BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter Of:	)	
	)	
EXELON GENERATION LLC,	)	
Petitioner,	)	
	)	
v.	)	PCB NO. 2015-204
	)	
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, IL 60601

Brad Halloran, Hearing Officer
Illinois Pollution Control Board
James R. Thompson Center
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1021 North Grand Avenue East
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Office of Legal Services
Illinois Department of Natural Resources
One Natural Resources Way
Springfield IL 62702-1271

PLEASE TAKE NOTICE that on the 16th day of October, 2015, on behalf of Exelon Generation LLC, **Responses to the Board's Questions** were filed with the Office of the Clerk of the Illinois Pollution Control Board.

Respectfully submitted,

EXELON GENERATION LLC

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PROTECTION AGENCY,	)	
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EXELON GENERATION LLC'S RESPONSES TO THE BOARD'S QUESTIONS

Exelon Generation LLC ("Exelon") submits the following responses to the Illinois Pollution Control Board's ("Board") September 1, 2015 questions.[1]

35 Ill. Adm. Code 106.1130(a)(1): Generating capacity

The petition states that Dresden Units 2 and 3 "have a combined maximum generating capacity of 2006 megawatts." Pet. at 6. Appendix D separately states that the two reactors are "capable of generating 2,006 net megawatts" and have "a combined maximum generating capacity of 1,824 megawatts electric." Exh. 1, App. D at D-1.

1. Please clarify the values for the generating capacity.

Response: Dresden Station's generating capacity can vary depending upon conditions. The maximum rated name plate generating capacity (which cannot be exceeded) for each operating Dresden Station unit (i.e. Unit 2 and Unit 3) is 1009 megawatts electric, for a combined generating capacity for the Station of 2018 megawatts electric.

35 Ill. Adm. Code 106.1130(b)(2): Summary information on temperature of discharge to receiving waters in narrative form

Table D-1 presents the frequency distribution of hourly intake (2003-2014) and discharge (1998-2014) temperatures for the period of June 15 through September 30.

2. Please provide "[s]ummary information on temperature of discharge to receiving waters in narrative form"(35 Ill. Adm. Code 106.1130(b)(2)) and difference between intake and discharge temperatures.

Response: Frequency distributions of hourly intake and discharge temperatures for the June 15 to September 30 time period were provided in Table D-1 in Appendix D of the Dresden Nuclear

[1] The Board's prefatory statements and related questions are set forth in italics followed by Exelon's responses.

Station §316(a) Demonstration ("the Demonstration"). The data show that Dresden Station discharge temperatures increased with increasing intake temperatures, although the delta temperature rise decreased with increasing intake temperatures. For the June 15 to September 30 time period, the warmest intake and discharge temperatures occurred in July or August and the coolest occurred in September. In July, as the intake temperature increased from 72.8°F at the 10-percentile level to 87.2°F at the 90-percentile level, the discharge temperature increased from 83.5°F to 90.7°F, while the delta temperature decreased from 10.7°F to 3.5°F. During September, the intake temperature increased from 63.6°F (10-percentile) to 79.8°F (90-percentile), while the discharge temperature increased from 77.4°F to 88.2°F. The corresponding delta temperature decreased from 13.8°F to 8.4°F while still providing a noticeable margin below the 90°F discharge limit.

The relationship between discharge and intake temperatures at Dresden Station is illustrated in Attachment 1 hereto, and the relationship between delta temperature rise and intake temperature is presented in Attachment 2. These two figures contain daily average data during time periods when both intake and discharge temperature data were available, primarily 2006 to 2009 and 2012 to 2014. Both figures display a linear relationship, with discharge temperature increasing and delta temperature rise decreasing with increasing intake temperature. In Attachment 1, the discharge temperature trend line increases from 80°F at a 65°F intake temperature and approaches 90°F as the intake temperature approaches 90°F. In Attachment 2, the delta temperature rise trend line decreases from 15°F at a 65°F intake temperature and approaches zero as the intake temperature approaches 90°F.

3. *Please explain the reason for the gap in data noted by EA Engineering, Science, and Technology (EA) from July 2003 to November 2005. Exh. 1, App. D at D-6, Table D-1, Table D-2.*

Response: Although thorough searches of Dresden Station files and records were conducted, Exelon was unable to retrieve or locate the missing data. The missing data cover about four years of intake data and three years of discharge data from the 16-year period examined by EA to assess natural temperature variability and operating conditions for its hydrothermal analysis. Fortunately, because data were available for many years prior and subsequent to the years for which data could not be found, EA was able to develop an accurate representation of temperature variability and operating conditions to conduct the hydrothermal analysis used in the Demonstration.

