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INDIANA MICHIGAN POWER

April 30, 2003

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DPR-58/74 Appendix B 5.4.1

Docket Nos.: 50-315
50-316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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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, 2002, through December 31, 2002, 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. Brian A. McIntyre, Manager of Regulatory Affairs, at (269) 697-5806.

Sincerely,

J. B. Giessner
Director, Technical Projects

DB/rdw

Attachment

IE25

c: H. K. Chernoff, NRC Washington, DC
K. D. Curry, Ft. Wayne AEP, w/o attachment
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J. T. King, MPSC, w/o attachment
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NRC Resident Inspector
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ATTACHMENT TO AEP:NRC:3541

ANNUAL ENVIRONMENTAL OPERATING REPORT

Donald C. Cook Nuclear Plant Units 1 & 2

Annual Environmental Operating Report

January 1 through December 31, 2002

Indiana Michigan Power Company
Bridgman, Michigan

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

TABLE OF CONTENTS

LIST OF APPENDICES

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, 2002.

The following table summarizes the pertinent data concerning the Plant's operation during the period from January 1 to December 31, 2002.

Parameter	**Unit 1**	**Unit 2**
Gross Electrical Generation (megawatt hours)	7,741,000	7,688,010
Unit Service Factor (%)	88.9	83.8
Unit Capacity Factor – Maximum Dependable Capacity Net (%)	88.4	82.8

II. CHANGES TO THE ENVIRONMENTAL TECHNICAL SPECIFICATIONS

There were no changes to Environmental Technical Specifications in 2002.

III. NON-RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

A. Non-Routine Reports

A summary of the 2002 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 2002.

C. Plant Design and Operation

During 2002, 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 2002 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 2002 are discussed in Appendix III of this report.

F. Special Reports

There were no Special Reports for 2002.

APPENDIX I

NON-ROUTINE REPORTS

2002

2002 Non-Routine Events

June 12, 2002 – At 1345 hours, a transformer failed and caught fire. Approximately 230 gallons of non-polychlorinated biphenyl (non-PCB) transformer oil leaked onto the ground or was consumed by the fire. The area is covered in a layer of crushed limestone that was collected and properly disposed. Some areas of the underlying soil were also contaminated with oil. This soil was also collected and properly disposed. No oil was discharged to the ground water or surface water.

June 28, 2002 – At 1830 hours, a current transformer was dropped during transport. The damaged current transformer leaked approximately 25 gallons of non-PCB transformer oil onto the ground. The area is covered in a layer of crushed limestone that was collected and properly disposed. Some areas of the underlying soil were also contaminated with oil. This soil was also collected and properly disposed. No oil was discharged to the ground water or surface water.

October 16, 2002 - The plant failed to obtain a Plant Heating Boiler (Outfall 00C) sample for Total Suspended Solids during a discharge period. Approximately 413 gallons of boiler water was discharged to the Plant's circulating water intake forebay (Outfall 00C) on this date. Samples taken later on October 19, 2002 confirmed that the boiler water discharge was within specification.

November 16, 2002 – At approximately 00:15 hours, a one half inch diameter Teflon tubing supply line to the service water chlorination pump failed during continuous chlorination operations. A leak of approximately two gallons per minute of ~12% sodium hypochlorite discharged into the forebay where it was diluted and carried through the circulating water system and finally discharged into Lake Michigan through Outfall 001 for approximately 9 hours. The Total Residual Oxidant (TRO) concentration at Outfall 001 ranged from 0.282 mg/l to 0.386 mg/l during the 9-hour period. The discharge exceeded the NPDES continuous permit limit of 0.038 mg/l during the 9-hour period. Since TRO is measured at the beginning of the discharge tunnel, we predicted a significant reduction in the TRO at the end of the pipe due to biofouling on the walls of the discharge pipe. Approximately 1,080 gallons of the ~12% sodium hypochlorite solution was discharged over the 9-hour period. When plant personnel discovered the leak on a routine tour, they responded immediately by securing the sodium hypochlorite tank. This spill did not pose a human health threat, as the concentration of sodium hypochlorite was less than normal drinking water levels. The high velocity discharge, the large dilution from the circulating water system, the sandy bottom and open lake, provided adequate dilution and absorbance to prevent any immediate or long-term environmental damage.

APPENDIX II

HERBICIDE APPLICATION REPORT

2002

AMERICAN ELECTRIC POWER

Date March 07, 2003

Subject 2002 Herbicide Application Report - Cook Nuclear Plant

From Jon H. Harner

To J. P. Carlson

The following herbicides were applied on the Owner Controlled Areas of the Cook Nuclear Plant during 2002:

Karmex (DF)
Razor
Oust
Riverdale IVM 2, 4-D
Hi-light Indicator
Round-Up Pro
ProScape Confront 19-2-9
Scotts Halts with Crabgrass Preventer

DeAngelo Brothers

On April 23, 24, and 26 of 2002, a mixture of Karmex with Hi-Light indicator, Razor, Oust, and IVM 2, 4-D was used for total plant control in the 69KV yard, railroad right-of-ways, around buildings (Training Center, Radioactive Materials Building, Kelly Building Warehouses, Building and Grounds Storage Garage, the Nuclear Services Center, Technical Support Office Complex, SES, Fab Shop, Paint Storage Building, Oil Storage Building, Environmental Waste Building, Steam Generator Mausoleum, CESA Yard, Mechanics Garage, Sewage Plants, Warehouses 4, 5, and 6), parking lots, sidewalk edges, dumpster yard, Fire Protection Tanks, Refueling Island, Steel Yard, W-Yard, and within the plant's protected area.

DeAngelo Brothers, a Michigan licensed herbicide applicator (Sean Jones – C005020178) on contract to the AEP Western Division performed the application. A total of 94.15 pounds of Karmex DF, 13.45 qts. of Razor, 26.9 oz. of Oust, 13.45 qts. of Riverdale IVM, and 52.2 oz of Hi-light Indicator were used for the application and spread over 13.5 acres.

On April 26, 2002, a spill occurred where two gallons of a dilute mixture of Karmex DF, Oust, Riverdale Razor, Riverdale IVM, and Hi-Light indicator was spilled onto the blacktop with two quarts going the sand. The location of this spill was adjacent to Warehouse #6. The details of the spill and subsequent clean up were documented in condition report #02116038. The following table details the application rates used compared to the allowable application rates. The herbicides were applied according to the manufacturer's labeled instructions and according to Federal and State requirements.

Product Name	Quantity Used	Quantity Used/Acre	Quantity Allowed/Acre
Karmex (DF)	94.15 lb.	7 lb.	15 lb.
Riverdale Razor	13.45 qt.	1 qt.	4.8 qt.
Oust	26.9 oz.	2 oz.	8 oz.
Riverdale IVM 2, 4-D	13.45 qt.	1 qt.	4 qt.
Hi-Light Indicator	52.2 oz.	3.9 oz./80 gal. mix	9.6 oz./80 gal. mix

Plant Buildings and Grounds

Round-Up Pro mixed with water in a backpack sprayer was used to spot spray weeds on May 23, 29, 30, July 12, 15, 30, and August 27 of 2002. The areas included, along the plant railroad tracks, motorcycle parking area, mulch around trees, curbing, blacktop, dry sewage treatment absorption ponds, decorative stone beds, and sidewalks. A total of 154.7 ounces of Round-Up Pro was used for spot spraying in 2002. On April 16, 18, and 19, 2002, 17 bags (171 lbs) of Scotts Halts Crabgrass Preventer fertilizer was applied to 5.5 acres (238,000 square feet) of lawn including areas in the protected area and in the owner controlled area. On July 17, 2002, 800 pounds of Proscape Confront fertilizer (setting #14 on spreader) was applied to lawn areas surrounding the Training Center.

