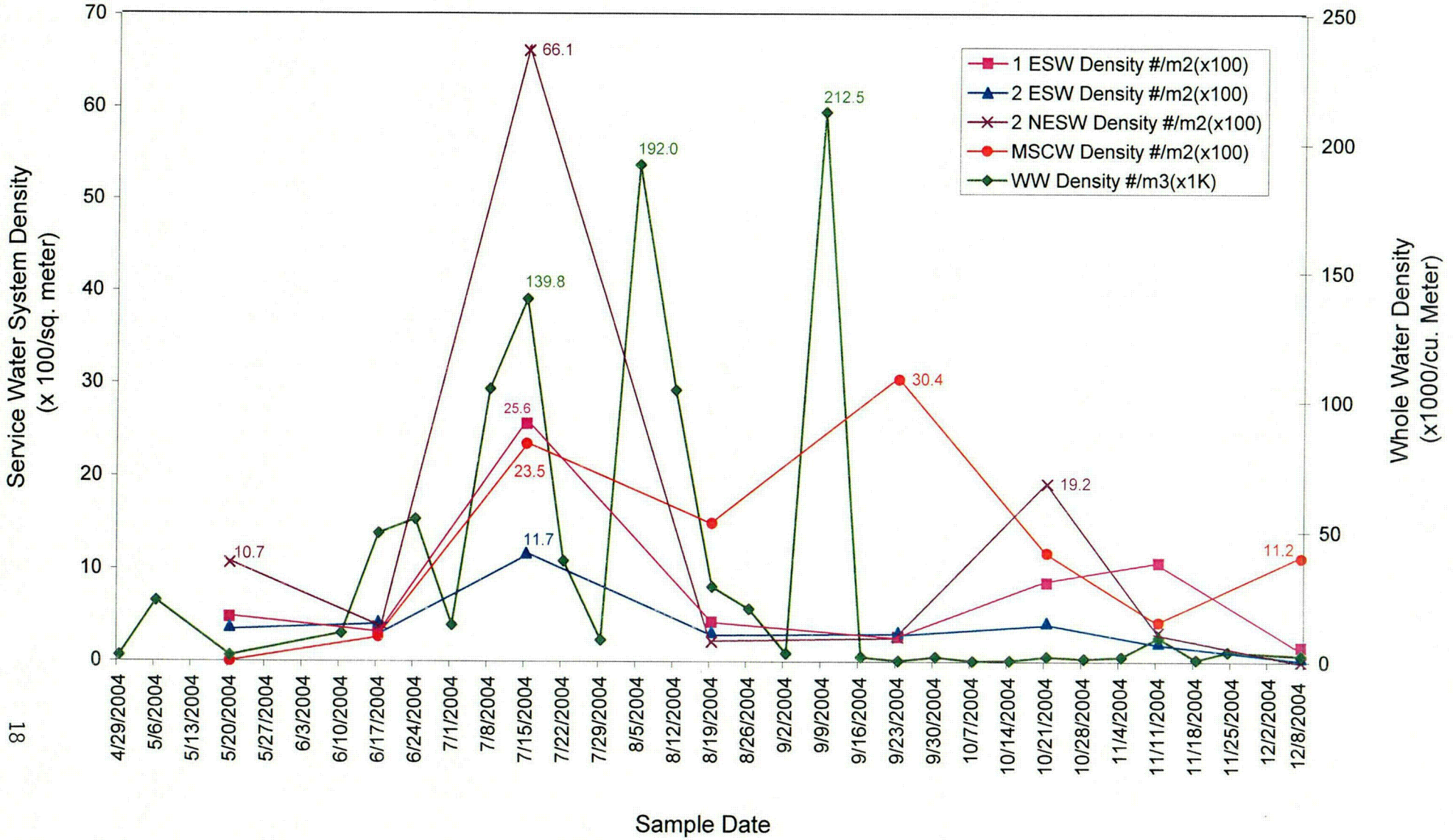
The settled postveliger density in the MSCW system in September was noticeably higher than those in the other systems that were being chlorinated. Because the MSCW is cross-tied with the NESW via a fire hose, the MSCW receives the same water and thus the same chlorine concentration as the NESW. This could have been attributed to the fact that flow was not consistent to the MSCW bio-box. To improve flow consistency, the bio-box flow check frequencies were increased from 3 days per week to daily. This resulted in a better correlation in settled postveligers between the NESW and MSCW bio-boxes sampled on 21 October and a further improvement on the 11 November sample date, but settlement in the MSCW bio-box was again elevated on the 8 December sample date. The isolation valve from the MSCW system is a gate valve that tends to silt up and slow flow to the bic- box. Operating the MSCW bio-box at a higher

