**BEFORE THE ILLINOIS POLLUTION CONTROL BOARD**

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| In the Matter Of: | ) | |
| | ) | |
| EXELON GENERATION LLC, | ) | |
| Petitioner, | ) | |
| | ) | |
| v. | ) | PCB NO. 14-123 |
| | ) | (Thermal Demonstration) |
| ILLINOIS ENVIRONMENTAL | ) | |
| PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

**NOTICE OF FILING**

**TO:** Office of the Clerk of the
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph Street, Suite 11-500
Chicago, Illinois 60601

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Office of Legal Services
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702-1271

**PLEASE TAKE NOTICE** that on the 16th day of July, 2014, Exelon Generation LLC's Response to Illinois Pollution Control Board Questions was filed with the Office of the Clerk of the Illinois Pollution Control Board.

Respectfully submitted,

EXELON GENERATION LLC

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ILLINOIS POLLUTION CONTROL BOARD

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|---|---|---|
| EXELON GENERATION LLC (QUAD CITIES NUCLEAR GENERATING STATION), | ) | |
| Petitioner, | ) | |
| v. | ) | PCB 14-123 (Thermal Demonstration) |
| ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

**Exelon Generation LLC's Response to Illinois Pollution Control Board Questions**

To assist the Board in its determination, Exelon Generation LCC ("Exelon") submits the following responses to the Illinois Pollution Control Board's ("IPCB") June 25, 2014 questions.

**Board Record**

1. Provide a copy of the current National Pollutant Discharge Elimination System ("NPDES") permit for the Quad Cities Nuclear Generating Station ("Quad Cities Station"). The Illinois Environmental Protection Agency ("Illinois EPA") and Iowa Department of Natural Resources ("Iowa DNR") jointly issued this permit (IL 0005037) on August 26, 2010 and it is effective until August 31, 2015. Pet. Exh. 1 App. A at A-10; Agency Recommendation at 1-2.

***Exelon Response*:** The current NPDES permit for Quad Cities Station is attached as Exhibit 1.

2. Provide a copy of all provisional variances issued by Illinois EPA addressing thermal discharges from the Quad Cities Station, and any extensions of those variances.

***Exelon Response*:** The provisional variance ("PV") and related reporting chronology for Quad Cities Station is set forth below.

**1988**: Provisional Variance PCB-88-129 issued on 8/18/88 (Exhibit 2).

**1989**: Provisional Variance PCB-89-115 issued on 7/13/89 (Exhibit 3).

**2005**: Provisional Variance IEPA-05-07 issued on 7/22/05 (Exhibit 4). The PV became effective when all 87.6 hours were consumed or when temperature exceeded 89 degrees. Neither trigger was exceeded, so the station was not required to meet the conditions of the PV.

**2006**:

1. Provisional Variance IEPA-07-01 issued on 7/19/06 (Exhibit 5).
2. Study Plan (special condition C of IEPA-07-01), submitted to IEPA on 8/2/2006 (Exhibit 6).
3. Provisional Variance IEPA-07-03 issued on 8/2/06 (Exhibit 7).
4. Preliminary Mussel Bed Monitoring Results, August 3-5, 2006 (special condition C of IEPA-07-01 & 07-03), submitted to IEPA on 8/17/2006 (Exhibit 8).
5. Temperatures and fish/aquatic life stress/mortality surveys (special condition A & B of IEPA-07-01 & 07-03), submitted to IEPA on 9/27/2006 (Exhibit 9).
6. Mussel bed monitoring results, September 20-25, 2006 (special condition C of IEPA-07-01 & 07-03), submitted to IEPA on 11/9/2006 (Exhibit 10).
7. Final report Mussel bed monitoring results, August 3-5 and September 20-25, 2006 (special condition C of IEPA-07-01 & 07-03), submitted to IEPA on 6/28/2007 (Exhibit 11).

**2007:** Provisional Variance IEPA 08-11 issued on 8/10/07 (Exhibit 12). The PV became effective when all 87.6 hours were consumed or when temperature exceeded 89 degrees. Neither trigger was exceeded, so the station was not required to meet the conditions of the PV.

**2012**:

1. Provisional Variance IEPA-12-11 issued on 3/21/12 (Exhibit 13).
2. Confirmation Quad Cities Station entered the PV (special condition G of IEPA-12-11), submitted to IEPA on 3/22/12 (Exhibit 14).
3. Temperatures and fish/aquatic life stress/mortality surveys (special condition C & D of IEPA-12-11), submitted to IEPA on 4/23/12 (Exhibit 15).
4. Provisional Variance IEPA-12-17 issued on 5/25/12 (Exhibit 16).
5. Temperatures and fish/aquatic life stress/mortality surveys (special condition C & D of IEPA-12-17) submitted to IEPA on 6/21/12 (Exhibit 17).
6. Provisional Variance IEPA-12-19 issued on 7/3/12 (Exhibit 18).
7. Provisional Variance IEPA-12-19 extension issued on 7/12/12 (Exhibit 19).
8. Provisional Variance IEPA-12-19 2nd extension issued on 7/24/12 (Exhibit 20).
9. Temperatures and fish/aquatic life stress/mortality surveys (special condition C & D of IEPA-12-19) submitted to IEPA on 8/14/12 (Exhibit 21).

3. Provide a copy of all reports or notices provided by Exelon to Illinois EPA or the Illinois Department of Natural Resources (Illinois DNR) as a condition of any provisional variance issued by Illinois EPA addressing thermal discharges from the Quad Cities Station.

***Exelon Response*:** *See Exelon Response* 2, above.

4. Provide a copy of the zone of passage curve developed during the "April 2002 Iowa Institute of Hydraulic Research Report (Jain, et al, 2002)." Pet. Exh. 1 App. C at C-20. Provide a copy of any subsequent zone of passage curves developed for the Quad Cities Station.

***Exelon Response:*** The 2002 and 2011 zone of passage curves are attached as Exhibits 22 and 23, respectively.

The 2002 curve assesses the zone of passage with respect to the volume of flow (i.e. discharge) in the Mississippi River, and shows that the zone of passage is 75% when river flow is at least 16,400 cubic feet per second ("cfs") using the diffuser configuration. The 2002 assessment evaluated how the zone of passage would be affected if the diffuser were reconfigured to optimize temperature distribution and concluded that reconfiguration would decrease the zone of passage with respect to volume of flow. In other words, reconfiguring the diffuser would be detrimental to maintaining a zone of passage. (*See* Summary and Conclusions (pp. 11-12) Numeric Model of the Diffuser Pipe System at the Quad Cities Nuclear Generating Station, April 2002, attached as Exhibit 24.)

The 2011 curve assesses zone of passage with respect to area. It shows the zone of passage is 75% at 12,700 cfs with the current diffuser configuration and 11,000 cfs with a reconfigured diffuser. Because volume of flow, not area, is the limiting factor for zone of passage compliance assessment purposes for the Quad Cities Station thermal discharge, reconfiguration of the diffuser was not considered a viable option for the Station.

5. Provide copies of the temperature monitoring curves developed by Exelon including TMC-1 (Pet. Exh. 1 App. A at A-11), TMC-2 (Pet. Exh. 1 App. A at A-11), the temperature monitoring curve last modified in 2001 (Pet. Exh. 1 App. A at A-12), "new" temperature monitoring curve (Pet. Exh. 1 App. E at E-5), "temperature monitoring curve identified as Figure 2 in December 2000 'Revised Temperature Monitoring Curve for Quad Cities Nuclear Generating Station' (Jain, 2000)" (Pet. Exh. 1 App. D at D-8), and all temperature monitoring curves used for compliance with the current NPDES permit.

***Exelon Response***: Attached as Exhibit 25 are: (1) the 1990 TMC-1 and TMC-2 curve (referenced in Exh. 1, App. A at A-11); (2) 1990 "new" temperature monitoring curve for 2-6 circ pumps, December 2000 revised temperature monitoring curve (referenced in Exh. E at E-5); and (3) Attachment 5 Revised Temperature Monitoring Curve at EPU, December 2000, currently used for NPDES compliance purposes. The "temperature monitoring curve last modified in 2001" is a typographical error in the 316a Demonstration report. The December 2000 temperature monitoring curve is the most recent revision of the curve.

6. Provide a larger copy of Figure 3 "Observed Temperatures, Date: September 16, 2003…LMS Thermal Survey" (Pet. Exh. 1, App. B at B-42) so that the numbers on the isotherms can be discerned.

***Exelon Response***: *See* Exhibit 26.

7. Provide a copy of the Upper Mississippi River National Wildlife and Fish Refuge Comprehensive Conservation Plan (*see, e.g.*, Pet. Exh. 1, App. A at A-44), including any appendix or list that identifies the Illinois and Iowa listed endangered or threatened species.

***Exelon Response*:** Attached as Exhibit 27 is the Upper Mississippi River National Wildlife and Refuge Comprehensive Conservation Plan ("Conservation Plan"). The Conservation Plan (pp. 47-48) explains that state listed threatened or endangered species for the refuge area are listed in the Environmental Impact Statement prepared in connection with the Conservation Plan. As explained in Exelon's Response 23, below, state listed species are addressed in the Habitat Conservation Plan and Incidental Take Permit developed for the proposed alternative thermal limitations for Quad Cities Station.

**Plant Location**

8. 35 Ill. Adm. Code 303.331 applies to the section of the Mississippi River from the Wisconsin border to the Rock River. What is the distance from the Wisconsin border to the Rock River in river miles?

***Exelon Response***: The distance from the Wisconsin border to the Rock River is 101.7 river miles.

9. How many river miles downstream from the Wisconsin border is the Quad Cities Station?

***Exelon Response***: Quad Cities Station is 74.2 river miles downstream from the Wisconsin border.

10. How many river miles upstream from the Rock River is the Quad Cities Station?

***Exelon Response***: Quad Cities Station is 27.5 river miles upstream from the Rock River.

**Method for Heat Dissipation**

11. Exelon states that a "diffuser system was installed in the Mississippi River in 1972 as an interim mode of discharge until the spray canal (closed cycle cooling) was completed." Pet. Exh. 1 App. D at D-9. This diffuser system was operated until May 1, 1974 when the spray canal commenced operations with one unit discharging to the spray canal. *Id.* On May 1, 1975, both units began discharging to the spray canal. *Id.* On December 23, 1983, the facility "commenced the current full open cycle mode of operation via the diffuser pipes." *Id.* at D-10. Clarify whether the diffuser pipe system currently in use (Pet. at 11-13) is the same system installed in 1972. Has Exelon modified the diffuser pipe since 1972 other than closing the 9 risers in the shallow zone of the river (Pet. at 12)?

***Exelon Response***: The diffuser pipe system currently in use is the same system installed in 1972. Exelon has not modified the diffuser pipe since 1972 other than closing the nine risers in the shallow zone of the river, which was performed after initial installation

12. Explain how and why the location of the current diffuser system was selected.

***Exelon Response***: A thermal modeling investigation performed by the Iowa Institute of Hydraulic Research ("IIHR") in 1970-71 recommended the current two pipe diffuser system and location based on field measurements from U.S. Geological Survey and three-dimensional modeling designed to distribute the Station thermal discharge across the river channel nearly in proportion to the river flow per unit width.

13. Exelon describes the diffuser pipe system used for cooling including measurements for the north and south pipes as well as spacing and orifice sizing of the discharge risers. Pet. at 11-13. Exelon depicts the diffuser pipe system graphically with two lines in Figures 1, 3, and E-1. Pet. Exh. 1 App. B at B-40, B-42, App. E at E-21. Provide a more detailed and dimensioned drawing of the diffuser pipe system, including risers with spacing, orifice dimensions, as well as depth and location in the receiving stream.

***Exelon Response***: Attached as Exhibit 28 are detailed dimensional drawings of the diffuser piping system. Drawings include Figure 1 from 1990 Jain report #175, Exelon drawings B-820, Site Plan for Discharge Piping, B-823 Discharge Pipe Layout and Details, B-860 Discharge structures contour plan, B-861 Discharge Structures Pipe and Diffuser elevation.

14. Describe how Exelon determines if the diffuser pipe system is performing as intended. Explain what data Exelon collects to evaluate this system and how Exelon uses field data for this purpose.

***Exelon Response***: River temperature measurements are taken during periods when ambient river temperatures are approaching permit discharge limits. Data from field measurements are compared to previous field data, and verify that the diffuser pipe system is performing as designed.

15. Describe how and when Exelon performs maintenance on the diffuser pipe system.

***Exelon Response***: Maintenance on the diffuser pipe system has not been necessary. As stated above, temperature data confirm that the diffuser system is operating as designed.

16. Exelon describes an investigation "to develop strategies and associated diffuser pipe modifications." Pet. Exh. 1 App. A at A-11; Pet. Exh. 1 App. E at E-5. Who conducted this investigation and when was it conducted?

***Exelon Response***: The referenced investigation, "Evaluation of the Quad Cities Nuclear Generating Station Diffuser Pipe System At Low River Flows," July 1990, was performed by Subhash C. Jain and John F. Kennedy of the Iowa Institute of Hydraulic Research. (*See* Exhibit 29.)

17. Would "reducing the condenser water discharge near the Iowa shore and increasing it in the deeper portion of the river section" (Pet. Exh. 1 App. A at A-11) improve the performance of the diffuser pipe system? Explain. How would this strategy affect the size of the mixing zone? Has Exelon implemented this strategy?

***Exelon Response***: According to IIHR's 1990 study, reconfiguring the diffuser piping system to reduce the condenser water discharge near the Iowa shore and increase it in the deeper portion of the river could yield a more uniform temperature distribution in a river cross sectional area, 500' downstream of the diffuser pipes. However, IIHR also concluded that such reconfiguration would decrease the zone of passage available during lower river flows. The size of the mixing zone would not change if the diffuser piping system were reconfigured. For these reasons, Exelon did not reconfigure the diffuser piping system.

18. Would "optimizing the sizes of the orifice plates for the risers of the diffuser pipe system" (Pet. Exh. 1 App. E at E-5) improve the performance of the diffuser pipe system? Explain. How would this strategy affect the size of the mixing zone? Has Exelon implemented this strategy?

***Exelon Response***: Similarly, optimizing orifice plates would reduce the condenser water discharge near the Iowa shore and increase it in the deeper portion of the river section. This could result in a minimally more uniform temperature distribution in a river cross sectional 500' downstream of the diffuser pipes, but would be detrimental to the zone of passage. The size of the mixing zone would not change. For these reasons, Exelon has not implemented this strategy.

19. 35 Ill. Adm. Code 302.102(b)(1) requires "Mixing must be confined in an area or volume of the receiving water no larger than the area or volume which would result after incorporation of outfall design measures to attain optimal mixing efficiency of effluent and receiving waters." Does the operation of the diffuser pipe system provide optimal mixing efficiency of the thermal effluent and the receiving water?

***Exelon Response***: Operation of the diffuser piping system was approved by the Pollution Control Board in 1983. The diffuser piping system was designed to optimize mixing of the Station's condenser cooling water with the volume of the Mississippi River flows. As shown by IIHR, reconfiguring the diffuser system to promote more uniform temperature distribution at a compliance measuring point 500 feet downstream of the diffuser pipes would adversely affect the available zone of passage, and, therefore, would not be optimal.

In addition, as discussed in Exelon's Petition, the test under Section 316(a) and the Board's regulations implementing Section 316(a) is whether Exelon has demonstrated that Quad Cities Station's operations has caused appreciable harm to the biological indigenous community. Exelon submits that its 316(a) Demonstration shows that the Station's operations, including operation of the diffuser piping system and designed and presently configured, have not caused any such harm.

**Communication**

20. Exelon generally describes presenting information in meetings and submitting information to governmental agencies. *See* Pet. at 14. Exelon also included with its petition an April 19, 2007 letter to the United States Environmental Protection Agency (USEPA). Pet. Exh. 2. Has Exelon specifically communicated with the United States Environmental Protection Agency (USEPA) regarding Exelon's current demonstration under Section 316(a) of the Clean Water Act (CWA) submitted to the Board in this proceeding? Has Exelon communicated with USEPA regarding the specific relief requested by Exelon in its petition? Has USEPA informed Exelon of whether USEPA approves of or objects to Exelon's proposed alternative thermal effluent limitations or Exelon's demonstration? If so, describe, and provide copies of, any response provided by USEPA. Describe communications with USEPA after April 19, 2007 regarding Exelon's CWA Section 316(a) demonstration.

***Exelon Response***: Exelon has communicated with USEPA regarding the 316(a) Demonstration for Quad Cities Station. In August 2009, Exelon representatives met with USEPA representatives to present and discuss the 316(a) Demonstration for Quad Cities Station and the process for obtaining alternative thermal limits for the Station. Exelon representatives met again with USEPA representatives in June 2013 to discuss the 316(a) Demonstration and the rulemaking proceeding pending before the Pollution Control Board to promulgate procedural rules for reviewing requests for relief under Section 316(a). In those meetings, USEPA representatives expressed their appreciation for being kept apprised of Exelon's plans and studies, and their general support for the Section 316(a) process by which Exelon planned to obtain review of the 316(a) Demonstration. USEPA did not express any objection or opposition to Exelon's plans.

21. Exelon states that in 2003, Exelon commenced studies "aimed at determining whether existing thermal limits could be relaxed without causing unacceptable environmental impacts." Pet. at 14. Exelon presented these plans in committee meetings as well as to Illinois EPA and Illinois DNR "to obtain their input." *Id.* In 2007, Exelon submitted to USEPA, with copies to United States Fish and Wildlife Service (USFWS), Illinois DNR, Iowa DNR, and Illinois EPA, its "detailed plans for additional studies to support its 316(a) Demonstration." *Id.*; *see also* Pet. Exh. 2. Has Illinois DNR informed Exelon of whether Illinois DNR approves of or objects to Exelon's proposed alternative thermal effluent limitation or Exelon's demonstration? If so, describe, and provide copies of, any response provided by Illinois DNR.

***Exelon Response***: In connection with Illinois DNR's review of the 316(a) Demonstration, Exelon's representatives responded to a number of questions raised regarding the Demonstration, including a mooneye die off incident that occurred in Pool 14 of the Mississippi River. Exelon committed to monitoring during high temperature/low flow events and to coordinating with the US Army Corps of Engineers when river flows were below the 75% percent zone of passage level. Exelon also committed to including site specific zone of passage measures in the 316(a) Demonstration. On March 28, 2011, Exelon received a letter from John Rogner, Illinois DNR Assistant Director, stating that Illinois DNR is in general agreement with Exelon's proposals.

(*See* Exhibit 30.) As required by the Board's rules, Exelon served its Petition, including the 316(a) Demonstration, on Illinois DNR when it initiated this proceeding.

22. Has Exelon communicated with Iowa DNR regarding Exelon's demonstration under CWA Section 316(a) submitted to the Board in this proceeding? Has Exelon communicated with Iowa DNR regarding the specific relief requested by Exelon in its petition? Has Iowa DNR informed Exelon of whether Iowa DNR approves of or objects to Exelon's proposed alternative thermal effluent limitations or Exelon's demonstration? If so, describe, and provide copies of, any response provided by Iowa DNR.

***Exelon Response***: Exelon has communicated with Iowa DNR regarding its plans to seek alternative thermal limitation for Quad Cities Station. In late 2009, Exelon provided Iowa DNR the draft 316(a) Demonstration for review. In response, the Iowa DNR Fisheries Bureau comments: (1) questioned whether Exelon's request for 3% excursion hours (262.8 hours) was supported based on the Summer 2006 high temperature event when 222 excursion hours were used; (2) stated additional information regarding the 2006 fish die-off incident was required; (3) questioned whether fish avoidance behavior during warm water events could have an adverse impact on recreational fishing in Pool 14; (4) questioned whether Heidi Dunn, Exelon's mussel expert, supported the request for 3% excursion hours: and (5) questioned why the bio-thermal (prospective demonstration) did not address the Higgins Eye mussel. (Exhibit 35.) The Iowa DNR permitting section also commented that: (1) the 316(a) Demonstration discussion regarding Illinois EPA's NPDES permitting authority for Quad Cities Station should include Iowa's role as a permit signatory; (2) Iowa water quality standards should be addressed in the 316(a) Demonstration; (3) the Demonstration should include the list of 93 species from which the RIS evaluated in the prospective demonstration were selected; (4) additional graphics showing potential areas of impacts to fish should be included in the Demonstration; and (5) the list of impaired waters in Pool 14 needed to be updated. (Exhibit 36.)

In response to Iowa DNR Fisheries Bureau comments, as well as comments from others, Exelon reduced the proposed alternative thermal limits to 2.5% excursion hours (219 hours) and included additional detail in the 316(a) Demonstration addressing the 2006 fish die-off incident. Because the additional excursion hours that would be allowed by the alternative thermal limits represent only about 1.5% of annual hours, any impacts to recreational fishing caused by avoidance behavior associated with excursion hour events will be minimal. The fact that possible impacts to mussels could not be evaluated as part of the bio-thermal assessment, due to the lack of thermal tolerance data for mussel species, caused Exelon to conduct extensive studies of the mussel community in Pool 14. These studies, conducted by Ms. Dunn, support the conclusion that the mussel population will not be harmed by the alternative thermal limits.

With respect to the Iowa DNR permit section comments, the alternative thermal limits proposed by Exelon are a derivation of the limits in the Quad Cities Station NPDES permit. The NPDES permit reflects the Illinois water quality standards governing heat. For that reason, there is no need to refer to the Iowa water quality standards or Iowa's signatory role on the permit as part of the 316(a) Demonstration. Also, the 316(a) Demonstration now includes the list of 93 species found in Pool 14 (*See* Table A-3, p. A-60.) Finally, the list of impaired waters included in the Demonstration is fully up-to-date.

**Endangered and Threatened Species**

23. USEPA's "Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements (DRAFT)," May 1, 1977 (316(a) Manual) provides that the permitting authority:

> checks with the Regional Director of the [U.S. Fish and Wildlife Service] and representatives of the [National Marine Fisheries Service] and States to make sure the study plan includes appropriate consideration of threatened or endangered species as well as other fish and wildlife resources. 316(a) Manual at 15.

State whether Exelon consulted with Illinois DNR on the inclusion of state-listed endangered or threatened species in the study plan for Exelon's CWA Section 316(a) demonstration? If so, what did Illinois DNR advise with respect to state-listed species? Provide copies of any response provided by Illinois DNR.

***Exelon Response***: Illinois DNR and Iowa DNR were consulted and participated in the original study plans for the 316a Demonstration and have been continually informed and updated regarding the 316(a) studies, investigations and proposed alternative thermal limits for Quad Cities Station. A draft of the 316(a) Demonstration was sent to both agencies, including the agency Endangered Species Coordinators, in November 2009. Illinois DNR and Iowa DNR were also consulted and participated in the development of the Habitat Conservation Plan (HCP) and Incidental Take Permit issued by USFWS. The consensus was that the threatened or endangered species that needed to be addressed in connection with Exelon's proposed alternative thermal limits were mussel species, particularly the federally-listed Higgins Eye mussel and the candidate species Sheepnose mussel. However, to insure against possible impacts to State-listed species, a provision was included in the HCP requiring continued coordination with state conservation agencies, and provisions were included in the Incidental Take Permit requiring monitoring of other rare mussel species and to providing for adaptive measures to be implemented to address possible impacts, if warranted.

24. State whether Exelon consulted with Iowa DNR on the inclusion of state-listed endangered or threatened species in the study plan for Exelon's CWA Section 316(a) demonstration? If so, what did Iowa DNR advise with respect to state-listed species? Provide copies of any response provided by Iowa DNR.

***Exelon Response***: *See* response to question 23, above.

25. USFWS approved a Habitat Conservation Plan and issued a Federal Fish and Wildlife Permit authorizing incidental taking of Higgins eye pearlymussel and Sheepnose mussel. Pet. at 25; Pet. Exh. 4 and 5. Is Exelon's requested alternative thermal effluent limitation an incidental taking of endangered or threatened species for these species or any other species under 17 Ill. Adm. Code 1080? If so, describe Exelon's plans for preparing an application for an incidental take authorization under Illinois rules. Has Exelon submitted the Habitat Conservation Plan to Illinois DNR?

***Exelon Response***: *See* answer to question 23, above. *See also* 17 Ill. Adm. Code 1080.10(c) and (d) allowing federally-approved HCPs and ITPs to be substituted for Illinois HCPs and ITPs.

26. Has Exelon addressed any requirements regarding endangered and threatened species for Iowa? Explain.

***Exelon Response***: *See* answer to question 23, above.

27. The state-listed species that occur on the Upper Mississippi River National Wildlife and Fish Refuge include: six mammals, 40 birds, 18 fish, seven reptiles, three amphibians, and 20 mussels. Pet. Exh. 1, App. A at A-44. Exelon states that state-listed threatened and endangered species "will be addressed in the Comprehensive Conservation Plan and appropriate step-down plans." *Id.* Does the Comprehensive Conservation Plan address the impacts from Exelon's requested alternative thermal effluent limitations on state-listed endangered or threatened species? If so, identify and provide the pertinent sections of the plan.

***Exelon Response***: As stated in Exelon's answer to question 23, the only state-listed species potentially impacted by the alternative thermal limits are mussels; those species, including state-listed species, are addressed in the HCP and ITP.

28. Describe the location of the Upper Mississippi River National Wildlife and Fish Refuge and, if not the entire refuge, which areas of the refuge are covered by the Comprehensive Conservation Plan. Describe the location of the refuge in relation to the Quad Cities Station. To the extent Exelon relies on the Comprehensive Conservation Plan or studies performed for the refuge, explain how those materials provide relevant information for Exelon's CWA Section 316(a) demonstration for the Quad Cities Station.

***Exelon Response***: The Refuge encompasses approximately 240,000 acres in four states in a more-or-less continuous stretch of 261 miles of Mississippi River floodplain from near Wabasha, Minnesota to near Rock Island, Illinois. The refuge is located in Minnesota, Wisconsin, Iowa and Illinois along the Mississippi River. The Refuge was established by act of Congress in 1924 for the purpose of providing a refuge and breeding ground for migratory birds, fish, other wildlife, and plants. Figure 1, page 16 of the Upper Mississippi River National Wildlife and Fish Refuge Comprehensive Conservation Plan (Exhibit 31) shows the overall location of the Upper Mississippi River National Wildlife and Fish Refuge (NWFR). The lower section of Pool 14 of the Mississippi River is shown in the attached drawing (Exhibit 32). This lower section drawing also shows the location of the Quad Cities Nuclear Station.

Exelon reviewed the Upper Mississippi River National Wildlife and Fish Refuge Comprehensive Conservation Plan (CCP) to ensure that its ongoing fishery studies and mussel monitoring are consistent with the goals of the CCP. The CCP was reviewed and taken into consideration as part of the preparation for the U.S. Fish and Wildlife Service Habitat Conservation Plan, Incidental Take Permit and Exelon's 316 (a) Demonstration. The fishery, thermal monitoring and mussel

studies that are identified in the 316 (a) Demonstration Report are not reliant on the ongoing CCP study results.

**Representative Important Species**

29. In its prospective demonstration, Exelon states that, in selecting species for evaluating the impact of its requested alternative thermal effluent limitation, it started with "a master fish taxa list containing 93 species that had been developed for Pool 14 during the course of 32 years of monitoring studies." Pet. Exh. 1 App. B at B-7; *see also* App. A at A-60 (Table A-3). Of these 93 species, Exelon selected four as representative important species (RIS). *Id.* On selecting RIS, USEPA's 316(a) Manual states

> The most thermally sensitive species (and species group) in the local area should be identified and their importance should be given special consideration, since such species (or species groups) might be most readily eliminated from the community if effluent limitations allowed existing water temperatures to be altered. Consideration of the most sensitive species will best involve a total aquatic community viewpoint. 316(a) Manual at 37.

Identify the most thermally sensitive species (and species group) of the 93 species. Explain how these thermally sensitive species were "given special consideration" and why they were not selected as RIS.

***Exelon Response***: Several perceived thermally sensitive species and/or guilds from the master tax list were included in the final 15 species list, from which the RIS were selected (App. B, Table 2, p. B-25). Thermally sensitive species would typically be near the edge of their natural range or would be slow thermally orienting species, and would include, in particular, the cold water-guilded species. Based on the criteria described on p. B-5, the final 15 species were then evaluated for available validated thermal histories to develop temperature tolerance polygons for the prospective demonstration. While only four fish species had sufficient information for thermal modeling, walleye, which is a cold water-guilded species, was among the four and is representative of the most thermally sensitive species.

30. In the definition of RIS in USEPA's 316(a) Manual, RIS "specifically include[s]" threatened or endangered species. 316(a) Manual at 78-79; *see also id.* at 37. Exelon found federally endangered *Lampsilis higginsii* in seven of fifteen beds, most abundantly in the Albany bed (upstream) and the Cordova bed (downstream). Pet. Exh. 1 App. C at C-15. Exelon also states that the Sheepnose mussel is present and it is a candidate species. *Id.* at C-14. Exelon also found state-listed species *Lampsilis teres* (Iowa endangered species) and *Ellipsaria lineolata* (Illinois threatened species) in eight of the fifteen beds. *Id.* Explain why these species were not evaluated or selected as RIS.

***Exelon Response***: There is insufficient thermal tolerance data available to include these mussel species as RIS in the prospective evaluation. For that reason, Exelon conducted extensive mussel sampling and monitoring activities to evaluate how mussels in the vicinity of Quad Cities

Station have reacted to thermal episodes, including episodes where river water temperatures were similar to those that could result from the alternative thermal limits proposed for the Station. On the basis of this evaluation, Exelon was able to conclude that the proposed alternative thermal limits would not adversely impact the mussel populations, and the HCP and ITP were developed to address any possible impacts to individuals. (*See* App. C, Section 2.6.)

31. USEPA's 316(a) Manual provides:

> receiving water temperatures outside any (State established) mixing zone will not be in excess of the upper temperature limits for survival, growth, and reproduction, as applicable, of any RIS occurring in the receiving water. 316(a) Manual at 71.

Exelon's requested alternative thermal effluent limitation would allow temperatures as high as 91°F during excursion hours at the edge of the mixing zone. Pet. Exh. 1 App. B at B-4. The temperature tolerance polygons (Figure A2-1 thru A2-4) show acute and chronic mortality temperatures for the four selected RIS. Pet. Exh. 1 App. B at B-12, B-80 to B-83. Will the requested alternative thermal effluent limitation be in excess of the upper temperature limits for survival, growth, and reproduction, as applicable, of any RIS?

***Exelon Response***: Although exceedances of the upper temperature limits in the tolerance polygons could occur, prospective modeling results and the actual experience at Quad Cities Station, based on mussel studies and long term fish monitoring, show that the RIS will not be impaired as a result of exposure to the maximum temperatures allowed by the alternate thermal limitations for the limited time periods in question. The quoted language from the 1977 316(a) manual provides (draft) guidance to reviewers of 316(a) predictive demonstrations to find a demonstration successful if, among other findings, the reviewer finds that upper temperature limits for survival, growth and reproduction of any RIS are exceeded. However, the guidance (even if it had been made final) does not require that alternative thermal limits should be denied whenever the limits may approach or exceed upper temperature limits, particularly for an existing discharger with a long history of operations and voluminous biological data regarding how its thermal discharges effect biota in the receiving waters. Rather, the test is whether an applicant has demonstrated that the thermal discharge has not caused appreciable harm to the balanced indigenous community. Exelon submits its demonstration satisfies that test.

**Biotic Category Analysis**

32. USEPA's 316(a) Manual sets forth decision criteria for six biotic categories. (*See* 316(a) Manual at Sections 3.3.1.1, 3.3.2.1, 3.3.3.1, 3.3.4.1, 3.3.5.1, and 3.3.6.1.) Exelon analyzed these categories in its petition. Summarize how Exelon's CWA Section 316(a) demonstration addresses each of the decision criteria for each of the biotic categories.

***Exelon Response***: It was not necessary for the 316(a) Demonstration to address each of the decision criteria set forth in the draft 316(a) manual. Section 3.3 of the draft manual relates to early screening procedures designed to avoid unnecessary "massive, comprehensive, baseline,

field sampling" that would support predictive determinations as to how plant discharges might affect specific biotic categories. In the case of Quad Cities Station, there already exist extensive biological data obtained from studies conducted during the Station's original licensing in the early 1970's and extensive post-licensing monitoring and studies that continue up to the present. These studies show that the Station's past operations (including operations that resulted in thermal discharges similar to those that would be allowed under the proposed alternative thermal limits) have not impaired the biotic categories listed in the manual. (See App. C, pp. C-8 – C-19.) Therefore, the analysis suggested by the manual was not needed to determine whether the proposed alternative thermal standards will adequately protect the BIC.

33. USEPA's 316(a) Manual provides that the receiving waters for a thermal discharge must not be "of such quality that in the absence of the proposed thermal discharge excessive growths of nuisance organisms would take place." 316(a) Manual at 71. Explain whether Pool 14 meets this provision.

***Exelon Response***: Quad Cities Station has not caused or contributed to the presence of nuisance organisms in Pool 14 and there is no reason to believe that discharges authorized by the proposed alternative thermal limitations would alter that situation.

34. Comment on whether Exelon has observed or received any reports of nuisance algal blooms in Pool 14 at any time since the Quad Cities Station began operations.

***Exelon Response***: Exelon has not received any reports or observed nuisance algal blooms in Pool 14 related to or associated with Quad Cities Station's operations.

35. Exelon reports that three unionid beds occur within 3500 meters (approximately two river miles) of the thermal diffuser: Steamboat Slough Bed. Upstream Bed, and Cordova Bed. Pet. Exh. 1 App. A at A-33. USEPA's 316(a) Manual states, "Areas which serve as spawning and nursery sites for important shellfish and/or macroinvertebrate fauna are considered as zero allowable impact areas and will be excluded from consideration for the discharge of waste heat. Plants sited in locations which would impact these critical functions will not be eligible for a 316(a) waiver." 316(a) Manual at 24-25. Explain whether the unionid beds identified near the Quad Cities Station are covered by this provision of the manual. Are Exelon's requested alternative thermal effluent limitations precluded by this provision? Explain.

***Exelon Response***: The provision quoted from the manual expressly applies to estuaries, and therefore does not apply to the Quad Cities Station receiving waters. In any event, the mussel beds in question will be addressed and protected by the Habitat Conservation Plan and Incidental Take Permit approved by USFWS.

36. 35 Ill. Adm. Code 302.102(b)(4) states, "Mixing is not allowed in waters containing mussel beds, endangered species habitat, fish spawning areas, areas of important aquatic life habitat, or any other natural features vital to the well being of aquatic life in such a

manner that the maintenance of aquatic life in the body of water as a whole would be adversely affected." Will Exelon's requested relief as to zone of passage comply with 35 Ill. Adm. Code 302.102(b)(4)? Explain.

***Exelon Response***: There are no features listed in Section 302.102(b)(4) present in the mixing zone authorized for the Quad Cities Station. The Cordova Bed, which has been identified as a critical habitat for the Higgins Eye mussel, is situated well downstream of the mixing zone. As previously stated, the HCP and ITP are designed to protect against potential adverse impacts to the Higgins Eye mussel population.

37. During the periods covered by any provisional variance issued by the Illinois EPA addressing thermal discharges from the Quad Cities Station, has the station observed or received reports of any fish mortalities or other adverse impacts to aquatic life? If so, describe.