The applications were performed by a licensed applicator, Rennard Williams, Sunstates Inc. The first

applications were not broadcast. Weeds were individually spot sprayed, therefore, product usage rates per acre are not reported for these applications. The application of fertilizer and fertilizer with crabgrass preventer was broadcast and the product usage rates are reported below. The herbicides were applied according to manufacturer's labeled instructions, Federal, and State requirements.

Product Name	Quantity Used	Concentration Used	Concentration Allowed
Round-Up Pro	154.7 oz.	Spot sprayed at 8.0 to 8.3 oz/gal	13.0 oz/gal for Spot spraying
Scotts Halts Crabgrass Preventer	17 bags	1 bag/14000 ft2	1 bag/13500 ft2
Confront (fertilizer)	800 lbs.	#14 setting on the Earthway Rotary Spreader	Label directions indicated a #12 to 14 setting on the Earthway Rotary Spreader

Mortality Inspection

On September 6 and 7, 2002, the mortality of these herbicide applications was inspected in accordance with PMP-2160-HER-001, Guidelines for the Application of Approved Herbicides, by environmental technician Mr. Dean Warlin. This inspection determined weed kills to be greater than 95% with a few specific exceptions. There was no evidence of over-spray or spillage in any of the application areas. Preparation and application descriptions were documented on PMP-2160.HER.001 Data Sheet 1 forms. No adverse environmental effects were noted during the inspection. The areas of poor mortality are as follows:

- Vegetation was present west of the 12 AB Loop Feed Enclosure by the managers parking lot.
- Vegetation was present on the West Side of the South Sewage Treatment Plant.
- Vegetation was present west of the CST shed, located in the U-2 RWST Yard.
- Lawns south of the New Office Building and west of the RMB had noticeable weed growth.

- Areas untreated in 2002 and need treatment in 2003.
    1. The 765kV, 345kV, and the 69kV yards. (These areas were not treated due to a failure of a transformer in the 345 kV yard on June 12, 2002.)

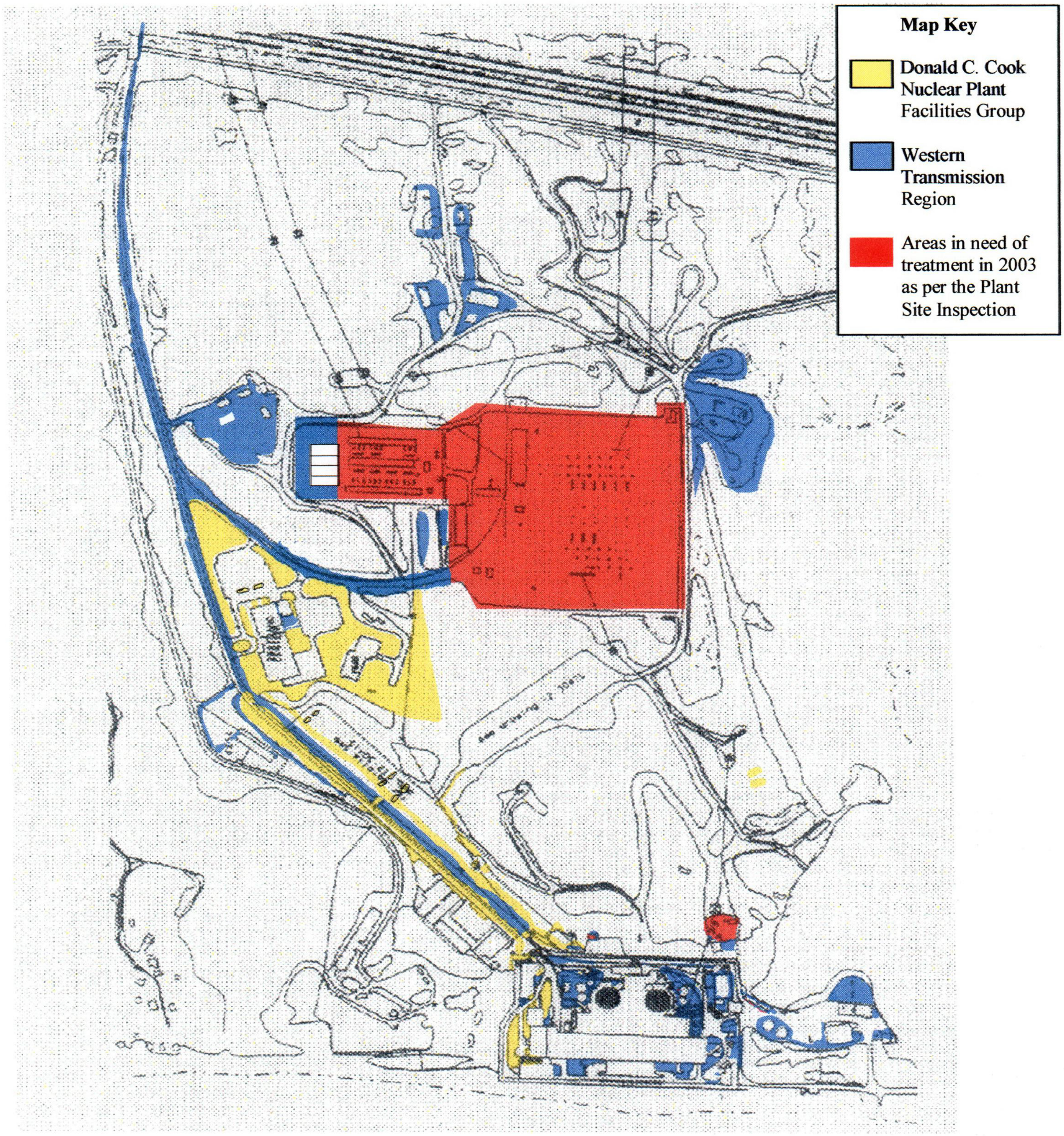
Summary

Based upon the review of the application records, manufacturer specifications, material safety data sheets (MSDSs) and inspection of the treated areas, the 2002 herbicide applications were conducted in accordance with the manufacturer's label and Federal and State requirements. As required by the State of Michigan, all personnel performing commercial herbicide applications were licensed by the state. 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.

A two gallon spill of a dilute mixture of Karmex DF, Oust Riverdale Razor, Riverdale IVM, and Hi-Light indicator was spilled onto the blacktop. Two quarts went to the sand. The details of the spill and subsequent clean up were documented in condition report #02116038.

At the time of the mortality inspection, no signs of spillage were apparent and no adverse environmental effects were observed.

Jon H. Harner – Environmental Supervisor



Map Key
Donald C. Cook Nuclear Plant Facilities Group
Western Transmission Region
Areas in need of treatment in 2003 as per the Plant Site Inspection

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APPENDIX III

MOLLUSK BIOFOULING MONITORING PROGRAM REPORT

2002

Mollusc Biofouling Monitoring Program 2002

Performed at Donald C. Cook Nuclear Plant

Performed and Submitted
By
Grand Analysis

Prepared for:

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

MOLLUSC BIOFOULING MONITORING PROGRAM 2002

March 2003

Grand Analysis
12684 Oak Park
Sawyer, Michigan 49125

Table of Contents

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 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 24 April through 12 December 2002. Peak densities occurred on 17 August, 22 August, 5 September and 3 October, with the major peak occurring on 5 September (107,975 veligers per cubic meter). This year's densities and peaks were lower than the previous six years' densities and peaks, from 1996 through 2001. Past years' studies have determined that zebra mussel density was 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. This would suggest that the zebra mussel population has possibly reached equilibrium in the southeast part of Lake Michigan.