In addition, Exelon has reviewed the Discharge Monitoring Reports ("DMRs") filed by Dresden Station covering the years for which data are missing. The DMRs provide sufficient information concerning Dresden Station discharge temperatures to allow full responses to Board Questions 7, 8, and 9 regarding the years in question. See Responses 7, 8, and 9, below.

35 Ill. Adm. Code 106.1130(c): A summary of compliance or non-compliance with thermal requirements at the facility in the past five years

Exelon states that Dresden Station has been operating under alternate thermal limits granted by the Board in PCB 79-134. Pet. at 13; see In the Matter of 410(c) Petition for Dresden Nuclear Generating Station, PCB 79-134 (July 9, 1981). Exelon states that, "[d]uring the past 5 years,

Dresden Station has operated in compliance with the thermal discharge limits in its NPDES [permit], with the exception of 2011 and 2012, when Dresden Station was granted provisional variances that allowed the Plant to exceed its NPDES thermal limits." Pet. at 11.

4. *Please indicate whether Dresden Station received any violation notices related to discharge temperature during the last 5 years.*

Response: Dresden Station has not received any violation notices related to discharge temperatures during the last five years.

5. *Please provide a copy of the provisional variances cited in the petition (Pet. at 11) and any extensions of those variances.*

Response: See Attachments 3 - 7.

6. *Please indicate whether Exelon was required to perform any studies or provide reports to the Illinois Environmental Protection Agency or Illinois Department of Natural Resources as a condition of receiving the provisional variances. If so, please provide copies for the record.*

Response: See Attachments 8 - 11. Exelon did not find the report documenting conditions associated with the March 2012 provisional variance in its files, though it believes such a report was prepared and submitted to Illinois EPA.

IEPA states that, "[u]nder the proposed alternative thermal limits, the Dresden Station discharge would only be authorized to exceed 90°F for 259 hours during indirect open cycling." Rec. at 10. Table D-3 presents the number of hours with discharge temperatures greater than *90°F by month.*

7. *Please calculate the total number of hours with discharge temperatures greater than 90°F from June 15 to September 30 for each year from 1998-2014.*

Response: The total number of hours with Dresden Station discharge temperatures greater than 90°F, from June 15 to September 30 for each year from 1998-2014 is presented in the table below.

	DNS Discharge Temperature > 90°F (Hours)				
Year	June	July	August	Sept	Total
1998	51	215	183	8	457
1999	22	274	111	0	407
2000	0	0	0	2	2
2001	0	171	168	0	339
2002	0	46	8	0	54
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0

2006	0	29	20	1	50
2007	0	0	19	0	19
2008	0	0	1	0	1
2009	81	0	0	1	82
2010	0	8	31	0	39
2011	0	122	106	0	228
2012	0	268	2	0	270
2013	0	59	0	0	59
2014	0	0	0	0	0

8. *Please calculate the number of hours over the maximum number of hours provided by PCB 79-134 for the same time periods.*

Response: The total number of hours over the maximum number of hours (259 hours) provided by PCB 79-134 with Dresden Station discharge temperatures greater than 90°F, from June 15 to September 30 for each year from 1998-2014 is presented in the table below.

Year	Discharge > 90°F (Hours)					Number of hours over 259 hours
	June	July	August	Sept	Total	
1998	51	215	183	8	457	198
1999	22	274	111	0	407	148
2000	0	0	0	2	2	0
2001	0	171	168	0	339	80
2002	0	46	8	0	54	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	29	20	1	50	0
2007	0	0	19	0	19	0
2008	0	0	1	0	1	0
2009	81	0	0	1	82	0
2010	0	8	31	0	39	0
2011	0	122	106	0	228	0
2012	0	268	2	0	270	11
2013	0	59	0	0	59	0
2014	0	0	0	0	0	0

9. *Of the hours with discharge temperature greater than 90°F in Table D-3, please indicate how many of those hours discharge temperatures were above 93°F by year.*

Response: The total number of hours with Dresden Station discharge temperatures greater than 93°F from June 15 to September 30 for each year from 1998-2014 is presented in the table below.

