ER REFERENCES TO BE DOCKETED

ATTACHMENT 11

0007352801

WC-AA-120-F-01
Revision 0
Page 1 of 1

PM WO Disposition Sheet
(APPLICABLE TO MID-WEST SITES ONLY)
Page 1 of 1

Unit: CO Procedure: N/A
PMID/RQ: 73528-01 Work Order #: N/A
PMID/RQ Title: Zebra Mussel Status Report
PMID/RQ Due Date: 3/25/14 PMID/RQ Late Date: 6/24/14

Signature/Authorization Approval Review:	**Name**	**Date**	**Time**
Shift Authorization to Start Work:	N/A	~~N/A~~	N/A
Work Started	Jill Bendis	3/19/14	12:00
Work Stopped:	Jill Bendis	3/19/14	12:30
Supv Review of Work Completion:	[signature]	3/19/14	1319
ANI Review of work package:			

PM Found Within Acceptance Criteria (YES) NO
PM Left Within Acceptance Criteria (YES) NO

Describe Preventative Maintenance (PM) Frequency Improvements (Circle One): (A) Consider Performing The PM Task(s) Less Frequently; (C) PM Task(s) Frequency Is Adequate; (D) Consider Performing The PM Task(s) More Frequently; (F) PM Does Not Exist Or Has Failed; (N) N/A

("Work Started" date (above shall be the credit date unless otherwise explained)
Complete one of the following:

Verify Credit Date Below: JB
3/19/14

Credit PM per another WO# _____
If crediting 'per another WO', verify credit date is 'Work Started' date of referenced WO.

- [x] Complete Sat – Credit PM
- [ ] Complete w/ Portions Unsat – Credit PM
- [ ] No Work Performed – Credit PM
- [ ] Partial PM Performance – Do Not Credit PM (PM Due/Late Dates will NOT advance)
- [ ] Failed – Do Not Credit (PM Due/Late Dates will NOT advance)
- [ ] No Work Performed – Do Not Credit (PM Due/Late Dates will NOT advance)
- [ ] Comments _____

ADDITIONAL REVIEW OF RESULTS (IF REQUIRED)

Title	Signature	Date

ZEBRA MUSSEL MONITORING PROGRAM
At LaSalle Nuclear Station, 2013

Prepared for

EXELON NUCLEAR
Warrenville, Illinois

HDR Engineering, Inc.
Environmental Science & Engineering Consultants
10207 Lucas Road, Woodstock, Illinois 60098

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1.0 INTRODUCTION

Exelon Nuclear has sponsored a zebra mussel (*Dreissena. polymorpha*) monitoring program since 1990 (ZEI 2003, LMS 2004-2005, HDR/LMS 2006-2007, HDR Engineering, Inc. 2008-2012). Stations electing to continue monitoring in 2013 include Braidwood Station, Byron Station, and LaSalle Station. Since the monitoring program began in 1990, zebra mussel colonization has occurred at all three of these stations, to varying degrees.

The principal objectives of these monitoring efforts at LaSalle are to:

- Detect the presence and densities of zebra mussels at the intake structures and source water bodies.
- Evaluate year-to-year changes in the zebra mussel populations, including settlement densities.
- Provide a basis for examining possible effects of zebra mussels on Station operations.

2.0 METHODS

2.1 ARTIFICIAL SUBSTRATE SAMPLING

To determine zebra mussel settlement densities, artificial substrates were placed in front of the LaSalle Station river intake in the Illinois River. Three arrays of artificial substrate samplers were placed, which included two Type A substrates and one Type B substrate.

Type A substrates consisted of two pieces of PVC pipe that were 15 cm (6 in.) long and had an inside diameter of 5.08 cm (2 in.) and an outside diameter of 6.08 cm (2.39 in.). Each pipe was cut in half lengthwise and rejoined using hose clamps. The PVC substrates were deployed by cable from the railing above the intake in a central location. Concrete blocks were used to anchor each sampling array to the bottom of the intake. One cumulative substrate sampler and one monthly (periodic) array was deployed at each sampling location. The PVC substrates were attached to the cable approximately 0.5 and 1.5 meters below the surface of the water, respectively. Artificial substrates were installed in front of the intake on 10 April. Retrieval of Type A substrates occurred on a monthly basis and consisted of gently removing the series of PVC pipes from the water and placing each individual sample into a labeled container containing a solution of 40% isopropyl alcohol. New PVC substrates were then placed on the monthly array and returned to their original positions in the water column. Cumulative substrates remained in the water from 10 April to 6 November.