Cumulative settlement was monitored in the forebay using microscope slides as artificial substrates. Analysis of the slides was done monthly to determine growth rates and cumulative settlement. Density and size data indicate that settlement started slowly in May and in June. This initial settlement consisted of new postveligers, or newly settled larvae as well as many translocators, defined as juveniles or adults that relocate. Settlement density peaked in September of the sampling season with a decrease in October, November and continuing into December.

These results are similar to 2001's densities but are contrary to previous years' results that

indicated a steady increase in postveliger densities month to month. September's peak settlement density in the forebay occurred two weeks after the major whole-water peak density. This is conceivable since the veligers start to settle at about two weeks after initial spawning. Postveliger density in the forebay was highest in September. The decrease in densities in the following months indicate that as the postveligers grow larger, many translocate, allowing those that remain, more room for growth. This is demonstrated by the forebay cumulative sampling results showing a continuous increase in average size of settled postveligers with decreasing density. The continuous growth of settled postveligers and presence of translocators indicate the need for chlorination during the veliger-spawning season, which in 2002 was 25 April thru 12 December.

Cumulative settlement was also monitored in the forebay using two six-inch PVC pipes. One PVC pipe was deployed on 14 June of 2001 and was retrieved on 20 June 2002. The settlement density and size of postveligers for this one-year period was 420,050 individuals/m^2 and 4,450*u* (4.5mm). The second PVC pipe was deployed 13 December 2001 and was retrieved 20 June 2002. The settlement density and size of postveligers for this six-month period was 52,700 individuals/m^2 and 2,030u (2.0mm). One PVC sampler was cleaned and returned to the forebay for a winter growth study.

Service Water Systems and Miscellaneous Sealing and Cooling Water

Cumulative settlement on the artificial substrates in the service water systems was reasonably low during the entire sampling season. The highest densities were found on 19 September in 1 ESW, NESW and MSCW (4,267 individuals/m^2, 17,866 individuals/m^2, and 40,000 individuals/m^2 respectively). The 19 September sampling date followed two weeks after the 5 September season's peak whole-water density, which can explain the peak cumulative settlement densities observed.

No biocide treatments were performed at the D.C. Cook Plant in 2002.

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 the presence of 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.

In 2002, as well as in 1999, 2000, and 2001, Grand Analysis conducted the monitoring program, designed to detect the timing of spawning and settling of zebra mussels at the Cook Nuclear Plant. The program also determines densities for: 1) whole water samples for planktonic veligers: and 2) artificial substrates set within the circulating water, ESW, NESW, and MSCW systems for cumulative postveliger settlement. PVC piping was used to determine cumulative settlement for a six-month period and a one-year period in the intake forebay.

1.2 Objectives

Specific objectives for the 2002 Mollusc Biofouling Monitoring Program were as follows:

- Conduct whole-water sampling of the circulating water system weekly (June-November), bimonthly (May), and monthly (April and December) to determine the presence and density of larval zebra mussels.

- Deploy artificial substrates in the intake forebay and service water systems to detect cumulative settlement of postveligers. Samples collected monthly from May through December.

- Deploy PVC piping, also as an artificial substrate, in the intake forebay to determine cumulative settlement during the growing season as well as over the following winter.

Chapter 2

Methods

2.1 Whole-Water Sampling

Whole-water sampling of the circulating water system was conducted from 25 April to 12 December 2002 (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-milliter 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 were counted and the average was

TABLE 2-1

SAMPLING SCHEDULE FOR ZEBRA MUSSEL MONITORING AT THE D.C. COOK NUCLEAR PLANT IN 2002

Date		Whole Water	Artificial Substrates
April	25	X	
May	9	X	
	23	X	X
June	6	X	
	13	X	
	20	X	X(*)
	27	X	
July	3	X	
	11	X	
	18	X	
	25	X	X
August	1	X	
	8	X	
	15	X	
	22	X	X
	29	X	
Sept.	5	X	
	12	X	
	19	X	X
	26	X	
Oct.	3	X	
	10	X	
	17	X	X
	24	X	
	31	X	
Nov.	7	X	
	14	X	X
	21	X	
	26	X	
Dec.	12	X	X

X(*) Removed and analyzed PVC after 6 months and 1 year

extrapolated to determine the number of individuals per cubic meter. This process was repeated for the second replicate and the mean of the two values was calculated to yield a final density value. The density was calculated as follows:

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

DF- Dilution Factor

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, artificial substrates were placed in the intake forebay, upstream of the trash racks. Sidestream samplers were installed on the return side of both service water systems and on the miscellaneous sealing and cooling water system to determine settlement in these systems. Samplers were equipped with modified test-tube racks designed to hold microscope slides for cumulative sampling.

2.2.1 Intake Forebay

On 25 April, substrate monitors, consisting of 80 microscope slides in test tube racks secured inside protective wire cages attached to a rope weighted by a concrete block, were suspended at mid-depth near the center of the intake forebay. Monthly, 10 slides were retrieved and analyzed for density and shell size according to the sampling schedule.

On 20 June, two PVC pipe sections were analyzed. The PVC sections measured 6 inches long and had an inside diameter of 3.5 inches. They 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 first PVC sampler had been suspended for six months and the second for one year. The PVC samplers were analyzed for densities and sizes of shells by scraping two different square inch sections of each of the PVC samplers. Cumulative monitoring was designed to provide information on accumulated infestation throughout the growing season.

2.2.2 Service Water Systems

Sidestream monitors 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 monitor contained two modified test tube racks containing 80 microscope slides. The racks held the slides above the monitor base that allowed silt and sediment to fall out before they could affect the slide settlement. The monitors were covered with a plant-approved fireproof fabric to limit light exposure. Plant personnel checked the monitors 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 subsampling technique was followed:

- The slides were subsampled 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 533.34 to obtain the density of zebra mussels per square meter. (One postveliger/microscope slide equals 533.34 veligers 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 2002. The whole-water sampling for free-swimming veligers coupled with monitoring post-veliger 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 range for the control of zebra mussel settlement, whereas, in past years' studies a 0.3-0.6 ppm range was used. This concentration range was lowered at the request of Chemistry in an effort to reduce service water systems corrosion rates. This year's data demonstrates good postveliger control measured at the lower chlorination rates. 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