TABLE 3-2

Density, Average Size, and Size Range of Settled Zebra Mussel Postveligers Collected on Cumulative Artificial Substrates Placed in the Forebay, in the Service Water Systems and Miscellaneous Sealing and Cooling Water System in the D.C. Cook Nuclear Plant in 2004.

Cumulative Samples															
	Forebay			NESW			MS&CW			1 ESW			2 ESW		
Date	Density (no/m2)	Avg Size (um)	Range (um)	Density (no/m2)	Avg. Size (um)	Range (um)	Density (no/m2)	Avg. Size (um)	Range (um)	Density (no/m2)	Avg. Size (um)	Range (um)	Density (no/m2)	Avg. Size (um)	Range (um)
5/20/2004	-	-	-	1,067	110	100-150	0	0	0	480	129	100-160	373	119	100-150
6/17/2004	206925	3253	580-11254	373	128	100-200	267	108	83-133	320	133	83-167	427	160	100-216
7/15/2004	-	-	-	6613	119	59-274	2347	201	98-2234	2560	131	59-274	1173	122	78-196
8/19/2004	-	-	-	213	205	97-242	1493	232	97-338	427	296	121-676	320	181	72-266
9/23/2004	-	-	-	267	no sample	no sample	3040	no sample	no sample	267	no sample	no sample	320	no sample	no sample
10/21/2004	-	-	-	1920	119	72-266	1173	108	72-217	853	162	97-580	427	181	72-266
11/11/2004	-	-	-	320	637	274-941	427	350	98-764	1067	443	176-1058	213	250	176-431
12/8/2004	-	-	-	0	0	0	1120	386	78-1215	160	418	216-745	53	118	118

FIGURE 3-2
D.C. Cook Plant - Whole Water Zebra Mussel Veliger Density and Zebra Mussel Postveliger Cumulative Settlement in the Service Water Systems



C03

flow rate, or opening wider the gate valve from the MSCW system and controlling the bio-box flow with its installed inlet ball valve, could resolve the low flow condition. These adjustments combined with daily bio-box checks, could better align the MSCW settlement data with the NESW settlement data in 2005.

The chlorination system was shut down on 3 October to accommodate diving and maintenance on the Circulating Water System during the Unit 2 C15 Refueling Outage. Chlorination was resumed on 3 November with the start-up of Unit 2. As expected, the 21 October date showed slightly elevated settlement densities in all of the systems due to the lack of chlorination during the month of October, but was lower than expected due to the low numbers of veligers present in the water column during this time period of interrupted chlorination. Once chlorination was resumed in early November, the settled densities in all systems decreased with the November and December sample dates with the exception of the MSCW sample on 8 December which was attributed to the low bio-box flow discussed above.

In summary, density and size data collected during 2004 in the service water systems and in the Miscellaneous Sealing and Cooling Water system sampling locations indicate low settlement throughout the sampling season with the exception of July and October. These elevated settlement densities were addressed by raising the chlorine concentration into the target band of 0.2-0.5 ppm TRC in July and resuming chlorination in November after the Unit 2 C15 Refueling Outage. Overall, the densities found in the service water systems in 2004 were similar compared to previous years' studies. The data indicates that prolonged settlement in the service water systems does not occur when chlorination is running which is illustrated by 2004's data. Furthermore, reports of visual inspections of heat exchangers

performed during the Unit 2 C15 Refueling Outage showed no live zebra mussel colonies residing in systems that were chlorinated.

3.2.3 Biocide Treatment

There were no biocide treatments in 2004.