***Exelon Response***: During the 2006 and 2012 excursion events, fish mortalities were documented in Pool 14. In 2006, impacts to the mussels beds were recorded in the fall survey. The 2012 mussel surveys showed no effects from the drought and elevated temperatures. In both years, none of the mortality events are attributed to the operations at QCNS.

The 2006 fish kill was primarily a species specific (mooneye) die-off. Two hundred eighty-one dead fish, representing 15 species, were observed over the 8 days. Over 74% of those fish observed were mooneye. Quad Cities Station observed extraordinarily large numbers of mooneye in the Station impingement samples for nearly two weeks, a full 10 days after river temperatures and flows returned to normal. These data show that the die-off was a systemic issue occurring quite far upstream from Quad Cities Station and was not related to the Station's discharge. The Station discharge is downstream of the impingement sample point.

The 2006 mussel surveys showed mortalities in both upstream and downstream mussel communities. Follow-up surveys conducted in 2007 show that community characteristics within mussel beds were not significantly affected by the Quad Cites Station thermal effluent. Mussel beds downstream of the Station exhibited similarities and differences in habitat and community characteristics with mussel beds upstream of the Station. Increased mortality noted in some beds in 2006 was not observed in 2007, and did not appear to affect mussel density either upstream or downstream of the Station.

During the 2012 summer events, there were no observations of unusual conditions including mortalities to fish or other aquatic life downstream of the Station. Large numbers of dead mature northern pike were observed during this time, however, across multiple Pools of the river. Both Illinois and Iowa DNR concluded the situation was not caused by Station operations. The die-off was documented all the way to Lock and Dam 13, over 15 river miles north of the Quad Cities Station. No other species were significantly affected by this event.

Low flow, drought conditions in 2012 do not appear to have affected any of the mussel beds sampled. No significant decreases in overall mussel density were observed in any of the beds.

38. In 2006, the Quad Cities Station used 222.75 excursion hours. Pet. Exh. 1 App. A at A-35; *see also* Pet. at 23. Exelon states that "increased mortality was observed" in the Upstream and Cordova mussel beds in 2006. *Id.* at A-36. Exelon also appears to report that these mortalities declined and populations increased in subsequent years. *Id.* Explain these population observations and the impact of the thermal discharge from the Quad Cities Station on this population decrease.

***Exelon Response***: *See* answer to question 37, above, regarding the 2006 events.

39. Describe the river flow and river temperature conditions in 2006 when the Quad Cities Station used 222.75 excursion hours. *See* above question. Identify the month and days in 2006 when the station used excursion hours. Did the station observe or receive reports of any fish mortalities or other adverse impacts to aquatic life during this period in 2006? If so, describe.

***Exelon Response***: Quad Cities Station used 61.3 excursion hours from 7/16/2006-7/19/2006. River flow during that period was generally around 21,000 cubic feet per second (cfs) and upstream temperatures ranged from 84º-86ºF. No reports or observations of fish mortalities were noted during this time.

From 7/29/2006-8/6/2006, flows began near 28,000 cfs and dropped to 23,500 cfs on 7/31. Upstream temperatures were in the 85º-86ºF range prior to 7/31. As the rived flow decreased, upstream temperatures increased at a faster rate than typical daily variations. By late afternoon on 7/31, upstream temperatures reached near 88ºF. Flows dropped to 12,700 cfs on 8/1 and 12,600 cfs on 8/2. Flows began to recover on 8/3 to 18,500 cfs, 27,600 cfs on 8/4, and 35,100 cfs on 8/5.

*See* answer to question 37, above, regarding fish mortalities observed in 2006.

40. In Exelon's retrospective analysis, Exelon reports on trends in long-term electrofishing fish monitoring over the past 41 years for freshwater drum, channel catfish, largemouth bass, bluegill, white crappie, black crappie, sauger, and flathead catfish. Pet. Exh. 1 App. C at C-17. Figures C-1 and C-2 illustrate the numbers of fish caught from 1971 to 2011 for the above listed species as well as common carp, river carpsucker, and gizzard shad. Explain why Exelon chose these species for Figures C-1 and C-2. Does Exelon have population data for other species? If so, which species? Have any other species shown a decrease in population during 1971 to 2011? If so, identify the species.

***Exelon Response***: Exelon has collected fish data for 93 species of fish since sampling began, in 1971. The species listed in the trend analysis were selected due to their abundance in the catch, which is needed for long-term trend monitoring. Incidental and low catches of fish do not allow for true trending because field conditions on a variable river can influence the perceived abundance of the species, even with fixed-point sampling. Common carp and river carpsucker has seen a slight decline over the past 41 years, as well. In contrast, sharp increases in largemouth bass, bluegill, freshwater drum and channel catfish have been observed throughout the 41 year span.

41. Figure C-1 illustrates the numbers of fish caught from 1971 to 2011 and for these types of fish shows the highest numbers were caught in 1971 and decreases after 1971. Pet. Exh. 1 App. C. Exelon also states that thermal discharges from Quad Cities Station since 1983 have not caused appreciable harm to finfish in Pool 14. *Id.* at C-18. Explain the observed trends in white crappie, black crappie, and sauger populations between 1971 and 1983, between 1983 and 2011, and for the entire period of 1971 to 2011 and describe the Quad Cities Station's thermal discharges during these periods.

***Exelon Response***: Operation of Quad Cities Station commenced in January 1972. The Station operated in open-cycle mode from January 1972 until May 1974, discharging cooling water to the river via a side-jet canal, from January through July 1972, and via the diffuser system from August 1972 through April 1974. Operation of the spray canal commenced in May 1974. The Station operated with the equivalent of one unit discharging cooling water to the canal and one unit discharging directly into the river (partial closed-cycle) until May 1975, when construction of the spray canal was completed and cooling water from both units was routed to the canal (closed-cycle). From December 1983 to present, the station has operated as an open cycle plant, using the diffuser piping system.

The top 5 collections of white crappie were in the first 5 years of open cycle operations. From 1976-1983 during closed cycle operations, white crappie saw much more variability in catches, but decreased significantly during that period. From 1984-present, the white crappie numbers have been fairly stable, but low when compared to the first 10 years of data.

Black crappie catch-per-effort (CPUE) was highest during the 4 of the first 5 years of open cycle operation, followed by a period of relative stability from 1976-1996, followed by lower but stable numbers from 1997 to present. The past 6 years (2008-2013) has seen an increase from the lows observed following the 1997 spring/summer high-water event.

Sauger CPUE was highly variable from 1971-1983, and continuing through 1990. From 1991-2005 sauger was lower but stable, while populations from 2006-2013 have been highly variable, but lower than historical peaks. Much of the sauger's preferred sand/gravel habitat has become populated with rooted aquatic macrophytes, which may explain the variability observed since 2006. The summer of 2006 was a period of extreme low water levels, and macrophyte beds became established in areas that were historically sand/gravel bottom areas with slight current. This also corresponds with the increase in bluegills and largemouth bass in the side channel/main channel border habitats.

Overall, white crappie, black crappie, and sauger populations declined at different rates and times during the 41 year period. None of these population changes correspond with the operational changes or high temperature events that occurred at Quad Cities Station.

42. Exelon states that trends in fish populations appear both upstream and downstream of the diffuser pipes. Pet. Exh. 1 App. C at C-17. Has Exelon observed that "decreases in the numbers of white crappie, black crappie, and sauger" occur both upstream and downstream of the diffuser pipes? Explain any data showing this trend.

***Exelon Response***: Exelon has observed these decreases both upstream and downstream of the plant. The data and trend analyses are reviewed on an annual basis by the Quad Cities Station Steering Committee, which includes both Illinois and Iowa DNRs. *See* response to Question 43, below.

43. Exelon states that trends in fish populations are due to habitat changes and other factors such as fishing practices and regulation. Pet. Exh. 1 App. C at C-17. Explain how habitat changes and any other factors contribute to "decreases in the numbers of white crappie, black crappie, and sauger."

***Exelon Response***: Fish seek out alternate preferred habitats when their current sites are no longer suitable for their daily needs such as food, shelter, reproduction, and overwintering. As the Mississippi River pools have aged over the past 40 years, siltation has increased and reduced the total amount of preferred habitat overall. This systemic issue is evidenced by multiple conservation organizations, and applies directly to the species in question.

44. Exelon states that "backwater species, such as white and black crappies have generally decreased due to degradation of the backwater areas and sloughs from sedimentation associated with the operation of the 9-foot navigation channel." Pet. Exh. 1 App. A at A-39. Expand on and provide support for this conclusion.

***Exelon Response***: Further explanation and support for Exelon's statement is provided by the following quote from the Upper Mississippi River fisheries Plan:

> "Sedimentation has been identified as one of the largest problems facing the Mississippi River (2). Sediment input occurs primarily through non-point source pollution attributable to agricultural and urban land use practices. The improvements to commercial navigation (including the construction of 29 navigation dams and other human activities) have increased sedimentation and effluent into the system, diminishing the quantity and quality of riverine habitat. Pooled areas of the UMR, especially backwaters, are most susceptible to sediment deposition (1). It is estimated that sediments are accumulating at an average of two cm per year in UMR backwaters. In addition, since 1930, Lake Pepin has lost an estimated 12% of its volume due to sedimentation (2). Thus Mississippi River backwaters, which are the most productive habitat for fish and wildlife, may be lost within 50 to 100 years (10). Generally, both the quantity and quality of aquatic habitat(s) in the majority of pools on the UMR are diminishing. These changes are due to the inevitable aging of the manmade navigation pools and the environmental impacts associated with the numerous human uses of the system. The Habitat Needs Assessment (HNA) estimated that there are approximately 1,121,608 acres of habitat on the UMR and identified approximately 623,831 acres of that habitat to be in need of maintenance and/or restoration (9). In addition, navigation related activities, flooding regimes, sedimentation, and land and recreational use have major effects on the river's ecosystem. Resulting physical changes will impact the abundance, distribution and diversity of all aquatic inhabitants including fish."

Janvrin, Jeff, et al. 2010. Upper Mississippi River fisheries plan 2010. Upper Mississippi River Conservation Committee. – Fish Technical Committee. Onalaska, WI (Exhibit 33.)

45. In response to Illinois EPA's recommendation, Exelon states that it will conduct a study of the populations of white crappie, black crappie, and sauger in Pool 14 by studying fish population data obtained upstream from the Quad Cities Station in Pool 13. Explain the basis for Exelon's conclusion that its requested alternative thermal effluent limitations will assure the protection of the populations of white crappie, black crappie, and sauger in Pool 14 in the absence of, or prior to studying, this data. Explain how such a future study will lead to an understanding of the cause or causes of a decrease in these populations between 1971 and 2011.

***Exelon Response***: The Long-term Resource Monitoring Program at Bellevue Iowa was established in 1991, is run by Iowa DNR, and is one of the longest continual fisheries databases besides Exelon's on the Mississippi River. Pool 13 has minimal industrial and municipal inputs and ends at River Mile 522.5, while the Quad Cities Station sits downstream in Pool 14 at River Mile 506. This entire pool (Pool 13) is not influenced by Quad Cities Station operations. Comparing Pool 13 data with Exelon's Pool 14 data, will confirm expert conclusions that white crappie, black crappie, and sauger populations trends are not unique to Pool 14.

46. Comment on requiring the following condition of Exelon:

> Exelon will conduct a study of white crappie, black crappie, and sauger populations in Pool 14 of the Mississippi River. Exelon will conduct this study during the term of the first NPDES permit containing the alternative thermal effluent limitations ordered by the Board. The results of this study will be made available to Illinois EPA and Illinois DNR when the Quad Cities Nuclear Generating Station applies for renewal of its NPDES permit.

***Exelon Response***: The proposed condition is acceptable to Exelon.

**Extent of Mixing Zone**

47. The NPDES permit for the Quad Cities Station defines a mixing zone as "a straight line across the Mississippi River, 500 feet downstream of the diffuser pipes." Pet. Exh. 1 at 3. Exelon states that the surface area of the river between the diffuser pipes and 500 feet downstream is 24.9 acres, slightly less than the 26 acres allowed by Board regulations as a mixing zone. Pet. Exh. 1 App. D at D-5; *see also* 35 Ill. Adm. Code 302.102(b)(12). What is the surface area of the mixing zone under Exelon's requested 66% zone of passage?

***Exelon Response****:* The surface area of the mixing zone under Exelon's requested 66% zone of passage would remain 24.9 acres.

48. Figure E-2 depicts the current mixing zone with a cross-hatched area in relation to unionid bed monitoring areas. Pet. Exh. 1 App. E at E-22. Provide a more close-up map depicting the current mixing zone.

***Exelon Response***: *See* Exhibit 34.

49. Provide a map depicting the mixing zone under Exelon's requested 66% zone of passage. Provide dimensions for the extent of the mixing zone upstream and downstream from the diffuser. Under a 66% zone of passage, at what distance downstream would be the edge of the designated mixing zone? Would that distance change based on river flow and plant flow?

***Exelon Response***: The Quad Cities Station mixing zone currently described in the NPDES Permit as "a straight line across the Mississippi River, 500 feet downstream of the diffuser pipes" would remain the same under Exelon's requested 66% zone of passage proposal. The "size" of the mixing zone remains the same, it is the zone of passage with respect to river water volume at the mixing zone location that would decrease in size to 66% of the water volume, during low flow events. The dimensions of the mixing zone Quad Cities Station uses for determining NPDES permit compliance remains constant and does not change based on river flow and plant discharge flow.

50. Exelon notes that the NPDES permit contains monthly maximum temperature limits for "representative locations in the main river" at the edge of the mixing zone and requirements for daily determination of the temperature at a river cross-section 500 feet downstream from the diffuser system. Pet. Exh. 1 App. A at A-11, A-12. Under a 66% zone of passage, at what distance downstream from the diffuser system would Exelon monitor the temperature? Describe the monitoring protocol including number of temperature readings, monitoring locations, and frequency of monitoring. Describe the monitoring method, for example, manual sampling or continuous remote sampling.

***Exelon Response***: Under the proposed 66% zone of passage, Exelon will continue to monitor temperature on a straight line 500 feet downstream from the diffuser system. Exelon's Quad Cities Station procedure for monitoring of river discharge describes the monitoring protocol as "obtaining temperature at several depths and at several regularly spaced locations on a line spanning the river upstream of the Station and 500' downstream of the station discharge". When performing field measurements, the station typically obtains temperature profiles at ten locations evenly spaced across the river width upstream of the diffusers and at ten locations 500' downstream of the diffusers. At the ten locations, temperatures are obtained 1' below the surface of the water and at 5' intervals down to the river bottom. Depending on river depth at the specific location each "profile" consists of between two and five temperature measurements (i.e. – 1' below surface, 5' below surface, 10', 15', 20'). The typical number of temperature measurements taken during a determination of the temperature at a river cross section is 40-45 measurements upstream of the diffusers and 40-45 measurements 500' downstream of the diffusers. The frequency of monitoring varies with river and environmental conditions. The station continuously records ambient river conditions at the Station's intake structure and temperature in the Station's discharge bay at the entrance to the diffuser pipes via remote thermal probes.

Personnel daily verify operability of remote temperature monitoring equipment and manually record intake and discharge temperatures. When deemed necessary by environmental conditions (as described in special condition 7 of the station NPDES permit), Station personnel manually perform field measurements as described above anywhere from minimum of once per day and up to 10 times per day. This may include field measurements throughout the night.

51. Provide a copy of the temperature monitoring curve that would be used to demonstrate compliance with Exelon's requested alternative thermal effluent limitations.

***Exelon Response***: Quad Cities Station plans to continue using the existing temperature monitoring curve, last modified in December of 2000. The station will continue using either the temperature monitoring curve, in combination with other data (both plant and environmental), or actual temperature measurements at a river cross-section 500 feet downstream from the diffuser system, as allowed by NPDES permit special condition 7.

52. Comment on using the zone of passage curve developed during the April 2002 Iowa Institute of Hydraulic Research Report (Jain, et al, 2002) (Pet. Exh. 1 App. C at C-20) to demonstrate compliance with the mixing zone size similar to what appears to be a similar provision in Special Condition 6 of the Quad Cities Station's NPDES permit (Pet. Exh. 1 App. D at D-7).

***Exelon Response***: The zone of passage curve from the April 2002 IIHR report shows the Station would comply with a minimum 66% zone of passage with respect to volume for all flows greater than 13,200 cfs. The 2002 zone of passage curve will be incorporated into Station procedures to demonstrate the Station is in compliance with minimum 66% zone of passage at all flows greater than or equal to 13,200 cfs. For flows below 13,200 cfs, the Station may need to reduce the amount of heat discharged to the river by reducing output or making other operational changes to maintain a 66% minimum zone of passage. Exelon will evaluate whether a corresponding table correlating heat reduction with maintenance of a 66% zone of passage could be developed during the initial NPDES permit cycle following issuance of a permit incorporating the proposed alternative thermal limitations.

**River Flow and Zone of Passage**

Table C-1 shows that a zone of passage only would be less than 75% (corresponding to mixing zone greater than 25%) when flow in Pool 14 is below 16,400 cubic feet per second when the plant is operating at full thermal load and the diffuser provides uniform mixing. (Pet. Exh. 1 App. C at C-31). Table C-1 also shows that Exelon's proposed zone of passage of 66% would not occur until flow drops to 13,200 cubic feet per second. *Id.* Further, the lowest 7-day average flow that occurs on average once every 10 years (7Q10) in Pool 14 is 13,800 cubic feet per second while the typical summertime flow is 30,000. *Id., see also* Pet. Exh. 1 at 20. Based on Table C-1, the requested 66% zone of passage appears to occur only at flows less than the 7Q10. Historical flow records show that river flow was below 16,400 cubic feet per second on only four days during March to May and twenty-one days during October from 1986 to 2013. Pet. Exh. 1 App. B at B-5.

53. Explain how and when the flow in Pool 14 is measured. Does the NPDES permit for the Quad Cities Station require these measurements? If so, describe the permit requirements.

***Exelon Response***: The station uses US Army Corps of Engineers ("USACE") Lock & Dam ("L&D") 13 outflow for permit compliance purposes. (L&D 13 is located approx. 16 miles upstream of the Station). There is negligible flow input from other tributaries between L&D 13 and the Station's intake, except during periods of heavy rains and flooding, at which time low flows in Pool 14 are not a concern. In the event L&D 13 flow measurements are not available, the Station may use either USACE L&D 14 outflow (located approx. 13 miles downstream of the Station) or the USGS site at Camanche (located approx. 5.3 miles upstream from the Station) for flow measurements. Flow measurements are recorded on USACE and USGS sites a minimum of once every 2 hours. NPDES permit special condition 7 and Station procedures specifies recording of river flow weekly when flows are above 23,000 cfs and daily when river flow falls below 23,000 cfs.

54. In Table 3 "Summary and Brief Explanation of the Values Selected for the Plan and River Design Conditions," Exelon states that the maximum level of heat discharged to the river is based on a cooling water flow rate of 2192 cubic feet per second at a temperature difference of 28°F. Pet. Exh. 1 App. B at B-27. Based on the full thermal load, explain whether the zone of passage could be smaller than the percentage values listed in Table C-1 for the corresponding flow rates.

***Exelon Response***: Based on full thermal load, the zone of passage will not be smaller than the percentage values listed in Table C-1. As explained in Table 3, this is the maximum amount of heat that will be discharged to the river based on both units operating at 100% capacity and all six circulating water pumps in operation, which is the limiting factor determining zone of passage. Operating with less cooling water flow while at 100% capacity will increase the temperature difference above 28°F, but the overall amount of heat rejected to the river does not change. Studies have shown that operating at maximum cooling water flow is the limiting factor when determining zone of passage.

55. Would Exelon's requested 66% zone of passage entitle Exelon to a 34% mixing zone at all times even when flows in Pool 14 are greater than 13,200 cubic feet per second?

***Exelon Response***: Theoretically, Exelon's requested zone of passage would restrict the volume of river water available for passage to no less than 66% at all times, even when flows are greater than 13,200 cfs. However, as demonstrated by the zone of passage curve developed during the April 2002 Iowa Institute of Hydraulic Research Report (Exh. __), at flows greater than 16,400, the zone of passage is 75% or greater.

56. Comment on the following alternative thermal effluent limitation:

> The mixing zone for the Quad Cities Nuclear Generating Station shall allow for a zone of passage that includes at least 75% of the

> cross sectional area and volume of flow of the Mississippi River when the river flow is 16,400 cubic feet per second or more and no less than 66% when river flow is less than 16,400 cubic feet per second.

***Exelon Response***: The proposed condition would be acceptable and most clearly reflects the proposed alternative zone of passage limitation proposed by Exelon.

57. Comment on the following alternative thermal effluent limitation:

> The mixing zone for the Quad Cities Nuclear Generating Station shall allow for a zone of passage that includes at least 66% of the cross sectional area and volume of flow of the Mississippi River when the river flow is 13,200 cubic feet per second or less.

***Exelon Response***: The limitation in Question 56, above, more fully and completely reflects Exelon's proposed zone of passage limitation than does this limitation.

58. Comment on the following alternative thermal effluent limitation:

> The mixing zone for the Quad Cities Nuclear Generating Station shall allow for a zone of passage that includes at least 66% of the cross sectional area and volume of flow of the Mississippi River when the river flow is 13,200 cubic feet per second or less. The mixing zone shall allow for a zone of passage that includes at least 75% of the cross sectional area and volume of flow of the Mississippi River when the river flow is 16,400 cubic feet per second or more. For flows between 13,200 cubic feet per second and 16,400 cubic feet per second, the mixing will be as follows:

| Flow (cfs) | Zone of Passage |
|---|---|
| 13500 | 67% |
| 13800 | 69% |
| 14000 | 70% |
| 14500 | 71% |
| 15000 | 72% |
| 15500 | 73% |

16000 74%

***Exelon Response***: While this limitation is technically accurate because it reflects the zone of passage curve, it does not appear to provide any additional benefit beyond what would be provided by the clear and concise limitation in Question 56, above.

59. Exelon requests relief from 35 Ill. Adm. Code 302.102(b)(8) of the Board's mixing zone rules. State whether Exelon has demonstrated that its requested 66% zone of passage meets the requirements for granting an adjusted standard under 415 ILCS 5/28.1(c)(1)-(4).

***Exelon Response***: Exelon's Petition was submitted pursuant to the Board's newly promulgated regulations, that allow a petitioner to obtain alternative thermal limits under Section 316(a) of the Clean Water Act, not as a petition seeking an adjusted standard. The Petition does not include a discussion of compliance alternatives or their corresponding costs as required by the Board's regulations governing adjusted standard requests. Nor does the petition make a showing that factors relating to Exelon's proposed zone of passage are substantially and significantly different than those relied upon by the Board in promulgating the generally applicable mixing zone regulations. Rather, the Petition shows that if the proposed zone of passage is allowed, protection and propagation of a balanced indigenous community of fish, shellfish and wildlife in the Quad Cities Station receiving waters will continue to be assured.

While it may be possible for Exelon to show that the proposed zone of passage would qualify as an adjusted standard, Exelon should not be required to do so. As stated above, the relief Exelon is seeking is allowable under the Section 316(a) criteria. Moreover, requiring that Exelon amend its Petition to include the adjusted standard process would unnecessarily delay the process. Exelon has already experienced literally years of regulatory delay in having its request for thermal relief considered. Exelon has taken a lead role in working through the issues surrounding USEPA's concerns regarding thermal regulation in Illinois and the lack of procedural regulations to implement Section 316(a) in the State. Under the circumstances, Exelon should not be made to experience further delay.

**Derating**

60. In its petition, Exelon notes that it would need to derate when river flow falls below 13,200 cubic feet per second to maintain the requested zone of passage of at least 66% (Pet. Exh. 1 App. C at C-23) and it would need to derate at certain low flows to maintain compliance with its proposed relief on excursion hours (Pet. Exh. 1 App. B at B-9, B-10). The excursion hour analysis used a scenario allowing a 3% limit on excursion hours. Under a 2.5% limit (219 hours) as currently proposed by Exelon, identify the conditions which would require Quad Cities Station to begin derating to maintain compliance with the requested alternative thermal effluent limitations.

***Exelon Response***: Operational changes, including possible power reductions, would be required whenever the Station was at risk of exceeding the 219 excursion hours allowed each calendar year or when the flow in the River falls below 13,200 cfs. The decision to request 2.5% excursion hours rather than 3% will cause the Station to initiate these measures sooner than it would if the alternative limit allowed 3% excursion hours.

61. Comment on including a condition to the requested alternative thermal effluent limitations and in the NPDES permit for the Quad Cities Station requiring Quad Cities Station to derate under specified conditions to maintain compliance.

***Exelon Response***: Neither the alternative thermal limitations nor the NPDES Permit should prescribe how the Station is operated.

62. Comment on the following alternative thermal effluent limitation:

> When river flow is below 13,200 cubic feet per second, the Quad Cities Nuclear Generating Station will derate as needed to maintain a zone of passage of no less than 66% of the cross sectional area and volume of flow of the Mississippi River.

***Exelon Response***: The alternative thermal limitations should not prescribe how the Station is operated.

63. Comment on the following alternative thermal effluent limitation:

> When river flow is below 15,000 cubic feet per second, the Quad Cities Nuclear Generating Station will derate as needed to comply with the annual allotment of excursion hours.

***Exelon Response***: The alternative thermal limitations should not prescribe how the plant is operated.

**Excursion Hours**

64. Identify all twelve month periods (by beginning and ending day, month, and year) when the Quad Cities Station exceeded the maximum numerical temperatures in 35 Ill. Adm. Code 303.331 by any degree during more than 87.6 hours.

***Exelon Response:***

| | |
|---|---|
| 8/18/88 through 8/3/89 | (8/01/88 -7/31/89) |
| 7/30/06 through 8/1/07 | (7/1/06 – 7/31/07) |
| 3/21/12 through 7/16/13 | (3/1/12 – 6/30/13) |

65. Identify all twelve month periods (by beginning and ending day, month, and year) when the Quad Cities Station exceeded the maximum numerical temperatures in 35 Ill. Adm. Code 303.331 by any degree during more than 219 hours.

***Exelon Response***: 8/5/06 through 7/16/07 (8/1/06 – 6/30/07)
3/26/12 through 3/29/13 (3/1/12-2/29/13)

66. Identify (by day, month, and year) all excursion hours when the Quad Cities Station exceeded the maximum numerical temperatures in 35 Ill. Adm. Code 303.331 by more than 3°F.

***Exelon Response***: 7/31/06 @ 14:00 – 8/3/06 @ 07:00 – 65 hours
3/20/12 @ 12:00 – 3/26/12 @ 18:00 – 150 hours

67. Identify (by day, month, and year) all excursion hours when the Quad Cities Station exceeded the maximum limits in 35 Ill. Adm. Code 303.331 by more than 5°F.

***Exelon Response***: The station has not exceeded the monthly maximum limits by more than 5 degrees.

68. Identify all instances when Exelon requested a provisional variance from Illinois EPA for additional excursion hours based on a rolling twelve month calculation but Exelon would not have been required to obtain such a variance under a calendar year calculation.

***Exelon Response***: July of 1989, based on use of 108 hours in August of 1988.
March of 2012, based on use 33 hours in July of 2011.

69. Identify all instances when Exelon curtailed operations during a rolling twelve month calculation but Exelon would not have been required to do so under a calendar year calculation.

***Exelon Response***: Due to timely issuance of provisional variances, Exelon has not needed to curtail power due to a rolling 12 month calculation.

70. Explain whether Exelon can use existing historic data to determine whether Exelon used more than 219 excursion hours in any twelve-month period and whether such thermal discharge adversely impacted aquatic life.

***Exelon Response***: Yes. During the 12 month period of March 2012 through February 2013, Quad Cities Station used 442.5 hours. Follow-up mussel surveys and long term fish monitoring show no adverse impact to aquatic life.

71. Comment on requiring the following condition of Exelon:

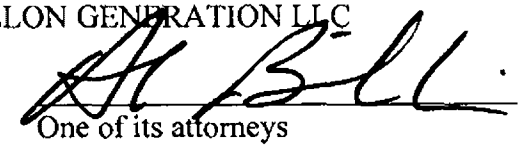
> Exelon will assess the impact on aquatic life when the Quad Cities Station uses more than 219 excursion hours in any twelve-month period. Exelon will conduct this study during the term of the first NPDES permit containing the alternative thermal effluent limitations ordered by the Board. The results of this study will be made available to Illinois EPA and Illinois DNR when the Quad Cities Nuclear Generating Station applies for renewal of its NPDES permit.

***Exelon Response***: This condition is acceptable.

Exelon appreciates the opportunity to respond to IPCB's questions, and respectfully renews its request that its Petition be granted by the Board.

Respectfully submitted,

EXELON GENERATION LLC

By: 
One of its attorneys

Alan P. Bielawski
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SIDLEY AUSTIN LLP
One South Dearborn
Chicago, Illinois 60603
Phone: (312) 853-7000
Fax: (312) 853-7036
abielawski@sidley.com
wdickett@sidley.com
knewman@sidley.com

**BEFORE THE ILLINOIS POLLUTION CONTROL BOARD**

| | | |
|---|---|---|
| In the Matter Of: | ) | |
| | ) | |
| EXELON GENERATION LLC, | ) | |
| Petitioner, | ) | |
| | ) | |
| v. | ) | PCB NO. 2014-123 |
| | ) | |
| ILLINOIS ENVIRONMENTAL | ) | |
| PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

**CERTIFICATE OF SERVICE**

I, the undersigned, certify that I have filed the attached Exelon Generation LLC's Response to Illinois Pollution Control Board Questions with:

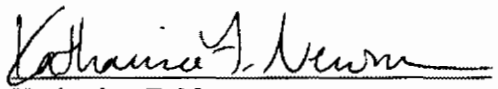
Office of the Clerk of the Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph Street, Suite 11-500
Chicago, Illinois 60601

Copies of these filings were also served on the following by U.S. Mail:

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Office of Legal Services
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Dated: July 16, 2014



Katharine F. Newman
SIDLEY AUSTIN LLP
One South Dearborn
Chicago, Illinois 60603
Phone: (312) 853-2038
Fax: (312) 853-7036
knewman@sidley.com

# Exhibit 1

Quad Cities Station NPDES Permit

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY**

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-2829
PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

217/782-0610

January 31, 2014

Exelon Generation Company, LLC
Quad Cities Generation Station
22710 206th Avenue North
Cordova, Illinois 61242

Re: Exelon Generation Company, LLC – Quad Cities Generating Station
NPDES Permit No. IL0005037
Modified Permit

Gentlemen:

The Illinois Environmental Protection Agency has reviewed the request for modification of the above-referenced NPDES Permit and issued a public notice based on that request. The final decision of the Agency is to modify the Permit as follows:

The modification was to change internal outfall C01 to outfall 003.

Enclosed is a copy of the modified Permit. You have the right to appeal this modification to the Illinois Pollution Control Board within a 35 day period following the modification date shown on the first page of the permit.

Should you have questions concerning the Permit, please contact Leslie Lowry at 217/782-0610.

Sincerely,

Alan Keller

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

SAK:LRL:05110101.docx

Attachment: Final Permit

cc: Records Unit
Compliance Assurance Section
Rockford Region
Iowa Department of Natural Resources
USEPA – Region 5

4302 N. Main St., Rockford, IL 61103 (815)987-7760
595 S. State, Elgin, IL 60123 (847)608-3131
2125 S. First St., Champaign, IL 61820 (217)278-5800
2009 Mall St., Collinsville, IL 62234 (618)346-5120
9511 Harrison St., Des Plaines, IL 60016 (847)294-4000
5407 N. University St., Arbor 113, Peoria, IL 61614 (309)693-5462
2309 W. Main St., Suite 116, Marion, IL 62959 (618)993-7200
100 W. Randolph, Suite 11-300, Chicago, IL 60601 (312)814-6026

NPDES Permit No. IL0005037

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Iowa Department of Natural Resources
NPDES Section
Henry A. Wallace Building
900 East Grand Avenue
Des Moines, Iowa 50319

# NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

## Modified (NPDES) Permit

Expiration Date: August 31, 2015

Issue Date: August 26, 2010
Effective Date: September 1, 2010
Modification Date: January 31, 2014

Name and Address of Permittee:

Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, Illinois 60555

Facility Name and Address:

Exelon Generation Company, LLC
Quad Cities Generating Station
22710 206th Avenue North
Cordova, Illinois 61242
(Rock Island County)

| Discharge Number and Name: | | Receiving Waters: |
|---|---|---|
| 001/002 | Open Cycle Diffusers | Mississippi River |
| B01 | Wastewater Treatment System | |
| A02 | Radwaste Treatment System Blowdown | |
| 003 | Sanitary Waste Treatment Plant | Mississippi River |

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of Ill. Adm. Code, Subtitle C and/or Subtitle D, Chapter 1, the Iowa Code Section 455B.174 and rule 567-64.3 of the Iowa Administrative Code, and the Clean Water Act (CWA), the above-named permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the standard conditions and attachments herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

Steven Williams
Iowa Department of Natural Resources
NPDES Section
Environmental Services Division

SAK:LRL:05110101.docx

Modification Date: January 31, 2014

NPDES Permit No. IL0005037

Effluent Limitations and Monitoring

1. From the modification date of this permit until the expiration date, the effluent of the following discharges shall be monitored and limited at all times as follows:

| PARAMETER | LOAD LIMITS lbs/day DAF (DMF) 30 DAY AVERAGE | LOAD LIMITS lbs/day DAF (DMF) DAILY MAXIMUM | CONCENTRATION LIMITS mg/l 30 DAY AVERAGE | CONCENTRATION LIMITS mg/l DAILY MAXIMUM | SAMPLE FREQUENCY | SAMPLE TYPE |
|---|---|---|---|---|---|---|
| Outfall 001/002 – Open Cycle Diffusers* (Average Flow = 1017.2 MGD) | | | | | | |
| The discharge consists of: | | | Approximate Flow (MGD) | | | |
| 1. Main Condenser Cooling Water | | | 972.4 | | | |
| 2. House Service Water | | | 44 | | | |
| 3. Radwaste Treatment System Blowdown (Outfall A02) | | | 0.055 | | | |
| 4. Wastewater Treatment Plant (Outfall B01) | | | 0.051 | | | |
| 5. House Service Water Strainer Backwash | | | 0.126 | | | |
| 6. Intake Screen Backwash | | | 0.508 | | | |
| 7. Units 1 and 2 Oil/Water Separators (stormwater) | | | Intermittent | | | |
| 8. Fish Culture Facilities | | | Intermittent | | | |
| 9. Crib House Floor Drain Sump** | | | 0.05 | | | |
| Flow (MGD) | See Special Condition 1. | | | | Daily | 24-Hour Total |
| pH | See Special Condition 2. | | | | 1/Month | Grab |
| Temperature*** | See Special Condition 7. | | | | Daily | Continuous |
| Total Residual Chlorine / Total Residual Oxidant | See Special Condition 4. | | | 0.05 | 1/Month | Grab |
| Zinc (Total)**** | | | Monitor Only | | 1/Quarter | Grab |

* - Outfall 001/002 consists two open cycle diffusers which are side by side and discharge equally into the Mississippi River. See Special Condition 5.
** - This sub-waste stream is an alternative routing from Outfall B01. See Special Condition 17.
*** - Daily grab samples for Temperature are allowed when the Continuous Temperature Recorder is inoperable.
**** - Quarterly sampling for zinc shall only be done when using the zinc-phosphate corrosion inhibitor.