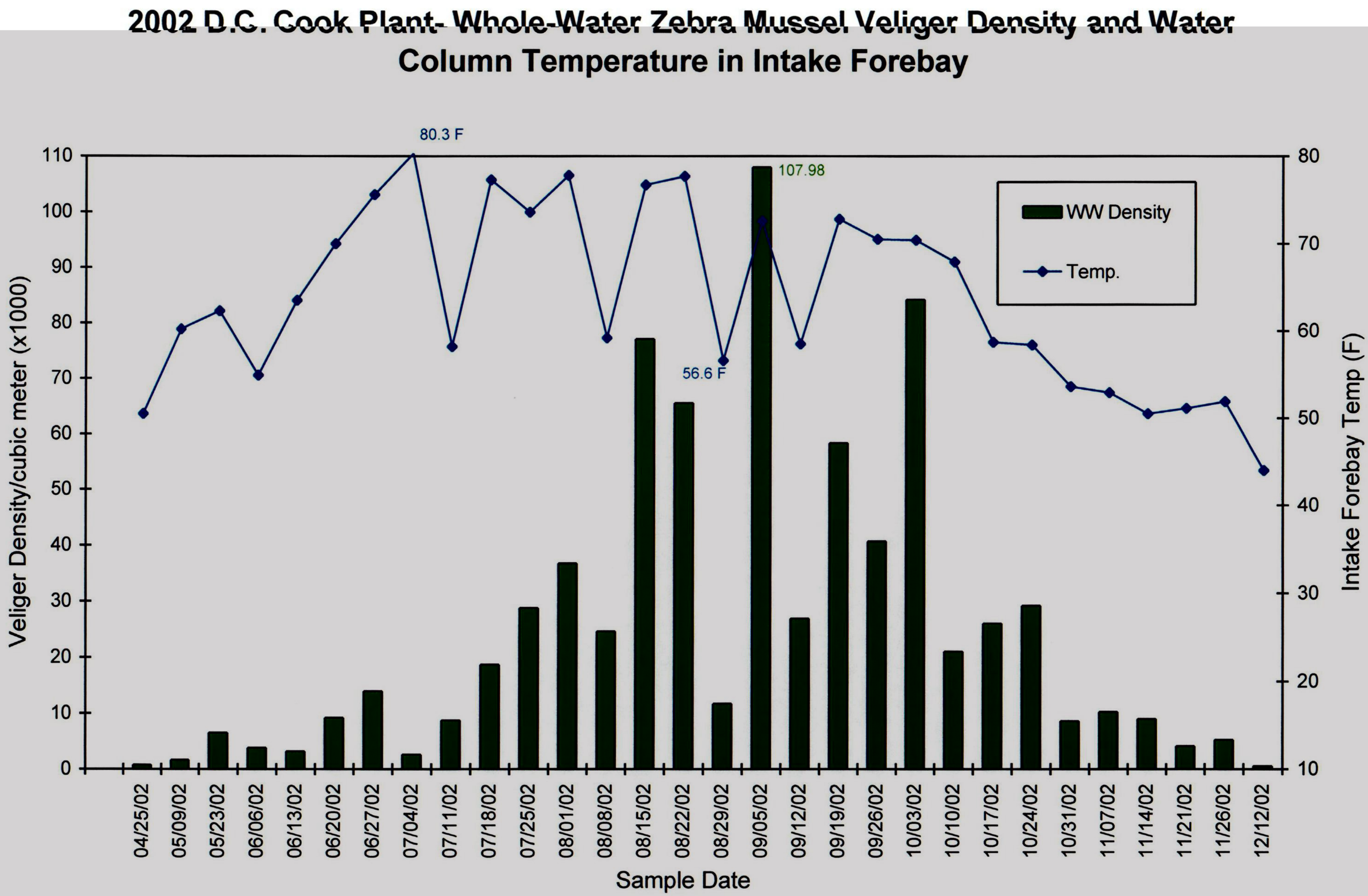
Sampling of planktonic veligers in the circulating water system was initiated 25 April and was completed on 12 December. Results are presented in Table 3-1 and in Figure 3-1. Veligers were present in all samples throughout the monitoring season. The major peak density occurred on 5 September (107,975ind./m^3). This major peak precisely corresponds with 2001's major peak observed on 6 September although 2001's density was over four times greater (473,000ind./m^3).

Table 3-1

Whole-Water Sampling Program Number of Zebra Mussel Veligers Per Cubic Meter, Veliger Size Range, and Mean Veliger Size (*u*m) Collected in the D.C. Nuclear Plant Forebay in 2002

Date	Density (No./m3)	Size Range (*u*m)	Mean Size (*u*m)
4-25-02	775	90-120	94
5-9-02	2700	90-130	107
5-23-02	6500	90-200	133
6-6-02	3825	90-160	111
6-13-02	3200	90-200	119
6-20-02	9225	90-300	122
6-27-02	13975	90-300	110
7-4-02	2600	90-200	130
7-11-02	8725	90-260	123
7-18-02	18725	100-300	146
7-25-02	28775	80-330	100
8-1-02	36775	100-300	139
8-8-02	24650	90-360	134
8-15-02	77100	90-260	145
8-22-02	65525	90-260	147
8-29-02	11725	90-300	162
9-5-02	107975	100-330	174
9-12-02	26900	90-360	148
9-19-02	58325	100-300	211
9-26-02	40700	100-360	211
10-3-02	84175	100-330	194
10-10-02	21025	100-430	193
10-17-02	26025	100-360	173
10-24-02	29225	100-300	190
10-31-02	8600	100-500	185
11-7-02	10275	90-360	185
11-14-02	8975	100-330	172
11-21-02	4125	100-400	177
11-26-02	5275	90-460	187
12-12-02	550	130-430	235

FIGURE 3-1



C02

Secondary peaks in 2002 were recorded on 15 August (77,100ind. /m^3), 22 August (65,525ind. /m^3), and 3 October (84,175ind. /m^3). The 2002's secondary peak densities were over two times less than 2001's secondary peaks. Overall, 2002 recorded the lowest whole-water densities since 1995. On 29 August (11,725ind. /m^3), an unusually low whole-water density was observed for the time of the sampling season. This corresponds with an unusually low water temperature observed in the lake of 56.5 degrees Fahrenheit. Water temperatures running in the fifties are less conducive to zebra mussel spawning and unusual for this time of the year.

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

Heaviest spawning activity occurred during mid-August through the beginning of October. Year 2002 densities were the lowest recorded since 1995. Year 2001 mean veliger densities were higher than year 2000 densities, which were higher than 1999 densities. Year 1999 veliger densities were almost three times higher than in 1998. In 1997, mean densities were twice as high as in 1999. The mean densities in 1993, 1994, 1995 and 1996 were all lower than in 1999.

In 1993, 1995 and 1996, peak densities were recorded during mid-September to the end of October. In June of 1994, due to unusually hot weather, an early peak occurred. Prior to 1997, peak periods of abundance typically occurred in mid-September. In 1997 through 2002, peaks occurred six to eight weeks earlier than the typical mid-September period for this region. After examining these varying results in peak abundances, we can conclude that there is not a good way to determine precisely when the peak abundance will occur each season, other than estimating

some time between July and October. Due to the extended shut down of both units during previous years' sampling, data comparisons each year should be kept in consideration.

Whole-water densities recorded during 1993 through 1995 for the November and December sampling periods were less than 1,000ind. /m^3 for sampling conducted after 3 November. During the 1996 through 2000 as well as 2002 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, therefore whole-water densities observed in November were less than 2,000 ind. /m^3. However, because of the late fall spawning in previous years, as well as this year, 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 25 April through 12 December. Spawning commenced in April and continued through the end of the sampling program. Peak veliger densities occurred during an 8-week period from mid-August to the beginning of October.