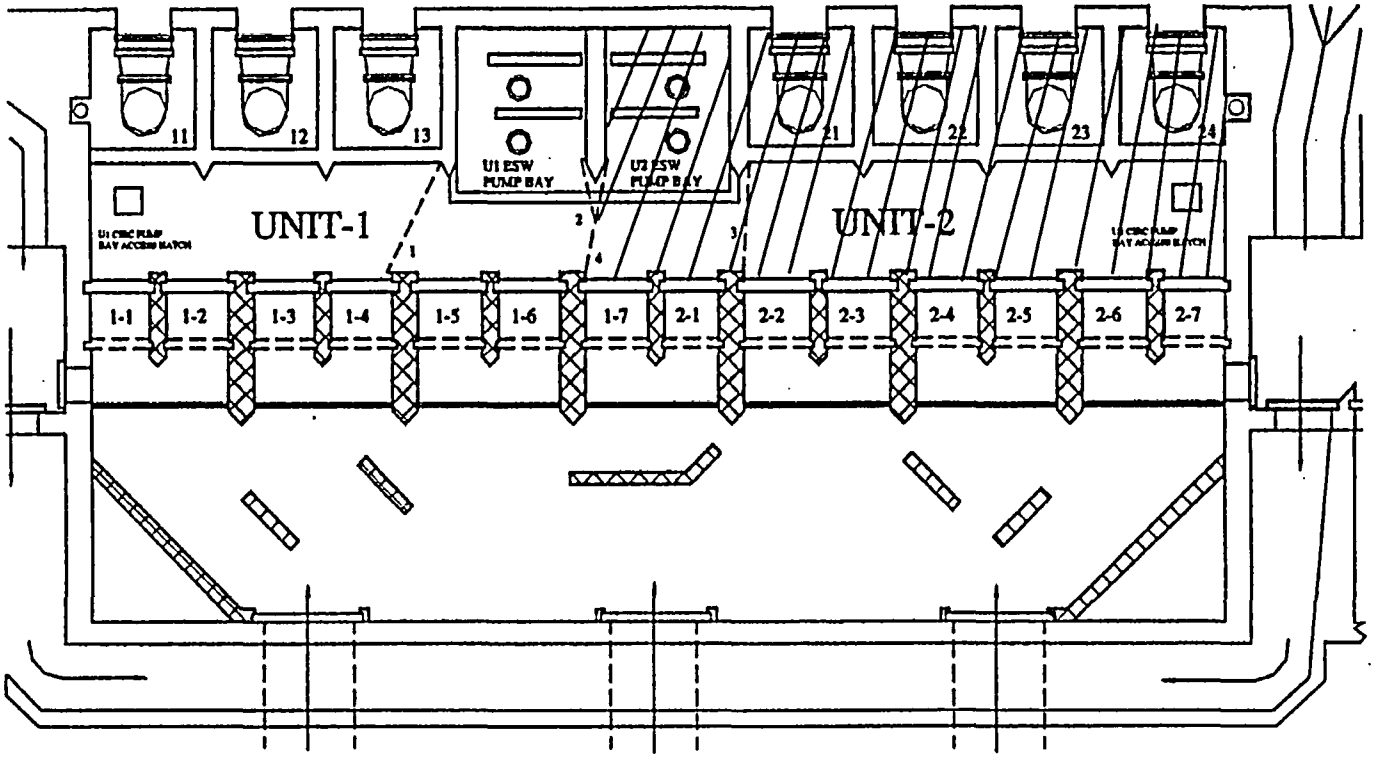
3.2.4 Mechanical Cleaning

During the Unit 2 C15 Refueling Outage divers were employed to mechanically clean sand, zebra mussels and debris from the walls and floors of the Unit 2 Circulating Water Intake Forebay and Unit 2 Condenser Inlet Tunnel. The Unit 2 Condenser Inlet Tunnel was cleaned in its entirety. The Unit 2 Intake Forebay was cleaned on the east (plant) side of the traveling screens (Figure 3-3). This included areas of the Unit 2 Circulating Water Pump and Unit 2 ESW Pump bays. The bays on the west (lake side) of the traveling screens to the trash racks, and further west of the trash racks extending to the west wall of the intake forebay were not cleaned. These areas were eliminated from the cleaning schedule due to diver safety and flow restraints and also with the expectation that the new robust multi-disk screens would be able to handle the zebra mussel sloughage from the walls and surfaces, and sand and mussel debris accumulation on the floor upstream.