NPDES Permit No. IL0005037

Effluent Limitations and Monitoring

1. From the modification date of this permit until the expiration date, the effluent of the following discharges shall be monitored and limited at all times as follows:

| PARAMETER | LOAD LIMITS lbs/day DAF (DMF) 30 DAY AVERAGE | LOAD LIMITS lbs/day DAF (DMF) DAILY MAXIMUM | CONCENTRATION LIMITS mg/l 30 DAY AVERAGE | CONCENTRATION LIMITS mg/l DAILY MAXIMUM | SAMPLE FREQUENCY | SAMPLE TYPE |
|---|---|---|---|---|---|---|
| Outfall B01 – Wastewater Treatment System* (DMF = 0.155 MGD) | | | | | | |
| The discharge consists of:** | | | Approximate Flow (MGD) | | | |
| 1. Crib House Floor Drain | | | 0.050 | | | |
| 2. Aux. Boiler Blowdown | | | Seasonal | | | |
| 3. Roof and Floor Drains | | | Intermittent | | | |
| 4. Portable Demineralizer Rinse Water | | | Intermittent | | | |
| Flow (MGD) | See Special Condition 1. | | | | 2/Month | 24-Hour Total |
| Total Suspended Solids | 19 | 39 | 15 | 30 | 2/Month | 8-Hour Composite |
| Oil and Grease | 19 | 26 | 15 | 20 | 1/Month | Grab |

* - Wastewater treatment system effluent is routed through an oil/water separator prior to discharge.
** - The listed contributory waste stream all pass through an oil/water separator (Units ½ oil/water separator) prior to entering the wastewater treatment plant. The crib house floor drain sump water may be discharged directly to Outfalls 001/002 as an alternative route. See Special Condition 17.

Outfall A02 - Radwaste Treatment System Blowdown*
(Average Flow = 0.055 MGD)

The discharge consists of:
1. Laundry Wastewater
2. Floor Drains
3. Equipment Drains
4. Reactor Water
5. Filter Backwash from Reactor Cleanup
6. Filter Backwash from Condensate Demineralizers
7. Laboratory Wastewater
8. Groundwater

| | | | | | | |
|---|---|---|---|---|---|---|
| Flow (MGD) | See Special Condition 1. | | | | Daily | 24-Hour Total |
| Total Suspended Solids | | | 15 | 30 | 1/Month | Grab |
| Oil and Grease | | | 15 | 20 | 1/Month | Grab |
| Boron | See Special Condition 16. | | Monitor Only | | 1/Discharge Event** | Grab |

* - The Permittee shall comply with the Nuclear Regulatory Commission, Title 10, regulations for discharge and monitoring of radioactive wastewater discharges. Wastewater is generally batch treated and recycled. Therefore the daily average discharge rate from Outfall A02 does not reflect influent flow rates.
** - When discharging sodium pentaborate.

NPDES Permit No. IL0005037

Effluent Limitations and Monitoring

1. From the modification date of this permit until the expiration date, the effluent of the following discharges shall be monitored and limited at all times as follows:

| | LOAD LIMITS lbs/day DAF (DMF) | | CONCENTRATION LIMITS mg/l | | | |
|---|---|---|---|---|---|---|
| PARAMETER | 30 DAY AVERAGE | DAILY MAXIMUM | 30 DAY AVERAGE | DAILY MAXIMUM | SAMPLE FREQUENCY | SAMPLE TYPE |
| Outfall 003 – Sanitary Waste Treatment Plant (DMF = 0.06 MGD) | | | | | | |
| Flow (MGD) | See Special Condition 1. | | | | 2/Month | 24-Hour Total |
| pH | See Special Condition 2. | | | | 2/Month | Grab |
| Total Residual Chlorine | See Special Condition 4 and 20. | | | 0.05 | 1/Month | Grab |
| Fecal Coliform | See Special Condition 13. | | | 400/100ml | 2/Month | Grab |
| $BOD_5$ | 15 | 30 | 30 | 60 | 2/Month | 24-Hour Composite |
| Total Suspended Solids | 15 | 30 | 30 | 60 | 2/Month | 24-Hour Composite |

NPDES Permit No. IL0005037

Special Conditions

SPECIAL CONDITION 1. Flow shall be measured in units of Million Gallons per Day (MGD) and reported as a monthly average and a daily maximum on the Discharge Monitoring Report.

SPECIAL CONDITION 2. The pH shall be in the range 6.0 to 9.0. The monthly minimum and monthly maximum values shall be reported on the DMR form.

SPECIAL CONDITION 3. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 4. All samples for Total Residual Chlorine shall be analyzed by an applicable method contained in 40 CFR 136, equivalent in accuracy to low-level amperometric titration or other methods found in Standard Methods for Examination of Water and Wastewater, current edition. Any analytical variability of the method used shall be considered when determining the accuracy and precision of the results.

SPECIAL CONDITION 5. Compliance with discharge limitations for Outfall 001 shall be determined by representative sampling of Outfall 002. Due to the configuration of the discharge bay, which is immediately upstream of the two open cycle diffusers, the effluent from the discharge bay flows into the two open cycle diffuser pipes, which equally release the discharge into the Mississippi River.

SPECIAL CONDITION 6. Nothing in this permit affects or abrogates the responsibilities or commitments of the Permittee herein as set forth in the agreement entered into by the Permittee in the consolidated cases of Izaak Walton League of America, et. al. v. Schlesinger, No. 2208-71 and People of the State of Illinois, et. al. v. United States Atomic Energy Commission, No. 2208-71 (U.S. District Court, District of Columbia).

SPECIAL CONDITION 7. Discharge of wastewater from this facility must not alone or in combination with other sources cause the receiving stream to violate the following thermal limitations at the edge of the mixing zone:

A. Maximum temperature rise above natural temperature must not exceed 5°F.

B. Water temperature at representative locations in the main river shall not exceed the maximum limits in the following table during more than one (1) percent of the hours in the 12 month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 3°F. (Main river temperatures are temperatures of those portions of the river essentially similar to and following the same thermal regime as the temperatures of the main flow of the river.)

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | 45 | 45 | 57 | 68 | 78 | 85 | 86 | 86 | 85 | 75 | 85 | 52 |

C. The area of diffusion of an effluent in the receiving water is a mixing zone, and that mixing zone shall not extend:

i. Over more than 25 percent of the cross sectional area or volume of flow in the Mississippi River;

ii. More than 26 acres of the Mississippi River

The following data shall be collected and recorded:

1. Weekly determination of the river flow rate (daily when the river flows fall below 23,000 cfs).
2. Daily determination of the ambient river temperature (at or upstream of station intakes).
3. Daily recording of station discharge rate.
4. Daily continuous recording of the temperature of the station discharge.
5. Daily determination of station load.
6. As deemed necessary according to the above data, daily determination of the cross-sectional average temperature at the 500 foot downstream cross-section in the river.

Compliance with the thermal limitations of Special Condition 7 shall be demonstrated as follows:

1. When river flow is 21,000 cfs or greater and the ambient river temperature is 5°F or more lower than the monthly limiting temperatures, the temperature monitoring curve[1] establishes that the permittee is in compliance for all power generation levels;

NPDES Permit No. IL0005037

Special Conditions

2. When the river flow is less than 21,000 cfs and/or the ambient river temperature is within 5° F of the monthly limiting temperatures, the permittee shall demonstrate compliance using either:

   a. Plant load, river flow, ambient river temperature, and the temperature monitoring curve, or

   b. Field measurement[2] of the river cross-sectional average temperature taken 500 feet downstream of the diffusers.

In the event that compliance monitoring shows that the permittee has exceeded the monthly limiting temperature, the number of hours of such exceedance shall be reported on the permittee's Discharge Monitoring Report.

[1]The temperature monitoring curve identified as figure 2 in the December 2000 "Revised Temperature Monitoring Curve for Quad Cities Nuclear Generating Station".

[2] When conditions such as ice formation render the Mississippi River inaccessible to marine activity, the Permittee may demonstrate compliance with the thermal limitations of Special Condition 7 by using the most recent field measurement data collected at a river flow equal to or less than the flow for which field measurement data cannot be collected. The most recent field measurement data shall be normalized to the power production level for the day when the river was inaccessible.

SPECIAL CONDITION 8. There shall be no discharge of polychlorinated biphenyl compounds from any discharge.

SPECIAL CONDITION 9. There shall be no discharge of complexed metal bearing wastestreams and associated rinses from chemical metal cleaning, unless this permit has been modified to include the new discharge.

SPECIAL CONDITION 10. Demonstration for the Quad Cities Nuclear Power Station in accordance with Section 316(a) and 316(b) of the Clean Water Act was approved by IEPA by letter dated July 28, 1981 and by the Iowa Department of Environmental Quality (IDEQ) by letter dated May 18, 1981. Based on these conclusions the following actions by the permittee are required:

A. The permittee shall monitor fish impingement once per week, year round. Each year's date shall be tabulated and compared to historical fish impingement data for the same period with the results submitted to IEPA Compliance Assurance Section and Iowa Department of Natural Resources by July 28, each year.

   Iowa Department of Natural Resources
   Attn. Fisheries Management Biologist
   Bellevue Research Station
   24143 Highway 52
   Bellevue, Iowa 52031

B. The permittee shall monitor water temperatures as described in Special Condition 7.

SPECIAL CONDITION 11. A permittee who wishes to establish the affirmative defense of upset as defined in 40 CFR 122.41(n) shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that: An upset occurred and that the permittee can identify the cause(s) of the upset; the permitted facility was at the time being properly operated; the permittee submitted notice of the upset as required in standard condition 12 of this permit; and the permittee complied with any remedial measures required in standard condition 4 of this permit.

SPECIAL CONDITION 12. Discharge is allowed from the Unit 1 oil/water separator and the Unit 2 oil/water separator in accordance with the Spill Prevention Control and Countermeasure Plan (SPCC). If an applicable effluent standard or water quality related effluent limitation is promulgated under Section 301 and 302 of the Clean Water Act (CWA) and that affluent or water quality standard or limitation is more stringent than any effluent or water quality limitations in this permit, or controls a pollutant not limited in this NPDES Permit, the Agencies shall revise or modify the permit in accordance with the promulgated standard and shall notify the permittee.

SPECIAL CONDITION 13. The daily maximum fecal coliform count shall not exceed 400 per 100 ml.

SPECIAL CONDITION 14. The Permittee shall record monitoring results on Discharge Monitoring Report (DMR) Forms using one such form for each outfall each month.

In the event that an outfall does not discharge during a monthly reporting period, the DMR Form shall be submitted with no discharge indicated.

The Permittee may choose to submit electronic DMRs (eDMRs) instead of mailing paper DMRs to the IEPA. More information, including registration information for the eDMR program, can be obtained on the IEPA website, http://www.epa.state.il.us/water/edmr/index.html.

NPDES Permit No. IL0005037

Special Conditions

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later then the 28th day of the following month, unless otherwise specified by the permitting authority.

Permittees not using eDMRs shall mail Discharge Monitoring Reports with an original signature to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

Attention: Compliance Assurance Section, Mail Code # 19

SPECIAL CONDITION 15. The Agency has determined that the effluent limitations in this permit constitute BAT/BCT for storm water which is treated in the existing treatment facilities for purposes of this permit reissuance, and no pollution prevention plan will be required for such storm water. In addition to the chemical specific monitoring required elsewhere in this permit, the permittee shall conduct an annual inspection of the facility site to identify areas contributing to a storm water discharge associated with industrial activity, and determine whether any facility modifications have occurred which result in previously-treated storm water discharges no longer receiving treatment. If any such discharges are identified the permittee shall request a modification of this permit within 30 days after the inspection. Records of the annual inspection shall be retained by the permittee for the term of this permit and be made available to the Agency on request.

SPECIAL CONDITION 16. The permittee shall monitor for boron during periods when Sodium Pentaborate is discharged as a result of tank testing and connection drainage from components in the radwaste treatment system. The effluent boron concentration in the subject discharge shall not cause the receiving stream to exceed the water quality standards in Section 302 of 35 Ill. Adm. Code, Chapter 1, Subtitle C. This permit may be modified to include effluent limitations or requirements which are consistent with applicable laws, regulations, or judicial orders. The Agency will public notice the permit modification.

SPECIAL CONDITION 17. Crib House Floor Drain Sump shall only be routed to the Outfall 001/002 Open Cycle Diffusers during periods when increased pump seal cooling water leakage is significant enough so as to overload the wastewater treatment plant. Alternate routing of this discharge shall not take place in lieu of proper maintenance and operation of the circulating pumps.

SPECIAL CONDITION 18. This permit authorizes the use of water treatment additives that were requested as part of this renewal. The use of any new additives, or change in those previously approved by the Agencies, or if the permittee increases the feed rate or quantity of the additives used beyond what has been approved by the Agencies, the permittee shall request a modification of this permit in accordance with the Standard Condition - Attachment H.

The permittee shall submit to the Agencies on a yearly basis a report summarizing their efforts with water treatment suppliers to find a suitable alternative to phosphorus based additives.

SPECIAL CONDITION 19. In order for the Agency to evaluate the potential impacts of cooling water intake structure operations pursuant to 40 CFR 125.90(b), the permittee shall prepare and submit information to the Agency outlining current intake structure conditions at this facility, including a detailed description of the current intake structure operation and design, description of any operational or structural modifications from original design parameters, source waterbody flow information, or other information as necessary. The information submitted should be in accordance with the previously submitted information collection proposal received by the Agency on May 10, 2005.

The information shall also include a summary of historical 316(b) related intake impingement and / or entrainment studies, if any, as well as current impingement mortality and / or entrainment characterization data; and shall be submitted to the Agency within six (6) months of the permit's effective date.

Upon the receipt and review of this information, the permit may be modified to require the submittal of additional information based on a Best Professional Judgement review by the Agency. This permit may also be revised or modified in accordance with any laws, regulations, or judicial orders pursuant to Section 316(b) of the Clean Water Act.

SPECIAL CONDITION 20. For a period of 12 months following the modification date of this Permit, Total Residual Chlorine must be monitored only at outfall 003.

A Total Residual Chlorine limit of 0.05 mg/l (Daily Maximum) for outfall 003 shall become effective 12 months from the modification date of this Permit.

NPDES Permit No. IL0005037

Special Conditions

The Permittee shall construct a dechlorination system or some alternative means of compliance in accordance with the following schedule:

| | | |
|---|---|---|
| 1. | Status Report | 3 months from the modification date |
| 2. | Status Report | 6 months from the modification date |
| 3. | Status Report | 9 months from the modification date |
| 4. | Obtain Operation Level | 12 months from the modification date |

Compliance dates set out in this Permit may be superseded or supplemented by compliance dates in judicial orders, or Pollution Control Board orders. This Permit may be modified, with Public Notice, to include such revised compliance dates.

The Permittee shall operate the dechlorination system or an alternative means of compliance in a manner to ensure continuous compliance with the Total Residual Chlorine limit, not to the extent that will result in violations of other permitted effluent characteristic, or water quality standards.

REPORTING

The Permittee shall submit a report no later than fourteen (14) days following the completion dates indicated above for each numbered item in the compliance schedule, indicating, a) tha date the item was completed, or b) that the item was not completed, the reason for non-completion, and the anticipated completion date.

**Attachment H**

**Standard Conditions**

**Definitions**

**Act** means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

**Agency** means the Illinois Environmental Protection Agency.

**Board** means the Illinois Pollution Control Board.

**Clean Water Act** (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

**NPDES** (National Pollutant Discharge Elimination System) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the Clean Water Act.

**USEPA** means the United States Environmental Protection Agency.

**Daily Discharge** means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

**Maximum Daily Discharge Limitation** (daily maximum) means the highest allowable daily discharge.

**Average Monthly Discharge Limitation** (30 day average) means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

**Average Weekly Discharge Limitation** (7 day average) means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

**Best Management Practices** (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

**Aliquot** means a sample of specified volume used to make up a total composite sample.

**Grab Sample** means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

**24-Hour Composite Sample** means a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

**8-Hour Composite Sample** means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

**Flow Proportional Composite Sample** means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **Duty to comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

(2) **Duty to reapply.** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **Proper operation and maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62 and 40 CFR 122.63. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

(8) **Duty to provide information.** The permittee shall furnish to the Agency within a reasonable time, any information which the Agency may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also furnish to the Agency upon request, copies of records required to be kept by this permit.

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency or USEPA (including an authorized contractor acting as a representative of the Agency or USEPA), upon the presentation of credentials and other documents as may be required by law, to:

(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor at reasonable times, for the purpose of assuring permit compliance, or as otherwise authorized by the Act, any substances or parameters at any location.

(10) **Monitoring and records.**

(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) The permittee shall retain records of all monitoring information, including all calibration and maintenance records, and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of this permit, measurement, report or application. Records related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503). This period may be extended by request of the Agency or USEPA at any time.

(c) Records of monitoring information shall include:

(1) The date, exact place, and time of sampling or measurements;

(2) The individual(s) who performed the sampling or measurements;

(3) The date(s) analyses were performed;

(4) The individual(s) who performed the analyses;

(5) The analytical techniques or methods used; and

(6) The results of such analyses.

(d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.

(a) **Application.** All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

(b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph (a); and

(2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and

(3) The written authorization is submitted to the Agency.

(c) **Changes of Authorization.** If an authorization under (b) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.

(d) **Certification.** Any person signing a document under paragraph (a) or (b) of this section shall make the following certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

(12) **Reporting requirements.**

(a) **Planned changes.** The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.
Notice is required when:

(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source pursuant to 40 CFR 122.29 (b); or

(2) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements pursuant to 40 CFR 122.42 (a)(1).

(3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

(b) **Anticipated noncompliance.** The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) **Transfers.** This permit is not transferable to any person except after notice to the Agency.

(d) **Compliance schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

(e) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).

(2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(f) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24-hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24-hours:

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit.

(2) Any upset which exceeds any effluent limitation in the permit.

(3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit or any pollutant which may endanger health or the environment.

The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24-hours.

(g) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12) (d), (e), or (f), st the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12) (f).

(h) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Bypass.**

(a) Definitions.

(1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

(2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

(b) Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs (13)(c) and (13)(d).

(c) Notice.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph (12)(f) (24-hour notice).

(d) Prohibition of bypass.

(1) Bypass is prohibited, and the Agency may take enforcement action against a permittee for bypass, unless:

(i) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(ii) There ware no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(iii) The permittee submitted notices as required under paragraph (13)(c).

(2) The Agency may approve an anticipated bypass, after considering its adverse effects, if the Agency determines that it will meet the three conditions listed above in paragraph (13)(d)(1).

(14) **Upset.**

(a) Definition. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(b) Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph (14)(c) are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

(c) Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidance that:

(1) An upset occurred and that the permittee can identify the cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in paragraph (12)(f)(2) (24-hour notice).

(4) The permittee complied with any remedial measures required under paragraph (4).

(d) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

(15) **Transfer of permits.** Permits may be transferred by modification or automatic transfer as described below:

(a) Transfers by modification. Except as provided in paragraph (b), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued pursuant to 40 CFR 122.62 (b) (2), or a minor modification made pursuant to 40 CFR 122.63 (d), to identify the new permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

(b) Automatic transfers. As an alternative to transfers under paragraph (a), any NPDES permit may be automatically

transferred to a new permittee if:

(1) The current permittee notifies the Agency at least 30 days in advance of the proposed transfer date;

(2) The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage and liability between the existing and new permittees; and

(3) The Agency does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement.

(16) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:

(a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

(1) One hundred micrograms per liter (100 ug/l);

(2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.

(3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or

(4) The level established by the Agency in this permit.

(b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(17) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:

(a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and

(b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

(c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(18) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:

(a) User charges pursuant to Section 204 (b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;

(b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and

(c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(19) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(20) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(21) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(22) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the Clean Water Act is subject to a fine of not less than $2,500 nor more then $25,000 per day of violation, or by imprisonment for not more than one year, or both. Additional penalties for violating these sections of the Clean Water Act are identified in 40 CFR 122.41 (a)(2) and (3).

(23) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

(24) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(25) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

(26) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(27) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board or any court with jurisdiction.

(28) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

# Exhibit 2

Provisional Variance PCB 88-129

ILLINOIS POLLUTION CONTROL BOARD
August 18, 1988

| | | |
|---|---|---|
| COMMONWEALTH EDISON QUAD CITIES POWER STATION, Petitioner, | ) | |
| v. | ) | PCB 88-129 |
| ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, Respondent. | ) | |

ORDER OF THE BOARD (by J.D. Dumelle):

This matter comes before the Board upon receipt of an August 18, 1988, Agency Recommendation concerning Petitioner, Commonwealth Edison Quad Cities Power Station's request for provisional variance from the limitations set forth at 35 Ill. Adm. Code 302.211 and Part 303.

On August 17, 1988, Petitioner filed a request for provisional variance with the Illinois Environmental Protection Agency (Agency) seeking temporary relief from this Board's water temperature standards.

Petitioner's NPDES permit sets water temperature limits at Petitioner's facility and prohibits Petitioner from exceeding these more than 1% of the time in any 12-month period. Additionally, at no time shall the water temperature exceed maximum temperatures by more than 3°F. Special condition No. 6, B NPDES Permit No. IL0002224.

Petitioner avers that the severe drought and extremely hot weather, low river flows, elevated ambient river temperatures, and decreased heat dissipation have imposed severe operating restrictions on the generating station. Owing to the weather Petitioner predicts that it will exhaust the 1% limit for maximum exceedances (of the 3°F condition) during mid-August of 1988. In support of this Petitioner has stated the following:

> "Typically, ambient water temperatures in pool No. 14 do not exceed 80° during the summer months. However, the unusually hot and dry weather we have experienced has caused ambient water temperatures to rise above 80° throughout much of the summer. Ambient water temperatures exceeding 84.2°F have occurred

regularly for short periods throughout July and August."

Recent data submitted by Petitioner indicates a river temperature of 86.5°F on August 17, 1988.

Notwithstanding this, the increase has occurred gradually and Petitioner claims that resulting environmental impact will be minimal. The Agency concurs in this judgement.

In its Agency Recommendation the IEPA urges this Board to grant the requested provisional variance stating that failure to do so would impose an arbitrary and unreasonable hardship on Petitioner.

The Board agrees; Petitioner is granted provisional variance from 35 Ill. Adm. Code 302.211 and Part 303 subject to the following conditions:

a. This variance shall begin when Quad Cities station uses up their NPDES permit allocated 87.6 hours for discharge of effluent hotter than the temperatures allowed in special conditions No. 6, B of their NPDES permit and continue for 45 days or when Quad Cities Station uses up the additional 175 hours received from granting this variance, whichever occurs first.

b. During the variance at no time shall the water temperature discharged exceed the maximum limits in special condition No. 6, B of their NPDES permit by more than 3°F.

c. During this variance, the Petitioner shall maintain a continuous temperature and flow recorder for the cooling blowdown to the Mississippi River. Such records shall be submitted with Petitioner's Discharge Monitoring Reports. The records submitted should indicate the daily temperature discharge to the Mississippi River.

d. The Petitioner shall mitigate possible adverse effects to the river's fishery and conduct daily observations of fish condition.

e. Within 10 days of the date of the Board's Order, Petitioner shall execute a Certificate of Acceptance and Agreement which shall be sent to Mark T. Books at the address indicated below:

Illinois Environmental Protection Agency
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276
ATTN: Mark T. Books

This variance shall be void if Petitioner fails to execute and forward the certificate within the ten day period. The ten day period shall be held in abeyance during any period that this matter is being appealed. The form of said Certification shall be as follows:

CERTIFICATION

I, (We), Commonwealth Edison Quad Cities Power Station, having read the Order of the Illinois Pollution Control Board, in PCB 88-129, dated August 18, 1988, understand and accept the said Order, realizing that such acceptance renders all terms and conditions thereto binding and enforceable.

Petitioner

By: Authorized Agent

Title

Date

IT IS SO ORDERED.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Order was adopted on the 18th day of August, 1988 by a vote of 6-0.

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board

August 23, 1988

CERTIFIED MAIL

Mr. Mark Books
Division of Water Pollution Control
Illinois Environmental Protection Agency
2200 Churchill Road
Post Office Box 19276
Springfield, Illinois 62794-9276

Subject: Provisional Variance for Quad Cities Generating Station--IPCB 88-129

Dear Mr. Books:

I, Commonwealth Edison, Quad Cities Power Station, having read the Order of the Illinois Pollution Control Board in PCB 88-129 dated August 18, 1988, understand and accept said Order, realizing that such acceptance renders all terms and conditions thereto binding and enforceable.

Commonwealth Edison
Dresden Generating Station
By: John H. Hughes
Environmental Affairs Manager
Dated: August 23, 1988

4387e
JPS:JHH:dd

bcc: R. L. Bax
File: 04-PER-N2
IPCB-88-129

# Exhibit 3

Provisional Variance PCB 89-115

ILLINOIS POLLUTION CONTROL BOARD
July 13, 1989

| | | |
|---|---|---|
| COMMONWEALTH EDISON<br>QUAD CITIES POWER STATION,<br><br>Petitioner,<br><br>v.<br><br>ILLINOIS ENVIRONMENTAL<br>PROTECTION AGENCY,<br><br>Respondent. | ) | PCB 89-115 |


OPINION AND ORDER OF THE BOARD (by J. Marlin):

This matter comes before the Board upon a recommendation filed by the Illinois Environmental Protection Agency ("Agency") on July 12, 1989 recommending the Board grant a 45-day provisional variance to Commonwealth Edison's Quad Cities Power Station. Commonwealth Edison requests a variance from their thermal discharge limitations under 35 Ill. Adm. Code 302.211 and Part 303.

Commonwealth Edison owns and operates Quad Cities nuclear-fueled electrical generating facility located near Cordova, Illinois on the Mississippi River. This station consists of 2 boiling water nuclear fission reactors each providing steam to a turbine generator. Two boiling water reactors provide a maximum capacity of 1666 megawatts. Circulating water used to cool and condense the steam from the generating process is discharged to the Mississippi River.

According to the Agency, Commonwealth Edison's NPDES permit states that, "Water temperature at representative locations in the main river shall not exceed the maximum limits identified in the following table during more than one (1) percent of the hours (87.6 hrs.) in the 12-month period ending with any month. Moreover, at no time shall the water temperature at such locations exceed the maximum limits in the following table by more than 3°F" (special condition #6, B, NPDES permit #IL0002224):

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | 45 | 45 | 57 | 68 | 78 | 85 | 86 | 86 | 85 | 75 | 65 | 52 |

Commonwealth Edison has stated that the extremely hot weather and moderate drought conditions have caused low river

flows, elevated ambient river temperatures, and decreased heat dissipation which have in various combinations imposed severe operating restrictions on several of Edison's generating stations. While at the same time, record electrical demands have occurred. This has resulted in Commonwealth Edison's electrical reserve levels to become dangerously low.

Commonwealth Edison has stated that the Quad Cities Station has used up all their available hours for the station as of July 10, 1989. The Agency agrees with Commonwealth Edison that denial of this provisional variance would impose an arbitrary or unreasonable hardship upon Commonwealth Edison.

Commonwealth Edison has requested an additional 100 hours to be used during this provisional variance period. Commonwealth Edison's current permit limits will allow them to recover 71.6 hrs. as of August 1, 1989. Commonwealth Edison has stated "we would like to point out that this request essentially grants only 28.4 hours of exceedance than we would normally experience under existing standards; however, it allows the redistribution of some of these hours into July, if necessary. In addition, the hours of standard temperature exceedance experienced during this provisional variance period shall not be credited toward the 87.6 hours exceedance limitation imposed by the NPDES permit" (Variance Request at 2). Commonwealth Edison has also stated that the request for additional hours will not affect their intention to observe the 3°F allowable temperature excursion.

Commonwealth Edison has stated that "typically, ambient water temperatures in Pool 14 do not exceed 80°F during the summer months. However, the unusually hot and dry weather we have experienced this summer have caused ambient water temperatures to raise above 80°F throughout much of the summer. Ambient water temperatures exceeding 84.2°F have occurred regularly for short periods throughout July. The rise in temperature has occurred gradually over several months time and the fish community has had sufficient time to respond to increased temperatures." The Agency obtained temperature data from Commonwealth Edison by phone on July 11, 1989 indicating the river temperature as of July 10, 1989 to be 85.7°F. Commonwealth Edison further stated that "fishery surveys conducted in July and August, 1988, have not detected any substantive change in community composition downstream from the Quad Cities Station discharge. Cool water species have responded to avoidance threshold temperatures and have moved to portions of the river more suited to their normal thermal preferences." The Agency therefore concurs with the Petitioner that the anticipated environmental impact of this variance will be minimal. The Agency also states that there are no public water supplies which would be adversely affected nor any federal laws which would preclude the granting of this variance.

The Board having received notification from the Agency that compliance on a short term basis with the thermal discharge limitations imposed by 35 Ill. Adm. Code 302.211 and Part 303 would impose an arbitrary or unreasonable hardship upon Commonwealth Edison, and the Board concurring in that notification will grant Commonwealth Edison's provisional variance, subject to the conditions suggested by the Agency.

This Opinion constitutes the Board's findings of fact and conclusions of law in this matter.

ORDER

1. Commonwealth Edison is hereby granted variance from 35 Ill. Adm. Code 302.211 and Part 303 for its Quad Cities Power Station, subject to the following conditions:

   a. This variance shall begin when Quad Cities Station uses up their NPDES permit allocation of 87.6 hours (July 10, 1989) for discharge of effluent hotter than the temperatures allowed in special condition #6, B of their NPDES permit and continue for 45 days or when Quad Cities Station uses up the additional 100 hours received from granting this variance, whichever occurs first. The hours used during this provisional variance period shall also be excluded from the 87.6 hours limitation imposed by their NPDES permit.

   b. During the variance, at no time shall the water temperature discharged exceed the maximum limits in special condition #6, B of their NPDES permit by more than 3°F.

   c. During this variance, Commonwealth Edison shall maintain a continuous temperature and flow recorder for the cooling blowdown to the Mississippi River. Such records shall be submitted with Commonwealth Edison's Discharge Monitoring Reports. The records submitted should indicate the daily temperature discharge to the Mississippi River.

   d. Commonwealth Edison shall mitigate possible adverse affects to the river's fishery and conduct daily observations of fish condition.

   e. Within 10 days of the date of this Order, Commonwealth Edison shall execute and submit a Certificate of Acceptance and Agreement shall be sent to Mark T. Books at the address indicated below:

      Illinois Environmental Protection Agency
      2200 Churchill Road

P. O. Box 19276
Springfield, IL 62794-9276

Attention: Mark T. Books

This variance shall be void if Commonwealth Edison fails to execute and forward the certificate within ten day period. The ten day period shall be held in abeyance during any period that this matter is being appealed. The form of said Certification shall be as follows:

CERTIFICATION

I, (We), _____, having read the Order of the Illinois Pollution Control Board, in PCB 89-115, dated July 13, 1989, understand and accept the said Order, realizing that such acceptance renders all terms and conditions thereto binding and enforceable.

_____
Petitioner

_____
By: Authorized Agent

_____
Title

_____
Date

Section 41 of the Environmental Protection Act, Ill. Rev. Stat. 1987 ch. 111 1/2 par. 1041, provides for appeal of Final Orders of the Board within 35 days. The Rules of the Supreme Court of Illinois establish filing requirements.

IT IS SO ORDERED.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 13th day of July, 1989, by a vote of 7-0.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board

# Exhibit 4

Provisional Variance IEPA 05-07

Exelon Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

PM-05-009

July 22, 2005

Mr. Roger Callaway
Compliance Assurance Section
Division of Water Pollution Control
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62794

Re: Quad Cities Nuclear Power Station NPDES Permit No. IL0005037
Provisional Variance Request – Emergency Application IEPA 05-07

Dear Mr. Callaway:

Thank you for the time, consideration and attention IEPA dedicated to Exelon's provisional variance request. We sincerely appreciate all of your efforts. Below is Quad Cities Station's Certificate of Acceptance of the Provisional Variance Order issued by IEPA in this matter.

Very Truly Yours,

Timothy K Hanley for

William R. Gideon
Plant Manager
Quad Cities Station

9 Pages

# Certificate of Acceptance

I(We), Timothy K Hanley, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in matter IEPA 05-07 dated July 22, 2005.

Exelon Generation Co. L.L.C/Quad Cities Station
Petitioner

Timothy K Hanley
Authorized Agent

Acting Plant Manager
Title

7/22/05
Date

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 - ( 217) 782-3397
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601 - (312) 814-6026

ROD R. BLAGOJEVICH, GOVERNOR DOUGLAS P. SCOTT, DIRECTOR

(217) 782-5544
TDD: (217) 782-9143

July 22, 2005

Dorothy Gunn, Clerk
Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, IL 60601

RE: **NOTICE OF PROVISIONAL VARIANCE APPROVAL**
**PV-06-07**

Dear Ms. Gunn:

Pursuant to Subsection 37(b) of the Environmental Protection Act (415 ILCS 5/37(b)), attached is a copy of the Illinois EPA's recent approval of a request for provisional variance. As you know, the Board must maintain for public inspection copies of all provisional variances filed with it by the Illinois EPA. Please feel free to call me at the number referenced above should you have any questions.

Sincerely,

Vera Herst
Assistant Counsel
Division of Legal Counsel

Attachment

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY**

July 22, 2005

| | | |
|---|---|---|
| **Exelon Generation Company, L.L.C.**<br>**Quad Cities Nuclear Power Station** | ) | |
| Petitioner, | ) | |
| v. | ) | IEPA – 05-07<br>(Provisional Variance-Water) |
| ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

Re: Provisional Variance From Special Condition 6B of NPDES Permit IL0005037

The Agency has completed its technical review of the attached provisional variance request submitted by Exelon Generation Company, L.L.C. Quad Cities Nuclear Power Station (Exelon's Quad Cities Station) on July 21, 2005 (Attachment A). Based on the review, the Agency GRANTS a provisional variance subject to specific conditions set forth below for a period of 45 days or until the additional 100 provisional variance excursion hours are utilized, whichever occurs first.

Exelon's Quad Cities Station is seeking a provisional variance from Special Condition 6B of its NPDES Permit IL0005037 (Attachment B), which limits the number of excursion hours and the maximum temperatures.

Exelon's Quad Cities Station is a nuclear-fueled steam electric generating facility located on the Mississippi River at River Mile 506.8 near Cordova, Illinois. It operates its cooling water system in open cycle mode. Cooling water is taken from the Mississippi River, passes through the plant system and is then discharged by diffusers into the Mississippi River. Maximum design flow of this system is 2,253 cfs.

Exelon's Quad Cities Station seeks a variance from Special Condition 6B of NPDES Permit IL0005037. This condition establishes the thermal discharge ranges for Exelon's Quad Cities Station. Additionally, it allows Exelon's Quad Cities Station excursion hours from these limits. Excursion hours are periods of time in which the temperature at

the edge of the mixing zone may be 3°F warmer than the temperature limit in the permit. Exelon's Quad Cities Station may only utilize 1% (87.6) of the hours in a 12-month period ending with any month as excursion hours. The permit also requires that water temperature in the Mississippi River at the edge of the mixing zone shall at no time exceed by 3°F the maximum limits of 86°F in July and August and 85°F in September.