Year	Discharge > 90°F (Hours)				
	June	July	August	Sept	Total
1998	3	5	0	0	8
1999	0	106	0	0	106
2000	0	0	0	0	0
2001	0	0	0	0	0
2002	0	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	0	0	0	0
2010	0	0	0	0	0
2011	0	0	0	0	0
2012	0	6	0	0	6
2013	0	0	0	0	0
2014	0	0	0	0	0

10. *Based on Table D-3, the number of hours with discharge temperature greater than 90°F has generally decreased from 1998 to 2014. To what would Exelon attribute that general decrease?*

Response: Exelon attributes the decrease to advances in modeling the cooling water use for Dresden Station, that have resulted in improved management of the plant's cooling system, along with the installation and operation of cooling towers that help cool the water in the Dresden Station cooling canal before it is discharged to the Illinois River. The cooling tower system, which is described in Section 4.2 of Appendix D to the Demonstration, consists of 54 helper cooling towers that were constructed between 1999 and 2002.

However, even with the improved modeling and use of the cooling towers, elevated air temperatures and low river flows periodically result in ambient conditions that overwhelm even the most efficient operation of the Dresden Station cooling system, necessitating the alternative thermal limits requested by Exelon for the Station.

35 Ill. Adm. Code 106.1130(d): The detailed plan of study submitted to the Agency pursuant to Section 106.1120(a) and the Agency's written response pursuant to Section 106.1120(f)

11. *Please indicate whether United States Environmental Protection Agency Region 5 participated in developing Exelon's plan of study or commented on the 316(a)*

demonstration for Dresden Station submitted with the instant petition. If so, please describe and provide copies of USEPA's response.

Response: The United States Environmental Protection Agency ("USEPA") participated in the development of the Dresden Station plan of study. Mr. Sean Ramach of USEPA Region 5 was provided the draft Dresden Station 316(a) Study Plan, and, thereafter, Mr. Ramach attended a meeting with Exelon and Illinois EPA on May 16, 2014 during which he provided comments regarding the Study Plan. During the meeting, detailed aspects of the various plans were discussed and Exelon agreed to modify the plan in response to the agencies' comments. Exelon has not received any further comments from USEPA on the Demonstration.

35 Ill. Adm. Code 106.1130(e)(3): Summaries of physical, chemical, biological and technical data supporting the demonstration, along with a discussion of the data

One of the conditions on relief granted in PCB 79-134 was that:

Commonwealth Edison shall conduct monitoring studies in conformity with Edison's two documents submitted to the Agency on May 23, 1980 entitled "Proposed Hydrothermal Study Plan for Summer 1980" and "Proposed 1980 Environmental Program" as modified by Agency suggestions as set forth in its Recommendation submitted on May 26, 1981. In the Matter of 410(c) Petition for Dresden Nuclear Generating Station, PCB 79-134, slip op. at 4 (July 9, 1981) (Condition 2).

12. *Please provide results of the monitoring studies required by this condition or explain whether and how the studies were incorporated into the current petition*

Response: Condition 2 of the Board's July 8, 1981 Order required that Commonwealth Edison conduct hydrothermal and environmental monitoring studies during the summer of 1981. The results of the studies are included as Attachments 12 and 13, hereto.

35 Ill. Adm. Code 106.1130(e)(4): criteria or methodology used to assess whether a balanced indigenous community of shellfish, fish and wildlife will be maintained in the receiving waters and the protection of threatened and endangered species

Exelon's demonstration states that "[f]ederally-protected freshwater mussels are not known to currently exist within the vicinity of the DNS" but refers to the sheepnose, snuffbox, and spectaclecase mussels. Exh. l, App. A at A-32, App. H at H-2. The U.S. Fish and Wildlife Service identifies the endangered Scaleshell mussel (Leptodea leptodon) in Grundy County. The 2014 mussel survey did not encounter this species. Exh. l, App. H at Figure H-3 (Survey Results).

13. *Please address whether any other information indicates that this species is now known to exist within the vicinity of the Dresden Station.*

Response: The Scaleshell mussel (*Leptodea leptodon*) was listed in 2001 as an endangered species by the U.S. Fish & Wildlife Service. Prior to July 2013, the known populations of this species (a total of 14) were all located in the Missouri River basin in Arkansas, Missouri, and Oklahoma (USFWS Scaleshell Fact Sheet, http://www.fws.gov/midwest/endangered/clams/scum_fct.html). Although the species is still listed as endangered in Illinois, the listing was due to historical collections; the species is essentially extirpated from the state.