In the Fall of 2004, the divers cleaned the intake crib velocity caps, ice guards, and trash racks of zebra mussels to remove the food source that attracts wild ducks to the intake cribs.

Figure 3-3

Screenhouse Intake Forebay



Note: Lined out area was cleaned during U2C15 Refueling Outage.

Chapter 4

Summary and Recommendations

4.1 Summary

The 2004 Mollusc Biofouling Monitoring Program was initiated on 29 April and continued to 8 December. The major spawning peak occurred on 9 September. The heaviest spawning period ran from 8 July through 9 September and covered three peaks occurring on 15 July, 5 August, and 9 September. The whole-water densities in this year's study were significantly lower than the recorded peak densities for 2001 and 2003.

The intake forebay PVC sampler showed a slightly lower density than the sample taken in 2003 with average organism size of less than half of that measured in 2003. The daily Spectrus CT1300 treatments performed in 2003 could have accounted for this lower abundance and smaller size range of individuals sampled in 2004.

The data indicates that the chlorination system was effective in preventing growth and prolonged settlement of postveligers in the service water systems. Settlement in the NESW system rose to 6,613 ind./m^2 on 15 July and was also up slightly in the MSCW and ESW systems on this date. A review of the chlorination data revealed that the chlorination system was operating below its target 0.2-0.5 ppm TRC band for NESW and in the lower end of the band for the remaining systems during this time period. Chlorine residuals were raised within their target bands on all systems in early August bringing all systems back under good postveliger settlement control. The settled postveliger density in the MSCW system in September was noticeably higher than those in the other systems being chlorinated. This was attributed to inconsistent flows through the MSCW bio-box which

was remedied by increasing flow check frequencies from 3 days per week to 7 days per week. As expected, postveliger settlement increased slightly in all systems in October due to the chlorination system being out of service during the Unit 2 C15 Refueling Outage. The impact was minimal as whole-water veliger densities were low during this October time period. Postveliger settlement was again brought under control when chlorination was resumed with the start-up of Unit 2 in early November. Reports of visual inspections of heat exchangers performed during the Unit 2 C15 Refueling Outage showed no live zebra mussel colonies residing in systems that were chlorinated.

4.2 Recommendations

Based on observations made during the course of this program, the following recommendations are being made:

- Whole-Water sampling should continue to be initiated in April to determine the presence of veligers in the water column, as currently implemented. The whole-water sampling frequency could be reduced from weekly to twice montly in the months of June, October, and November.
- Studies of cumulative postveliger settlement should continue to be conducted from May through December, as currently implemented.
- Chlorination should continue to run throughout the spawning season, as currently implemented. Specific attention to keeping the systems chlorinated within the target band of 0.2-0.5 ppm TRC during the peak veliger spawning months of July, August and September should be made.
- Maintain daily bio-box flow checks to ensure bio-box conditions are representative of system conditions. Make valve adjustments to operate the

MSCW bio-box at a higher flow rate to prevent silting in the system isolation valve.

- Chlorination data from all water systems (ESW, NESW, and MSCW) and temperature data should continue to be made available to allow meaningful interpretation of results.