3.2 Artificial Substrate Sampling

3.2.1 Circulating Water System

Cumulative artificial substrate monitoring was conducted at the center forebay location (which is protected by a deflector wall) from 23 May to 12 December. Cumulative settlement densities for the forebay are shown in Figure 3-2. Table 3-2 provides density and size information for the settled postveligers. The results show the highest peak in the forebay's density to occur in

FIGURE 3-2

2002 D.C. Cook Plant- Number of Zebra Mussels Settled on Cumulative Substrate Samplers in the Intake Forebay

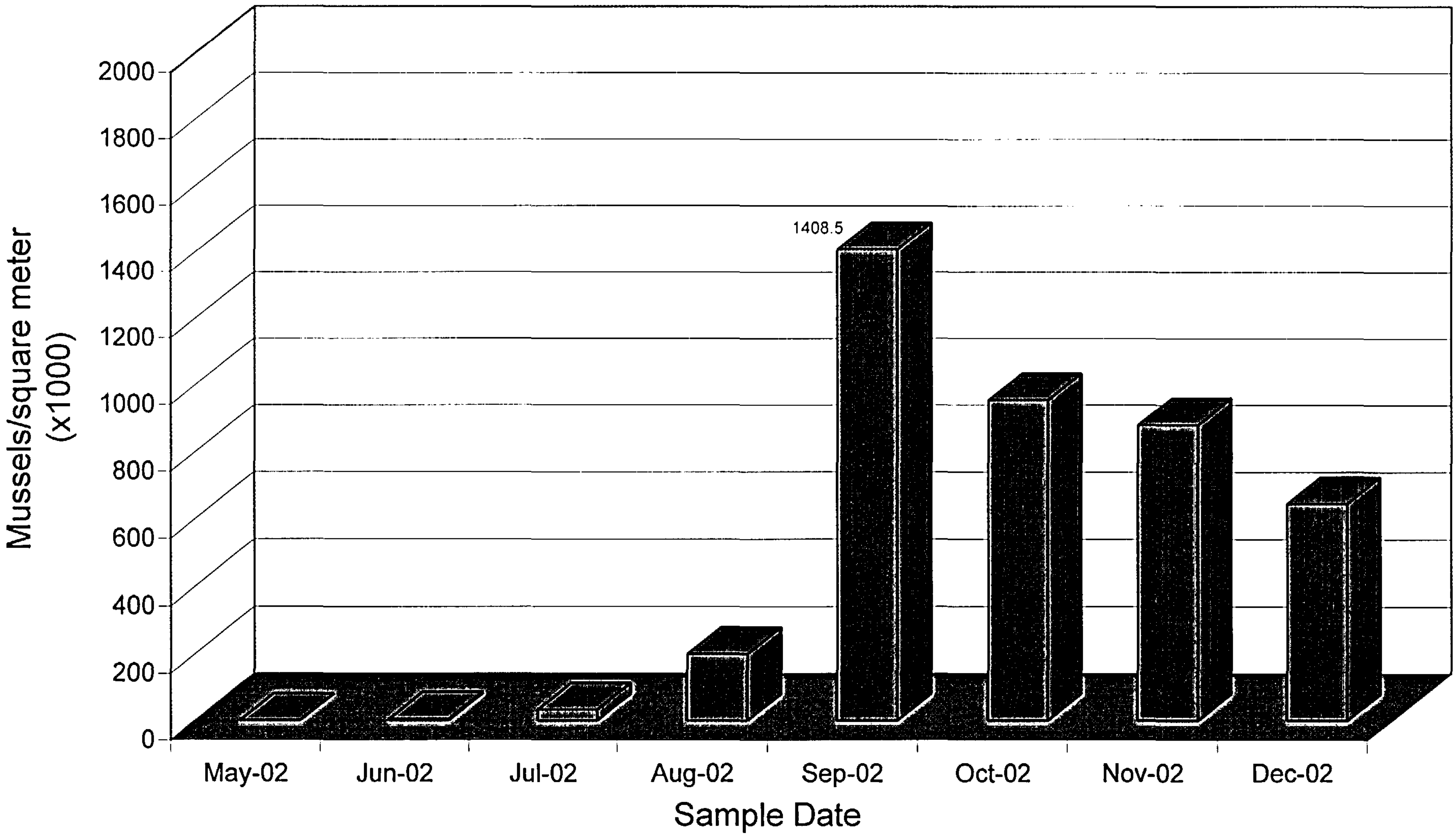


Table 3-2

Density (No./m2), Average Size (um), and Size Range (um), 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 2002.

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)
5/23/02	533	1018	230-1620	160	850	730-990	320	290	200-430	107	795	760-830	0	0	0
6/20/02	4587	960	300-4360	53	1060	1060	53	230	230	213	1558	660-2400	160	487	200-1060
7/25/02	31840	671	260-2970	0	0	0	53	200	200	267	930	230-3570	107	230	230
8/22/02	198613	635	230-7620	800	223	160-300	1120	224	160-400	160	230	200-260	373	267	200-360
9/19/02	1408533	936	230-14190	17866	248	200-360	40000	203	130-300	4267	260	200-400	427	254	230-300
10/17/02	954607	1338	260-17490	213	245	230-260	959	254	200-300	533	287	230-400	267	276	260-300
11/14/02	880267	1227	230-16400	3467	325	230-530	640	277	160-360	1280	288	200-600	747	284	230-330
12/12/02	645120	1776	260-17000	800	353	230-430	296	318	200-500	213	430	300-660	107	330	260-400

September (1,408,533 ind./m^2). This followed two weeks after the peak whole water density was observed. In October, the forebay density slightly decreased as well as in November and December. Overall, forebay settlement densities were lower in 2002 compared to last year. This would be expected since the whole-water densities in 2002 were lower.

The mean sizes of the settled postveligers found in the forebay increased monthly from 9 August through 13 December with the exception of November where a slight decrease is observed. Figure 3-2 and Table 3-2 show that the sizes of the settled postveligers continued to increase and the densities continued to remain high throughout the sampling season. This indicates new postveligers continued to settle on the forebay slides throughout the season which is characteristic from previous years and could be expected because of whole-water activity observed into December. Once again, this demonstrates the need to chlorinate the service water systems through the end of the sampling season.

In past years' studies, biocide treatments had been applied to the intake tunnels thus treating the intake forebay, service water systems and the MSCW system downstream. Decreases in settlement were noted in these areas after the treatments. In 2000, the applications of BetzDearborn Spectrus CT 1300 biocide and EVAC targeted the intake pipelines individually. In 2002, no biocide treatments were performed at the D.C. Cook Nuclear Plant.

Cumulative settlement was also monitored in the forebay using two six-inch PVC pipes with 3.5 inch inside diameters. One PVC pipe was set in the forebay on 14 June of 2001 and examined on 20 June 2002. This allowed us to determine the average density and size range for the 12 months. The density on the substrate was 420,050 ind./m^2. Individuals ranged from 1,200*u*-17,000*u* (1.2mm-17mm) and the mean size of fifty randomly selected individuals was 4,450*u* (4.5mm). This 12-month density is lower than previous years' 6-month densities. This is a reasonable

finding since the whole-water densities were the lowest since 1995. The second PVC pipe was set 13 December 2001 and retrieved 20 June 2002. The 6-month density on the substrate was 52,700 ind./m^2. Individuals ranged from 750*u*-5,900*u* (.75mm-5.9mm) and the mean size of fifty randomly selected individuals was 2030*u* (2.0mm). The low density is a reasonable finding because the zebra mussels become less conducive to spawning as the water becomes colder.