Normally, Exelon's Quad Cities Station can operate within these limits because the ambient temperature in the Mississippi River at the intake points (or above the plant) remain below the non-excursion hour temperature limit. Ordinarily, the Mississippi River has significant river flows. These significant river flows act to enable Exelon's Quad Cities Station to meet its permit conditions even when ambient temperatures approach non-excursion hour temperature limit. However, at this time the Mississippi River is at extremely low flow condition. This low flow condition coupled with high ambient river temperatures is the basis of the need for this provisional variance.

Inlet river temperatures have been ranging around 83°F to 86°F. The long range weather forecasts predict the current drought and temperature conditions the continue for several more weeks. This could cause the ambient river temperature to exceed non-excursion hour temperature limits for significant periods of time. Current predictions indicate Exelon's Quad Cities Station will use all of its permitted excursion hours around July 23, 2005. Petitioner claims the only alternative available for the station, other than relief pursuant to this provisional variance request, is to shut down the station. Derating the facility will not resolve this situation due to the high ambient temperatures. In addition, power demand is extremely high due to the current weather conditions.

The Agency has reviewed the requested provisional variance and has concluded the following:

1. The environmental impact from the requested relief will be closely monitored and the Agency will be immediately notified of any significant impact along with actions taken to remedy the problem;

2. No other reasonable alternatives appear available;

3. No public water supplies will be affected;

4. No federal regulations will preclude the granting of this request; and

5. Exelon's Quad Cities Station will face an arbitrary and unreasonable hardship if the request is not granted.

The Agency hereby GRANTS the Exelon's Quad Cities Station a provisional variance from Special Condition 6B of NPDES Permit IL0005037 as follows:

(1) Exelon's Quad Cities Station is granted 100 provisional variance excursion hours;

(2) The provisional variance will begin on the date that Exelon's Quad Cities Station either (1) exhausts the 87.6 permitted excursion hours or (2) on the date that Exelon's Quad Cities Station first exceeds the current permitted excursion hour temperature limits (July 89°, August 89°, and September 88°). The provisional variance will end on the date that the 100 provisional variance excursion hours are used, but in no case later than 45 days following the start of the provisional variance period.

(3) Exelon's Quad Cities Station, during the 100 provisional variance excursion hours, may exceed the maximum temperature limit stated in Special Condition 6B in NPDES permit IL0005037 by no more than 5°F (July 91°, August 91°and September 90°).

This provisional variance includes the following conditions:

A. During the variance period, when excursion hours are being used, Exelon's Quad Cities Station must continuously monitor intake, discharge and receiving water temperatures and to visually inspect intake and discharge areas at least three times daily to assess any mortalities to fish and other aquatic life;

B. Exelon's Quad Cities Station shall document environmental conditions during the term of the provisional variance, including the activities described in A above of this Section, and submit the documentation to the Agency and the Department of Natural Resources within 30 days after the provisional variance expires;

C. Exelon's Quad Cities Station shall immediately implement biological activities to characterize how fish and other aquatic life respond to the thermal conditions resulting from the provisional variance; to document these activities; and to submit the documentation to the Agency and the Department of Natural Resources within 60 days after completing the monitoring survey, as described below. Specifically, Exelon's Quad Cities Station must prepare a study plan within three days of the beginning date of this provisional variance to address the issue of increased excursion hours (increase in thermal stress) on Unionid Mussels in the Mississippi River in the vicinity of the discharge. The plan must include a survey of the mussel beds identified in a recent report: Draft Report: Unionid Mussel Biothermal Assessment for the Quad Cities Nuclear

Station, Mississippi River Miles 503.0 to 506.9 (Attachment C). The survey must address the apparent health of the mussels within the mussel beds given the current high river temperatures. Dives to ascertain ongoing effects on the mussel beds must begin as soon as possible given current dry and hot weather conditions and no later than Monday, July 25, 2005. Conditions pertinent to the mussel populations to be recorded during the surveys will be much the same as conducted for the baseline study referenced above. These must include but are not limited to mussel species occurrence and density, age, zebra mussel infestation and apparent condition, i.e., any outward signs of heat stress such as morbidity, reflex time, position in the substrate, etc. Plant discharge temperatures, upstream river temperatures, incidence of excursion hours and other pertinent information must be provided to build an understanding of the conditions to which the mussels have recently been exposed. Surveys must continue until excursion hours are no longer being utilized, or in other words, until the weather conditions causing the need for more excursion hours have moderated. The final report for this study must address the changes noted in mussel populations from the previous study. Verbal reports are due to the Agency at regular intervals during the surveys. These reports must include any information on mussel die-off. If mussel die-off downstream from the discharge is found and is attributable to the thermal effects of the effluent, as compared to the condition of upstream populations, a monetary settlement will be required as calculated by the formula the Illinois Department of Natural Resources uses for mussel die-off settlements;

D. Exelon's Quad Cities Station shall immediately notify the Agency and the Department of Natural Resources of any unusual conditions, including mortalities to fish or other aquatic life; to immediately take action to address the problem; to investigate and document the cause and seriousness of the unusual conditions while providing updates to the Agency and the Department of Natural Resources as changes occur until normal conditions return; to notify the Agency and the Department of Natural Resources when normal conditions return; and to submit the documentation to the Agency and the Department of Natural Resources within 30 days after normal conditions return;

E. Exelon's Quad Cities Station shall develop and implement a response and recovery plan to address any adverse environmental impact due to thermal conditions resulting from the provisional variance, including loss and damage to aquatic life;

F. Exelon's Quad Cities Station must conduct a feasibility study for incorporation of supplemental cooling capabilities (cooling towers at the plant or other potential technologies) to avoid reliance on thermal provisional variances in the future. The study must consider both

technical and economic feasibility. Exelon's Quad Cities Station must consider, but is not limited to studying the following aspects of this issue: the type and placement of cooling towers; the efficiency of the towers, i.e. how many towers would be necessary to cool the effluent a certain amount; the cost of the towers relative to the profitability of the plant during extreme summer weather conditions and the time frame for obtaining and installing towers. A final report on tower feasibility along with Exelon's Quad Cities Station conclusions for implementing a portable cooling tower program, are due to the Agency within six months of the beginning date of this provisional variance;

G. Exelon's Quad Cities Station shall notify Roger Callaway of the Agency by telephone at 217/782-9720 when the need for the 100 requested excursion hours begin and again if the excursion hours are totally utilized. Written confirmation of each notice shall be sent within five days to the following address:

Illinois Environmental Protection Agency
Bureau of Water - Water Pollution Control
Attention: Roger Callaway
1021 North Grand Avenue East, MC #19
Springfield, Illinois 62794-9276

H. Exelon's Quad Cities Station shall sign a certificate of acceptance of this provisional variance and forward that certificate to Roger Callaway at the address indicated above within one day of the date of this order. The certification should take the following form:

I(We)_____, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in _____dated _____.

_____
Petitioner

_____
Authorized Agent

_____
Title

_____
Date

Exelon's Quad Cities Station shall continue to monitor and maintain compliance with all other parameters and conditions specified in its NPDES Permit No. IL0005037.

The Illinois EPA grants this provisional variance in accordance with its authority contained in Sections 35(b), 36 (c), and 37(b) of the Illinois Environmental Protection Act (415 ILCS 5/35(b), 36(c), and 37(b) (2004). The decision to grant this provisional variance is not intended to address compliance with any other applicable laws or regulations.

GRANTED:

William D. Ingersoll

William D. Ingersoll
Acting Chief Legal Counsel

DATE: July 22, 2005

# Exhibit 5

Provisional Variance IEPA 07-01

Exelon Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

PM-06-012

July 20, 2006

Mr. Roger Callaway
Compliance Assurance Section
Division of Water Pollution Control
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62794

Re: Quad Cities Nuclear Power Station NPDES Permit No. IL0005037
Provisional Variance Request – Emergency Application IEPA 07-01

Dear Mr. Callaway:

Thank you for the time, consideration and attention IEPA dedicated to Exelon's provisional variance request. We sincerely appreciate all of your efforts. Below is Quad Cities Station's Certificate of Acceptance of the Provisional Variance Order issued by IEPA in this matter.

Very Truly Yours,

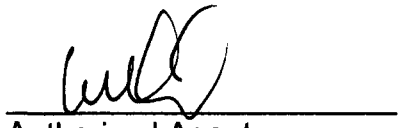
William R. Gideon
Plant Manager
Quad Cities Station

9 Pages

# Certificate of Acceptance

I(We), Randy Gideon, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in matter IEPA 07-01 dated July 19, 2006.

Exelon Generation Co. L.L.C/Quad Cities Station
Petitioner



Authorized Agent

Plant Manager
Title

07/20/2006
Date

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY**

July 19, 2006

| | | |
|---|---|---|
| **Exelon Generation Company, L.L.C.**<br>**Quad Cities Nuclear Power Station** | ) | |
| Petitioner, | ) | |
| v. | ) | IEPA – 07-01<br>(Provisional Variance-Water) |
| ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

Re: Provisional Variance From Special Condition 6B of NPDES Permit IL0005037

Dear Mr. Gideon:

The Agency has completed its technical review of the attached provisional variance request (Exhibit A) dated July 17, 2006, and submitted by Exelon Generation Company, L.L.C. Quad Cities Nuclear Power Station (Exelon's Quad Cities Station).

Based on the review, the Agency GRANTS the requested variance subject to specific conditions set forth below for a period of 45 days or until the additional 100 excursion hours are utilized, whichever occurs first.

Exelon's Quad Cities Station is seeking a provisional variance from Special Condition 6B of its NPDES permit beginning the day its current 87.6 excursions hours are utilized to continue operation of its generating station.

Exelon's Quad Cities Station is a nuclear fueled steam electric generating facility located on the Mississippi River at River Mile 506.8 near Cordova, Illinois. It operates its cooling water system in open cycle mode. Cooling water is taken from the Mississippi River, passes through the plant system and is then discharged by diffusers into the Mississippi River. Maximum design flow of this system is 2,253 cfs.

Exelon's Quad Cities Station seeks a variance from Special Condition 6B of NPDES Permit IL0005037. This condition establishes the thermal discharge ranges for Exelon's

Quad Cities Station. Additionally, it allows Exelon's Quad Cities Station excursion hours from these limits. Excursion hours are periods of time in which the temperature at the edge of the mixing zone may be 3°F warmer than the temperature limit in the permit. Exelon's Quad Cities Station may utilize only 1% (87.6) of the hours in a 12-month period ending with any month as excursion hours.

The Special Condition 6B also requires that water temperature in the Mississippi River at the edge of the mixing zone shall at no time exceed by 3°F the maximum limits of 86°F in July and August and 85°F in September. Normally, Exelon's Quad Cities Station can operate within these limits because the ambient temperature in the Mississippi River at the intake points (or above the plant) remains below the non-excursion hour temperature limit.

Ordinarily, the Mississippi River has significant river flows. These significant river flows enable Exelon's Quad Cities Station to meet its permit conditions even when ambient temperatures approach non-excursion hour temperature limit. At this time, however, the Mississippi River is at extremely low flow condition. The river flow is currently at 21,000 cfs compared to a normal river flow of 68,000 cfs. This low flow condition, coupled with high ambient river temperatures, are the bases for the need for additional excursion hours.

Inlet river temperatures have been ranging around 83°F to 86°F. Based on long range weather forecasts and continued low river flow conditions, Petitioner predicts it will consume a large percentage of its permitted excursion hours before the end of this summer, even though a cold front is predicted to reduce the current extreme heat condition. Petitioner claims the only alternative available for the station, other than relief pursuant to this provisional variance request, is to shut down the station. Derating the facility will not resolve this situation due to the high ambient temperatures. In addition, power demand is extremely high because of the current weather conditions.

The Agency has reviewed the requested provisional variance and has concluded the following:

1. The environmental impact from the requested relief will be closely monitored and the Agency will be immediately notified of any significant impact along with actions taken to remedy the problem;

2. No other reasonable alternatives appear available;

3. No public water supplies will be affected;

4. No federal regulations will preclude the granting of this request; and

5. Exelon Quad Cities Station will face an arbitrary and unreasonable hardship if the request is not granted.

The Agency hereby GRANTS the Exelon Quad Cities Station a provisional variance from Special Condition 6B of NPDES Permit IL0005037 as follows:

(1) Exelon's Quad Cities Station is granted 100 provisional variance excursion hours;

(2) The provisional variance will begin (1) on the date that Exelon's Quad Cities Station either exhausts the 87.6 permitted excursion hours or (2) on the date that Exelon Quad Cities Station first exceeds the current permitted excursion hour temperature limits (July 89°F, August 89°F, and September 88°F). The provisional variance will end on the date that the 100 provisional variance excursion hours are used, but in no case later than 45 days following the start of the provisional variance period.

(3) Exelon's Quad Cities Station, during the 100 provisional variance excursion hours, may exceed the maximum temperature limit stated in Special Condition 6B in NPDES permit IL0005037 by no more than 5° (July 91°F, August 91°F, and September 90°F).

This provisional variance is subject to the following conditions:

A. During the variance period Exelon Quad Cities Station shall continuously monitor intake, discharge and receiving water temperatures and to visually inspect intake and discharge areas at least three times daily to assess any mortalities to fish and other aquatic life;

B. Exelon Quad Cities Station shall document environmental conditions during the term of the provisional variance, including the activities described in A above of this Section, and submit the documentation to the Agency and the Department of Natural Resources within 30 days after the provisional variance expires;

C. Exelon's Quad Cities Station shall continue ongoing biological studies to characterize how fish and mussels respond to thermal conditions present in the affected portion of the Mississippi River. These studies include those mentioned on page five of Exelon's July 17, 2006 Emergency Application for Provisional Variance. These same studies were described in a July 11, 2006 e-mail message (Exhibit B) from Exelon to Mr. Rob Thompson of USEPA Region 5 relating the efforts by Exelon to study aspects of river biology suggested at recent meetings concerning long-term relief from existing water quality standards at this site. In addition, Exelon must conduct a mussel study specific to this provisional variance; to document this activity; and to submit the documentation for the mussel study to the Agency and the Department of Natural Resources within 60 days after

completing the survey described herein. Specifically, Exelon's Quad Cities Station must prepare a study plan within three days of the beginning date of this provisional variance to address the issue of increased excursion hours (increase in thermal stress) on unionid mussels in the Mississippi River in the vicinity of the discharge. The plan must include a survey of the mussel beds identified in a recent report: Draft Report: Unionid Mussel Biothermal Assessment for the Quad Cities Nuclear Station, Mississippi River Miles 503.0 to 506.9 (Exhibit C). The survey must address the apparent health of the mussels within the mussel beds given the higher than allowed river temperatures and longer duration of temperature excursions. Survey dives to ascertain effects on the mussel beds must begin as soon as possible after either the increase of excursion hours or maximum temperature relief afforded by the provisional variance are utilized. Conditions pertinent to the mussel populations to be recorded during the surveys will be much the same as conducted for the baseline study referenced above. These must include but are not limited to mussel species occurrence and density, age, zebra mussel infestation and apparent condition, i.e., any outward signs of heat stress such as morbidity, reflex time, position in the substrate, etc. Plant discharge temperatures, upstream river temperatures, incidence of excursion hours and other pertinent information must be provided to build an understanding of the conditions to which the mussels have recently been exposed. Surveys must continue until excursion hours are no longer being utilized, or in other words, until the weather conditions causing the need for more excursion hours have moderated. The final report for this study must address the changes noted in mussel populations from the previous study. Verbal reports are due to the Agency at regular intervals during the surveys. These reports must include any information on mussel die-off. If mussel die-off downstream from the discharge is found and is attributable to the thermal affects of the effluent, as compared to the condition of upstream populations, a monetary settlement will be required as calculated by the formula the Illinois Department of Natural Resources uses for mussel die-off settlements;

D. Exelon Quad Cities Station shall immediately notify the Agency and the Department of Natural Resources of any unusual conditions, including mortalities to fish or other aquatic life; shall immediately take action to remedy the problem; shall investigate and document the cause and seriousness of the unusual conditions while providing updates to the Agency and the Department of Natural Resources as changes occur until normal conditions return; shall notify the Agency and the Department of Natural Resources when normal conditions return; and shall submit the documentation to the Agency and the Department of Natural Resources within 30 days after normal conditions return;

E. Exelon Quad Cities Station shall develop and implement a response and recovery plan to address any adverse environmental impact due to thermal conditions resulting from the provisional variance, including loss and damage to aquatic life;

F. Quad Cities Station shall notify Roger Callaway of the Agency by telephone at 217/782-9720 when the need for the 100 additional excursion hours begin and again if the excursion hours are totally utilized. Written confirmation of each notice shall be sent within five days to the following address:

Illinois Environmental Protection Agency
Bureau of Water - Water Pollution Control
Attention: Roger Callaway
1021 North Grand Avenue East, MC #19
Springfield, Illinois 62794-9276

G. Exelon Quad Cities Station shall sign a certificate of acceptance of this provisional variance and forward that certificate to Roger Callaway at the address indicated above within one day of the date of this order. The certification should take the following form:

I(We)_____, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in _____dated _____.

_____
Petitioner

_____
Authorized Agent

_____
Title

_____
Date

Exelon Quad Cities Station shall continue to monitor and maintain compliance with all other parameters and conditions specified in its NPDES Permit No. IL0005037.

The Illinois EPA grants this provisional variance in accordance with its authority contained in Sections 35(b), 36 (c), and 37(b) of the Illinois Environmental Protection Act (415 ILCS 5/35(b), 36(c), and 37(b) (2004). The decision to grant this provisional variance is not intended to address compliance with any other applicable laws or regulations.

Sincerely,

Robert A. Messina
Chief Legal Counsel

# Track results detail

## Tracking results detail for 36590384143

**Tracking summary**

| | | |
|---|---|---|
| Current Status | ✓ **Shipment delivered.** | View Signature |
| Delivered on | 7/24/2006 8:45 am | |
| Delivered to | Door | |
| Signed for by | **LD LOF EPA** | What is this? |

## Tracking history

| Date and Time | Status | Location |
|---|---|---|
| 7/24/2006 8:45 am | Shipment delivered. | Springfield, IL Why is thi |
| 7/22/2006 7:07 am | Arrived at DHL facility. | Springfield, IL |
| 1:34 am | Transit through sort facility. | South Bend, IN |
| 7/21/2006 6:02 pm | Departing origin. | Moline, IL |
| 4:33 pm | Picked Up by DHL. | Public Drop Box |

***Ship From:***
EXELON NUCLEAR
Cordova, IL 61242
United States

Attention:
EXELON NUCLEAR

***Ship To:***
IL EPA-COMPLIANCE
Springfield, IL 62794
United States

Attention:
IL EPA-COMPLIANCE

***Shipment Information:***
Ship date: 7/21/2006
Pieces: 1
Total weight: 1 lb *
Ship Type: Letter Expre
Shipment Reference:
Service: Next Day
Special Service: Next
Description:

Tracking detail provided by DHL: 7/28/2006, 11:07:03 am pt.

**Track nev**

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- ▸ Track DHL Same Day service

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# Exhibit 6

Study Plan

8/2/2006

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

Exelon Nuclear

PM-06-016

August 2, 2006

Mr. Roger Callaway
Illinois Environmental Protection Agency
Compliance Assurance Section
Bureau of Water – Water Pollution Control
1021 North Grand Avenue East, MC#19
Springfield, Illinois 62794-9276

Subject: IEPA Order 07-01 dated July 19, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated July 17, 2006

Dear Mr. Callaway:

In accordance with Special Condition "C" of the Agency's Order 07-01 dated July 19, 2006 regarding the provisional variance for Quad Cities Station, we are submitting the following study plans concerning fish and mussels that may be affected by the Station's discharges during operations authorized by the Provisional Variance.

This letter also serves as Quad Cities Station's required written notification to the Agency in accordance with Special Condition "F" of the Agency's Order 07-01 dated July 19, 2006 regarding the provisional variance for Quad Cities Station. Special Condition "F" requires Quad Cities Station to notify the Agency in writing within five days of notification of entering the provisional variance granted by IEPA Order 07-01. The provisional variance period began at approximately 1800 on Sunday, July 30, 2006 when Quad Cities exhausted the original 87.6 hours specified in their NPDES Permit. A phone call message was left with you by John Petro on Sunday, July 30, 2006 at 1620 informing you of the start of the provisional variance period.

**Fish Monitoring Plan**

Once it is determined that permitted excursion hours (> 87.6 hours) have been exhausted and Provisional Variance excursion hours are being used, Fish Lab Staff (HDR/LMS and/or Exelon) will perform daily surveys to document any stress or mortality to fish and other aquatic life, both upstream and downstream of the Quad Cities Station discharge. Surveys will be conducted from a boat and will be performed from 14:00 hrs to 17:00 hrs. Each daily survey will consist of visual surveys of the shoreline area encompassing each of eight designated long-term monitoring sampling areas (three upstream, five downstream). Water temperature and dissolved oxygen concentration will be measured at each Mississippi River location during each survey. Any observations of fish/aquatic life mortality or stress will be documented at the lowest taxonomic level practicable. Individuals will be counted and size range will be estimated.

On any date that Provisional Variance hours are being used, three visual inspections of the Station's intake and discharge areas will be conducted by Station Staff. These visual surveys will be spaced such that several hours elapse between observations. Areas to be surveyed are: (1) from the barge ramp, downstream from the intake fore bay approximately 100 ft (intake area); (2) along the Iowa shoreline from 500 to 1000 ft downstream of the diffuser; and (3) along the Illinois shoreline 500 to 1000 ft downstream of the diffuser. Station Staff will document the number and general category of dead or stressed fish/aquatic life. If, during any observation, it appears that unusual numbers of individuals are exhibiting difficulty in swimming, respiring or other aberrant behavior, the Station Staff will contact the Quad Cities Fish Lab who will dispatch a team to determine the magnitude of the event and species affected. If Fish Lab Staff believe significant and unusual fish mortalities are occurring, the Shift Manager will be notified so that notifications can be made to Illinois EPA and Illinois DNR.

A report will be prepared and submitted to the Agency and Department of Natural Resources within 60 days after completing the fish monitoring described above.

**Unionid (Mussel) Monitoring Plan**

The sampling areas and methods for the mussel monitoring program will be similar to the 2004 and 2005 mussel monitoring surveys conducted at Quad Cities Station by Ecological Specialists Inc. Sampling will start August 3, 2006 with a follow-up survey planned for the end of September. The primary objective of the sampling will be to determine the condition of unionids under increased excursion hour conditions in the Steamboat Slough Bed, Cordova Bed, and Upstream Bed, which are the mussel beds identified in the Draft Unionid Mussel Biothermal Assessment, Exhibit C of the Order.

During the survey, unionid species composition and species richness will be estimated from qualitative sampling. Unionid density, age structure, and mortality will be estimated from quantitative sampling. Metrics will be compared spatially and temporally.

Qualitative sampling will consist of at least 20 and 25, 5-minute samples in each bed for the August and September sampling, respectively. A diver will collect all unionids encountered (visually and tactually) during a 5-minute sampling interval. Depth, substrate, and GPS position, bottom temperature, dissolved oxygen, and surface velocity will be recorded at each point. Condition of unionids will be noted from the divers perspective (*e.g.*, position in substrate, gaping, siphoning) and by the malacologist (*e.g.*, responsiveness, excessive mucous, emaciation). Both live and freshly dead unionids will be identified as to species, counted, and categorized as adult or juvenile (≤5 years old). Documentation of the degree of zebra mussel infestation will also be noted.

Quantitative sampling will consist of collecting at least 40 and 90 randomly located whole substrate 0.25m$^2$ quadrat samples at each mussel bed for the August and September sampling, respectively. The August sample size will be sufficient to detect acute changes in community parameters and the September sample size will be sufficient to detect a 25% change in mean density within a 95% confidence interval based on data collected in 2004 and 2005. For each sample, a diver will excavate all substrate within a 0.25m$^2$ quadrat into a 20L bucket, which will be brought to the surface and sieved through 12mm and 6mm sieves. Substrate composition will be visually assessed according to the Wentworth Scale (Wentworth, 1922). Quadrat position and depth will also be recorded for each quadrat. Live and freshly dead unionids (shiny nacre, periostracum intact, dead less than one year) will be identified to species, aged (external annuli count), and measured (length in mm). Sexually dimorphic species will be checked for gravidity. River temperature and excursion hour use information in conjunction with the mussel analysis will be used to evaluate the relationship of the mussel condition to specific temperatures.

A letter report will be prepared and submitted to the Agency and the Department of Natural Resources within two weeks of completing the unionid monitoring survey which is scheduled to start on August 3, 2006. This initial report will include a preliminary summary of data (% mortality, condition, species composition, temperature and dissolved oxygen conditions). A full report will be prepared within 60 days of completing the second monitoring survey planned for the end of September, which will include meaningful metrics of detected mussel conditions.

If you should have any questions regarding these study plans, please contact Vicki Neels at (309) 227-3200, Mark Stuhlman at (309) 227-2765, or John Petro at (630) 657-3209.

Very truly yours,

William R. Gideon
Plant Manager
Quad Cities Station

cc: Letter Book

# Exhibit 7

Provisional Variance IEPA 07-03

Exelon Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

PM-06-018

August 2, 2006

Mr. Roger Callaway
Compliance Assurance Section
Division of Water Pollution Control
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, Illinois 62794

Re: Quad Cities Nuclear Power Station NPDES Permit No. IL0005037
Provisional Variance Request – Emergency Application IEPA 07-03

Dear Mr. Callaway:

Thank you for the time, consideration and attention IEPA dedicated to Exelon's provisional variance request. We sincerely appreciate all of your efforts. Below is Quad Cities Station's Certificate of Acceptance of the Provisional Variance Order issued by IEPA in this matter.

Very Truly Yours,

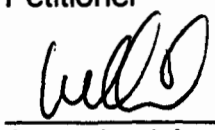
William R. Gideon
Plant Manager
Quad Cities Station

10 Pages

# Certificate of Acceptance

I(We), Randy Gideon, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in matter IEPA 07-03 dated August 2, 2006.

Exelon Generation Co. L.L.C/Quad Cities Station
Petitioner



Authorized Agent

Plant Manager
Title

08/02/2006
Date

**ILLINOIS ENVIRONMENTAL PROTECTION AGENCY**

August 2, 2006

| | | |
|---|---|---|
| **Exelon Generation Company, L.L.C.**<br>**Quad Cities Nuclear Power Station** | ) | |
| Petitioner, | ) | |
| v. | ) | IEPA – 07-03<br>(Provisional Variance-Water) |
| ILLINOIS ENVIRONMENTAL PROTECTION AGENCY, | ) | |
| Respondent. | ) | |

Re: Provisional Variance From Special Condition 6A and 6B of NPDES Permit IL0005037

Dear Mr. Gideon:

The Agency has completed its technical review of the attached provisional variance extension request submitted by Exelon Generation Company, L.L.C. Quad Cities Nuclear Power Station (Exelon's Quad Cities Station) on August 1, 2006.

Based on the review, the Agency GRANTS the requested variance subject to specific conditions set forth below for a period of 45 days.

Exelon's Quad Cities Station is a nuclear fueled steam electric generating facility located on the Mississippi River at River Mile 506.8 near Cordova, Illinois. It operates its cooling water system in open cycle mode. Cooling water is taken from the Mississippi River, passes through the plant system and is then discharged by diffusers into the Mississippi River. Maximum design flow of this system is 2,253 cfs.

Exelon's Quad Cities Station seeks a variance from Special Condition 6A and 6B of NPDES Permit IL0005037. These conditions establish thermal discharge limits for Exelon's Quad Cities Station. Additionally, 6B allows Exelon's Quad Cities Station excursion hours from these limits. Excursion hours are periods of time in which the temperature at the edge of the mixing zone may be 3°F warmer than the temperature limit in the permit. Exelon's Quad Cities Station may only utilize 1% (87.6) of the hours in a 12 month period ending with any month as excursion hours.

The permit also requires that water temperature in the Mississippi River at the edge of the mixing zone shall at no time exceed by 3°F the maximum limits of 86°F in July and August and 85°F in September. Normally, Exelon's Quad Cities Station can operate within these limits because the ambient temperature in the Mississippi River at the intake points (or above the plant) remain below the non-excursion hour temperature limit.

Ordinarily, the Mississippi River has significant river flows. These significant river flows act to enable Exelon's Quad Cities Station to meet its permit conditions even when ambient temperatures approach non-excursion hour temperature limit. However, at this time, the Mississippi River is at extremely low flow condition. The river flow is currently at 12,800 cfs compared to a normal river flow of 68,000 cfs. This low flow condition coupled with high ambient river temperatures and the need to maintain power on the grid with stability problems during this extreme weather condition period is the basis of the need for this provisional variance. Exelon's Quad Cities Station has already derated its two units by 200 megawatts in order to comply with the 91 degree limit of the provisional variance granted in IEPA 07-01.

On July 31, 2006 the Army Corps of Engineers made two significant reductions in the amount of flow in the Mississippi River. The first reduction reduced the flow from 23,000 cfs to 18,000 cfs. The second reduction reduced the flow from 18,000 cfs to 13,000 cfs. As of August 1, 2006 the flow is at 12,800 cfs. Upstream river temperatures are currently at 87.1 degrees Fahrenheit and the downstream temperature is currently 90.9 degrees Fahrenheit.

In addition to the current conditions of the Mississippi River there is also a very high demand of power due to the extreme weather conditions with a resulting high load condition of the grid which is currently having stability problems. At the current time PJM (organization responsible for power distribution) anticipates the implementation of Emergency Procedures to meet the high load demands in the Northern Illinois area in an attempt to prevent brownouts and rolling blackouts. Should PJM issue a warning then the Quad Cities Plant will need to ramp up power to meet demands. This power demand could result in the river temperatures increasing up to 7 degrees Fahrenheit which would result in a maximum downstream temperature of 93 degrees Fahrenheit. This condition would last until such time as emergency condition exits after which time the plant would resume operations to maintain the 5 degrees delta T allowed in the IEPA Order 07-01.

The Agency has reviewed the requested provisional variance and has concluded the following:

1. The environmental impact from the requested relief will be closely monitored and the Agency will be immediately notified of any significant impact along with actions taken to remedy the problem;

2. No other reasonable alternatives appear available;

3. No public water supplies will be affected;

4. No federal regulations will preclude the granting of this request; and

5. Exelon Quad Cities Station will face an arbitrary and unreasonable hardship if the request is not granted.

The Agency hereby GRANTS the Exelon Quad Cities Nuclear Power Station a provisional variance from Special Condition 6A and 6B of NPDES Permit IL0005037 for a period of 45 days subject to the following conditions:

1. During the period of time that either river flow is less than 27,500 cfs or upstream ambient river temperature exceeds 83 degrees Fahrenheit, Exelon's Quad Cities Station may exceed the maximum temperature limit stated in Special Condition 6B in NPDES permit IL0005037 by no more than 5 degrees Fahrenheit. (August 91 degrees Fahrenheit and September 90 degrees Fahrenheit)
2. During any period when either river flow is less than 27,500 cfs or upstream ambient river temperature exceeds 83 degrees Fahrenheit, and PJM issues an Emergency Warning Exelon's Quad Cities Station may exceed the maximum temperature limit stated in Special Condition 6B in NPDES permit IL0005037 by no more than 7 degrees Fahrenheit. (August 93 degrees Fahrenheit and September 92 degrees Fahrenheit)

This variance is subject to the following conditions:

A. During the variance period Exelon Quad Cities Station must continuously monitor intake, discharge and receiving water temperatures and to visually inspect intake and discharge areas at least three times daily to assess any mortalities to fish and other aquatic life;

B. Exelon Quad Cities Station shall document environmental conditions during the term of the provisional variance, including the activities described in A above of this Section, and submit the documentation to the Agency and the Department of Natural Resources within 30 days after the provisional variance expires;

C. Exelon's Quad Cities Station shall continue ongoing biological studies to characterize how fish and mussels respond to thermal conditions present in the affected portion of the Mississippi River. These studies include those mentioned on page 5 of Exelon's July 17, 2006 Emergency Application for Provisional Variance. These same studies were described in a July 11, 2006 e-mail message (attached) from Exelon to Mr. Rob Thompson of

USEPA Region 5 relating the efforts by Exelon to study aspects of river biology suggested at recent meetings concerning long-term relief from existing water quality standards at this site. In addition, Exelon must conduct a mussel study specific to this provisional variance; to document this activity; and to submit the documentation for the mussel study to the Agency and the Department of Natural Resources within 60 days after completing the survey described herein. Specifically, Exelon's Quad Cities Station must prepare a study plan within three days of the beginning date of this provisional variance to address the issue of increased excursion hours (increase in thermal stress) on unionid mussels in the Mississippi River in the vicinity of the discharge. The plan must include a survey of the mussel beds identified in a recent report: Draft Report: Unionid Mussel Biothermal Assessment for the Quad Cities Nuclear Station, Mississippi River Miles 503.0 to 506.9 (attached). The survey must address the apparent health of the mussels within the mussel beds given the higher than allowed river temperatures and longer duration of temperature excursions. Survey dives to ascertain effects on the mussel beds must begin as soon as possible after either the increase of excursion hours or maximum temperature relief afforded by the provisional variance are utilized. Conditions pertinent to the mussel populations to be recorded during the surveys will be much the same as conducted for the baseline study referenced above. These must include but are not limited to mussel species occurrence and density, age, zebra mussel infestation and apparent condition, i.e., any outward signs of heat stress such as morbidity, reflex time, position in the substrate, etc. Plant discharge temperatures, upstream river temperatures, incidence of excursion hours and other pertinent information must be provided to build an understanding of the conditions to which the mussels have recently been exposed. Surveys must continue until excursion hours are no longer being utilized, or in other words, until the weather conditions causing the need for more excursion hours have moderated. The final report for this study must address the changes noted in mussel populations from the previous study. Verbal reports are due to the Agency at regular intervals during the surveys. These reports must include any information on mussel die-off. If mussel die-off downstream from the discharge is found and is attributable to the thermal affects of the effluent, as compared to the condition of upstream populations, a monetary settlement will be required as calculated by the formula the Illinois Department of Natural Resources uses for mussel die-off settlements;

D. Exelon Quad Cities Station shall immediately notify the Agency and the Department of Natural Resources of any unusual conditions, including mortalities to fish or other aquatic life; to immediately take action to remedy the problem; to investigate and document the cause and seriousness of the unusual conditions while providing updates to the Agency and the Department of Natural Resources as changes occur until

normal conditions return; to notify the Agency and the Department of Natural Resources when normal conditions return; and to submit the documentation to the Agency and the Department of Natural Resources within 30 days after normal conditions return;

E. Exelon Quad Cities Station shall develop and implement a response and recovery plan to address any adverse environmental impact due to thermal conditions resulting from the provisional variance, including loss and damage to aquatic life;

F. Quad Cities Station shall notify Roger Callaway of the Agency by telephone at 217/782-9720 when the conditions that trigger this variance are present and again when those conditions subside. Written confirmation of each notice shall be sent within five days to the following address:

Illinois Environmental Protection Agency
Bureau of Water - Water Pollution Control
Attention: Roger Callaway
1021 North Grand Avenue East, MC #19
Springfield, Illinois 62794-9276

G. Exelon Quad Cities Station shall sign a certificate of acceptance of this provisional variance and forward that certificate to Roger Callaway at the address indicated above within one day of the date of this order. The certification should take the following form:

I (We)_____, hereby accept and agree to be bound by all terms and conditions of the provisional variance granted by the Agency in _____dated _____.