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Appendix Table 1

Chlorination Values for 2004 Zebra Mussel Monitoring Program

Date	1 ESW (ppm)	2 ESW (ppm)	1NESW (ppm)	2 NESW (ppm)
5/2/2004			0.49	0.36
5/3/2004	0.1	0.12	0.34	0.2
5/5/2004	0.12	0.12	0.64	< 0.08
5/6/2004				
5/7/2004	0.14	0.14	0.39	< 0.08
5/9/2004	< 0.08	< 0.08	0.37	0.26
5/9/2004	< 0.08	< 0.08		
5/10/2004	0.1	0.09	0.35	0.17
5/10/2004		0.1		
5/11/2004	<0.08	< 0.08		
5/12/2004	< 0.08	< 0.08	0.21	0.15
5/13/2004	< 0.08	< 0.08	0.46	0.32
5/14/2004	< 0.08	< 0.08	0.5	0.12
5/14/2004	< 0.08	< 0.08		
5/14/2004	< 0.08	0.09		
5/15/2004	< 0.08	< 0.08		
5/16/2004	< 0.08	< 0.08		
5/17/2004	PSC	PSC	0.44	0.22
5/19/2004		< 0.08	0.42	0.21
5/20/2004	1.27	< 0.08		
5/20/2004	< 0.08	1.43		
5/20/2004	0.45	0.48		
5/21/2004	0.32	0.28	0.46	0.3
5/22/2004	0.42	0.29		
5/22/2004	0.4	0.41		
5/23/2004	0.13	0.1	0.12	0.35
5/23/2004	0.22	0.22	0.11	0.46
5/23/2004	0.16	0.2	0.52	0.18
5/23/2004	0.14	0.14	0.57	0.2
5/23/2004	0.54	0.54		
5/23/2004	0.4	0.42		
5/24/2004	0.15	0.16	0.21	0.55
5/24/2004	0.26	0.28	0.15	0.6
5/25/2004			0.55	0.19
5/26/2004	0.94	0.19	0.11	0.43
5/26/2004	0.85	0.36	0.47	0.31
5/27/2004	0.45	0.23	0.12	0.53
5/28/2004	0.48	0.48	< 0.08	0.09
5/29/2004			0.4	0.51
5/31/2004	0.27	0.28	0.2	0.18
6/2/2004	0.46	0.42	PSC	PSC
6/4/2004	0.44	0.73	PSC	PSC
6/5/2004	0.27	0.34		

Appendix Table 1

Chlorination Values for 2004 Zebra Mussel Monitoring Program

Date	1 ESW (ppm)	2 ESW (ppm)	1NESW (ppm)	2 NESW (ppm)
6/6/2004			0.29	0.48
6/7/2004	0.52	0.55	< 0.08	0.2
6/8/2004	0.11	0.23	0.11	0.55
6/8/2004	< 0.08	0.15	0.15	0.69
6/8/2004	0.09	0.24	0.11	0.62
6/9/2004	0.49	0.43	0.18	0.47
6/10/2004			0.15	
6/11/2004	0.31	0.31	0.48	0.22
6/14/2004	0.42	0.41	0.49	0.21
6/16/2004	0.27	0.38	0.45	0.29
6/18/2004	0.33	0.36	0.46	0.39
6/21/2004	0.38	0.35	0.18	0.5
6/23/2004	0.41	0.25	0.48	0.11
6/23/2004			0.63	0.17
6/25/2004	0.66	0.18	0.31	0.11
*6/25/2004	.11/.22	.29/.1	0.49	0.14
6/26/2004	0.38	0.12	0.14	0.43
6/27/2004			0.17	0.49
6/27/2004			0.33	0.29
6/28/2004	OOS		0.21	0.53
6/30/2004			0.28	0.16
7/2/2004	< 0.08	0.36	0.29	0.4
7/5/2004	0.19	0.4	0.46	0.13
7/5/2004				0.23
7/7/2004	0.4	< 0.08	0.23	0.25
7/8/2004			0.08	0.14
7/9/2004	0.24	0.27	< 0.08	0.09
7/12/2004	0.12	0.13	< 0.08	0.25
7/12/2004			< 0.08	0.15
7/12/2004	0.08	0.1		
7/13/2004	0.09	0.12	0.08	0.32
7/14/2004			< 0.08	
7/14/2004	0.58	0.58	0.71	0.27
7/15/2004	0.27	0.28	0.59	0.24
7/16/2004	0.2		< 0.08	< 0.08
7/16/2004	0.2			
7/19/2004	0.21			
7/21/2004	0.41	0.12		
7/22/2004		0.18		
*7/23/2004		0.16/0.13	OOS	OOS
7/25/2004	0.26	0.18	OOS	OOS
7/26/2004			OOS	OOS