Type B substrate arrays consist of a microscope slide rack (Dura-Sampler) attached in the same manner as the PVC Type A arrays. Retrieval of Type B substrates occurred on a monthly basis and required gently removing the microscope slide samplers from the water and placing eight glass slides from each sampler into an appropriately labeled container containing 40% isopropyl alcohol. New glass slides were then installed into the slide samplers and returned to their original location. PVC and glass were chosen as principle substrates because it has been shown that PVC is a preferred substrate (Walz 1975), while glass slides allow for a standard measurement of settlement densities and examination under a low powered binocular microscope (Marsden 1992).

Two Type A and one Type B sample arrays were placed within the LaSalle Station Cooling Lake on 10 April. Substrates were set at depths of 1.0, 3.0 and 5.0 meters on a cable suspended between a surface float and a concrete anchor. Both cumulative and monthly substrates were set. Monthly retrieval of Type A and Type B substrates was conducted as described above. Sampling

was concluded on 6 November with the removal of all the substrates from the LaSalle Station intake and cooling lake. Monitoring was designed to provide information on accumulated infestation and growth of settled zebra mussels throughout the growing season.

Settlement was determined by scraping the inside and outside of both halves of each PVC pipe sampler. The area of the substrate that was sampled was calculated by first finding the inside and outside circumferences of the PVC pipe.

$$c = \pi d$$

Where:

c = circumference of a circle

$\pi = 3.14$

d = diameter of a circle

The total area of PVC pipe that was sampled was calculated by summing the total area sampled inside of the PVC pipe plus the total area sampled outside of the PVC pipe. The inside and outside area of the PVC pipe was calculated using the following equation:

$$A = c \times l$$

Where:

A = area sampled

c = circumference of a circle

l = length of the PVC pipe

The number of mussels found was then converted from number per square inch to the conventional number per square meter. Shell lengths (measured along the longest axis) were also measured for up to 50 individuals to obtain maximum, minimum, and mean sizes for each substrate. Shells less than 1.0 mm in length were measured to the nearest 25 microns using an ocular micrometer that was calibrated to a stage micrometer. Shells greater than 1.0 mm in length were measured to the nearest half-millimeter using a standard metric ruler.

2.3 WATER QUALITY MEASUREMENTS

Four physicochemical parameters (temperature, dissolved oxygen, pH and conductivity) were measured in conjunction with the sampling program. These data were collected at each location prior to each sampling effort. All physicochemical measurements were made at one meter below the surface of the water. Temperature (°C), dissolved oxygen (ppm), and conductivity (µmhos) were measured using either a YSI Model 85 Oxygen, Conductivity, Temperature, and Salinity meter, a YSI Model 30 Temperature and Conductivity meter, or a YSI Model 55 Temperature and Dissolved Oxygen meter. An Oakton WP pH Tester1 was used to determine pH.

Temperature monitors (Onset HOBO Pro V2 Temp Loggers) were attached at mid-depth to the cumulative and monthly substrates to record hourly changes in temperature throughout the entire sampling period. Periodic temperature data was downloaded on a monthly basis, while cumulative temperature recordings were monitored by a separate logger from 10 April through 6 November.

3.0 RESULTS AND DISCUSSION

3.1 ARTIFICIAL SUBSTRATE SAMPLING

3.1.1 Intake Substrates

Two zebra mussels were collected on the monthly substrates from the LaSalle Station river intake. One juvenile mussel which measured 5.0 mm was collected in August, and another measuring 2.0 mm was collected in September. Each mussel represents a settlement density of 18/m^2 (Table 3-1). Analysis of the surface cumulative substrate (0.5 m) revealed heavy filamentous algae and bryozoans colonies covering the outside of the substrate. The inside of the pipe contained numerous caddis fly larvae and bryozoan colonies. The bottom cumulative substrate (1.5 m) was also covered both inside and outside with caddis fly larvae, bryozoans, eight adult zebra mussels and one juvenile zebra mussel (Table 3-1). All zebra mussels were located on the inside of the pipe. These mussels measured from 4.5 mm to 21.5 mm, and averaged 13.9 mm. The calculated settlement density on the inside of the pipe was 370/m^2. Because no mussels were found on the outside of the pipe, the calculated density for the bottom (1.5 m) artificial substrate location was 168/m^2. Most of these individuals represent adult zebra mussels that translocated from adjacent habitats. As a cursory note, eleven adult zebra mussels were also removed from the cumulative temperature monitor assembly.