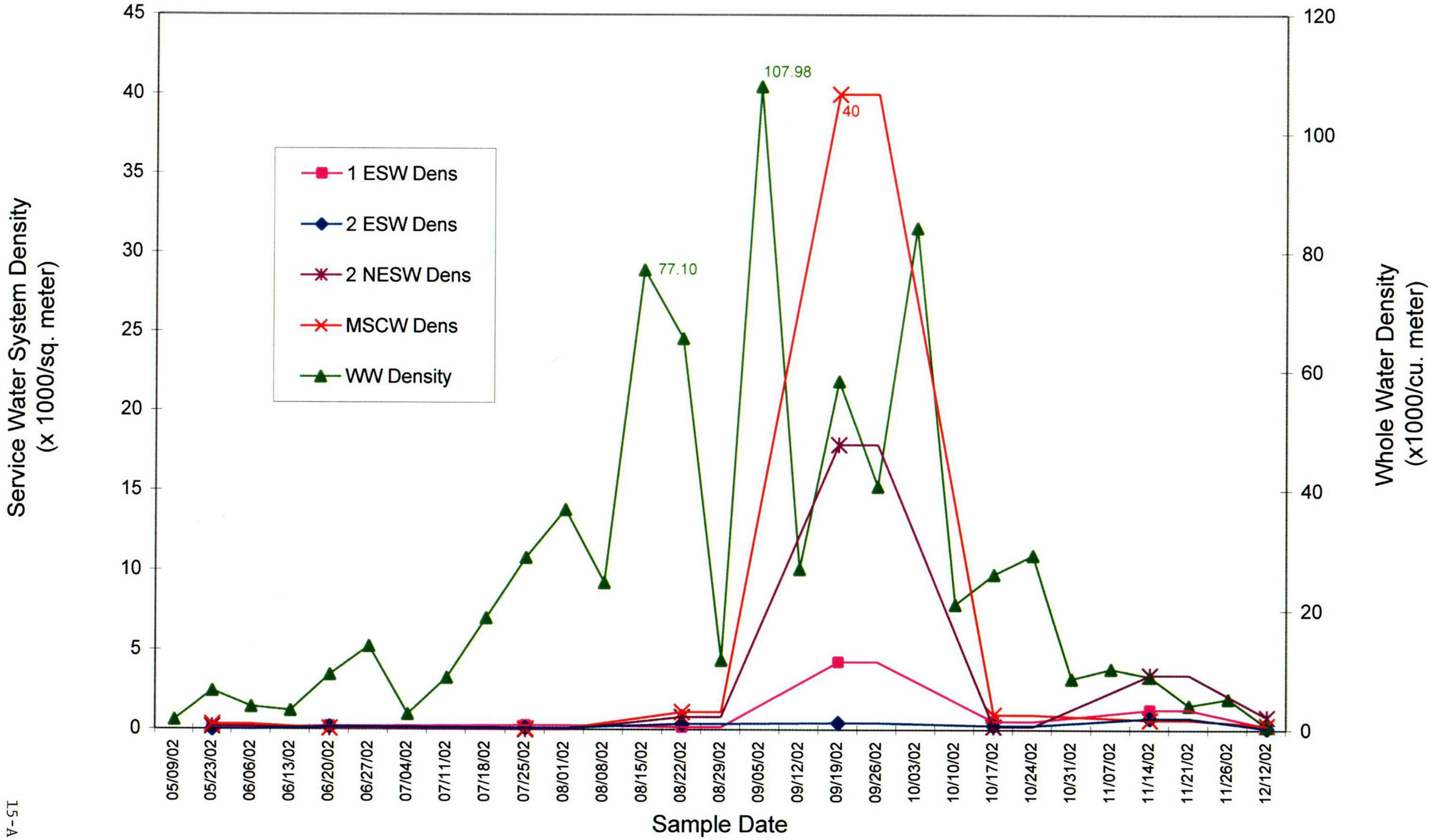
3.2.2 Service Water Systems and Miscellaneous Sealing and Cooling Water System

The return sides (after systems use) of the ESW and NESW systems and the MSCW system were monitored in the 2002 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 was done on a monthly basis in 2002.

Artificial substrate slides were set on 25 April and ten slides per month were examined and not replaced. Results are shown in Figure 3-3 in Table 3-2. The data indicates that the chlorination system was effective in preventing growth and prolonged settlement of postveligers in the service water systems. The highest settlement in all of the service water systems with the exception of 2ESW was seen in September. Referring to Table 3-2, peak settlement densities are observed on 19 September in 1 ESW, MSCW and NESW systems (4,267 in. /m^2, 40,000 in. /m^2 and 17,866 ind. /m^2 respectively). These densities were observed two weeks following the peak whole water density on 5 September. Due to a broken NESW chlorine injection quill, chlorination was not being administered on 18 September for approximately 10 hours prior to the time of sampling, which explains the peak settlements in MSCW and NESW. The high settlement indicates quick postveliger settlement when chlorination is not being administered and also demonstrates the

FIGURE 3-3

2002 D.C. Cook Plant- Whole-Water Zebra Mussel Veliger Density and Zebra Mussel Postveliger Cumulative Settlement in the Service Water Systems



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need for continuous chlorination to prevent settlement from occurring. The peak 2ESW density was observed on 14 November (747 ind. /m^2). Smaller peaks in the NESW and 1ESW systems were also observed on 14 November (3,467 ind. /m^2 and 1,280 ind. /m^2). The lower December densities demonstrate the effectiveness of chlorination when it is properly administered and warrants the need for chlorination during the peak-settling season.

Mean sizes in all of the service water systems showed that the settlement of postveligers had some steady growth from November through December although densities decreased. The decrease in density can be attributed to the chlorination system coupled with the cold-water temperatures observed in Nov and Dec.

Comparison of daily water temperatures recorded in the DMRs for the months of October, November and the first half of December for 1993 through 2002 indicate that October's mean temperatures are conducive to zebra mussel spawning (see chart below). The November and December 2002 recorded average temperatures were less conducive to spawning as the whole-water densities indicate.

Mean Intake Water Temperatures (°F)

Year	October	November	December (1-15)
1993	58.3	49.0	44.6
1994	56.2	48.1	43.4
1995	57.6	45.8	38.8
1996	61.6	48.9	42.2
1997	58.8	46.3	39.1
1998	57.0	49.0	47.9
1999	57.1	50.4	45.1
2000	56.9	47.6	37.7
2001	58.1	54.6	51.7
2002	63.0	50.6	42.3

In summary, density and size data collected during 2002 in the service water systems and in the miscellaneous sealing and cooling system sampling locations indicate low settlement throughout the sampling season with the exception of September and November. The 19 September peak settlement densities followed two weeks after the 5 September peak whole water density. Overall, compared to previous years' studies, the densities found in the service water systems in 2002 were slightly higher. This could be attributed to the lower chlorination target range used in 2002. However, data indicates that prolonged settlement in the service water systems does not occur when chlorination is running which is illustrated by 2002's data.

3.2.3 Biocide Treatment

There was no biocide treatment performed during the 2002 sampling season.

3.2.4 Quality Assurance/Quality Control Samples

The results of the samples, analyzed on 14 November, by Grand Analysis, and on 15 November, by an independent analyzer, are summarized as follows:

	Grand Analysis	**Independent**	
Sample	Onsite Density	QA/QC Density	% Agreement
Whole-water	8,975 ind./m3	9,800 ind./m3	92%
1ESW	1,280 ind./m^2	1,280 ind./m^2	100%
2 ESW	747 ind./m^2	747 ind./m^2	100%
NESW	3,467 ind./m^2	3,467 ind./m^2	100%
MSCW	640 ind./m^2	640 ind./m^2	100%

Chapter 4

Summary and Recommendations

4.1 Summary

The 2002 Mollusc Biofouling Monitoring Program was initiated on 25 April and continued to 12 December. The major spawning peak occurred on 5 September. The heaviest spawning period ran from 15 August through 3 October. The whole-water densities in this year's study were the lowest observed since 1995.