_____
Petitioner

_____
Authorized Agent

_____
Title

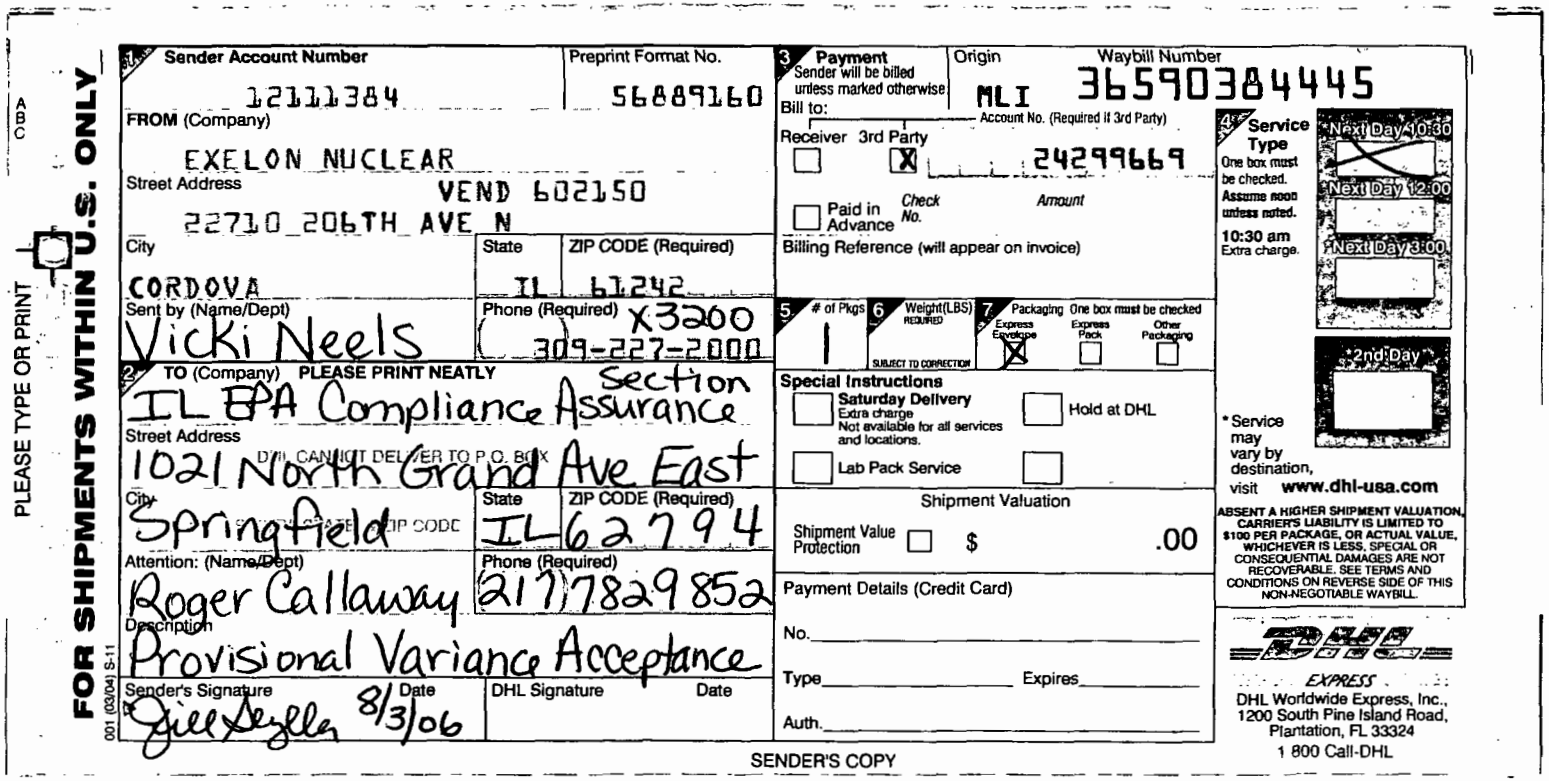
_____
Date

Exelon Quad Cities Station shall continue to monitor and maintain compliance with all other parameters and conditions specified in its NPDES Permit No. IL0005037.

The Illinois EPA grants this provisional variance in accordance with its authority contained in Sections 35(b), 36 (c), and 37(b) of the Illinois Environmental Protection Act (415 ILCS 5/35(b), 36(c), and 37(b) (2004). The decision to grant this provisional variance is not intended to address compliance with any other applicable laws or regulations.

Sincerely,

Robert A. Messina
Chief Legal Counsel



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1 Sender Account Number: 12111384

Preprint Format No.: 56889160

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Origin: MLI

Waybill Number: 36590384445

FROM (Company): EXELON NUCLEAR

Street Address: VEND 602150
22710 206TH AVE N

City: CORDOVA

State: IL

ZIP CODE (Required): 61242

Sent by (Name/Dept): Vicki Neels

Phone (Required): X3200
( 309-227-2000

☐ Paid in Advance — Check No. — Amount

Billing Reference (will appear on invoice)

5 # of Pkgs: 1

6 Weight(LBS) REQUIRED — SUBJECT TO CORRECTION

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2 TO (Company) PLEASE PRINT NEATLY: IL EPA Compliance Section Assurance

Street Address: DHL CANNOT DELIVER TO P.O. BOX
1021 North Grand Ave East

City: Springfield

State: IL

ZIP CODE (Required): 62794

Attention: (Name/Dept): Roger Callaway

Phone (Required): 2177829852

Description: Provisional Variance Acceptance

Sender's Signature: Gill Dezelle Date: 8/3/06

DHL Signature — Date

Special Instructions
☐ Saturday Delivery — Extra charge. Not available for all services and locations.
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## Tracking results detail for 36590384445

**Tracking summary**

| | | |
|---|---|---|
| Current Status | ✓ **Shipment delivered.** | View Signature |
| Delivered on | 8/4/2006 9:53 am | |
| Delivered to | Door | |
| Signed for by | **LD LOF EPA** | What is this? |

## Tracking history

| Date and Time | | Status | Location |
|---|---|---|---|
| 8/4/2006 | 9:53 am | Shipment delivered. | Springfield, IL Why is thi |
| | 8:52 am | With delivery courier. | |
| | 7:29 am | Arrived at DHL facility. | Springfield, IL |
| | 1:45 am | Transit through sort facility. | South Bend, IN |
| 8/3/2006 | 6:23 pm | Departing origin. | Moline, IL |
| | 4:42 pm | Picked Up by DHL. | Public Drop Box |

***Ship From:***
IL 61242
United States

Attention:

***Ship To:***
IL 62794
United States

Attention:

***Shipment Information:***
Ship date: 8/3/2006
Pieces:
Total weight: *
Ship Type:
Shipment Reference:
Service: Next Day
Special Service: Next
Description:

Tracking detail provided by DHL: 8/4/2006, 8:55:45 am pt.

**Track new**



*** Note on weight:**
The weights displayed on this website are the weights provided when the shipment was created. Actu weights may be different and will be provided on invoice.

**Track**

- Track by number
- Track by reference
- Get delivery signature
- Track DHL Same Day service

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# Exhibit 8

Preliminary Mussel Bed Monitoring Results

August 3-5, 2006

Exelon Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

PM-06-020

August 17, 2006

Mr. Roger Callaway
Illinois Environmental Protection Agency
Compliance Assurance Section
Bureau of Water – Water Pollution Control
1021 North Grand Avenue East, MC#19
Springfield, Illinois 62794-9276

Subject: Letter Report – August 3-5, 2006 Mussel Bed Monitoring Results

References: IEPA Order 07-01 dated July 19, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated July 17, 2006

IEPA Order 07-03 dated August 2, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated August 1, 2006

Dear Mr. Callaway:

Special Condition "C" of the Agency's Order 07-01 dated July 19, 2006 and Special Condition "C" of the Agency's Order 07-03 dated August 2, 2006 regarding the provisional variances for Quad Cities Station require the submittal of a fish and mussel monitoring plan to the Agency. Quad Cities Letter PM-06-016 transmitted the required study plan to the Agency on August 2, 2006.

Attached is a letter report from Ecological Specialists Inc. that includes a preliminary summary of data (% mortality, condition, species composition, temperature and dissolved oxygen conditions) from the mussel bed monitoring that took place on August 3-5, 2006. The letter report concludes that the elevated water temperature downstream of the Quad Cities Station discharge did not cause acute mortality to either adult or young mussels in either the Steamboat Slough Bed or the Cordova Bed.

A full report will be prepared within 60 days of completing the second monitoring survey planned for the end of September, 2006 which will include meaningful metrics of detected mussel conditions.

8 Pages

If you should have any questions regarding these study plans, please contact Vicki Neels at (309) 227-3200, Mark Stuhlman at (309) 227-2765, or John Petro at (630) 657-3209.

Very truly yours,

William R. Gideon
Plant Manager
Quad Cities Station

WRG/MS/jas
Attachment

cc: Mr. Mike Conlin
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702

Mr. Dan Sallee
Illinois Department of Natural Resources
2317 E. Lincoln Way
Suite A
Sterling, Illinois 61081

**ECOLOGICAL SPECIALISTS, INC.**

MISSOURI HOME OFFICE
1417 Hoff Industrial Drive • O'Fallon, MO 63366
P: 636.281.1982 • F: 636.281.0973

OHIO BRANCH OFFICE
470-A Schrock Road • Columbus, OH 43229
P: 614.430.3780 • F: 636.430.3781

*www.ecologicalspecialists.com*

August 15, 2006

Mr. John Petro
Exelon Corp.
Warrenville, IL

Dear John:

Ecological Specialists, Inc. monitored unionid mussels within three unionid beds (Upstream Bed, Steamboat Slough Bed, and Cordova Bed) near your Quad Cities Nuclear Station August 3 to August 5, 2006. Within each bed, we collected 40 randomly located 0.25$m^2$ whole substrate quantitative samples and 20-5 minute qualitative samples. For each qualitative sample, we measured surface and bottom water temperature and dissolved oxygen.

Water temperature ranged from 29.2°C to 29.9°C in the Upstream Bed (Aug 5), 31.3°C to 31.5°C in the Steamboat Slough Bed (August 4), and 29.8 to 30.3°C in the Cordova Bed (August 4) (Table 1). Surface and bottom temperature were similar. The higher temperature recorded in the Cordova Bed on August 3 compared to the Steamboat Slough Bed on August 4 and 5 is due to difference in sample dates, as water temperature cooled with the increase in discharge (Table 2). Dissolved oxygen was well above saturation on the surface and bottom at all sample points except one point near the bank in Steamboat Slough, where DO was near 5ppm.

The high water temperature preceding and during sampling did not seem to have an acute effect on unionids. Unionids at all sites exhibited normal behavior. Animals were in the substrate near the substrate/water interface. Siphoning activity could not be evaluated due to lack of visibility. However, all retrieved unionids were tightly closed as usual. No gaping, excessive mucous or slow response time was noted. Additionally, community parameters were comparable to previous monitoring. Unionid density was similar within the Cordova and Upstream Beds, while Steamboat Slough density was high compared to previous monitoring (Table 3). Species richness remained consistent in all three beds. Unionid mortality was <10% within all three beds. The percentage of young unionids in the Upstream and Cordova beds was similar among monitoring events, but was higher in July 2006 in the Steamboat Slough Bed (23%) than in previous years (10 to 12%).

Also similar to previous monitoring, several (10 in 2006) *Lampsilis higginsii* were collected in the Cordova Bed, one was found in the Upstream Bed, and none were collected in the Steamboat Slough Bed. *Ligumia recta* were found in all three beds, and *Ellipsaria lineolata* was found in the Upstream and Cordova Beds.

Zebra mussels were sparse in all three beds. Much of the substrate in the Cordova Bed now consists of zebra mussel shells, and many of the unionids are still covered with byssal threads (indicating recent infestation). However, <3 zebra mussels were found on 5% of the unionids in Cordova Bed quantitative samples. Zebra mussels were most abundant in the Upstream Bed, where <10 zebras were attached to 34% of the unionids in quantitative samples. No live zebra mussels were found on unionids collected in quantitative samples in the Steamboat Slough Bed, although a few unionids were covered with byssal threads and a few small zebra mussels were attached to a few of the unionids found in qualitative samples.

Based on these preliminary results, the elevated water temperature downstream of the QCNS discharge did not cause acute mortality to unionids in either the Steamboat Slough or Cordova Beds to either adult or young unionids. These beds will be monitored again in late September/early October to determine if this summer's temperature resulted in any latent mortality.

Sincerely,

Heidi L. Dunn
President
Ecological Specialists, Inc.

Table 1. QCNS preliminary results of unionid monitoring, August 2006.

| | Upstream | Steamboat Slough | | Cordova | |
|---|---|---|---|---|---|
| Date | 5-Aug | 4-Aug | 5-Aug | 3-Aug | 4-Aug |
| Temperature (°C) | | | | | |
| Surface | | | | | |
| Min | 29.7 | 31.3 | 30.8 | 31.4 | 29.8 |
| Max | 29.9 | 31.5 | 31.2 | 31.9 | 30.3 |
| Bottom | | | | | |
| Min | 29.2 | 31.3 | 30.8 | 31.4 | 30.0 |
| Max | 29.8 | 31.5 | 31.2 | 31.6 | 29.8 |
| DO (ppm) | | | | | |
| Surface | | | | | |
| Min | 11.1 | 4.8 | 11.2 | 8.7 | 7.8 |
| Max | 11.9 | 9.9 | 11.9 | 10.7 | 9.1 |
| Bottom | | | | | |
| Min | 9.7 | 5.1 | 11.2 | 8.2 | 7.7 |
| Max | 11.8 | 10.3 | 12.0 | 10.1 | 8.8 |
| Total no. | 588 | 400 | | 424 | |
| Density | 8.3 | 9.2 | | 3.8 | |
| % mortality | 6.7 | 1.1 | | 7.5 | |
| %≤ 5 yrs old | 55.4 | 22.8 | | 43.2 | |
| CPU | 25.3 | 15.4 | | 19.4 | |
| No. species | 20 | 17 | | 20 | |
| T&E's | | | | | |
| *Lampsilis higginsii* | 1 | | | 10 | |
| *Ellipsaria lineolata* | 13 | | | 3 | |
| *Ligumia recta* | 6 | 1 | | 33 | |

Table 2. Discharge during unionid monitoring, August 2006.

| Date | Lock and Dam 14 discharge (cfs) |
|---|---|
| 1-Aug | 12,780 |
| 2-Aug | 12,650 |
| 3-Aug | 18,544 |
| 4-Aug | 27,695 |
| 5-Aug | 35,189 |
| 6-Aug | 35,286 |

Table 3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004 July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Species rel. abundance (%)[1] | | | | | | | | | |
| Ambleminae | | | | | | | | | |
| *Amblema plicata* | 17.5 | 20.3 | 18.7 | 41.5 | 26.8 | 30.9 | 27.9 | 50.0 | 24.6 |
| *Fusconaia ebena* | WD | - | WD | - | - | - | WD | - | - |
| *Fusconaia flava* | 6.2 | 1.4 | 5.2 | X | 9.8 | 2.1 | X | 3.3 | 3.1 |
| *Megalonaias nervosa* | - | 1.4 | - | - | - | - | 2.9 | X | 4.6 |
| *Quadrula metanevra* | 1.0 | - | WD | - | - | - | WD | - | - |
| *Quadrula nodulata* | 1.0 | X | 1.2 | 9.8 | 2.4 | 6.4 | - | - | - |
| *Quadrula p. pustulosa* | 8.2 | 4.3 | 9.1 | 4.9 | 7.3 | 5.3 | 5.9 | 6.7 | 4.6 |
| *Quadrula quadrula* | 6.2 | 4.3 | 6.7 | 4.9 | 14.6 | 17.0 | 2.9 | X | 2.3 |
| *Tritogonia verrucosa* | WD | - | WD | - | - | - | SF | - | WD |
| Total Ambleminae | 40.1 | 31.9 | 40.9 | 61.1 | 61.0 | 61.7 | 39.6 | 60.0 | 39.2 |
| Anodontinae | | | | | | | | | |
| *Arcidens confragosus* | X | X | 0.4 | x | 2.4 | X | x | 3.3 | X |
| *Lasmigona c. complanata* | X | 1.4 | 2.4 | 2.4 | X | X | 1.5 | X | 1.5 |
| *Pyganodon grandis* | X | <0.5 | 1.2 | x | 2.4 | X | X | X | 0.8 |
| *Strophitus undulatus* | WD | - | - | - | - | - | - | - | - |
| *Utterbackia imbecillis* | 1.0 | <0.5 | 0.4 | - | X | X | X | FD | 1.5 |
| Total Anodontinae | 1.0 | 1.4 | 4.4 | 2.4 | 4.9 | 0.0 | 1.5 | 3.3 | 3.8 |
| Lampsilinae | | | | | | | | | |
| *Actinonaias ligamentina* | x | - | - | - | - | - | X | - | - |
| ***Ellipsaria lineolata*** | **1.0** | **1.4** | **X** | **2.4** | **X** | - | **WD** | - | **X** |
| *Lampsilis cardium* | 5.2 | 11.6 | 7.9 | 4.9 | X | 5.3 | 7.4 | 6.7 | 5.4 |
| ***Lampsilis higginsii*** | - | **X** | **0.4** | - | - | - | **1.5** | **X** | **0.8** |
| *Lampsilis teres* | WD | 1.4 | WD | - | - | - | - | - | - |
| *Leptodea fragilis* | 6.2 | 11.6 | 7.1 | x | 2.4 | 4.3 | 33.8 | 16.7 | 29.2 |
| ***Ligumia recta*** | **1.0** | **X** | **0.8** | - | - | **1.1** | **1.5** | **X** | **6.2** |
| *Obliquaria reflexa* | 38.1 | 30.4 | 27.8 | 26.8 | 22.0 | 22.3 | 8.8 | 3.3 | 6.9 |
| *Obovaria olivaria* | 5.2 | 2.9 | 2.4 | 2.4 | - | X | X | X | 0.8 |
| *Potamilus alatus* | X | X | X | - | - | X | X | X | 0.8 |
| *Potamilus ohiensis* | 1.0 | 2.9 | 0.8 | X | 7.3 | 3.2 | 1.5 | 3.3 | X |
| *Toxolasma parvus* | - | | 1.2 | - | - | WD | 1.5 | 6.7 | 3.8 |
| *Truncilla donaciformis* | X | 4.3 | 5.6 | - | 2.4 | 2.1 | 2.9 | - | 2.3 |
| *Truncilla truncata* | 1.0 | | 0.8 | - | X | X | WD | - | 0.8 |
| Total Lampsilinae | 58.7 | 66.7 | 54.8 | 36.5 | 34.1 | 38.3 | 58.9 | 36.7 | 56.9 |

Table 3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004 July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Total no.[2] | 902 | 399 | 822 | 547 | 426 | 657 | 320 | 164 | 375 |
| Ave. no./$m^{2}$[2,1] | 8.1±3.1 | 6.9±3.1 | 11.2±2.0 | 3.5±2.0 | 4.1±1.2 | 4.2±0.9 | 5.7±1.9 | 3.1±1.3 | 5.8±1.5 |
| Ave. CPUE [3] | 57.5 | 15.7 | 22.8 | 36.4 | 19.3 | 22.5 | 15.8 | 6.7 | 10.2 |
| Ave. no. species/qual sample[3] | 10.7 | 6.0 | 6.3 | 7.8 | 5.6 | 7.2 | 6.6 | 3.3 | 5.1 |
| Total no. species[2] | 21 | 21 | 21 | 15 | 16 | 18 | 20 | 18 | 21 |
| Total live/FD species per site | | | 25 | | | 19 | | | 22 |
| Theoretical species richness[3] | | | | | | | | | |
| 100 | 13 | 16 | 14 | 12 | 11 | 13 | 15 | 15 | 15 |
| 250 | 15 | 19 | 17 | 14 | 14 | 16 | 18 | 18 | 17 |
| 500 | 17 | 21 | 19 | 16 | 15 | 18 | 21 | 20 | 20 |
| 1000 | 19 | 24 | 21 | 17 | 17 | 20 | 23 | 22 | 22 |
| 5000 | 23 | 29 | 26 | 22 | 21 | 24 | 28 | 27 | 27 |
| Regression slope | 6.53 ±0.29 | 7.85 ±0.27 | 6.99 ±0.17 | 5.81 ±0.23 | 5.64 ±0.26 | 6.53 ±0.29 | 7.71 ±0.13 | 7.43 ±0.38 | 7.27 ±0.15 |
| %Mortality[1] | 6.7 | 1.4 | 3.1 | 4.7 | 2.4 | 3.1 | 24.4 | 21.1 | 3.0 |
| Ave. no. FD/$m^{2}$[1] | 0.6 ±0.5 | 0.2±0.2 | 0.4±0.2 | 0.2 ±0.2 | 0.1 ±0.2 | 0.1 ±0.2 | 1.8 ±1.6 | 0.8 ±0.9 | 0.2 ±0.2 |
| %≤3 years old[1] | 3.1 | 18.6 | 24.2 | 2.4 | 4.8 | 6.4 | 33.8 | 0 | 29.2 |
| %≤5 years old[1] | 36.1 | 42.0 | 50.4 | 9.8 | 11.9 | 11.7 | 58.8 | 25.7 | 47.7 |
| % of species w/ ≤5 yrs[1] | 73.3 | 46.7 | 80.0 | 33.3 | 41.7 | 63.6 | 53.8 | 55.6 | 61.1 |
| Ave. no.≤5yrs/$m^{2}$[1] | 2.9 ±1.4 | 2.9 ±1.5 | 5.6 ±0.8 | 0.3 ±0.3 | 0.5 ±0.2 | 0.5 ±0.3 | 3.3 ±1.3 | 0.9 ±0.5 | 2.8 ±1.0 |
| Ave. no.>5yrs/$m^{2}$[1] | 5.2 ±2.0 | 3.9 ±1.8 | 5.6 ±1.4 | 3.1 ±1.9 | 3.6 ±1.2 | 3.7 ±0.9 | 2.3 ±1.0 | 1.9 ±1,1 | 3.0 ±0.8 |

[1]Quantitative data only; [2]Quantitative and Qualitative combined; [3]Qualitative data only

# Exhibit 9

Temperatures and Fish/Aquatic Life Stress/Mortality Surveys

Exelon®
Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

PM-06-024

September 27, 2006

Mr. Roger Callaway
Illinois Environmental Protection Agency
Compliance Assurance Section
Bureau of Water – Water Pollution Control
1021 North Grand Avenue East, MC#19
Springfield, Illinois 62794-9276

Subject: Letter Report – Provisional Variances IEPA-07-01 & IEPA-07-03 Temperatures and Fish/Aquatic Life Stress/Mortality Surveys

References: IEPA Order 07-01 dated July 19, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated July 17, 2006

IEPA Order 07-03 dated August 2, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated August 1, 2006

Dear Mr. Callaway:

Special Condition "A & B" of the Agency's Order 07-01 dated July 19, 2006 and Special Condition "A & B" of the Agency's Order 07-03 dated August 2, 2006 regarding the provisional variances for Quad Cities Station require the following during the variance period: 1) continuously monitor intake, discharge, and receiving water temperatures, 2) visually inspect intake and discharge areas at least three times daily to assess any mortalities to fish and other aquatic life, 3) document environmental conditions during the term of the provisional variance, including the activities above and to submit the documentation to the Agency and Department of Natural Resources within 30 days after the provisional variance expires.

Attached is the subject documentation required by provisional variances IEPA-07-01 and IEPA-07-03 Special Condition "A & B".

During the Variance Period there were no observations of unusual conditions including mortalities to fish or other aquatic life downstream of Quad Cities Station discharge due to station discharge.

23 Pages

If you should have any questions regarding these study plans, please contact Vicki Neels at (309) 227-3200, Mark Stuhlman at (309) 227-2765, or John Petro at (630) 657-3209.

Very truly yours,

William R. Gideon
Plant Manager
Quad Cities Station

WRG/MS/jas
Attachments:
Attachment 1: Quad Cities Station Provisional Variance Temperature and Flow Data.
Attachment 2: Quad Cities Station Daily Fish/Aquatic Life Stress/Mortality Surveys During Provisional Variances IEPA-07-01 and IEPA-07-03.
Attachment 3: Quad Cities Station Three Times Daily Fish/Aquatic Life Stress/Mortality Surveys During Provisional Variances IEPA-07-01 and IEPA-07-03.
Attachment 4: Time Above the Maximum Temperature Limits.

cc: Mr. Mike Conlin
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702

Mr. Dan Sallee
Illinois Department of Natural Resources
2317 E. Lincoln Way, Suite A
Sterling, Illinois 61081

## ATTACHMENT 1

**Month: July 2006** **QUAD CITIES STATION PROVISIONAL VARIANCE TEMPERATURE and FLOW DATA**

| Day | Temperature (°F) Intake Bay Avg. | Temperature (°F) Intake Bay Max. | Temperature (°F) Discharge Bay Avg. | Temperature (°F) Discharge Bay Max. | Daily Flow (MGD) Thru Intake | Mississippi River Flow CFS (06:00 @ L&D 14) | Maximum Upstream Field Survey Temperature | Maximum Downstream Field Survey Temperature | On the Clock Y/N Provisional Variance (PV) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 77.7 | 78.5 | 106.3 | 107.3 | 1,416 | 37,600 | | | N | |
| 2 | 77.9 | 78.5 | 107.1 | 110.1 | 1,416 | 31,900 | | | N | |
| 3 | 77.9 | 78.6 | 105.5 | 106.8 | 1,416 | 32,200 | | | N | |
| 4 | 78.7 | 79.6 | 106.9 | 108.3 | 1,416 | 32,200 | | | N | |
| 5 | 78.9 | 79.6 | 107.5 | 108.3 | 1,416 | 34,900 | | | N | |
| 6 | 79.0 | 80.0 | 107.5 | 108.6 | 1,416 | 31,100 | | | N | |
| 7 | 80.4 | 81.7 | 108.7 | 109.9 | 1,416 | 25,700 | | | N | * |
| 8 | 81.7 | 82.8 | 110.0 | 111.2 | 1,416 | 22,000 | 80 | 82 | N | * |
| 9 | 82.5 | 83.8 | 110.6 | 112.2 | 1,416 | 20,600 | | | N | * |
| 10 | 81.9 | 82.6 | 109.9 | 110.8 | 1,416 | 21,300 | | | N | * |
| 11 | 80.8 | 81.6 | 108.9 | 109.6 | 1,416 | 21,500 | | | N | * |
| 12 | 78.5 | 79.1 | 107.0 | 107.6 | 1,416 | 27,800 | 78 | 80 | N | |
| 13 | 79.0 | 79.9 | 107.3 | 108.3 | 1,416 | 27,600 | | | N | |
| 14 | 81.2 | 82.7 | 109.9 | 110.9 | 1,416 | 25,200 | | | N | * |
| 15 | 83.8 | 85.2 | 111.9 | 113.1 | 1,416 | 22,900 | 82 | 84 | N | * |
| 16 | 85.9 | 87.5 | 114.0 | 115.4 | 1,416 | 21,000 | 84 | 87 | Y | * |
| 17 | 87.3 | 88.7 | 115.7 | 117.5 | 1,416 | 21,100 | 86 | 89 | Y | * |
| 18 | 86.6 | 87.2 | 114.4 | 115.1 | 1,436 | 21,200 | 85 | 88 | Y | * |
| 19 | 84.9 | 86.1 | 112.3 | 113.4 | 1,416 | 21,700 | 84 | 87 | Y | * |
| 20 | 84.1 | 84.8 | 112.2 | 113.1 | 1,416 | 19,700 | | | N | * |
| 21 | 81.8 | 83.1 | 110.1 | 111.2 | 1,416 | 20,900 | | | N | * |
| 22 | 78.9 | 80.3 | 107.8 | 109.2 | 1,416 | 27,400 | | | N | |
| 23 | 79.7 | 81.4 | 108.2 | 109.4 | 1,416 | 27,400 | | | N | |
| 24 | 80.9 | 82.2 | 109.5 | 110.8 | 1,416 | 27,300 | | | N | |
| 25 | 81.8 | 82.9 | 110.2 | 111.4 | 1,416 | 26,100 | | | N | |
| 26 | 82.2 | 83.7 | 110.5 | 111.2 | 1,416 | 26,400 | | | N | |
| 27 | 82.5 | 83.5 | 111.1 | 111.5 | 1,416 | 26,400 | 82 | 84 | N | |
| 28 | 83.4 | 85.0 | 112.1 | 113.6 | 1,416 | 28,000 | 82 | 85 | N | |
| 29 | 85.0 | 86.4 | 113.7 | 115.0 | 1,416 | 27,700 | 86 | 87 | Y | |
| 30 | 86.2 | 87.5 | 114.8 | 116.1 | 1,416 | 27,900 | 85 | 87 | Y-PV | |
| 31 | 88.7 | 91.1 | 115.6 | 118.6 | 1,416 | 23,500 | 88 | 91 | Y-PV | * |
| **Minimum** | **77.7** | **78.5** | **105.5** | **106.8** | **1,416** | **19,700** | **78** | **80** | | |
| **Average** | **81.9** | **83.1** | **110.2** | **111.5** | **1,417** | **26,071** | **84** | **86** | | |
| **Maximum** | **88.7** | **91.1** | **115.7** | **118.6** | **1,436** | **37,600** | **88** | **91** | | |

*** With river flow below 26,000 cfs, Intake temperature higher than upstream field survey due to heated discharge being drawn upstream into intake.**

## ATTACHMENT 1

**Month: August 2006** **QUAD CITIES STATION PROVISIONAL VARIANCE TEMPERATURE and FLOW DATA**

| Day | Temperature (°F) Intake Bay Avg. | Temperature (°F) Intake Bay Max. | Temperature (°F) Discharge Bay Avg. | Temperature (°F) Discharge Bay Max. | Daily Flow (MGD) Thru Intake | Mississippi River Flow CFS (06:00 @ L&D 14) | Maximum Upstream Field Survey Temperature | Maximum Downstream Field Survey Temperature | On the Clock Y/N Provisional Variance (PV) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 91.0 | 91.6 | 110.7 | 113.7 | 1,436 | 12,700 | 88 | 91 | Y-PV | * |
| 2 | 90.6 | 91.6 | 112.6 | 116.1 | 1,456 | 12,600 | 87 | 91 | Y-PV | * |
| 3 | 87.1 | 90.1 | 115.2 | 117.1 | 1,456 | 18,500 | 87 | 90 | Y-PV | * |
| 4 | 84.9 | 85.5 | 113.5 | 114.2 | 1,436 | 27,600 | | 88 | Y-PV | ** |
| 5 | 84.6 | 85.5 | 113.1 | 114.0 | 1,436 | 35,100 | | 87 | Y-PV | ** |
| 6 | 83.4 | 84.8 | 111.9 | 113.4 | 1,436 | 35,200 | | 87 | Y-PV | ** |
| 7 | 82.6 | 83.3 | 111.1 | 111.9 | 1,436 | 35,200 | | | N | |
| 8 | 82.1 | 83.0 | 109.8 | 111.5 | 1,436 | 39,800 | | | N | |
| 9 | 81.3 | 82.2 | 108.2 | 109.0 | 1,436 | 39,600 | | | N | |
| 10 | 80.1 | 81.2 | 107.0 | 108.2 | 1,436 | 36,400 | | | N | |
| 11 | 79.3 | 80.0 | 106.3 | 107.0 | 1,416 | 32,000 | | | N | |
| 12 | 79.4 | 80.5 | 106.3 | 107.3 | 1,416 | 28,900 | | | N | |
| 13 | 80.7 | 81.8 | 108.8 | 110.4 | 1,416 | 24,200 | | | N | * |
| 14 | 82.0 | 82.5 | 110.4 | 111.0 | 1,416 | 17,900 | | | N | * |
| 15 | 81.4 | 82.4 | 109.4 | 110.6 | 1,416 | 18,200 | 79 | 82 | N | * |
| 16 | 80.3 | 81.1 | 108.5 | 109.3 | 1,416 | 22,200 | | | N | * |
| 17 | 79.3 | 79.7 | 107.7 | 108.1 | 1,416 | 26,800 | | | N | |
| 18 | 78.5 | 79.0 | 106.9 | 107.5 | 1,416 | 26,600 | | | N | |
| 19 | 77.8 | 78.7 | 106.2 | 107.0 | 1,416 | 26,400 | | | N | |
| 20 | 78.8 | 79.4 | 107.0 | 107.7 | 1,416 | 22,000 | | | N | * |
| 21 | 79.3 | 79.9 | 107.6 | 108.4 | 1,416 | 22,200 | | | N | * |
| 22 | 80.4 | 81.4 | 108.8 | 110.0 | 1,416 | 22,000 | | | N | * |
| 23 | 81.7 | 82.8 | 110.1 | 111.3 | 1,416 | 20,700 | | | N | * |
| 24 | 82.1 | 83.3 | 110.6 | 111.8 | 1,416 | 20,600 | 80 | 83 | N | * |
| 25 | 82.3 | 83.1 | 110.9 | 112.0 | 1,416 | 18,900 | | | N | * |
| 26 | 80.2 | 82.2 | 108.7 | 110.6 | 1,416 | 24,100 | | | N | * |
| 27 | 78.1 | 78.4 | 106.7 | 107.0 | 1,416 | 36,400 | | | N | |
| 28 | 76.4 | 77.8 | 104.9 | 106.4 | 1,416 | 35,900 | | | N | |
| 29 | 75.0 | 75.4 | 103.5 | 104.0 | 1,416 | 38,600 | | | N | |
| 30 | 75.1 | 75.8 | 103.7 | 104.4 | 1,416 | 38,300 | | | N | |
| 31 | 74.7 | 75.5 | 103.3 | 104.1 | 1,396 | 35,000 | | | N | |
| **Minimum** | **74.7** | **75.4** | **103.3** | **104.0** | **1,396** | **12,600** | **79** | **82** | | |
| **Average** | **81.0** | **81.9** | **108.7** | **109.8** | **1,423** | **27,439** | **84** | **87** | | |
| **Maximum** | **91.0** | **91.6** | **115.2** | **117.1** | **1,456** | **39,800** | **88** | **91** | | |

*** With river flow below 26,000 cfs, Intake temperature higher than upstream field survey due to heated discharge being drawn upstream into intake.**

**** Downstream field survey temperatures are estimated based on inlet temperature, discharge temperature, intake flow and river temperature.**

## Attachment 2

## Quad Cities Station Daily Fish/Aquatic Life Stress/Mortality Surveys During Provisional Variances IEPA-07-01 and IEPA-07-03

Exelon Corporation and HDR/LMS monitored fish behavior daily before and during the variance hours (7/30/06 to 8/6/2006) at the eight electrofishing stations normally sampled for the Long-Term Monitoring Program at Quad Cities Nuclear Station (QCNS). The eight electrofishing stations are shown in the attached Figure 1-1. Observations along the shoreline near the plant were also noted. Five of the electrofishing stations (Stations 8, 9, 10, 11 and 13) are downstream of the diffuser while three electro-fishing stations (Stations 3, 4 and 5) are upstream from the diffuser. At each station, temperature and dissolved oxygen were each taken. Near surface samples (about 1 foot below the surface) were taken. Fish were identified to species (if possible) and given an approximate length.