3.1.2. Cooling Lake Substrates

No zebra mussels were collected on the monthly substrates from the LaSalle Station Cooling Lake throughout the seven month sampling period (Table 3-2). Cumulative substrates were 90-100% covered with bryozoan colonies. All depths sampled (1.0, 3.0, 5.0 m) were observed to have a similar degree of colonization.

3.2 WATER QUALITY MEASUREMENTS

Physicochemical parameters (temperature, dissolved oxygen, pH and conductivity) were measured in conjunction with the sampling program are presented in Tables 3-1 and 3-2. Water quality measurements were taken during each of the sampling dates at the LaSalle Station intake and cooling water lake.

Table 3-1. Water Quality Parameters and Mean Zebra Mussel Densities Collected Monthly During the 2013 Sampling Effort at LaSalle Intake.

		Water Quality						Juveniles		Adults	
Date	Days/ Sample	Time	Temp. (°C)	DO (ppm)	pH	Cond. (µmhos)	Sample Depth	Glass	PVC	Glass	PVC
04/10/13		08:20	13.6	10.3	7.9	762					
05/01/13	21	08:45	16.4	8.37	8.1	636		-	-	-	-
06/05/13	35	08:55	19.1	7.01	7.6	505		-	-	-	-
07/16/13	41	09:00	29.5	7.25	8.0	743		-	-	-	-
08/14/13	29	13:30	28.4	9.81	8.2	770		-	-	-	-
09/10/13	25	08:45	27.8	8.76	8.0	875	1.5m	-	1@5mm	-	-
10/09/13	29	08:55	20.7	9.3	7.6	755	1.5m	-	1@2mm	-	-
11/06/13	28	09:10	12.4	10.1	8.2	534		-	-	-	-
cumulative							1.5m		1@4.5mm		8 ave. 13.9mm

Table 3-2. Water Quality Parameters and Mean Zebra Mussel Densities Collected Monthly During the 2013 Sampling Effort at LaSalle Cooling Lake.

		Water Quality						Juveniles		Adults	
Date	Days/ Sample	Time	Temp. (°C)	DO (ppm)	pH	Cond. (µmhos)	Sample Depth	Glass	PVC	Glass	PVC
04/10/13		09:05	17.7	8.55	8.3	1230	-	-	-	-	-
05/01/13	21	09:35	16.4	10.09	8.4	1380	-	-	-	-	-
06/05/13	35	10:10	27.9	6.73	8.5	1490	-	-	-	-	-
07/16/13	41	09:50	35.3	7.68	8.8	1416	-	-	-	-	-
08/14/13	29	14:05	32.3	10.46	8.7	1542	-	-	-	-	-
09/10/13	25	09:33	32.2	5.89	8.8	1747	-	-	-	-	-
10/09/13	29	10:15	25.8	8.3	8.6	1530	-	-	-	-	-
11/06/13	28	10:05	18.0	9.35	8.5	1305	-	-	-	-	-

3.2.1 Intake Water Quality

Temperatures at the LaSalle Station intake ranged from 8.4° Ç on 21 April to 32.6° C on 20 July (Figure 3-1). Dissolved oxygen (DO) concentrations ranged from 7.01 ppm on 5 June to 10.3 ppm on 10 April (Table 3-1). Recordings for pH ranged from 7.6 to 8.2 and conductivity ranged from 505 to 875 µmhos throughout the sampling season. Hourly water temperature data recorded by the Onset loggers from 12 May at 12:00 through 14 May at 15:00 was not included in the dataset due to a drop in the Illinois River pool water level which left the water temp loggers above the river surface. This drop in pool water level was due to damage to the lock and dam at Marseilles, Illinois which occurred during the spring flood.

3.2.2 Cooling Lake Water Quality

Temperatures from the LaSalle Station cooling lake ranged from 12.6° C on 26 April to 37.3° C on 18 July (Figure 3-2). Dissolved oxygen (DO) concentrations ranged from 5.89 ppm on 9 September to 10.46 ppm on 14 August (Table 3-2). Recordings for pH ranged from 8.3 to 8.8 and conductivity ranged from 1230 to 1747 µmhos throughout the sampling season.