Cumulative settlement in the forebay began slowly in May and in June. In September, two weeks following the peak whole-water density (107,975 ind. /m^3) of the sampling season, the peak forebay density (1,408,533 ind. /m^2) of the season was observed. Forebay densities remained high throughout the season although a decrease was seen from October through December. Mean sizes of settled postveligers increased from August through December. Based on mean sizes, translocators were seen from August through December.

Peak cumulative settlement densities occurred in September in the NESW, 1 ESW, and the MSCW systems. These densities correspond with a peak period of spawning measured in the whole-water samples. Secondary peak settlement occurred in November in NESW, 1 ESW and 2 ESW. The December densities show a decrease in all the water systems, which illustrate the effectiveness as well as the importance of continuous chlorination on settlement rates.

4.2 Recommendations

Based on observations made during the course this program, Grand Analysis is making the following recommendations:

- Whole-Water sampling should continue to be initiated in April to determine the presence of veligers in the water column, as currently implemented.
- 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.
- 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.
- Chlorination target rates (TRC) should run 0.2-0.5 ppm unless monthly settlement densities increase. If increases are observed, a target rate of 0.3-0.6 ppm should be resumed.
- Forebay artificial substrate slides should be eliminated from the study due to the difficulty to accurately record the densities because of the heavy infestation as well as the inaccurate conditions found in the slide racks and cages. Instead, PVC piping should be used and analyzed monthly. PVC piping more clearly indicates the conditions found in the forebay.
- PVC piping should also be used as an artificial substrate as a visual aid showing what is actually settled in the forebay before and after cleaning or before and after chemical treatments. The PVC pipes can be conveniently pulled and examined anytime throughout the year.

References

Lawler, Matusky, & Skelly Engineers LLP. 1999. Mollusc biofouling monitoring during 1998, Donald C. Cook Nuclear Plant: Final Report.

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Grand Analysis. 2000. Mollusc Biofouling Monitoring Project for 2000. Performed at Donald C. Cook Nuclear Plant. Final Report.

Grand Analysis. 2001. Mollusc Boifouling Monitoring Program for 2001. Performed at Donald C. Cook Nuclear Plant. Final Report.

Appendix Table 1

Chlorination Values for 2002 Zebra Mussel Monitoring Program

Date	ESW 1 (ppm)	ESW 2 (ppm)	NESW 1 (ppm)	NESW 2 (ppm)	Comments
4/25/02	nc	nc	nc	nc	
4/26/02	nc	nc	nc	nc	
4/27/02	nc	nc	nc	nc	
4/28/02	nc	nc	nc	nc	
4/29/02	nc	nc	nc	nc	
4/30/02	nc	nc	nc	nc	
5/1/02	nc	nc	nc	nc	
5/2/02	nc	nc	nc	nc	
5/3/02	nc	nc	nc	nc	
5/4/02	nc	nc	nc	nc	
5/5/02	nc	nc	nc	nc	
5/6/02	nc	nc	nc	nc	
5/7/02	nc	nc	nc	nc	
5/8/02	nc	nc	nc	nc	
5/9/02	nc	nc	nc	nc	
5/10/02	nc	nc	nc	nc	
5/11/02	nc	nc	nc	nc	
5/12/02	nc	nc	nc	nc	
5/13/02	nc	nc	nc	nc	
5/14/02	nc	nc	nc	nc	
5/15/02	nd	nd	nd	nd	chlorination started
5/16/02	nd	nd	nd	nd	
5/17/02	nd	nd	nd	nd	
5/18/02	nd	nd	nd	nd	
5/19/02	nd	nd	nd	nd	
5/20/02	nd	nd	nd	nd	
5/21/02	nd	nd	nd	nd	
5/22/02	0.15	<.08	nd	0.35	
5/23/02	0.09	0.09	nd	0.46	
5/24/02	0.13	0.1	nd	0.65	
5/25/02	<.08	0.1	nd	0.49	
5/26/02	nd	nd	nd	nd	
5/27/02	0.08	<.08	nd	0.24	
5/28/02	nd	nd	nd	nd	
5/29/02	0.11	0.12	psc	0.19	
5/30/02	0.14	0.14	0.71	0.38	
5/31/02	nd	nd	nd	nd	
6/1/02	nd	nd	nd	nd	
6/2/02	nd	nd	nd	nd	
6/3/02	0.11	0.13	nd	0.15	
6/4/02	0.16	0.18	0.47	0.31	
6/5/02	0.18	0.18	0.45	0.34	
6/6/02	nd	nd	nd	nd	
6/7/02	nd	nd	nd	nd	
6/8/02	nd	nd	nd	nd	
6/9/02	nd	nd	nd	nd	
6/10/02	nd	nd	nd	nd	
6/11/02	<.08	<.08	0.46	0.21	

Appendix Table 1

Chlorination Values for 2002 Zebra Mussel Monitoring Program

Date	ESW 1 (ppm)	ESW 2 (ppm)	NESW 1 (ppm)	NESW 2 (ppm)	Comments
6/12/02	nd	nd	nd	nd	
6/13/02	nd	nd	nd	nd	
6/14/02	nd	nd	nd	nd	
6/15/02	nd	nd	nd	nd	
6/16/02	nd	nd	nd	nd	
6/17/02	nd	nd	nd	nd	
6/18/02	<.08	<.08	nd	nd	
6/19/02	nd	nd	0.58	psc	
6/20/02	nd	nd	nd	nd	
6/21/02	nd	nd	nd	nd	
6/22/02	nd	nd	nd	nd	
6/23/02	nd	nd	nd	nd	
6/24/02	nd	nd	nd	nd	
6/25/02	<.08	<.08	psc	0.2	
6/26/02	nd	nd	nd	nd	
6/27/02	nd	nd	nd	nd	
6/28/02	nd	nd	nd	nd	
6/29/02	nd	nd	nd	nd	
6/30/02	nd	nd	nd	nd	
7/1/02	nd	nd	nd	nd	
7/2/02	<.08	<.08	0.52	0.25	
7/3/02	nd	nd	nd	nd	
7/4/02	nd	nd	nd	nd	
7/5/02	nd	nd	nd	nd	
7/6/02	nd	nd	nd	nd	
7/7/02	nd	nd	nd	nd	
7/8/02	<.08	0.08	nd	0.32	
7/9/02	<.08	<.08	0.49	0.33	
7/10/02	nd	nd	nd	nd	
7/11/02	nd	nd	nd	nd	
7/12/02	nd	nd	nd	nd	
7/13/02	nd	nd	nd	nd	
7/14/02	nd	nd	nd	nd	
7/15/02	nd	nd	nd	nd	
7/16/02	0.18	0.18	nd	0.33	
7/17/02	nd	nd	nd	nd	
7/18/02	nd	nd	nd	nd	
7/19/02	nd	nd	nd	nd	
7/20/02	nd	nd	nd	nd	
7/21/02	nd	nd	nd	nd	
7/22/02	nd	nd	nd	nd	
7/23/02	0.11	<.08	nd	0.2	
7/24/02	nd	nd	psc	nd	
7/25/02	nd	nd	nd	nd	
7/26/02	nd	nd	nd	nd	
7/27/02	nd	nd	nd	nd	
7/28/02	nd	nd	nd	nd	
7/29/02	nc	nc	nc	nc	no chlorination