Water temperature ranged from 28.8°C to 32.4°C in the upstream samples sites, while temperatures ranged from 29.2°C to 34.0°C in the downstream sites. Temperatures below the diffuser were generally higher than those above, as expected. The highest temperatures observed were in Area 2 (upstream) and Area 10 (downstream), both of which are the farthest point from the diffuser and have more backwater characteristics. Dissolved oxygen was well above saturation at all sample points (10.8 to 18.7 ppm).

Two hundred eight-one fish representing fifteen species were observed during the sampling period. All of these fish were dead or were stressed to the point of probable mortality. General fish mortality was noted at nearly every station at least one day during the sampling period, with significantly more observations at Area 5 and Area 13. These two sites are main channel border sites and were also highly affected by the prevailing southwest wind. This was especially evident for Area 13, which is an area of high deposition due to the prevailing wind and the morphology of the river. This area has historically accumulated all types of river debris. Vegetation along the Area 13 shoreline (eel grass beds) has a tendency to collect fish as they float by.

Mooneye could be observed floating in the main channel throughout the sampling period during all times of the day above and below the diffuser. Mooneye was the prominent species affected by the high temperatures. They accounted for 209 of the 281 observations (74.4%). Mooneye has an upper lethal temperature somewhere between 29°C and 31°C (G. Seegert, EA Engineering, Science, & Technology, Inc., personal communication). All size groups can be found in these observations, signifying several age classes being affected.

Other species with 5 or more observations include common carp, river carpsucker, channel catfish, shorthead redhorse, walleye, and freshwater drum. All of these species are generally abundant in these sampling areas.

Based on these preliminary results, the elevated water temperature downstream of the QCNS discharge did not cause acute mortality to fish below the diffuser. The long-term monitoring program has continued and any notable effects from the summer heat will be noted in regards to species composition, general health and age distribution.

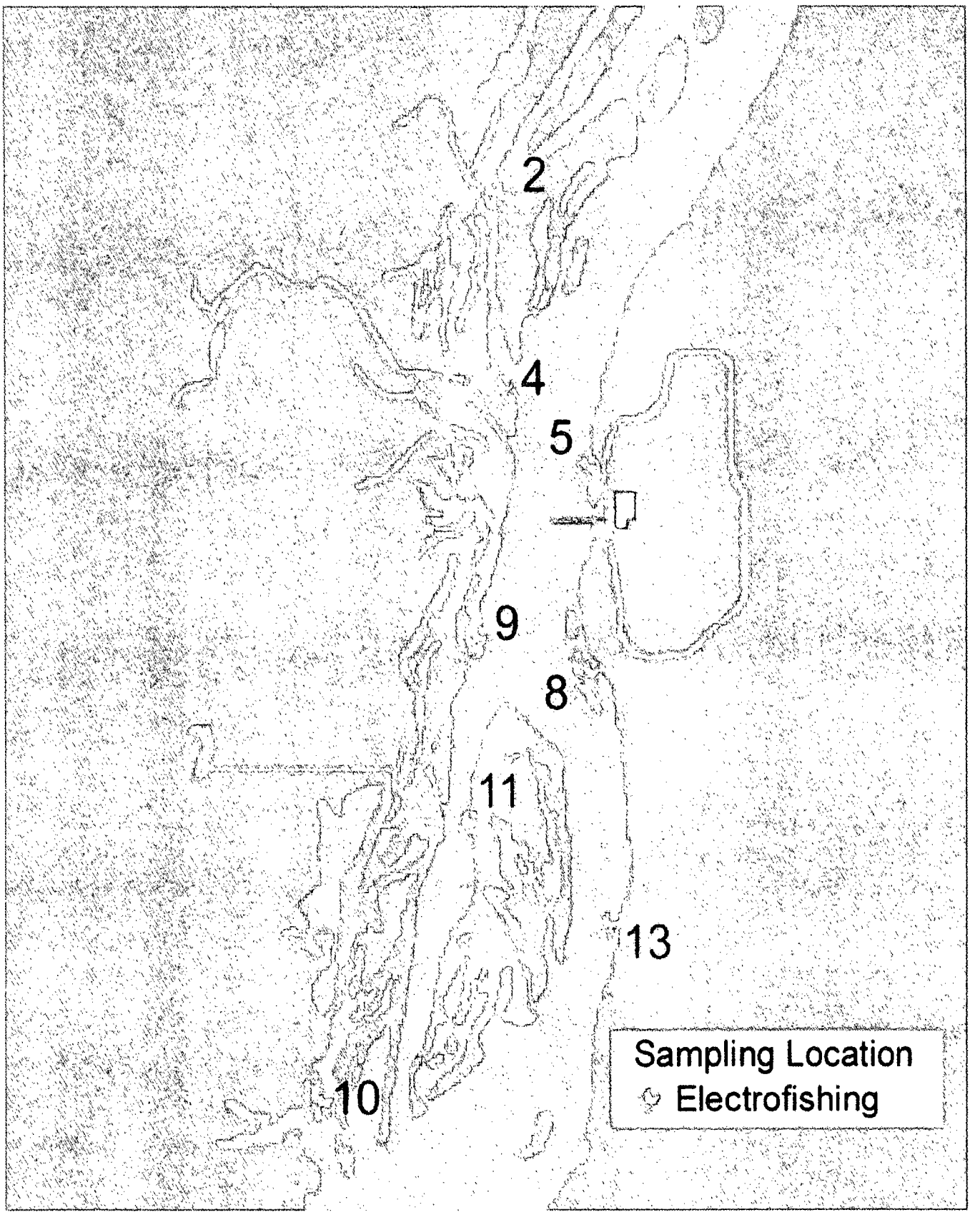


Figure 1-1. Electrofishing Locations in Pool 14 of the Mississippi River near Quad Cities Station.

7/30/2006

Crew: J. Haas (Exelon)

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 15:48 | 29.7 | 12.3 | Channel Catfish 1-12" |
| 4 | 15:54 | 29.8 | 12.4 | none |
| 5 | 17:03 | 29.4 | 11.4 | Mooneye 1-12" |
| | | | | |
| Downstream 8 | 16:57 | 31.8 | 14.3 | (1) |
| 9 | 16:02 | 31.0 | 11.5 | None |
| 10 | 16:21 | 34.0 | 13.9 | None |
| 11 | 16:08 | 30.8 | 12.0 | None |
| 13 | 16:39 | 31.9 | 14.0 | (2) |

(1) Common Carp 12", 18"; Channel Catfish 10"

(2) Shorthead Redhorse 12", 12"; Mooneye 12"; Freshwater Drum 20"; Channel Catfish 10"

Notes: Photos Available, a few fish floating in the main channel

7/31/2006

Crew: J. Haas (Exelon)

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 16:14 | 30.8 | 16.0 | Smallmouth Buffalo 28"-Freshly dead |
| 4 | 16:09 | 30.6 | 14.4 | None |
| 5 | 14:51 | 30.0 | 13.3 | None |
| | | | | |
| Downstream 8 | 15:10 | 31.8 | 16.6 | Walleye 24"-Freshly dead |
| 9 | 15:58 | 31.9 | 14.4 | None |
| 10 | 15:41 | 32.2 | 14.6 | None |
| 11 | 15:53 | 31.4 | 11.6 | None |
| 13 | 15:29 | 31.6 | 14.7 | (1) |

(1) Channel Catfish 3-6", 2-8", 10", 12", 2-14", 16", 20"; Common Carp 18", Shorthead Redhorse 18", River Carpsucker 16"

Notes: Some fish in main channel floating above and below diffuser, mostly channel catfish and a few mooneye.
Shad (lively) all along area 13.
Wind SW 10-15
Nothing below barge ramp, intake (1000 ft), or IA shoreline.

8/1/2006

Crew: J. Haas (Exelon)

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 16:06 | 32.4 | 18.7 | None |
| 4 | 15:50 | 31.2 | 18.4 | River Carpsucker 18" |
| 5 | 14:12 | 31.4 | 14.1 | (1) |
| | | | | |
| Downstream 8 | 14:28 | 33.9 | 14.4 | Mooneye 10"-moribund |
| 9 | 14:39 | 32.3 | 14.3 | Common Carp 16" |
| 10 | 15:05 | 33.2 | 18.2 | None |
| 11 | 14:46 | 32.4 | 13.4 | Mooneye 10", 12" |
| 13 | 15:21 | 33.9 | 15.9 | (2) |

(1) Mooneye 12", 12" (several days old); Channel Catfish 2-8"

(2) Mooneye 8", 8-10", 14-12"; Channel Catfish 3-6", 8", 10", 12"; Common Carp 12"', 14", 18", 24"; Gizzard Shad 12"; Shorthead Redhorse 14"; White Bass 14"; Freshwater Drum 14", Walleye 14"

Notes: Ran into Dan Sallee and relayed the situation and current observations
Nothing below barge ramp, intake (1000 ft), or IA shoreline.

8/2/2006

Crew: J. Haas (Exelon)

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 14:14 | 30.4 | 14.1 | None |
| 4 | 14:20 | 30.0 | 13.1 | None |
| 5 | 15:35 | 30.8 | 14.1 | (1) |
| Downstream 8 | 15:26 | 33.0 | 16.0 | Mooneye 2-8", 2-10", 2-12" |
| 9 | 14:27 | 31.9 | 14.6 | None |
| 10 | 14:50 | 31.4 | 15.5 | None |
| 11 | 14:32 | 32.0 | 12.5 | Mooneye 10" |
| 13 | 15:05 | 32.1 | 15.0 | (2) |

(1) Mooneye 3-10", 5-12", 16"; Channel Catfish 2-6", 2-8"; Freshwater Drum 12"; Sauger 14"; Walleye 12"

(2) Mooneye 33-10", 41-12", 14"; Common Carp 18"; River Carpsucker 14", 16"; Freshwater Drum 16"; Channel Catfish 12"; Shorthead Redhorse 16"

Notes: Any wind swept shoreline outside of the sampling areas had mooneye and a few other species washed up
Nothing below barge ramp, intake (1000 ft), or IA shoreline.

8/3/2006

Crew: HDR/LMS

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 14:45 | 30.2 | 12.8 | None |
| 4 | 15:00 | 30.3 | 14.2 | None |
| 5 | 15:18 | 30.1 | 12.9 | Mooneye 3 (8"-10"), 1 (10"-12") |
| Downstream 8 | 15:31 | 31.2 | 13.1 | Northern Pike 24" |
| 9 | 15:46 | 31.7 | 12.4 | None |
| 10 | 16:48 | 31.4 | 14.5 | Shorthead Redhorse 16" |
| 11 | 15:58 | 31.3 | 11.4 | Highfin Carpsucker 10" |
| 13 | 16:15 | 31.4 | 11.5 | Mooneye 81 8"-12"; River Carpsucker 16"; Freshwater Drum 2-18"; Walleye 18"; Northern Pike 24" |

Notes: The majority of the fish counted had been dead for at least 24 hours.
Nothing below barge ramp, intake (1000 ft), or IA shoreline.

8/4/2006

Crew: HDR/LMS

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 15:51 | 30.2 | 12.9 | None |
| 4 | 15:05 | 30.1 | 12.5 | None |
| 5 | 14:35 | 29.7 | 12.4 | Mooneye 10"; Channel Catfish 6" |
| Downstream 8 | 14:14 | 31.4 | 12.3 | None |
| 9 | 16:00 | 31.4 | 13.3 | None |
| 10 | 16:25 | 32.4 | 14.8 | None |
| 11 | 16:10 | 31.0 | 12.5 | None |
| 13 | 16:45 | 30.6 | 13.4 | Mooneye 10"-12"; Channel Catfish 2-6"; Bluegill 6"; Common Carp 18"; Northern Pike 24"; Walleye 18" |

Notes: A few dead fish are seen near the intake forbay area, but are well into the weedy area.
Only a few new dead fish. Flows have increased and temperatures seemingly are decreasing.

8/5/2006

Crew: HDR/LMS

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 14:00 | 29.8 | 11.9 | None |
| 4 | 14:10 | 29.5 | 12.5 | None |
| 5 | 14:22 | 29.2 | 13.6 | Bigmouth Buffalo 16" |
| | | | | |
| Downstream 8 | 14:38 | 29.5 | 13.5 | None |
| 9 | 14:53 | 30.7 | 12.9 | None |
| 10 | 15:55 | 30.5 | 14.7 | Shorthead Redhorse 14" |
| 11 | 15:05 | 30.6 | 12.7 | None |
| 13 | 15:28 | 29.9 | 14.8 | River Carpsucker 14"; Walleye 18" |

Notes: Cloudy & Cooler. Nothing below barge ramp, intake (1000 ft), or IA shoreline.

8/6/2006

Crew: HDR/LMS

| Location | Time | Temp (C) | Dissolved $O_{2\ (ppm)}$ | Fish Observed (Dead unless specified) |
|---|---|---|---|---|
| Upstream 2 | 14:00 | 28.8 | 10.8 | None |
| 4 | 14:08 | 28.8 | 11.1 | None |
| 5 | 14:20 | 28.9 | 12.1 | None |
| | | | | |
| Downstream 8 | 14:32 | 29.2 | 14.3 | None |
| 9 | 14:40 | 30.3 | 11.6 | River Carpsucker 16" |
| 10 | 15:06 | 29.9 | 12.1 | None |
| 11 | 14:46 | 29.7 | 12.1 | None |
| 13 | 15:25 | 29.5 | 13.7 | Mooneye 10"; Walleye 10" |

Notes: Storm in the early morning, cooler temperatures. Nothing below barge ramp, intake (1000 ft), or IA shoreline.

Fish Observed Above the Plant (Only Station 5)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Gizzard shad | | | | | | | | |
| 12" | | | | | | | | |
| Mooneye | | | | | | | | |
| 6"-8" | | | | | | | | |
| 8"-10" | | | | 3 | 3 | 1 | | |
| 10"-12" | 1 | | 2 | 5 | 1 | | | |
| 12"-14" | | | | | | | | |
| 14"-16" | | | | 1 | | | | |
| Northern Pike | | | | | | | | |
| 24" | | | | | | | | |
| Common Carp | | | | | | | | |
| 12" | | | | | | | | |
| 14" | | | | | | | | |
| 18" | | | | | | | | |
| 24" | | | | | | | | |
| Bigmouth Buffalo | | | | | | | | |
| 16" | | | | | | | 1 | |
| River Carpsucker | | | | | | | | |
| 14" | | | | | | | | |
| 16" | | | | | | | | |
| 18" | | | | | | | | |

Fish Observed Below the Plant (Only Station 13)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Gizzard shad | | | | | | | | |
| 12" | | | 1 | | | | | |
| Mooneye | | | | | | | | |
| 6"-8" | | | 1 | | | | | |
| 8"-10" | | | 8 | 33 | 81 | | | 1 |
| 10"-12" | 1 | | 14 | 41 | * | 1 | | |
| 12"-14" | | | | 1 | | | | |
| 14"-16" | | | | | | | | |
| Northern Pike | | | | | | | | |
| 24" | | | | | 1 | 1 | | |
| Common Carp | | | | | | | | |
| 12" | | | | | | | | |
| 14" | | | 1 | | | | | |
| 18" | | 1 | | 1 | | 1 | | |
| 24" | | | 1 | | | | | |
| Bigmouth Buffalo | | | | | | | | |
| 16" | | | | | | | | |
| River Carpsucker | | | | | | | | |
| 14" | | | | 1 | | | 1 | |
| 16" | | 1 | | 1 | 1 | | | |
| 18" | | | | | | | | |

Fish Observed Above the Plant (Only Station 5)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Shorthead Redhorse | | | | | | | | |
| 12" | | | | | | | | |
| 14" | | | | | | | | |
| 18" | | | | | | | | |
| Channel Catfish | | | | | | | | |
| 6" | | | | 2 | | 1 | | |
| 8" | | | 2 | 2 | | | | |
| 10" | | | | | | | | |
| 12" | | | | | | | | |
| 14" | | | | | | | | |
| 16" | | | | | | | | |
| 20" | | | | | | | | |
| White bass | | | | | | | | |
| 14" | | | | | | | | |
| Bluegill | | | | | | | | |
| 6" | | | | | | | | |
| Sauger | | | | | | | | |
| 14" | | | | 1 | | | | |
| Walleye | | | | | | | | |
| 10" | | | | | | | | |
| 12" | | | | 1 | | | | |
| 14" | | | | | | | | |
| 18" | | | | | | | | |
| 24" | | | | | | | | |

Fish Observed Below the Plant (Only Station 13)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Shorthead Redhorse | | | | | | | | |
| 12" | 2 | | | | | | | |
| 14" | | | 1 | | | | | |
| 18" | | 1 | | | | | | |
| Channel Catfish | | | | | | | | |
| 6" | | 3 | 3 | | | 2 | | |
| 8" | | 2 | 1 | | | | | |
| 10" | 1 | 1 | 1 | | | | | |
| 12" | | 1 | 1 | 1 | | | | |
| 14" | | 2 | | | | | | |
| 16" | | 1 | | | | | | |
| 20" | | 1 | | | | | | |
| White bass | | | | | | | | |
| 14" | | | 1 | | | | | |
| Bluegill | | | | | | | | |
| 6" | | | | | | 1 | | |
| Sauger | | | | | | | | |
| 14" | | | | | | | | |
| Walleye | | | | | | | | |
| 10" | | | | | | | | 1 |
| 12" | | | | | | | | |
| 14" | | | 1 | | | | | |
| 18" | | | | | 1 | 1 | 1 | |
| 24" | | | | | | | | |

Fish Observed Above the Plant (Only Station 5)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Freshwater Drum | | | | | | | | |
| 12" | | | | 1 | | | | |
| 14" | | | | | | | | |
| 16" | | | | | | | | |
| 18" | | | | | | | | |
| 20" | | | | | | | | |
| Total | 1 | 0 | 4 | 16 | 4 | 2 | 1 | 0 |

Fish Observed Below the Plant (Only Station 13)

| | 30-Jul | 31-Jul | 1-Aug | 2-Aug | 3-Aug | 4-Aug | 5-Aug | 6-Aug |
|---|---|---|---|---|---|---|---|---|
| Freshwater Drum | | | | | | | | |
| 12" | | | | | | | | |
| 14" | | | 1 | | | | | |
| 16" | | | | 1 | | | | |
| 18" | | | | | 2 | | | |
| 20" | 1 | | | | | | | |
| Total | 5 | 14 | 35 | 80 | 86 | 7 | 2 | 2 |

* Included in the 8-10 inch group

## Attachment 3

## Three Times Daily Fish/Aquatic Life Stress/Mortality Surveys During Provisional Variances IEPA-07-01 and IEPA-07-03

Once it is determined that permitted excursion hours (87.6) have been exhausted and provisional variance excursion hours are being used, Fish Lab staff (LMS and/or Exelon) will perform daily surveys to document the extent of stress and mortality to fish and other aquatic life, both upstream and downstream from Quad Cities discharge. Surveys will be conducted from a boat and will be performed from 14:00 hrs to 17:00 hrs. Each daily survey will consist of visual surveys of the shoreline area encompassing each of our eight designated long-term monitoring sampling areas (three upstream, five downstream). Water temperature and dissolved oxygen concentration will be measured at each location during each survey. Any observations of fish/aquatic life mortality or stress will be documented at the lowest taxonomic level practicable. Individuals will be counted and size range will be estimated.

On any date that provisional variance hours are being used, chemistry crews will make three visual inspections of the Station's intake and discharge areas. These visual surveys should be spaced such that several hours elapse between observations. Areas to be surveyed are from the barge ramp, downstream from the intake fore bay approximately 100 ft (intake area); along the Iowa shoreline from 500 to 1000 ft downstream of the diffuser; and along the Illinois shoreline 500 to 1000 ft downstream of the diffuser. Crews will document the number and general category of dead or stressed fish/aquatic life. If, during any observation, it appears a "fish kill" is occurring (numbers of individuals exhibiting difficulty in swimming or breathing), the chemistry crew will contact the Fish Lab who will dispatch a team to determine the magnitude of the event and species affected. If Fish Lab staff believe a "fish kill" is underway, the Shift Manager will be notified so that Illinois EPA and Illinois DNR can be notified as well.

Contacts & Phone Numbers:

| | | |
|---|---|---|
| Exelon | Jeremiah Haas | Lab: 309/227-2867 |
| | | Home/Cell: 309/236-9149 |
| LMS | Tim Bowzer | Lab: 309/654-2284 |
| | | Home: 563/243-5278 |
| | | Cell: 563/357-6908 |
| Exelon | John Petro | Home: 815/436-0178 |
| | | Cell: 312/813-5916 |
| | | Pager: 630/603-7060 |

## Quad Cities Station

## Field Observation Survey

Date: 7/30/06 – 8/01/06 Crew: Chemistry & Fish Lab Personnel

| Sampling Location | Time | Temp. (°F) | Observed Mortality or Presence of Stress |
|---|---|---|---|
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 12:30 on 7/30/06<br><br>PV IEPA-07-01 entered 7/30/06 @ 18:20 | 86 up<br>87 down | No mortality or presence of stress |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 06:30 on 7/31/06<br><br>PV IEPA-07-01 | 86 up<br>88 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 13:00 on 7/31/06<br><br>PV IEPA-07-01 | 87 up<br>89 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 19:00 on 7/31/06<br><br>PV IEPA-07-01 | 88 up<br>91 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 09:00 on 8/1/06<br><br>PV IEPA-07-01 | 87 up<br>91 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 12:00 on 8/1/06<br><br>PV IEPA-07-01 | 88 up<br>91 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 17:00 on 8/1/06<br><br>PV IEPA-07-01 | 88 up<br>89 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| | | | |

Notes: PV IEPA-07-01 entered 7/30/06 @18:20.
PV IEPA-07-03 entered 8/3/06 @22:20.

## Quad Cities Station

## Field Observation Survey

Date: 8/2/06 – 8/04/06 Crew: Chemistry & Fish Lab Personnel

| Sampling Location | Time | Temp. (°F) | Observed Mortality or Presence of Stress |
|---|---|---|---|
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 07:00 on 8/2/06<br>PV IEPA-07-01 | 86 up<br>90 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 12:00 on 8/2/06<br>PV IEPA-07-01 | 87 up<br>91 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 16:00 on 8/2/06<br>PV IEPA-07-01 | 87 up<br>91 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 06:00 on 8/3/06<br>PV IEPA-07-01 | 87 up<br>901 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 13:00 on 8/3/06<br>PV IEPA-07-01 | 86 up<br>88 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 17:00 on 8/3/06<br>PV IEPA-07-03 entered 8/3/06 @ 22:20 | 86 up<br>88 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 06:00 on 8/4/06<br>PV IEPA-07-03 | 84 up<br>86 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. One estimated 15-20 lb paddlefish observed in channel upstream of plant |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 10:00 on 8/4/06<br>PV IEPA-07-03 | 84 up<br>86 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 18:00 on 8/4/06<br>PV IEPA-07-03 | 85 up<br>87 down | No mortality along shorelines or presence of stress. Few dead fish in channel both upstream and downstream of diffusers. |

## Quad Cities Station

## Field Observation Survey

Date: 8/5/06 – 8/06/06 Crew: Chemistry & Fish Lab Personnel

| Sampling Location | Time | Temp. (°F) | Observed Mortality or Presence of Stress |
|---|---|---|---|
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 0800 on 8/5/06<br>PV IEPA-07-03 | 84 up<br>86 down | No mortality along shorelines or presence of stress. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 12:30 on 8/5/06<br>PV IEPA-07-03 | 84 up<br>86 down | No mortality along shorelines or presence of stress. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 17:00 on 8/5/06<br>PV IEPA-07-03 | 85 up<br>87 down | No mortality along shorelines or presence of stress. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 10:30 on 8/06/06<br>PV IEPA-07-03 | 82 up<br>84 down | No mortality along shorelines or presence of stress. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 14:00 on 8/6/06<br>PV IEPA-07-03 | 83 up<br>85 down | No mortality along shorelines or presence of stress. |
| Illinois shoreline 1000' Upstream to power lines South & Iowa shoreline 1000' Upstream to power lines South | 17:00 on 8/6/06<br>PV IEPA-07-03 | 84 up<br>86 down | No mortality along shorelines or presence of stress. |
| | | | |
| | | | |

Notes:

**ATTACHMENT 4**
**Time Above the Maximum Temperature Limits**
**Page 1 of 1**

1. Maximum temperature rise above natural temperature shall **not** exceed 5 °F outside the 500 ft mixing zone.

2. Water temperature at representative locations in the main river shall **not** exceed the maximum limits in the following table during more than one (1) percent of the hours in the 12-month period ending with any month. Moreover, at **no** time shall the water temperature at such locations exceed the maximum limits in the following table by more than 3°F.

| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | 45 | 57 | 68 | 78 | 85 | 86 | 86 | 85 | 75 | 65 | 52 |

| DATE/TIME ABOVE LIMIT | DATE/TIME BELOW LIMIT | HOURS ABOVE LIMIT | HOURS ACCUMULATED |
|---|---|---|---|
| 7/16/06 @ 13:45 | 7/19/06 @ 03:00 | 61.3 | 61.3 |
| 7/29/06 @ 16:00 | 7/30/06 @ 18:20 | 26.3 | 87.6* |
| 7/30/06 @ 18:20 | 8/1/06 @ 00:00 | 29.7 | 117.3* |
| 8/1/06 @ 00:00 | 8/4/06 @ 06:30 | 78.5 | 195.8 |
| 8/4/06 @ 14:00 | 8/5/06 @ 06:00 | 16.0 | 211.8 |
| 8/5/06 @ 1500 | 8/6/06 @ 02:00 | 11.0 | 222.8 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Provisional Variance PV IEPA-07-01 entered 7/30/06 @ 18:20.

Provisional Variance PV IEPA-07-03 entered 8/3/06 @ 22:20.

* Variance hour accumulation continued 7/30/06 @ 18:20 and 8/1/06 @ 00:00. Hours recorded above to document the use of the 1% (87.6 hrs) and total for the month (DMR purposes).

Reviewed By: Mark Stuhlman Date: 9/19/06

# Exhibit 10

Mussel Bed Monitoring Results

September 20-25, 2006

Exelon.
Nuclear

Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

SVP-06-109

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 17, 2006

Mr. Roger Callaway
Illinois Environmental Protection Agency
Compliance Assurance Section
Bureau of Water – Water Pollution Control
1021 North Grand Avenue East, MC#19
Springfield, Illinois 62794-9276

Subject: Letter Report – September 20-25, 2006 Mussel Bed Monitoring Results
Final Report – 2005 Unionid Mussel Monitoring near Quad Cities Nuclear Station

References: IEPA Order 07-01 dated July 19, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated July 17, 2006

IEPA Order 07-03 dated August 2, 2006 related to Quad Cities Nuclear Power Station Provisional Variance Request Letter dated August 1, 2006

Dear Mr. Callaway:

Special Condition "C" of the Agency's Order 07-01 dated July 19, 2006 and Special Condition "C" of the Agency's Order 07-03 dated August 2, 2006 regarding the provisional variances for Quad Cities Station require the station to conduct a mussel study specific to the provisional variances and to submit the documentation for the mussel study to the Agency and the Department of Natural Resources within 60 days after completing the survey. Quad Cities Letter PM-06-020 transmitted the summary of mussel study that took place August 3-5, 2006.

Attached is a letter report from Ecological Specialists Inc. that includes a preliminary summary of data (% mortality, condition, species composition, temperature and dissolved oxygen conditions) from the mussel bed monitoring that took place September 20-25, 2006. The letter report concludes that the elevated water temperature downstream of the Quad Cities Station discharge did not cause acute mortality to mussels in either the Steamboat Slough Bed or the Cordova Bed to either adult or young mussels.

(18)

Also attached is the final report of the Unionid Mussel Monitoring near the Quad Cities Nuclear Station that was performed July 26-28, 2005 and October 2-12, 2005. The final 2006 report will be prepared and submitted to the agency during the second quarter of 2007.

If you should have any questions regarding these study plans, please contact Vicki Neels at (309) 227-3200, Mark Stuhlman at (309) 227-2765, or John Petro at (630) 657-3209.

Sincerely,

Timothy J. Tulon
Site Vice President
Quad Cities Station

TJT/MS/jas

Attachments

cc: Mr. Mike Conlin
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702

Mr. Dan Sallee
Illinois Department of Natural Resources
2317 E. Lincoln Way, Suite A
Sterling, Illinois 61081

**ECOLOGICAL SPECIALISTS, INC.**

MISSOURI HOME OFFICE
1417 Hoff Industrial Drive • O'Fallon, MO 63366
P: 636.281.1982 • F: 636.281.0973

OHIO BRANCH OFFICE
470-A Schrock Road • Columbus, OH 43229
P: 614.430.3780 • F: 636.430.3781

*www.ecologicalspecialists.com*

November 13, 2006

Mr. John R. Petro
Exelon Generation
4300 Winfield Road
Warrenville, IL 60555

Dear John:

Ecological Specialists, Inc. monitored unionid mussels within three unionid beds (Upstream Bed, Steamboat Slough Bed, and Cordova Bed) near Quad Cities Nuclear Station (QCNS) from September 20 to September 25, 2006. Within each bed, we collected 90 randomly located 0.25m² whole substrate quantitative samples and 25-5 minute qualitative samples. For each qualitative sample, we measured surface and bottom water temperature, dissolved oxygen, and current velocity.

Water temperature ranged from 16.1°C to 17.2°C in the Upstream Bed (Sept. 25), 18.1°C to 19.5°C in the Steamboat Slough Bed (Sept. 24), and 17.5 to 18.5°C in the Cordova Bed (Sept. 24) (Table 1). Surface temperature was slightly higher than bottom temperature at all three beds. The lowest DO occurred in the Cordova Bed, where DO was below saturation (near 5ppm) in parts of the bed and super saturated in others (18.1ppm). DO in both the Upstream and Steamboat Slough Beds was less variable, ranging from 7.1 to 9.4ppm in the Upstream Bed and 7.0 to 11.9ppm in the Steamboat Slough Bed. Current velocity on the surface and bottom were similar in the Upstream Bed and Cordova Bed, but widely variable in the Steamboat Slough Bed. The Mississippi River flow measured at Lock and Dam 14 at LeClaire during the time period August 1, 2006 through September 30, 2006 is shown in Table 2.

Unionids at all three monitoring sites exhibited normal behavior. They were in the substrate near the substrate/water interface. Siphoning activity could not be evaluated due to lack of visibility. However, all retrieved unionids were tightly closed as usual. No gaping, excessive mucous or slow response time was noted. Additionally, community parameters were comparable to previous monitoring. Mortality was slightly higher in September than in August in all three beds, but unionid density was within the range of 2004 and 2005 monitoring data (Table 3). The percentage of

young unionids in the Upstream and Cordova beds was similar among monitoring events, but was higher in both August (23%) and September (39%) in 2006 in the Steamboat Slough Bed than in previous years (10 to 12%).

Also similar to previous monitoring, several (10 in August 2006 and 11 in September 2006) *Lampsilis higginsii* were collected in the Cordova Bed, one was found in the Upstream Bed in August, and none were collected in the Steamboat Slough Bed. *Ligumia recta* were found in all three beds, and *Ellipsaria lineolata* was found in the Upstream and Cordova Beds.

Based on these preliminary results, the elevated water temperature downstream of the QCNS discharge during the summer of 2006 did not cause acute mortality to unionids in either the Steamboat Slough or Cordova Beds to either adult or young unionids.