Appendix Table 1

Chlorination Values for 2004 Zebra Mussel Monitoring Program

Date	1 ESW (ppm)	2 ESW (ppm)	1NESW (ppm)	2 NESW (ppm)
7/26/2004	0.2	0.18	OOS	OOS
7/28/2004	0.25	0.35	OOS	OOS
7/30/2004	0.22	0.21	OOS	OOS
8/2/2004	< 0.08	< 0.08	OOS	OOS
8/3/2004	< 0.08	< 0.08	0.67	0.28
8/4/2004	< 0.08	< 0.08	0.72	0.19
8/4/2004	0.61	0.12	0.75	0.29
8/4/2004			0.76	0.28
8/4/2004			0.41	0.3
8/5/2004	0.32	0.37		
8/6/2004	0.85	0.43	0.22	0.4
8/6/2004	0.95	0.18		
8/7/2004	0.35	0.45		
8/9/2004	0.16	0.16	< 0.08	0.65
8/11/2004	0.36	0.22	0.3	0.18
8/12/2004			< 0.08	1
8/13/2004	0.21	0.26	0.08	0.69
8/13/2004				0.35
8/16/2004		0.09	0.12	0.92
8/16/2004	0.11			
8/17/2004	0.23	0.18	0.74	0.1
8/18/2004	0.21	0.21	0.48	0.19
8/20/2004	0.42	0.62	0.18	0.24
8/23/2004	< 0.08	< 0.08	< 0.08	0.77
8/24/2004	0.12	0.18	< 0.08	0.79
8/25/2004	0.09	0.09	< 0.08	0.84
8/26/2004	0.09	0.77	0.68	0.27
8/27/2004	< 0.08	< 0.08	0.76	0.21
8/28/2004		0.26	0.6	0.36
8/30/2004	0.36	0.69	0.14	0.67
8/31/2004	0.33	0.65	0.1	0.6
9/1/2004	0.21	0.81	0.12	1.5
9/3/2004	PSC	PSC	PSC	PSC
9/6/2004	OOS	OOS	OOS	OOS
9/8/2004	OOS	OOS	OOS	OOS
9/13/2004	< 0.08	< 0.08	OOS	OOS
9/14/2004	0.11	< 0.08	OOS	OOS
9/14/2004	< 0.08	< 0.08	OOS	OOS
9/15/2004	< 0.08	< 0.08	OOS	OOS
9/17/2004	< 0.08	< 0.08	OOS	OOS
9/20/2004	< 0.08	< 0.08	OOS	OOS

Appendix Table 1

Chlorination Values for 2004 Zebra Mussel Monitoring Program

Date	1 ESW (ppm)	2 ESW (ppm)	1NESW (ppm)	2 NESW (ppm)
9/22/2004	< 0.08	< 0.08	OOS	OOS
9/27/2004	< 0.08	< 0.08	OOS	OOS
9/28/2004			0.73	0.21
9/29/2004	< 0.08	< 0.08	0.89	0.26
9/30/2004			0.79	0.21
10/1/2004	< 0.08	< 0.08	0.66	0.23
10/2/2004			0.74	0.14
10/3/2004	PSC	PSC	PSC	PSC
10/4/2004	PSC	PSC	PSC	PSC
10/6/2004	PSC	PSC	PSC	PSC
10/13/2004	PSC	PSC	PSC	PSC
10/18/2004	PSC	PSC	PSC	PSC
10/20/2004	PSC	PSC	PSC	PSC
10/25/2004	PSC	PSC	PSC	PSC
10/27/2004	PSC	PSC	PSC	PSC
11/1/2004	PSC	PSC	PSC	PSC
11/3/2004			<0.08	< 0.08
11/3/2004	0.24	0.24	<0.08	1.08
11/4/2004			< 0.08	1.31
11/4/2004			0.12	0.83
11/5/2004	< 0.08	< 0.08	< 0.08	1.28
11/6/2004			0.2	0.67
11/6/2004			< 0.08	0.98
11/8/2004	0.29	OOS	0.51	0.46
11/10/2004	0.43		0.5	0.43
11/12/2004	0.27	0.27	0.45	0.42
11/13/2004			0.42	0.42
11/15/2004	0.39	0.48	0.72	0.41
11/17/2004	0.88	0.42	0.53	0.13
11/17/2004	< 0.08		0.08	1.19
11/17/2004	0.45		< 0.08	0.74
11/19/2004	0.5	0.63	0.24	0.59
11/22/2004	0.09	0.17	0.43	0.34
11/24/2004	0.31	0.41	0.17	0.47
11/26/2004	0.19	0.34	0.26	0.68
11/29/2004	0.5	0.5	0.47	0.35

PSC - Plant Specific Condition - Plant configuration did not support chlorination.

OOS - Chlorination System out of service for maintenance.

* - Samples taken at both ESW headers.

APPENDIX IV

SPECIAL REPORTS

2004

NONE