Appendix Table 1

Chlorination Values for 2002 Zebra Mussel Monitoring Program

Date	ESW 1 (ppm)	ESW 2 (ppm)	NESW 1 (ppm)	NESW 2 (ppm)	Comments
7/30/02	nc	nc	nc	nc	no chlorination
7/31/02	nc	nc	nc	nc	"
8/1/02	nc	nc	nc	nc	"
8/2/02	nd	nd	nd	nd	
8/3/02	nd	nd	nd	nd	
8/4/02	nd	nd	nd	nd	
8/5/02	nd	nd	nd	nd	
8/6/02	0.23	0.23	psc	<.08	
8/7/02	nd	nd	nd	nd	
8/8/02	nd	nd	nd	nd	
8/9/02	nd	nd	nd	nd	
8/10/02	nd	nd	nd	nd	
8/11/02	nd	nd	nd	nd	
8/12/02	nd	nd	nd	nd	
8/13/02	0.1	0.09	psc	<.08	
8/14/02	nd	nd	nd	nd	
8/15/02	nd	nd	nd	nd	
8/16/02	nd	nd	nd	nd	
8/17/02	nd	nd	nd	nd	
8/18/02	nd	nd	nd	nd	
8/19/02	nd	nd	nd	nd	
8/20/02	psc	<.08	psc	psc	
8/21/02	nd	nd	nd	nd	
8/22/02	nd	nd	nd	nd	
8/23/02	nd	nd	nd	nd	
8/24/02	nd	nd	nd	nd	
8/25/02	nd	nd	nd	nd	
8/26/02	nd	nd	nd	nd	
8/27/02	nd	nd	nd	nd	
8/28/02	0.1	0.09	psc	psc	
8/29/02	nd	nd	nd	nd	
8/30/02	nd	nd	nd	nd	
8/31/02	nd	nd	nd	nd	
9/1/02	nd	nd	nd	nd	
9/2/02	nd	nd	nd	nd	
9/3/02	0.13	0.12	psc	nd	
9/4/02	nd	nd	nd	nd	
9/5/02	nd	nd	nd	nd	
9/6/02	nd	nd	nd	nd	
9/7/02	nd	nd	0.2	0.1	
9/8/02	nd	nd	0.35	0.12	
9/9/02	nd	nd	nd	nd	
9/10/02	<.08	<.08	nd	nd	
9/11/02	0.49	0.5	0.45	0.25	
9/12/02	nd	nd	nd	nd	
9/13/02	nd	nd	nd	nd	
9/14/02	nd	nd	nd	nd	
9/15/02	nd	nd	nd	nd	

Appendix Table 1

Chlorination Values for 2002 Zebra Mussel Monitoring Program

Date	ESW 1 (ppm)	ESW 2 (ppm)	NESW 1 (ppm)	NESW 2 (ppm)	Comments
9/16/02	nd	nd	nc	nc	
9/17/02	0.3	0.3	0.13	psc	
9/18/02	nd	nd	0.75	<.08	
9/19/02	nd	nd	nd	nc	
9/20/02	nd	nd	nd	nd	
9/21/02	nd	nd	nd	nd	
9/22/02	nd	nd	nd	nd	
9/23/02	nd	nd	nd	nd	
9/24/02	<.08	0.08	0.3	<.08	
9/25/02	nd	nd	nd	nd	
9/26/02	nd	nd	nd	nd	
9/27/02	nd	nd	nd	nd	
9/28/02	nd	nd	nd	nd	
9/29/02	nd	nd	nd	nd	
9/30/02	nd	nd	nd	nd	
10/1/02	0.1	0.09	0.25	0.1	
10/2/02	0.13	0.21	0.39	0.5	
10/3/02	nd	nd	nd	nd	
10/4/02	nd	nd	nd	nd	
10/5/02	nd	nd	nd	nd	
10/6/02	nd	nd	nd	nd	
10/7/02	nd	nd	nd	nd	
10/8/02	0.15	0.14	0.74	0.29	
10/9/02	0.2	0.22	nd	nd	
10/10/02	nd	nd	nd	nd	
10/11/02	nd	nd	nd	nd	
10/12/02	nd	nd	nd	nd	
10/13/02	nd	nd	nd	nd	
10/14/02	nd	nd	nd	nd	
10/15/02	0.1	0.11	0.83	0.24	
10/16/02	nd	nd	nd	nd	
10/17/02	nd	nd	nd	nd	
10/18/02	nd	nd	nd	nd	
10/19/02	nd	nd	nd	nd	
10/20/02	nd	nd	nd	nd	
10/21/02	nd	nd	0.61	0.2	
10/22/02	nd	nd	nd	nd	
10/23/02	0.31	0.25	0.89	0.28	
10/24/02	nd	nd	nd	nd	
10/25/02	nd	nd	nd	nd	
10/26/02	nd	nd	nd	nd	
10/27/02	nd	nd	nd	nd	
10/28/02	nd	nd	nd	nd	
10/29/02	0.49	0.45	nd	nd	
10/30/02	nd	nd	psc	psc	
10/31/02	nd	nd	nd	nd	
11/1/02	nd	nd	nd	nd	

Appendix Table 1

Chlorination Values for 2002 Zebra Mussel Monitoring Program

Date	ESW 1 (ppm)	ESW 2 (ppm)	NESW 1 (ppm)	NESW 2 (ppm)	Comments
11/2/02	nd	nd	nd	nd	
11/3/02	nd	nd	nd	nd	
11/4/02	nd	nd	nd	nd	
11/5/02	nd	nd	nd	nd	
11/6/02	nd	nd	nd	nd	
11/7/02	nd	nd	nd	nd	
11/8/02	<.08	<.08	0.83	0.23	
11/9/02	nd	nd	nd	nd	
11/10/02	<.08	<.08	0.57	0.3	
11/11/02	<.08	<.08	0.66	0.3	
11/12/02	0.5	0.4	0.55	0.31	
11/13/02	nd	nd	nd	nd	
11/14/02	nd	nd	nd	nd	
11/15/02	nd	<.08	nd	0.37	
11/16/02	nd	nd	nd	nd	
11/17/02	nc	nc	nc	nc	no chlorination
11/18/02	nc	nc	nc	nc	"
11/19/02	nc	nc	nc	nc	"
11/20/02	nc	nc	nc	nc	"
11/21/02	nc	nc	nc	nc	"
11/22/02	nd	nd	nd	nd	
11/23/02	<.08	<.08	<.08	0.12	
11/24/02	<.08	<.08	0.29	0.22	
11/25/02	nd	nd	nd	nd	
11/26/02	<.08	<.08	0.49	psc	
11/27/02	<.08	<.08	nd	nd	
11/28/02	nd	nd	nd	nd	
11/29/02	nd	nd	nd	nd	
11/30/02	nd	nd	nd	nd	
12/1/02	nd	nd	nd	nd	
12/2/02	nd	nd	nd	nd	
12/3/02	nd	nd	0.5	psc	
12/4/02	nd	nd	nd	nd	
12/5/02	0.13	0.13	nd	nd	
12/6/02	nd	nd	nd	nd	
12/7/02	nd	nd	0.62	0.29	
12/8/02	nd	nd	nd	nd	
12/9/02	0.16	0.15	nd	nd	
12/10/02	0.24	0.23	0.49	0.35	
12/11/02	nd	nd	nd	nd	
12/12/02	nd	nd	nd	nd	

APPENDIX IV

SPECIAL REPORTS

2002

(NONE)