Sincerely,

Heidi L. Dunn
President

Table 1. QCNS preliminary results of unionid monitoring, August and September 2006.

| | Upstream | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|
| Date | 5-Aug | 25-Sep | 4-Aug | 5-Aug | 24-Sep | 3-Aug | 4-Aug | 24-Sep |
| Temperature (°C) | | | | | | | | |
| Surface | | | | | | | | |
| Min | 29.7 | 16.7 | 31.3 | 30.8 | 18.2 | 31.4 | 29.8 | 17.5 |
| Max | 29.9 | 17.2 | 31.5 | 31.2 | 19.5 | 31.9 | 30.3 | 18.5 |
| Bottom | | | | | | | | |
| Min | 29.2 | 16.1 | 31.3 | 30.8 | 18.1 | 31.4 | 30.0 | 17.7 |
| Max | 29.8 | 16.8 | 31.5 | 31.2 | 19.5 | 31.6 | 29.8 | 18.5 |
| DO (ppm) | | | | | | | | |
| Surface | | | | | | | | |
| Min | 11.1 | 7.5 | 4.8 | 11.2 | 7.9 | 8.7 | 7.8 | 5.6 |
| Max | 11.9 | 8.5 | 9.9 | 11.9 | 11.9 | 10.7 | 9.1 | 18.1 |
| Bottom | | | | | | | | |
| Min | 9.7 | 7.1 | 5.1 | 11.2 | 7.0 | 8.2 | 7.7 | 4.3 |
| Max | 11.8 | 9.4 | 10.3 | 12.0 | 9.5 | 10.1 | 8.8 | 18.1 |
| Velocity (m/sec) | | | | | | | | |
| Surface | | | | | | | | |
| Min | | 0.1 | | | 0.2 | | | 0.0 |
| Max | | 0.2 | | | 1.3 | | | 0.2 |
| Bottom | | | | | | | | |
| Min | | 0.1 | | | 0.1 | | | 0.0 |
| Max | | 0.2 | | | 1.0 | | | 0.1 |
| Unionids | | | | | | | | |
| Total no. | 588 | 560 | 400 | | 533 | 424 | | 677 |
| Density | 8.3 | 11.1 | 9.2 | | 4.0 | 3.8 | | 2.9 |
| % mortality | 6.7 | 14.7 | 1.1 | | 8.2 | 7.5 | | 33.3 |
| %≤ 5 yrs old | 55.4 | 49.8 | 22.8 | | 38.9 | 43.2 | | 42.2 |
| CPU | 25.3 | 12.4 | 15.4 | | 17.7 | 19.4 | | 27.8 |
| No. species | 20 | 21 | 17 | | 14 | 20 | | 16 |
| T&E's | | | | | | | | |
| *Lampsilis higginsii* | 1 | | | | | 10 | | 11 |
| *Ellipsaria lineolata* | 13 | 1 | | | | 3 | | |
| *Ligumia recta* | 6 | 6 | 1 | | 3 | 33 | | 18 |

Table 2. Discharge (L&D 14 at LeClaire) during unionid monitoring, August and September 2006.

| Date | Discharge (cfs) | Date | Discharge (cfs) |
|---|---|---|---|
| 8/1/06 6:00 | 12,780 | 9/1/06 6:00 | 25,420 |
| 8/2/06 6:00 | 12,650 | 9/2/06 6:00 | 25,171 |
| 8/3/06 6:00 | 18,544 | 9/3/06 6:00 | 23,486 |
| 8/4/06 6:00 | 27,695 | 9/4/06 6:00 | 21,239 |
| 8/5/06 6:00 | 35,189 | 9/5/06 6:00 | 21,255 |
| 8/6/06 6:00 | 35,286 | 9/6/06 6:00 | 23,722 |
| 8/7/06 6:00 | 35,204 | 9/7/06 6:00 | 27,758 |
| 8/8/06 6:00 | 39,828 | 9/8/06 6:00 | 27,631 |
| 8/9/06 6:00 | 39,687 | 9/9/06 6:00 | 25,037 |
| 8/10/06 6:00 | 36,457 | 9/10/06 6:00 | 22,849 |
| 8/11/06 6:00 | 32,050 | 9/11/06 6:00 | 22,560 |
| 8/12/06 6:00 | 28,911 | 9/12/06 6:00 | 28,253 |
| 8/13/06 6:00 | 24,259 | 9/13/06 6:00 | 37,691 |
| 8/14/06 6:00 | 17,968 | 9/14/06 6:00 | 34,922 |
| 8/15/06 6:00 | 18,212 | 9/15/06 6:00 | 28,211 |
| 8/16/06 6:00 | 22,270 | 9/16/06 6:00 | 27,033 |
| 8/17/06 6:00 | 26,845 | 9/17/06 6:00 | 24,340 |
| 8/18/06 6:00 | 26,620 | 9/18/06 6:00 | 24,418 |
| 8/19/06 6:00 | 26,497 | 9/19/06 6:00 | 24,448 |
| 8/20/06 6:00 | 22,043 | 9/20/06 6:00 | 30,178 |
| 8/21/06 6:00 | 22,200 | 9/21/06 6:00 | 28,776 |
| 8/22/06 6:00 | 22,044 | 9/22/06 6:00 | 24,027 |
| 8/23/06 6:00 | 20,702 | 9/23/06 6:00 | 21,257 |
| 8/24/06 6:00 | 20,652 | 9/24/06 6:00 | 22,691 |
| 8/25/06 6:00 | 18,979 | 9/25/06 6:00 | 25,820 |
| 8/26/06 6:00 | 24,180 | 9/26/06 6:00 | 27,931 |
| 8/27/06 6:00 | 36,438 | 9/27/06 6:00 | 27,762 |
| 8/28/06 6:00 | 35,901 | 9/28/06 6:00 | 28,013 |
| 8/29/06 6:00 | 38,632 | 9/29/06 6:00 | 27,854 |
| 8/30/06 6:00 | 38,307 | 9/30/06 6:00 | 25,913 |
| 8/31/06 6:00 | 35,034 | | |

http://www2.mvr.usace.army.mil/WaterControl/stationinfo2.cfm?sid=MI14&fid=LECI4&dt=S

Table 3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004 July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Species rel. abundance (%)[1] | | | | | | | | | |
| Ambleminae | | | | | | | | | |
| *Amblema plicata* | 17.5 | 20.3 | 18.7 | 41.5 | 26.8 | 30.9 | 27.9 | 50.0 | 24.6 |
| *Fusconaia ebena* | WD | - | WD | - | - | - | WD | - | - |
| *Fusconaia flava* | 6.2 | 1.4 | 5.2 | X | 9.8 | 2.1 | X | 3.3 | 3.1 |
| *Megalonaias nervosa* | - | 1.4 | - | - | - | - | 2.9 | X | 4.6 |
| *Quadrula metanevra* | 1.0 | - | WD | - | - | - | WD | - | - |
| *Quadrula nodulata* | 1.0 | X | 1.2 | 9.8 | 2.4 | 6.4 | - | - | - |
| *Quadrula p. pustulosa* | 8.2 | 4.3 | 9.1 | 4.9 | 7.3 | 5.3 | 5.9 | 6.7 | 4.6 |
| *Quadrula quadrula* | 6.2 | 4.3 | 6.7 | 4.9 | 14.6 | 17.0 | 2.9 | X | 2.3 |
| *Tritogonia verrucosa* | WD | - | WD | - | - | - | SF | - | WD |
| Total Ambleminae | 40.1 | 31.9 | 40.9 | 61.1 | 61.0 | 61.7 | 39.6 | 60.0 | 39.2 |
| Anodontinae | | | | | | | | | |
| *Arcidens confragosus* | X | X | 0.4 | x | 2.4 | X | x | 3.3 | X |
| *Lasmigona c. complanata* | X | 1.4 | 2.4 | 2.4 | X | X | 1.5 | X | 1.5 |
| *Pyganodon grandis* | X | <0.5 | 1.2 | x | 2.4 | X | X | X | 0.8 |
| *Strophitus undulatus* | WD | - | - | - | - | - | - | - | - |
| *Utterbackia imbecillis* | 1.0 | <0.5 | 0.4 | - | X | X | X | FD | 1.5 |
| Total Anodontinae | 1.0 | 1.4 | 4.4 | 2.4 | 4.9 | 0.0 | 1.5 | 3.3 | 3.8 |
| Lampsilinae | | | | | | | | | |
| *Actinonaias ligamentina* | x | - | - | - | - | - | X | - | - |
| ***Ellipsaria lineolata*** | **1.0** | **1.4** | **X** | **2.4** | **X** | - | **WD** | - | **X** |
| *Lampsilis cardium* | 5.2 | 11.6 | 7.9 | 4.9 | X | 5.3 | 7.4 | 6.7 | 5.4 |
| ***Lampsilis higginsii*** | - | **X** | **0.4** | - | - | - | **1.5** | **X** | **0.8** |
| *Lampsilis teres* | WD | 1.4 | WD | - | - | - | - | - | - |
| *Leptodea fragilis* | 6.2 | 11.6 | 7.1 | x | 2.4 | 4.3 | 33.8 | 16.7 | 29.2 |
| ***Ligumia recta*** | **1.0** | **X** | **0.8** | - | - | **1.1** | **1.5** | **X** | **6.2** |
| *Obliquaria reflexa* | 38.1 | 30.4 | 27.8 | 26.8 | 22.0 | 22.3 | 8.8 | 3.3 | 6.9 |
| *Obovaria olivaria* | 5.2 | 2.9 | 2.4 | 2.4 | - | X | X | X | 0.8 |
| *Potamilus alatus* | X | X | X | - | - | X | X | X | 0.8 |
| *Potamilus ohiensis* | 1.0 | 2.9 | 0.8 | X | 7.3 | 3.2 | 1.5 | 3.3 | X |
| *Toxolasma parvus* | - | | 1.2 | - | - | WD | 1.5 | 6.7 | 3.8 |
| *Truncilla donaciformis* | X | 4.3 | 5.6 | - | 2.4 | 2.1 | 2.9 | - | 2.3 |
| *Truncilla truncata* | 1.0 | | 0.8 | - | X | X | WD | - | 0.8 |
| Total Lampsilinae | 58.7 | 66.7 | 54.8 | 36.5 | 34.1 | 38.3 | 58.9 | 36.7 | 56.9 |

Table 3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004 July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Total no.[2] | 902 | 399 | 822 | 547 | 426 | 657 | 320 | 164 | 375 |
| Ave. no./$m^{2}$[1] | 8.1±3.1 | 6.9±3.1 | 11.2±2.0 | 3.5±2.0 | 4.1±1.2 | 4.2±0.9 | 5.7±1.9 | 3.1±1.3 | 5.8±1.5 |
| Ave. CPUE [3] | 57.5 | 15.7 | 22.8 | 36.4 | 19.3 | 22.5 | 15.8 | 6.7 | 10.2 |
| Ave. no. species/qual sample[3] | 10.7 | 6.0 | 6.3 | 7.8 | 5.6 | 7.2 | 6.6 | 3.3 | 5.1 |
| Total no. species[2] | 21 | 21 | 21 | 15 | 16 | 18 | 20 | 18 | 21 |
| Total live/FD species per site | | | 25 | | | 19 | | | 22 |
| Theoretical species richness[3] | | | | | | | | | |
| 100 | 13 | 16 | 14 | 12 | 11 | 13 | 15 | 15 | 15 |
| 250 | 15 | 19 | 17 | 14 | 14 | 16 | 18 | 18 | 17 |
| 500 | 17 | 21 | 19 | 16 | 15 | 18 | 21 | 20 | 20 |
| 1000 | 19 | 24 | 21 | 17 | 17 | 20 | 23 | 22 | 22 |
| 5000 | 23 | 29 | 26 | 22 | 21 | 24 | 28 | 27 | 27 |
| Regression slope | 6.53 ±0.29 | 7.85 ±0.27 | 6.99 ±0.17 | 5.81 ±0.23 | 5.64 ±0.26 | 6.53 ±0.29 | 7.71 ±0.13 | 7.43 ±0.38 | 7.27 ±0.15 |
| %Mortality[1] | 6.7 | 1.4 | 3.1 | 4.7 | 2.4 | 3.1 | 24.4 | 21.1 | 3.0 |
| Ave. no. FD/$m^{2}$[1] | 0.6 ±0.5 | 0.2±0.2 | 0.4±0.2 | 0.2 ±0.2 | 0.1 ±0.2 | 0.1 ±0.2 | 1.8 ±1.6 | 0.8 ±0.9 | 0.2 ±0.2 |
| %≤3 years old[1] | 3.1 | 18.6 | 24.2 | 2.4 | 4.8 | 6.4 | 33.8 | 0 | 29.2 |
| %≤5 years old[1] | 36.1 | 42.0 | 50.4 | 9.8 | 11.9 | 11.7 | 58.8 | 25.7 | 47.7 |
| % of species w/ ≤5 yrs[1] | 73.3 | 46.7 | 80.0 | 33.3 | 41.7 | 63.6 | 53.8 | 55.6 | 61.1 |
| Ave. no.≤5yrs/$m^{2}$[1] | 2.9 ±1.4 | 2.9 ±1.5 | 5.6 ±0.8 | 0.3 ±0.3 | 0.5 ±0.2 | 0.5 ±0.3 | 3.3 ±1.3 | 0.9 ±0.5 | 2.8 ±1.0 |
| Ave. no.>5yrs/$m^{2}$[1] | 5.2 ±2.0 | 3.9 ±1.8 | 5.6 ±1.4 | 3.1 ±1.9 | 3.6 ±1.2 | 3.7 ±0.9 | 2.3 ±1.0 | 1.9 ±1,1 | 3.0 ±0.8 |

[1]Quantitative data only; [2]Quantitative and Qualitative combined; [3]Qualitative data only

# Final Report: Unionid Mussel Monitoring near Quad Cities Nuclear Station, Mississippi River Miles 504 to 507.5

**Prepared for:**
**Exelon Generation Company**
**Warrenville, IL**

**Prepared by:**
**Ecological Specialists, Inc.**
**O'Fallon, Missouri**

ESI Project #05-017

**November 2006**

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Table of Contents



List of Figures



List of Tables

## 1.0 Introduction

In July 2005, Exelon Generating Company (Exelon) sought 100 additional excursion hours to support Quad Cities Nuclear Station (QCNS) continued operation during a period of anticipated low flow and high ambient water temperature. (Due to better than anticipated weather and river flow conditions, QCNS did not use the additional excursion hours.) Special Condition "C" of the Illinois Environmental Protection Agency's (Illinois EPA) Order granting the requested additional excursion hours required monitoring of three unionid (freshwater mussel) beds (Cordova Bed, Upstream Bed, and Steamboat Slough Bed) to determine if unionid bed characteristics changed because of these additional excursion hours. Exelon requested that Ecological Specialists, Inc. (ESI) conduct the monitoring program ordered by Illinois EPA. This report describes the results of the 2005 monitoring program and compares unionid bed characteristics temporally and spatially.

**2.0 Methods**

Cordova, Upstream (UP), and Steamboat Slough (SS) beds were sampled July 26, 27, and 28 and October 2 through 12, 2005 following methods used in 2004. Density, age distribution, and observed mortality were estimated from quantitative samples. Species richness was estimated from qualitative samples.

Random points for quantitative sampling within each bed were generated using GIS and plotted on a Hummingbird Depthfinder w/GPS matrix 76. Quantitative sampling consisted of a diver excavating all substrate material from a $0.25m^2$ quadrat to a depth of 15cm into a 20L bucket at each random point. The surface crew retrieved the sample and rinsed it through 6mm and 12mm sieves. Substrate and debris were searched and unionids removed. All live unionids were identified to species, measured (length in mm), aged (external annuli count), and returned to the river. Freshly dead shells (FD; nacre shiny, hinge flexible, valves attached, with or without tissue; dead within one year) were identified and counted. Weathered shells (WD; nacre chalky, hinge brittle, valves typically separated, periostracum intact) and subfossil shells (SF; periostracum eroded, valves separate, very chalky) were noted as present. Substrate characteristics (Wentworth scale) and depth (pneumometer) were recorded for each sample. Forty (40) and 90 quantitative samples were collected in each bed in July and October 2005, respectively.

The objective of qualitative sampling is to collect as many individuals as possible, increasing the probability of finding rare species (Kovalak *et al.*, 1986). For each qualitative sample, a diver searched for and collected unionids for 5 min. intervals at 20 and 25 points spread throughout each bed in July and October, respectively. All live and fresh shells of unionids were identified, designated as adults (>3 years old for Anodontinae and Lampsilinae; >5 years old for Ambleminae) or juveniles (≤3 years old for Anodontinae and Lampsilinae; ≤5 years old for Ambleminae), and counted. Live unionids were returned to the river. The position of each qualitative point was recorded with a Trimble Pathfinder XP or Hummingbird depthfinder GPS. Additionally, water temperature, dissolved oxygen (DO), and current velocity were recorded at each qualitative point.

Analysis of variance (ANOVA) was used to detect differences in total, juvenile and adult density, Ambleminae, and Lampsilinae density; and density of freshly dead shells among dates and Upstream and SS bed. Data was Log (x+1) transformed for ANOVAs and significance level was $p<0.05$ for all tests. Regression was used to determine the slope (rate of increase) of species with respect to cumulative individuals using the equation; cumulative species = slope * log (cumulative individuals). The intercept constant was set to zero, as no species are present if no individuals are collected.

**3.0 Results and Discussion**

3.1 Upstream Bed

Habitat conditions within the UP bed have remained similar among the three monitoring events (July 2004, July 2005 and October 2005). UP bed is located near the mouth of the Wapsipinicon River and upstream of QCNS diffuser discharge (see Figure 1-1). Substrate is a mixture of primarily sand, silt, and clay, with sand being the major constituent (Table 3-1). However, substrate constituents varied considerably among sample points (CV near or exceeding 100 except for sand). Depth within the sampled area ranged from 0.6 to 7.3m. Dissolved oxygen (DO) was slightly below saturation during July 2004 and October 2005, but supersaturated in July 2005. The high DO during July 2005 is possibly a result of higher levels of aquatic flora with the low flow and high temperature conditions that occurred between July 16 and 23 (ambient water temperature > 28.9°C [84°F] and discharge <40,000cfs; Table 3-2). Current velocity averaged ≤0.5m/sec in July 2004, July 2005, and October 2005, but was most variable in July 2005, ranging from 0.03 to 0.6m/sec (see Table 3-1).

Water temperature measured approximately 0.5m above the substrate in July 2005 averaged 26.9°C and ranged from 26.5 to 27.0°C (see Table 3-1). These temperatures are very similar to those recorded in the intake bay by QCNS on July 28, 2005 (25.5°C min, 26.2°C ave, 27.1°C max; see Table 3-2). Water temperature during this study was slightly lower and discharge was higher than worst case conditions used in Holly *et al.*'s (2004) model (28.9°C to 29.2°C and 22,500cfs, respectively).

Zebra mussel (*Dreissena polymorpha*) infestation was moderate (a few zebra mussels on most unionids) in 2004, but declined to an average of <1 and a maximum of 10 zebra mussels per unionid in 2005.

The UP bed unionid community characteristics were also similar among monitoring events. The bed is species rich and moderately dense, most species show evidence of recent recruitment into the community, and mortality is low. The slope of the cumulative individuals vs. cumulative species regression was high, averaging near seven (Table 3-3). Twenty-five (25) species were collected in the UP Bed, with 21 species (84%) collected during each sampling event. The community consists of approximately 60% Lampsilinae species and 40% Ambleminae species (see Table 3-3). *Obliquaria reflexa* (approximately 1/3 of the community) was the dominant Lampsilinae, and *Amblema plicata* (20%) was the dominate Ambleminae species. The federally endangered *Lampsilis higginsii* was collected in July and October 2005. *Ellipsaria lineolata* (Illinois and Iowa threatened species) and *Ligumia recta* (Illinois threatened species) were found in all three monitoring events.

Unionid density in the UP bed averaged near 8 unionids/$m^2$ and did not differ significantly among sampling events (see Table 3-3). Young unionids were abundant in the community with 35 to 50% of unionids collected being ≤5 years old. Density of unionids ≤5 years old was significantly higher in October 2005 than during July 2004 and 2005, while density of unionids >5 years old has remained constant. Mortality is low (<10%) and density of freshly dead shells has not changed significantly with time.

Parameters within the subfamilies Lampsilinae and Ambleminae were also similar, with the exception of young Ambleminae (Table 3-4). Density of Ambleminae >5 years old, and both juvenile and adult groups of Lampsilinae did not differ significantly with monitoring time. However, the density of ≤5 year old Ambleminae was significantly greater in October 2005 than in July of 2004 or 2005. Additionally, although not significantly different, fewer young Ambleminae were found in July 2005 compared to July 2004. The mode for Ambleminae age was eight in July 2004 and seven in October 2005, but 14 in July 2005 (Table 3-5). Young Ambleminae must have been present in July 2005, as several one to five year old individuals were collected in October. This may be an artifact of sample size (48, 40, and 90 in July 2004, July 2005, and October 2005, respectively) or young Ambleminae were less susceptible to collection; size smaller than 6mm or perhaps buried deeper in the substrate. However, when all collected Ambleminae (both qualitative and quantitative samples) are considered, all six species in July 2004, four of the six species in July 2005, and all of the five species found in October 2005 were represented by youngsters (see Table 3-4).

Warmer July temperatures in 2005 did not appear to affect the condition of Ambleminae, as all individuals collected were behaving normally (no gaping, slow response time, or excess mucous), and no freshly dead Ambleminae were collected. One young *Quadrula quadrula* was collected as a freshly dead shell in July 2004, and one *Quadrula p. pustulosa* and one *A. plicata* adult were collected as freshly dead shells in October 2005. Thus, higher water temperature in July 2005 did not seem to affect Ambleminae condition or mortality.

No significant differences in Lampsilinae density, adults or juveniles, were found (see Table 3-4). Modal age at all three sample times was 5 years old, and young *O. reflexa* (the dominant species in the UP bed) were represented (see Table 3-5). When all collected unionids are considered, young of nine of 11 and 12 Lampsilinae species were collected in July 2004 and October 2005, respectively, whereas half of the Lampsilinae species collected in July 2005 were represented by young animals. No freshly dead Lampsilinae were collected in July 2005, and only a few adult Lampsilinae were found freshly dead in October 2005.

3.2 Steamboat Slough Bed

The SS bed is located approximately 750m downstream of the QCNS mixing zone (see Figure 1-1). Substrate in the SS bed was primarily sand, and depth ranged from 0.9 to 4.3m (see Table 3-1). Current velocity varied from 0.1 to 0.6m/sec. DO ranged from a low of 6.4mg/L in 2004 to a high of 12.8mg/L in July 2005 and was similar to UP bed DO. Very few zebra mussels were found in the SS bed, with an average of only 0.1 zebra mussels/unionid in 2005. As in 2004, zebra mussels increased with distance from the discharge.

Water temperature averaged 1.0°C, 2.6°C, and 1.8°C higher than in the UP bed in July 2004, July 2005, and October 2005, respectively (see Table 3-1). Water temperature measured in this study was very similar to temperature recorded by QCNS downstream of their discharge in July 2005 (see Table 3-2). Water temperature during July 2005 sampling ranged from 27.5 to 30.0°C, and maximum temperature calculated downstream of the discharge ranged from 27.9 to

30.2°C on sampling dates. Modeled temperature in the SS bed with 28.9°C intake temperature and 22,500cfs was 31.4 to 32.1°C, which is one to two degrees higher than the highest calculated discharge temperature (31.1°C) in 2005, however discharge was higher in 2005 than that assumed by the model (see Table 3-2).

The unionid community within the SS Bed varies from the UP bed in that Ambleminae comprise over 60% and Lampsilinae approximately 36% of the species in the SS Bed. Similar to the UP Bed, *A. plicata* is the dominant Ambleminae species, and *O. reflexa* is the dominant Lampsilinae species (see Table 3-3). However, in the UP bed *O. reflexa* (33%) is the most abundant and *A. plicata* (19%) second most abundant, while in the SS Bed *A. plicata* (33%) was dominant and *O. reflexa* (23%) the second most abundant species. Other species that seemed more abundant in the SS Bed include *Quadrula nodulata* and *Q. quadrula*. Species not found in this bed include *Megalonaias nervosa*, *Quadrula metanevra*, *Actinonaias ligamentina*, *L. higginsii*, and *Lampsilis teres*. Both Illinois threatened species *L. recta* (October) and *E. lineolata* (July) were collected in the SS Bed in 2005.

Total, freshly dead shell, ≤5 year old, and >5 year old density did not differ significantly among monitoring events. However, total density was somewhat lower (although not significantly at $p<0.05$), and ≤5 year old density was significantly lower than in the SS Bed compared to the UP Bed (see Table 3-3). Density of freshly dead shells and unionids >5 years old were similar between beds. Additionally, young unionids represented 33 to 64% of the species in the SS Bed, compared to 47 to 80% in the UP bed.

Many of the unionids collected in July 2005 were warm to the touch, and one *Lampsilis cardium* (0.2% of the unionids found) was gaping. One very recently dead *L. cardium* was found with tissue still attached to the shell. Unionids in the SS Bed were of normal temperature and none were gaping in October 2005.

Most of the differences between the SS and UP beds occur within the Lampsilinae. Ambleminae total density, density of unionids ≤5 years old (except for October 2005 in the UP Bed), and density of Ambleminae >5 years old were similar between the UP and SS beds (see Table 3-4). The number of Ambleminae species and mortality was also similar between beds. In contrast, total, ≤5 year old, and >5 year old Lampsilinae density was significantly lower in the SS Bed than in the UP bed.

Age distribution of Ambleminae in the SS Bed was similar to the UP Bed in July 2004, with modal age between seven and eight years, and in July 2005, with modal age between 13 and 14 years old (see Table 3-5 and Table 3-6). However, modal age declined to seven years in the UP Bed in October, whereas modal age in the SS Bed remained 13 years. Density of young Ambleminae was significantly higher in the UP Bed October 2005 sample than in the SS Bed or the other samples in the UP bed (see Table 3-4).

Lampsilinae age distribution did differ between beds. Modal Lampsilinae age was five years compared to eight or nine years in the UP compared to SS bed, but was consistent over time in both beds (see Tables 3-5 and 3-6). Interestly, no

young *O. reflexa* were found in SS bed quantitative samples during any of the monitoring events, although they were the dominant Lampsilinae species. Several young *O. reflexa* were collected in the UP bed during each sampling event.

Although some community characteristics in the SS Bed differed from the UP Bed, these characteristics remained constant over time within the SS Bed. A few *L. cardium* seemed affected during the warmer July temperature in 2005, but overall effects on the bed appeared minimal.

3.3 Cordova Bed

The Cordova Bed is one of the Essential Habitat Areas designated in the *L. higginsii* recovery plan (USFWS, 2004). This bed has historically harbored a dense and diverse unionid community. However, density within this bed has declined in recent years primarily due to heavy zebra mussel infestation (ESI, 2005). The portion of the Cordova Bed sampled in this study is approximately 3000m downstream of QCNS mixing zone, and on the Illinois bank (diffusers discharge along the Iowa bank).

Cordova Bed differs from the UP and SS beds, in that this bed occurs along a slight outside bend and substrate is coarser (see Table 3-1). Substrate in the Cordova Bed also contains nearly 10% shell material, both zebra mussels and unionids. Depth within the sampled portion of the Cordova Bed ranged from 0.6 to 6.7m. Unionids were historically more abundant in deeper water, however density has declined in the deeper areas presumably due to zebra mussel infestation. Unionids are now also abundant in siltier shallow areas. Current velocity averaged 0.2m/sec during all three sampling events. DO was 6.0mg/L in July 2004 and 8.3mg/L in October 2005, similar to both the SS and UP beds. DO was not measured during July 2005 due to equipment malfunction.

Water temperature in the Cordova Bed averaged 25.3°C in July 2004 and 2005, and 18.8°C during October 2005 (see Table 3-1). These temperatures were lower than both UP and SS beds, even though modeling predicted higher water temperature in the Cordova Bed than in the UP Bed under high ambient water temperature and low discharge conditions (see Table 3-2).

Zebra mussel infestation declined in 2005 compared to 2004. Unionids were covered with zebra mussels in July 2005, whereas an average of 0.3 and 1.3 zebra mussels infested unionids in 2005 (see Table 3-1).

Unionid community characteristics differ from the UP and SS beds. Species composition is approximately 50% Ambleminae and 50% Lampsilinae (see Table 3-3). Similar to the other beds, *A. plicata* is the dominant Ambleminae, however, *Leptodea fragilis* is the dominant Lampsilinae species compared to *O. reflexa* in the other beds. *Megalonaias nervosa* was collected consistently in the Cordova Bed, whereas *Q. nodulata* was not found in the Cordova Bed during this study. Additionally, *L. higginsii* and *L. recta* seem more abundant in the Cordova Bed, whereas *E. lineolata* seems less abundant. All of the species found in the Cordova Bed (22 total) have also been collected in the UP Bed, however

*Q. metanevra*, *Q. nodulata*, and *L. teres* were not recovered in the Cordova Bed during this study, although these species were collected in the Cordova Bed in previous studies (ESI, 2005).

Density was not statistically compared to the UP and SS bed, as the Cordova Bed differs with respect to habitat conditions. However, community characteristics have remained consistent within the Cordova Bed during this study. Total density averaged 5.7, 3.1, and 5.8 unionids/$m^2$ in July 2004, July 2005, and October 2005, respectively (see Table 3-3). The slope of the species vs. individuals regression was very high, being over 7.25 during all sampling events. Mortality was higher than the other beds during July 2004 and 2005, however it declined during October 2005. July 2005 mortality was likely residual from zebra mussel infestation. The density of younger unionids seemed to decline in July 2005, however density of young unionids in July 2004 (3.3/$m^2$) and October 2005 (2.8/$m^2$) was similar. Density of unionids >5 years old was consistent among samples, averaging 2.3, 2.0, and 3.0/$m^2$ in the three sampling events.

As in the other two beds, Ambleminae density, for both young and older Ambleminae was consistent among monitoring events (see Table 3-4). The apparent decline in density during July 2005 sampling was primarily due to the lower density of young Lampsilinae (0.1/$m^2$ in July 2005, compared to 1.4 and 1.6/$m^2$ in July 2004 and October 2005). Lampsilinae mortality was also higher than in other beds in both July 2004 and 2005, however no freshly dead Lampsilinae were found in quantitative sampling during the October 2005 sampling. Most of the young Ambleminae were A. *plicata* similar to the other beds (Table 3-7). However, the most abundant young Lampsilinae was *L. fragilis*, rather than *O. reflexa* as in the other two beds.

Age distribution of Ambleminae was most similar to the SS Bed, with modal age of 8 years in July 2004, and 13 years in both July and October 2005 (see Table 3-7). Lampsilinae age distribution differed from both UP and SS beds. Modal age in the Cordova Bed was 4 years in July 2004 and October 2005, and 7 years in July 2005.

**4.0 Conclusions**

Most unionids within the SS Bed did not seem to be affected by July 2005 water temperatures. Community characteristics within this bed were consistent over the three monitoring events. Although unionid shells were warm to the touch, only one unionid was observed gaping and only one was collected dead with tissue (very recent mortality). Additionally, mortality did not differ from July 2004 to October 2005. Water temperatures recorded during this study in both the UP and SS beds were comparable to those calculated and measured by the QCNS. Water temperature was lower than predicted by modeled values, however discharge was higher during July 2005 than the discharge used during modeling. Cordova Bed water temperature was predicted to be higher than the UP Bed under high ambient water temperature conditions, but measured water temperature during this study was lower than both other beds. This suggests that the Cordova Bed may not be as affected by higher temperature as previously thought (ESI, 2005).

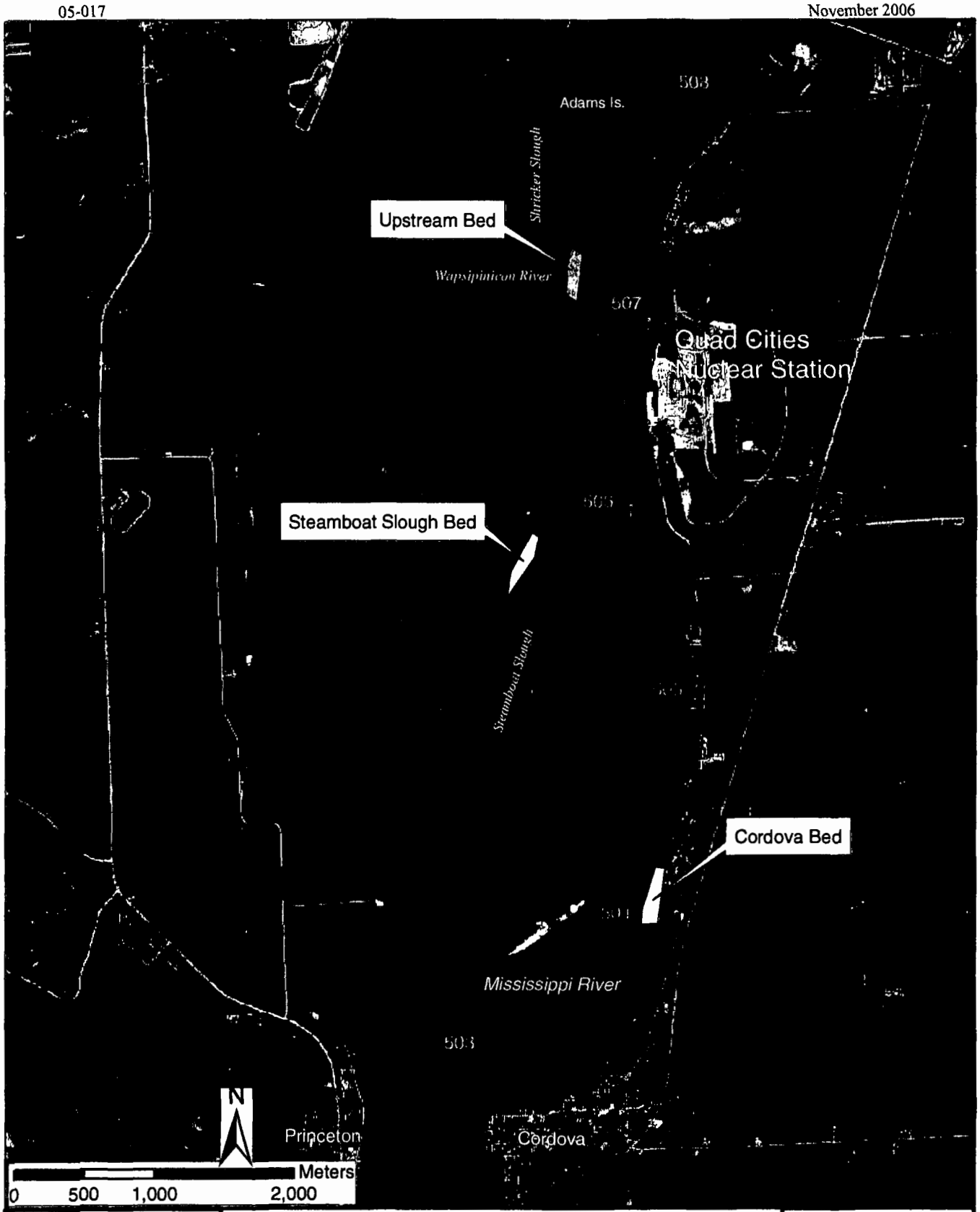
**5.0 Literature Cited**

Ecological Specialists, Inc. (ESI). *Draft report: Unionid mussel Biothermal assessment for the Quad Cities Nuclear Station, Mississippi River miles 503.0 to 506.9.* Prepared for Exelon Generation Company, Warrenville, IL. ESI project no. 04-012.

Holly, F. M., S. Li, and L. J. Weber. 2004. *River temperature predictions downstream of Quad Cities Nuclear Generating Station.* Submitted to Exelon Generation, Warrenville, IL. 46pp.

Kovalak, W. P., S. D. Dennis, and J. M. Bates. 1986. Sampling effort required to find rare species of freshwater mussels. Pages 35-45 *in* B. G. Isom (ed.). *Rationale for sampling and interpretation of ecological data in the assessment of freshwater ecosystems.* ASTM STP 894.