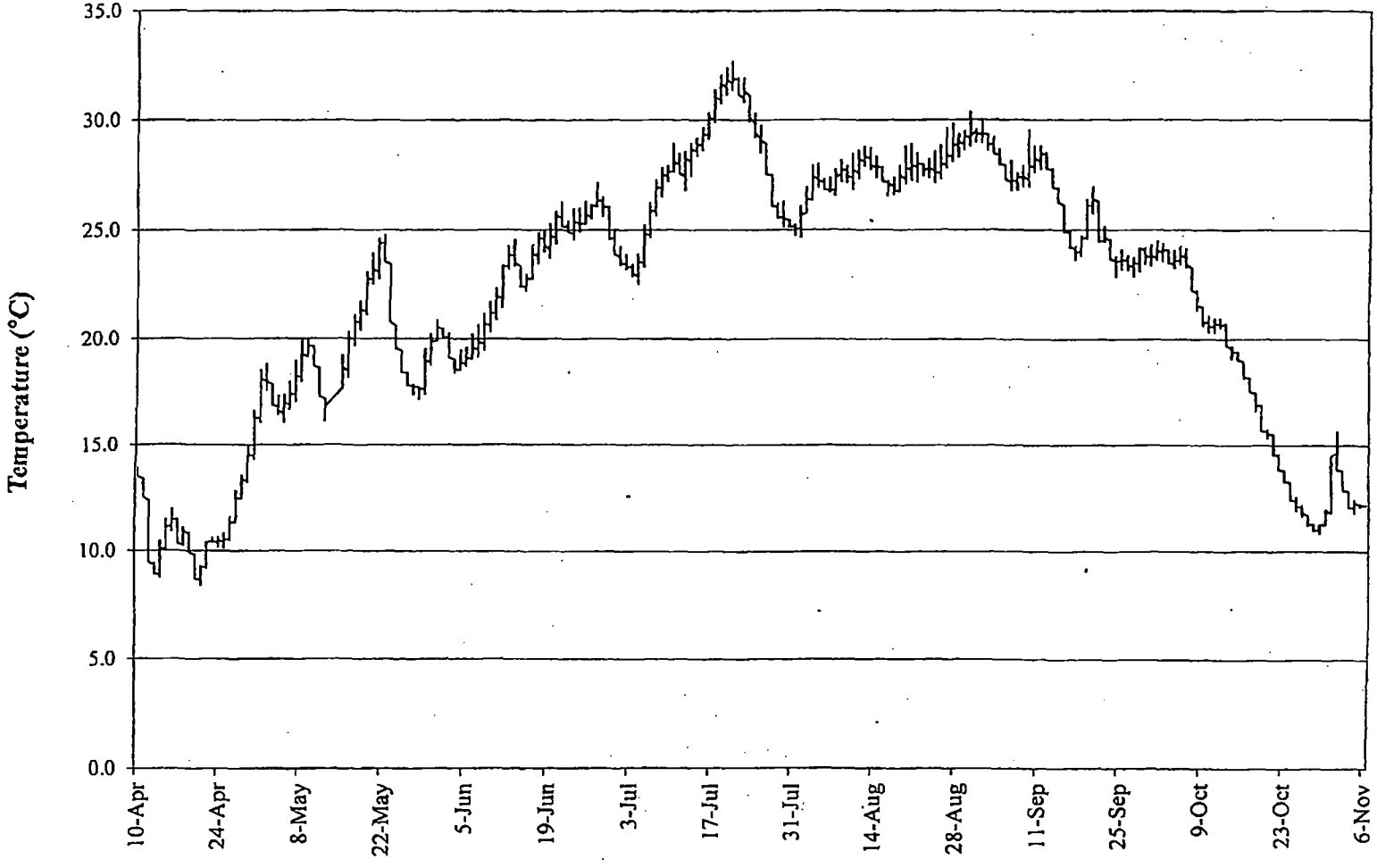

Figure 3-1. Temperature Profile at the LaSalle Station Intake for the Period of 10 April to 6 November, 2013.

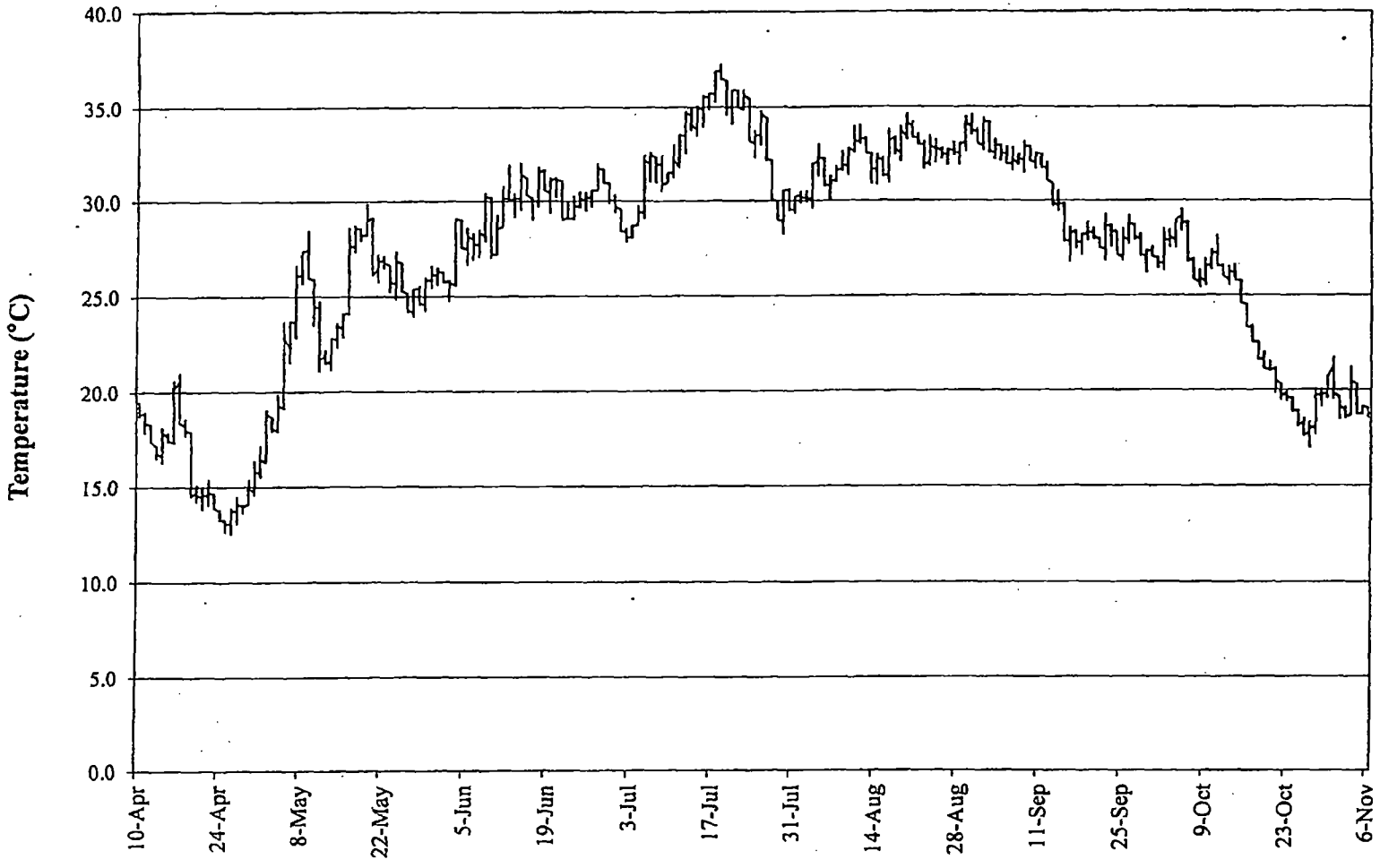

Figure 3-2. Temperature Profile at LaSalle Lake for the Period of 10 April to 6 November, 2013.

4.0 SUMMARY AND RECOMMENDATIONS

In 2013, two zebra mussels were found on the periodic (monthly) substrates from the river intake at LaSalle Station. These juveniles measured 2.0 mm and 5.0 mm in length and represent a settlement density of 18/m^2 each. Nine zebra mussels were recovered from the inside of the river intake cumulative bottom (1.5 m) substrate. One juvenile (4.5 mm) and eight adults (8.0 mm - 21.5 mm) represent a settlement density of 168/m^2. No zebra mussels were recovered from the intake cumulative surface substrate. As a cursory note, eleven adult zebra mussels were also recovered from the cumulative temperature logger assembly. The cumulative substrates from LaSalle Lake had no zebra mussel settlement, but were 90-100% covered by bryozoan colonization at all sample depths.

Early detection of zebra mussel colonization is essential for uninterrupted Station operation. Because zebra mussels are present in the Illinois River, they are continually reintroduced to the cooling lake through make-up water. Continued monitoring is important to recognize the circumstances associated with zebra mussel infestation and colonization.

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