U.S. Fish and Wildlife Service (USFWS). 2004. *Higgins Eye Pearlymussel* (Lampsilis higginsii) *recovery plan: first revision.* Ft. Snelling, MN. 126pp.




| | | |
|---|---|---|
| ECOLOGICAL SPECIALISTS, INC. | Figure 1-1. Upstream, Steamboat Slough, and Cordova Bed sample areas, July 2004, July 2005, and October 2005. | ESI |

Table 3-1. Comparison of Upstream, Steamboat Slough, and Cordova bed habitat conditions between July 2004, July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | | | | | | |
| Sample date | July 15- 16, 2004 | July 28, 2005 | October 6, 2005 | July 16, 2004 | July 26 -28, 2005 | October 5- 6, 2005 | July 13-14, 2004 | July 27, 2005 | October 3-4, 2005 |
| Discharge (cfs)[1] | 67,226; 65,969 | 41,262 | 52,887 | 65,969 | 39,203; 41,262 | 54,383; 52,887 | 72,916; 69,220 | 38,153 | 47,125; 52,245 |
| Calc. discharge temp (F)[2] | 77.7 | 79.2 | | 79.9 | 81.8, 77.9 | | NA | | |
| Calc. discharge temp (°C)[2] | 25.4 | 26.2 | | 26.6 | 27.7, 25.5 | | | | |
| Dist from bank (m) | 45 to 115 | 45 to 115 | 45 to 115 | 35 to 115 | 35 to 115 | 35 to 115 | 10 to 90 | 10 to 90 | 10 to 90 |
| Dist from mix zone (m) | 730 to 1130 | 730 to 1130 | 730 to 1130 | 675 to 1125 | 675 to 1125 | 675 to 1125 | 3030 to 3365 | 3030 to 3365 | 3030 to 3365 |
| Substrate Ave % (CV) | | | | | | | | | |
| % Boulder | - | - | - | - | - | 2 (22) | 0.5 | 3 (2.6) | 2 (700) |
| % Cobble | - | - | - | 0.2 (762) | - | - | 2 (377) | - | 1 (663) |
| % Gravel | 1 (300) | 0.3 (632) | 2 (192) | 0.5 (645) | - | - | 13 (152) | 6 (118) | 10 (142) |
| % Sand | 57 (66) | 88 (18) | 56 (67) | 90 (21) | 91 (21) | 95 (16) | 33 (105) | 77 (29) | 66 (39) |
| % Silt | 36 (99) | 11 (126) | 15 (159) | 6 (200) | 9 (211) | 3 (166) | 27 (106) | 6 (128) | 9 (212) |
| % Clay | 5 (224) | 1 (304) | 26 (121) | 3 (281) | 0.1 (632) | - | 13 (185) | - | - |
| % Detritus | 0.1 (755) | - | 0.1 (954) | 0.7 (313) | 1 (371) | - | 0.7 (332) | - | 0.3 (412) |
| % Shell | 0.7 (343) | - | 1 (215) | - | - | 0.1 (954) | 12 (181) | 8 (171) | 13 (143) |
| Depth (m) | | | | | | | | | |
| Ave. | 3.4 | 2.7 | 4.9 | 2.4 | 1.8 | 2.7 | 2.0 | 2.1 | 3.0 |
| Range | (0.9 to 6.4) | (0.6 to 5.8) | (0.9 to 7.3) | (1.7 to 3.7) | (0.9 to 2.7) | (0.9 to 4.3) | (0.6 to 3.4) | (1.2 to 3.7) | (0.6 to 6.7) |
| CV | 15.8 | 51.1 | 102.0 | 24.3 | 20.0 | 74.1 | 28.3 | 85.7 | 146.7 |
| Temp (°C) | | | | | | | | | |
| Ave. | 25.5 | 26.9 | 19.9 | 26.5 | 29.5 | 21.7 | 25.3 | 25.3 | 18.6 |
| Range | (25.3 to 26.1) | (26.5 to 27.0) | (19.7 to 20.1) | (25.0 to 27.0) | (27.5 to 30.0) | (20.8 to 22.9) | (23.0 to 26.3) | (23.0 to 26.8) | (12.2 to 19.5) |
| CV | 1.6 | 0.9 | 0.6 | 1.2 | 3.0 | 4.4 | 0.6 | 5.9 | 5.3 |
| DO (mg/L) | | | | | | | | | |
| Ave. | 6.2 | 12.1 | 8.4 | 6.7 | 9.1 | 8.1 | 6 | | 8.3 |
| Range | (6.0 to 7.2) | (11.1 to 12.5) | (8.1 to 8.9) | (6.4 to 7.4) | (7.5 to 12.8) | (7.8 to 8.9) | (5.7 to 6.6) | | (7.2 to 14.0) |
| CV | 21.8 | 2.3 | 2.9 | 10.9 | 20.7 | 3.1 | 12.6 | | 3.7 |
| Current velocity (m/sec) | | | | | | | | | |
| Ave. | 0.5 | 0.3 | 0.4 | 0.4 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 |
| Range | (0.2 to 0.6) | (0.03 to 0.60) | (0.19 to 0.54) | (0.2 to 0.6) | (0.11 to 0.30) | (0.14 to 0.45) | (0.1 to 0.4) | (0.06 to 0.30) | (0.05 to 0.45) |
| CV | 30.4 | 52.9 | 27.1 | 15.7 | 20.7 | 30.5 | 48.2 | 41.6 | 53.6 |
| Rel. zebra mussel inf.[3] | Moderate | 0.1 (0 to 2) | 0.7 (0 to 7) | Minor | 0.1 (0 to 1) | 0.1 (0 to 10) | Very heavy | 0.3 (0 to 5) | 1.3 (0 to 50) |
| Modeled values[4] | | | | | | | | | |
| Modeled temp. @17,500cfs | 28.9 to 29.2 | | | 31.8 to 32.5 | | | 30.7 to 30.8 | | |
| Modeled temp. @20,000cfs | 28.9 to 29.2 | | | 31.6 to 32.1 | | | 30.3 to 30.7 | | |
| Modeled temp. @22,500cfs | 28.9 to 29.2 | | | 31.4 to 32.1 | | | 30.3 to 30.5 | | |
| Low flow velocity (m/sec) | 0.2 | | | 0 | | | 0.1 | | |

[1]Lock and Dam 14 (LeClaire, IA; MRM 493.3)

[2]Calculated temperatures represent Upstream/Intake Bay temperatures (Upstream bed) or Calculated Maximum Downstream Temperature (Steamboat Slough Bed) (Appendix B)

[3]Minor=a few zebras attached to a few unionids; moderate=a few zebra mussels attached to most unionids; very heavy=most unionids coated or encased with zebra mussels; 2005, average and range of zebra mussels per unionid

[4]Estimated from Holly *et al.* (2004)

Table 3-2. Comparison of intake and discharge water temperature (°C) to modeled and measured temperature, July 2005.

| | Upstream/Intake Bay Temperatures[1] | | | Discharge Bay Temperatures[1] | | | | | Max. downstream temperature[1] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Minimum | Average | Maximum | Minimum | Average | Maximum | Discharge Flow CFS | River Flow CFS | Calculated | Measured | Hours Accumulated |
| 1 | 25.8 | 26.4 | 26.7 | 40.2 | 40.9 | 41.2 | 2222 | 74,820 | 27.2 | | |
| 2 | 25.4 | 25.7 | 26.1 | 39.6 | 40.2 | 40.6 | 2222 | 74,527 | 26.5 | | |
| 3 | 24.9 | 25.4 | 25.8 | 39.3 | 39.9 | 40.3 | 2222 | 70,636 | 26.2 | | |
| 4 | 24.4 | 24.8 | 24.9 | 39.0 | 39.3 | 39.4 | 2222 | 70,045 | 25.4 | | |
| 5 | 24.0 | 24.6 | 25.2 | 38.6 | 39.2 | 39.8 | 2191 | 66,526 | 25.6 | | |
| 6 | 24.5 | 24.9 | 25.4 | 39.1 | 39.5 | 40.1 | 2191 | 66,275 | 25.9 | | |
| 7 | 24.6 | 25.2 | 26.0 | 39.2 | 39.8 | 40.6 | 2191 | 62,245 | 26.5 | | |
| 8 | 24.9 | 25.7 | 26.5 | 39.6 | 40.3 | 41.2 | 2191 | 62,176 | 27.0 | | |
| 9 | 25.5 | 26.3 | 27.2 | 40.1 | 40.9 | 41.9 | 2191 | 58,482 | 27.7 | | |
| 10 | 26.0 | 26.8 | 27.8 | 40.6 | 41.5 | 42.4 | 2191 | 55,564 | 28.4 | | |
| 11 | 26.4 | 27.1 | 27.7 | 41.1 | 41.7 | 42.4 | 2191 | 53,178 | 28.3 | | |
| 12 | 26.3 | 26.7 | 27.3 | 40.9 | 41.4 | 41.9 | 2191 | 53,396 | 27.9 | | |
| 13 | 25.7 | 26.1 | 26.6 | 40.3 | 40.8 | 41.3 | 2191 | 48,335 | 27.3 | | |
| 14 | 25.9 | 26.8 | 27.8 | 40.6 | 41.4 | 42.4 | 2191 | 49,068 | 28.4 | 27.8 | 0 |
| 15 | 27.1 | 27.9 | 28.7 | 41.7 | 42.6 | 43.4 | 2191 | 42,532 | 29.5 | | |
| 16 | 28.0 | 28.7 | 29.6 | 42.6 | 43.4 | 44.3 | 2191 | 39,943 | 30.4 | 30.6 | 5 |
| 17 | 28.7 | 29.4 | 30.2 | 43.2 | 44.1 | 44.9 | 2222 | 39,800 | 31.0 | 31.1 | 16 |
| 18 | 29.0 | 29.4 | 29.9 | 43.5 | 43.9 | 44.4 | 2222 | 39,761 | 30.7 | 30.6 | 7.5 |
| 19 | 28.2 | 28.9 | 29.3 | 42.8 | 43.4 | 44.0 | 2222 | 38,932 | 30.2 | 30.0 | 0 |
| 20 | 28.2 | 28.8 | 29.3 | 42.7 | 43.4 | 44.2 | 2222 | 38,863 | 30.1 | | |
| 21 | 28.7 | 29.1 | 29.9 | 43.4 | 43.7 | 44.3 | 2222 | 27,980 | 31.1 | 30.0 | 0 |
| 22 | 28.8 | 29.3 | 30.0 | 43.4 | 43.9 | 44.6 | 2222 | 28,205 | 31.1 | 31.1 | 14 |
| 23 | 28.6 | 29.0 | 29.7 | 43.1 | 43.6 | 44.3 | 2222 | 36,131 | 30.6 | 30.0 | 0 |
| 24 | 27.9 | 28.4 | 28.9 | 38.6 | 42.8 | 43.5 | 2222 | 42,305 | 29.7 | 29.4 | 0 |
| 25 | 28.4 | 29.0 | 29.7 | 37.8 | 42.3 | 44.3 | 2222 | 48,179 | 30.3 | | |
| 26 | 27.7 | 28.6 | 29.3 | 42.4 | 43.2 | 43.9 | 2222 | 39,203 | 30.2 | | |
| 27 | 26.2 | 26.8 | 27.7 | 41.1 | 41.7 | 42.4 | 2222 | 38,153 | 28.5 | | |
| 28 | 25.5 | 26.2 | 27.1 | 40.4 | 41.2 | 42.1 | 2222 | 41,262 | 27.9 | | |
| 29 | 25.8 | 26.6 | 27.2 | 40.8 | 41.6 | 42.3 | 2191 | 40,974 | 28.0 | | |
| 30 | 25.9 | 26.6 | 27.3 | 40.9 | 41.6 | 42.3 | 2191 | 44,524 | 28.0 | | |
| 31 | 26.2 | 26.6 | 26.9 | 41.3 | 41.6 | 42.0 | 2191 | 38,664 | 27.8 | | |
| | | | | | | | | | 31.1 | 31.1 | Total Hrs = 42.5 |
| Modeled temperature[2] | | | | | | | | 22,500 | | | |
| | Intake | | 28.9 | | | | | | | | |
| | Upstream bed | | 28.9 to 29.2 | | | | | | 31.4 to 32.1 | | |
| | SS bed | | | | | | | | 30.3 to 30.5 | | |
| | Cordova Bed | | | | | | | | | | |
| Measured temperature[3] | | | | | | | | | | | |
| 26 | Upstream bed | 26.9 | 27 | | | | | | | | |
| 27 | SS bed | | | | | | | | | 29.5 | |
| 28 | Cordova Bed | | | | | | | | | 26.8 | |

[1]Data provided by Exelon (Appendix B); [2]Estimated from Holly *et al.* (2004); [3]Measured during this study

Table 3-3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004, July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Species rel. abundance (%)[1] | | | | | | | | | |
| Ambleminae | | | | | | | | | |
| *Amblema plicata* | 17.5 | 20.3 | 18.7 | 41.5 | 26.8 | 30.9 | 27.9 | 50.0 | 24.6 |
| *Fusconaia ebena* | WD | - | WD | - | - | - | WD | - | - |
| *Fusconaia flava* | 6.2 | 1.4 | 5.2 | X | 9.8 | 2.1 | X | 3.3 | 3.1 |
| *Megalonaias nervosa* | - | 1.4 | - | - | - | - | 2.9 | X | 4.6 |
| *Quadrula metanevra* | 1.0 | - | WD | - | - | - | WD | - | - |
| *Quadrula nodulata* | 1.0 | X | 1.2 | 9.8 | 2.4 | 6.4 | - | - | - |
| *Quadrula p. pustulosa* | 8.2 | 4.3 | 9.1 | 4.9 | 7.3 | 5.3 | 5.9 | 6.7 | 4.6 |
| *Quadrula quadrula* | 6.2 | 4.3 | 6.7 | 4.9 | 14.6 | 17.0 | 2.9 | X | 2.3 |
| *Tritogonia verrucosa* | WD | - | WD | - | - | - | SF | - | WD |
| Total Ambleminae | 40.1 | 31.9 | 40.9 | 61.1 | 61.0 | 61.7 | 39.6 | 60.0 | 39.2 |
| Anodontinae | | | | | | | | | |
| *Arcidens confragosus* | X | X | 0.4 | x | 2.4 | X | x | 3.3 | X |
| *Lasmigona c. complanata* | X | 1.4 | 2.4 | 2.4 | X | X | 1.5 | X | 1.5 |
| *Pyganodon grandis* | X | <0.5 | 1.2 | x | 2.4 | X | X | X | 0.8 |
| *Strophitus undulatus* | WD | - | - | - | - | - | - | - | - |
| *Utterbackia imbecillis* | 1.0 | <0.5 | 0.4 | - | X | X | X | FD | 1.5 |
| Total Anodontinae | 1.0 | 1.4 | 4.4 | 2.4 | 4.9 | 0.0 | 1.5 | 3.3 | 3.8 |
| Lampsilinae | | | | | | | | | |
| *Actinonaias ligamentina* | X | - | - | - | - | - | X | - | - |
| ***Ellipsaria lineolata*** | **1.0** | **1.4** | **X** | **2.4** | **X** | - | **WD** | - | **X** |
| *Lampsilis cardium* | 5.2 | 11.6 | 7.9 | 4.9 | X | 5.3 | 7.4 | 6.7 | 5.4 |
| ***Lampsilis higginsii*** | - | **X** | **0.4** | - | - | - | **1.5** | **X** | **0.8** |
| *Lampsilis teres* | WD | 1.4 | WD | - | - | - | - | - | - |
| *Leptodea fragilis* | 6.2 | 11.6 | 7.1 | x | 2.4 | 4.3 | 33.8 | 16.7 | 29.2 |
| ***Ligumia recta*** | **1.0** | **X** | **0.8** | - | - | **1.1** | **1.5** | **X** | **6.2** |
| *Obliquaria reflexa* | 38.1 | 30.4 | 27.8 | 26.8 | 22.0 | 22.3 | 8.8 | 3.3 | 6.9 |
| *Obovaria olivaria* | 5.2 | 2.9 | 2.4 | 2.4 | - | X | X | X | 0.8 |
| *Potamilus alatus* | X | X | X | - | - | X | X | X | 0.8 |
| *Potamilus ohiensis* | 1.0 | 2.9 | 0.8 | X | 7.3 | 3.2 | 1.5 | 3.3 | X |
| *Toxolasma parvus* | - | | 1.2 | - | - | WD | 1.5 | 6.7 | 3.8 |
| *Truncilla donaciformis* | X | 4.3 | 5.6 | - | 2.4 | 2.1 | 2.9 | - | 2.3 |
| *Truncilla truncata* | 1.0 | | 0.8 | - | X | X | WD | - | 0.8 |
| Total Lampsilinae | 58.7 | 66.7 | 54.8 | 36.5 | 34.1 | 38.3 | 58.9 | 36.7 | 56.9 |

Table 3-3. Comparison of Upstream, Steamboat Slough, and Cordova beds unionid community characteristics between July 2004, July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Total no.[2] | 902 | 399 | 822 | 547 | 426 | 657 | 320 | 164 | 375 |
| Ave. no./$m^{2}$[2,1] | 8.1±3.1AB | 6.9±3.1AB | 11.2±2.0B | 3.5±2.0A | 4.1±1.2A | 4.2±0.9A | 5.7±1.9 | 3.1±1.3 | 5.8±1.5 |
| Ave. CPUE [3] | 57.5 | 15.7 | 22.8 | 36.4 | 19.3 | 22.5 | 15.8 | 6.7 | 10.2 |
| Ave. no. species/qual sample[3] | 10.7 | 6.0 | 6.3 | 7.8 | 5.6 | 7.2 | 6.6 | 3.3 | 5.1 |
| Total no. species[2] | 21 | 21 | 21 | 15 | 16 | 18 | 20 | 18 | 21 |
| Total live/FD species per site | | | 25 | | | 19 | | | 22 |
| Theoretical species richness[3] | | | | | | | | | |
| 100 | 13 | 16 | 14 | 12 | 11 | 13 | 15 | 15 | 15 |
| 250 | 15 | 19 | 17 | 14 | 14 | 16 | 18 | 18 | 17 |
| 500 | 17 | 21 | 19 | 16 | 15 | 18 | 21 | 20 | 20 |
| 1000 | 19 | 24 | 21 | 17 | 17 | 20 | 23 | 22 | 22 |
| 5000 | 23 | 29 | 26 | 22 | 21 | 24 | 28 | 27 | 27 |
| Regression slope | 6.53 ±0.29 | 7.85 ±0.27 | 6.99 ±0.17 | 5.81 ±0.23 | 5.64 ±0.26 | 6.53 ±0.29 | 7.71 ±0.13 | 7.43 ±0.38 | 7.27 ±0.15 |
| %Mortality[1] | 6.7 | 1.4 | 3.1 | 4.7 | 2.4 | 3.1 | 24.4 | 21.1 | 3.0 |
| Ave. no. FD/$m^{2}$[1] | 0.6 ±0.5A | 0.2±0.2A | 0.4±0.2A | 0.2 ±0.2A | 0.1 ±0.2A | 0.1 ±0.2A | 1.8 ±1.6 | 0.8 ±0.9 | 0.2 ±0.2 |
| %≤3 years old[1] | 3.1 | 18.6 | 24.2 | 2.4 | 4.8 | 6.4 | 33.8 | 0 | 29.2 |
| %≤5 years old[1] | 36.1 | 42.0 | 50.4 | 9.8 | 11.9 | 11.7 | 58.8 | 25.7 | 47.7 |
| % of species w/ ≤5 yrs[1] | 73.3 | 46.7 | 80.0 | 33.3 | 41.7 | 63.6 | 53.8 | 55.6 | 61.1 |
| Ave. no.≤5yrs/$m^{2}$[1] | 2.9 ±1.4B | 2.9 ±1.5B | 5.6 ±0.8C | 0.3 ±0.3A | 0.5 ±0.2A | 0.5 ±0.3A | 3.3 ±1.3 | 0.9 ±0.5 | 2.8 ±1.0 |
| Ave. no.>5yrs/$m^{2}$[1] | 5.2 ±2.0A | 3.9 ±1.8A | 5.6 ±1.4A | 3.1 ±1.9A | 3.6 ±1.2A | 3.7 ±0.9A | 2.3 ±1.0 | 2.0 ±1.1 | 3.0 ±0.8 |

[1]Quantitative data only; [2]Quantitative and Qualitative combined; [3]Qualitative data only
Different letters within a row indicates a significant difference (ANOVA, $p<0.05$)

Table 3-4. Comparison of Ambleminae and Lampsilinae in Upstream, Steamboat Slough, and Cordova beds among July 2004, July 2005, and October 2005.

| | Upstream | | | Steamboat Slough | | | Cordova | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 | Jul-04 | Jul-05 | Oct-05 |
| Ambleminae | | | | | | | | | |
| Total no.[1] | 39 | 22 | 103 | 25 | 25 | 58 | 27 | 18 | 51 |
| Total no.[3] | 396 | 145 | 236 | 335 | 259 | 347 | 120 | 79 | 151 |
| Ave. no./$m^{2,1}$ | 3.3±1.6A | 2.2±1.3A | 4.6±1.4A | 2.1±1.4A | 2.5±1.0A | 2.6±0.7A | 2.2±1.1 | 1.8±1.1 | 2.3±0.8 |
| Ave. no.≤5yrs/$m^{2,1}$ | 0.5±0.4A | 0.1±0.2A | 1.7±0.7B | 0.2±0.2A | 0.2±0.3A | 0.2±0.2A | 0.8±0.6 | 0.5±0.4 | 0.5±0.4 |
| Ave. no.>5yrs/$m^{2,1}$ | 2.8±1.3A | 2.1±1.2A | 2.9±0.9A | 2.0±1.3A | 2.3±1.0A | 2.4±0.7A | 1.4±0.8 | 1.3±1.0 | 1.8±1.7 |
| Total no. species[2] | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 |
| Total no. juv species | 6 | 4 | 5 | 5 | 4 | 4 | 4 | 2 | 4 |
| Total no. adult species | 5 | 6 | 5 | 5 | 5 | 5 | 6 | 5 | 5 |
| %Mortality[1] | 2.5 | 0 | 1.9 | 3.8 | 0 | 1.7 | 10.0 | 14.3 | 7.8 |
| Lampsilinae | | | | | | | | | |
| Total no.[1] | 57 | 46 | 184 | 15 | 14 | 36 | 40 | 11 | 74 |
| Total no.[3] | 378 | 169 | 321 | 163 | 123 | 197 | 116 | 50 | 72 |
| Ave. no./$m^{2,1}$ | 4.8±2.0B | 4.6±2.1B | 6.1±1.5B | 1.3±0.9A | 1.4±0.8A | 1.6±0.6A | 3.4±1.3 | 1.1±0.7 | 3.3±1.0 |
| Ave. no.≤3yrs/$m^{2,1}$ | 0.8±0.7AB | 1.4±0.9B | 2.0±0.8B | 0A | 0.2±0.3A | 0.2±0.2A | 1.4±0.7 | 0.1±0.2 | 1.6±0.7 |
| Ave. no.>3yrs/$m^{2,1}$ | 3.9±1.6B | 3.2±1.7AB | 4.1±1.3B | 1.3±0.9A | 1.2±0.7A | 1.4±0.6A | 2.0±0.8 | 1.0±0.6 | 1.7±0.6 |
| Total no. species[2] | 11 | 10 | 12 | 9 | 7 | 10 | 11 | 9 | 12 |
| Total no. juv species | 9 | 5 | 9 | 7 | 3 | 5 | 8 | 4 | 4 |
| Total no. adult species | 11 | 9 | 11 | 7 | 7 | 10 | 9 | 9 | 12 |
| %Mortality[1] | 8.1 | 0 | 3.5 | 6.3 | 6.7 | 7.1 | 37.5 | 26.7 | 0 |

[1]Quantitative data only; [2]Quantitative and Qualitative combined; [3]Qualitative data only
Different letters within a row indicates a significant difference (ANOVA, $p<0.05$)

Table 3-5. Age distribution of unionid species collected from the Upstream Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | ≥21 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | - | 2 | 1 | 2 | 4 | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | - | - | 17 |
| | *Fusconaia flava* | - | - | - | - | - | 1 | - | 2 | 2 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 6 |
| | *Quadrula metanevra* | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Quadrula nodulata* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Quadrula p. pustulosa* | - | - | - | - | 1 | - | 2 | 1 | - | 3 | - | - | 1 | - | - | - | - | - | - | - | - | - | 8 |
| | *Quadrula quadrula* | - | - | - | 1 | 1 | - | - | 1 | - | 1 | 1 | - | - | - | 1 | - | - | - | - | - | - | - | 7 |
| Ambleninae total | | 0 | 0 | 1 | 1 | 4 | 3 | 4 | 8 | 3 | 5 | 3 | 2 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| Anodontinae total | *Utterbackia imbecillis* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Ellipsaria lineolata* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Lampsilis cardium* | - | - | 1 | - | - | 1 | - | - | - | 2 | - | - | 1 | - | - | - | - | - | - | - | - | - | 5 |
| | *Leptodea fragilis* | - | - | 1 | 1 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6 |
| | *Ligumia recta* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Obliquaria reflexa* | - | 1 | 7 | 6 | 5 | 5 | 3 | 6 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 37 |
| | *Obovaria olivaria* | - | - | - | 2 | - | - | 1 | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | 5 |
| | *Potamilus ohiensis* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Truncilla truncata* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Lamsilinae total | | 0 | 1 | 9 | 11 | 7 | 7 | 7 | 6 | 3 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| July 2004 total | | | 1 | 10 | 13 | 11 | 10 | 11 | 14 | 6 | 9 | 3 | 2 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 98 |

Table 3-5. Age distribution of unionid species collected from the Upstream Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | ≥21 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jul-05 | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | - | 1 | - | - | - | - | 1 | 2 | - | - | 3 | 4 | 2 | 1 | - | - | - | - | - | 14 |
| | *Fusconaia flava* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 |
| | *Megalonaias nervosa* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| | *Quadrula p. pustulosa* | - | - | - | - | - | - | - | 1 | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 3 |
| | *Quadrula quadrula* | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | - | - | - | - | - | - | 3 |
| Ambleminae Total | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 3 | 0 | 2 | 4 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 22 |
| Anodontinae Total | *Lasmigona c. complanat* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 |
| | *Ellipsaria lineolata* | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Lampsilis cardium* | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 8 |
| | *Lampsilis teres* | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Leptodea fragilis* | 1 | 1 | 3 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 |
| | *Obliquaria reflexa* | - | - | 5 | 5 | 5 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 21 |
| | *Obovaria olivaria* | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | *Potamilus ohiensis* | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | *Truncilla donaciformis* | - | - | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| Lampsilinae Total | | 1 | 1 | 11 | 7 | 8 | 3 | 5 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| July 2005 total | | 1 | 1 | 11 | 7 | 9 | 3 | 5 | 2 | 1 | 3 | 4 | 2 | 4 | 5 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 1 | 70 |

Table 3-5. Age distribution of unionid species collected from the Upstream Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | ≥21 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Amblema plicata* | - | 1 | 6 | 6 | 7 | 4 | 1 | 6 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | - | 1 | - | - | - | - | - | 48 |
| | *Fusconaia flava* | - | - | 4 | - | 1 | 2 | - | 2 | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | 13 |
| | *Quadrula nodulata* | - | - | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Quadrula p. pustulosa* | 1 | 1 | 1 | 3 | - | 2 | 1 | 3 | 4 | 3 | 1 | 2 | - | 1 | - | - | - | - | - | - | - | - | 24 |
| | *Quadrula quadrula* | - | 2 | - | 3 | - | 3 | 1 | 1 | 1 | 1 | 2 | - | 1 | 1 | - | - | 1 | - | - | - | - | - | 17 |
| Ambleminae Total | | 1 | 4 | 12 | 13 | 8 | 12 | 3 | 12 | 8 | 7 | 7 | 4 | 4 | 4 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 105 |
| | *Arcidens confragosus* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Lasmigona c. complanat* | - | - | - | - | - | - | - | - | 2 | - | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 7 |
| | *Pyganodon grandis* | - | - | - | - | - | 1 | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | 3 |
| | *Utterbackia imbecillis* | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Anodontinae Total | | | 1 | | 1 | | 1 | | | 2 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| | *Ellipsaria lineolata* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| | *Lampsilis cardium* | - | 1 | - | - | 1 | 1 | 1 | 5 | 2 | 3 | 1 | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 21 |
| | *Lampsilis higginsii* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Leptodea fragilis* | 1 | 3 | 5 | 2 | 4 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 20 |
| | *Ligumia recta* | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | *Obliquaria reflexa* | - | 4 | 15 | 13 | 13 | 8 | 11 | 4 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 70 |
| | *Obovaria olivaria* | - | 1 | 1 | - | 1 | - | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 6 |
| | *Potamilus alatus* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Potamilus ohiensis* | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Toxolasma parvus* | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Truncilla donaciformis* | 4 | 4 | 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 14 |
| | *Truncilla truncata* | - | - | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Lampsilinae Total | | 7 | 15 | 23 | 20 | 22 | 11 | 16 | 10 | 2 | 6 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 143 |
| | Oct total | 8 | 20 | 35 | 34 | 30 | 24 | 19 | 22 | 12 | 14 | 10 | 8 | 7 | 4 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 260 |

Table 3-6. Age distribution of unionid species collected from the Steamboat Slough Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 25 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | - | - | 2 | 2 | - | 4 | 2 | 2 | 4 | - | - | 1 | - | - | - | - | - | - | - | - | 17 |
| | *Quadrula nodulata* | - | - | - | - | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| | *Quadrula p. pustulosa* | 1 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | *Quadrula quadrula* | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Ambleminae total | | 1 | 0 | 0 | 1 | 0 | 2 | 7 | 0 | 5 | 2 | 2 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| Anodontinae total | *Lasmigona c. complanat* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 |
| | *Ellipsaria lineolata* | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Lampsilis cardium* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 2 |
| | *Obliquaria reflexa* | - | - | - | - | 2 | - | 2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 11 |
| | *Obovaria olivaria* | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Lampsilis total | | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 4 | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| Total July 2004 | | 1 | 0 | 0 | 1 | 2 | 2 | 9 | 4 | 10 | 3 | 2 | 4 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| | Jul-05 | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | - | 1 | - | - | - | - | 1 | 1 | 1 | 1 | 1 | 2 | 1 | - | - | 2 | - | - | - | - | 11 |
| | *Fusconaia flava* | - | - | - | - | - | - | - | - | 1 | - | - | - | 1 | - | 1 | - | - | - | 1 | - | - | - | - | 4 |
| | *Quadrula nodulata* | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Quadrula p. pustulosa* | - | - | - | 1 | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Quadrula quadrula* | - | - | - | - | - | - | - | 2 | - | - | 1 | - | 1 | - | - | 1 | 1 | - | - | - | - | - | - | 6 |
| Ambleminae Total | | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 | 1 | 4 | 1 | 3 | 1 | 3 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 25 |
| | *Arcidens confragosus* | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 |
| | *Pyganodon grandis* | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Anodontinae Total | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| | *Lampsilis cardium* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Leptodea fragilis* | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Obliquaria reflexa* | - | - | - | - | 1 | - | - | 1 | 1 | 2 | 1 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | 9 |
| | *Potamilus ohiensis* | - | 1 | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Truncilla donaciformis* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| Lampsilinae Total | | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 2 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| July 2005 total | | 0 | 2 | 0 | 1 | 2 | 1 | 0 | 3 | 4 | 3 | 5 | 3 | 3 | 2 | 4 | 2 | 1 | 0 | 3 | 0 | 1 | 0 | 1 | 42 |

Table 3-6. Age distribution of unionid species collected from the Steamboat Slough Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 25 | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct-05 | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | - | 1 | - | 1 | - | - | 2 | - | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 2 | 5 | 1 | - | 29 |
| | *Fusconaia flava* | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | 2 |
| | *Quadrula nodulata* | 1 | - | - | - | - | 1 | - | - | 1 | 2 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 6 |
| | *Quadrula p. pustulosa* | - | - | - | - | - | - | - | - | 1 | - | - | - | 1 | - | 1 | 1 | - | 1 | - | - | - | - | - | 5 |
| | *Quadrula quadrula* | - | - | 1 | - | 1 | 1 | 1 | 3 | 1 | 1 | - | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | 16 |
| Ambleminae Total | | 1 | 0 | 1 | 0 | 2 | 2 | 2 | 3 | 3 | 5 | 0 | 6 | 3 | 2 | 5 | 6 | 4 | 4 | 1 | 2 | 5 | 1 | 0 | 58 |
| | *Lampsilis cardium* | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | - | - | - | - | 1 | - | - | 5 |
| | *Leptodea fragilis* | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| | *Ligumia recta* | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Obliquaria reflexa* | - | - | - | - | 1 | 2 | 1 | 2 | 2 | 2 | 4 | 1 | 4 | 1 | 1 | - | - | - | - | - | - | - | - | 21 |
| | *Potamilus ohiensis* | - | - | - | - | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Truncilla donaciformis* | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Lampsilinae Total | | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 2 | 6 | 1 | 4 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 36 |
| October 2005 total | | 3 | 1 | 2 | 1 | 4 | 5 | 4 | 5 | 6 | 7 | 6 | 7 | 7 | 4 | 7 | 7 | 4 | 4 | 1 | 2 | 6 | 1 | 0 | 94 |

Table 3-7. Age distribution of unionid species collected from the Cordova Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jul-04 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | 1 | 5 | 3 | - | 1 | - | 2 | 1 | - | 1 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | - | - | 19 |
| | *Megalonaias nervosa* | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | 2 |
| | *Quadrula metanevra* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0 |
| | *Quadrula p. pustulosa* | - | - | - | - | - | - | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 |
| | *Quadrula quadrula* | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Ambleminae total | | 0 | 1 | 5 | 3 | 0 | 1 | 1 | 3 | 1 | 1 | 2 | 4 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| Anodontinae total | *Lasmigona c. complanat* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Lampsilis cardium* | - | - | - | - | 1 | 1 | - | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| | *Lampsilis higginsii* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Leptodea fragilis* | 1 | 1 | 7 | 7 | 5 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 23 |
| | *Ligumia recta* | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Obliquaria reflexa* | - | 1 | 4 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6 |
| | *Potamilus ohiensis* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Toxolasma parvus* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Truncilla donaciformis* | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Lampsilinae total | | 1 | 2 | 14 | 8 | 6 | 5 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| July 2004 total | | 1 | 3 | 19 | 11 | 6 | 6 | 2 | 5 | 2 | 3 | 2 | 4 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 |
| | Jul-05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | - | 1 | 2 | 1 | - | - | - | - | - | - | 1 | 1 | 3 | 1 | 2 | 1 | - | 1 | - | - | - | - | 14 |
| | *Fusconaia flava* | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Quadrula p. pustulosa* | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Ambleminae Total | | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 17 |
| Anodontinae Total | *Arcidens confragosus* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 |
| | *Lampsilis cardium* | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| | *Leptodea fragilis* | - | - | - | - | 1 | - | - | - | 2 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | 4 |
| | *Obliquaria reflexa* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Potamilus ohiensis* | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Toxolasma parvus* | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Lampsilinae Total | | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| July 2005 total | | 0 | 0 | 0 | 4 | 5 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 2 | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 28 |

Table 3-7. Age distribution of unionid species collected from the Cordova Bed, July 2004 and 2005, and October 2005.

| Subfamily | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Tot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct-05 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Amblema plicata* | - | - | 1 | 1 | 7 | 4 | 2 | - | 1 | - | - | 1 | 1 | 2 | 2 | 1 | 5 | 2 | 1 | - | - | 1 | - | - | 32 |
| | *Fusconaia flava* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - | - | - | - | - | - | 4 |
| | *Megalonaias nervosa* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 | 1 | - | 1 | 6 |
| | *Quadrula p. pustulosa* | - | 1 | - | 1 | - | 1 | - | - | - | - | - | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 6 |
| | *Quadrula quadrula* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | 3 |
| Ambleminae Total | | 0 | 1 | 1 | 2 | 7 | 6 | 2 | 1 | 1 | 0 | 0 | 2 | 2 | 4 | 4 | 2 | 5 | 4 | 2 | 1 | 1 | 2 | 0 | 1 | 51 |
| | *Lasmigona c. complanat* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 2 |
| | *Pyganodon grandis* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Utterbackia imbecillis* | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 |
| Anodontinae Total | | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | *Lampsilis cardium* | - | - | - | - | 1 | - | 1 | - | - | - | 1 | 1 | - | - | 2 | 1 | - | - | - | - | - | - | - | - | 7 |
| | *Lampsilis higginsii* | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Leptodea fragilis* | 14 | 9 | 8 | 2 | - | - | 2 | - | - | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 38 |
| | *Ligumia recta* | - | - | - | - | 3 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | - | 8 |
| | *Obliquaria reflexa* | - | - | 2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 9 |
| | *Obovaria olivaria* | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Potamilus alatus* | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | *Toxolasma parvus* | - | - | - | 1 | - | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 |
| | *Truncilla donaciformis* | 1 | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | *Truncilla truncata* | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Lampsilinae Total | | 15 | 9 | 11 | 6 | 7 | 6 | 7 | 1 | 0 | 3 | 3 | 1 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 |
| October 2005 total | | 15 | 10 | 13 | 9 | 15 | 12 | 9 | 3 | 1 | 3 | 3 | 3 | 2 | 4 | 7 | 3 | 7 | 4 | 2 | 1 | 1 | 2 | 0 | 1 | 130 |