In July 2013, during an extensive mussel survey conducted during 4 foot drawdown of the Illinois River to repair the Marseilles Lock and Dam, a single Scaleshell mussel specimen was found at river mile 258.5 (by Kevin Cummings, Illinois Natural History Survey ("INHS") Mussel Collection Curator). The specimen was located 13.5 river miles downstream of Dresden Station, in a different navigational pool. It was the first specimen found in Illinois in nearly a century (pers. comm., Kevin Cummings and Jeremy Tiemann, INHS). To date, no other confirmed collections of this species have occurred in Illinois.

The thermal demonstration states that threatened and endangered fish and mussel species were collected in the vicinity of the Dresden Station: river redhorse, greater redhorse, pallid shiner, western sand darter, banded killifish, purple wartyback, and blank sandshell. Exh. 1, App. A at A-34, App. H at H-4. The Illinois Department of Natural Resources' EcoCAT tool indicated other endangered and threatened species present in the vicinity of the Dresden discharge. Agency Recommendation at 12. Under 17 Ill Adm. Code 1075.40, activity authorized by a State agency that may affect a listed species or its essential habitat must be evaluated through a consultation with IDNR. IEPA's recommendation states that "IDNR evaluated the submittal and determined that impacts to the protected resources are unlikely. IDNR terminated the consultation on May 5, 20 15." Agency Recommendation at 12-13.

14. *Please clarify whether the submittal evaluated by IDNR included the Demonstration (Exh. 1) and its appendices, particularly Appendices A and H.*

Response: IDNR received all sections of the Demonstration, including Appendices A and H. The Demonstration was discussed in full during Exelon's meeting with Illinois EPA and IDNR on April 30, 2015.

35 Ill. Adm. Code 106.1130(g)(l): alternative effluent limitation

NPDES Permit IL0002224 establishes a temperature parameter and includes Special Conditions 3 and 11 addressing for temperature for 3 outfalls: Outfall 001(Unit 1 House Service Water to the Illinois River); Outfall 002 (Cooling Pond Blowdown to the Illinois River); and Outfall 004 (Cooling Pond Siphon Discharge to the Kankakee River). Agency Recommendation, Att. 1. Special Condition 3 incorporates the alternative thermal effluent limitation only for "cooling pond blowdown", which is Outfall 002. Special Condition 18 requiring an updated 316(a) demonstration refers to "the thermal discharge from its Dresden Nuclear Power Station" and "the seasonal alternate effluent limitations granted under the original demonstration". Special Condition 18 does not specifically identify that it applies to a particular outfall.

15. *Please clarify whether the requested alternative thermal effluent limitation applies only to Outfall 002 Cooling Pond Blowdown.*

Response: The requested alternative thermal effluent limitation applies only to Outfall 002 – Cooling Pond Blowdown.

Outfall 001 applies to Unit 1, which was removed from service in 1979. In the event effluent were to be discharged from this outfall, it is subject to the Board's generally applicable thermal limitations.

Outfall 004 was designed and installed by the US Army Corps of Engineers and is operated by the Illinois Emergency Management Agency for the purposes of preventing ice jams, and related flooding, that occur in the winter. The outfall is not operated in the months during which the proposed alternative thermal limits would apply.

Exelon explains that, under the relief granted in PCB 79-134, "[c]ompliance with the limits was to be measured at the end of the discharge pipe from the cooling pond to the River, not at the edge of a mixing zone." Pet. at 13. The Board's order in PCB 79-134 states that "[t]he proposed amendment [by Commonwealth Edison to Rule 203(i)(3) and (4), now codified as 35 Ill. Adm. Code 302.211(d) and (e)] does not include a mixing zone. . . ." PCB 79-134, slip. op at 1(July 9, 1981). Similarly, Exelon's demonstration also states that "[c]ompliance with the ATL [alternative thermal effluent limit] is measured end of pipe discharge point from DNS to the River." Exh. 1, App. D at D-5.

The NPDES Permit IL0002224 Special Condition 3 states that "([f]or outfalls 001 and 002) [t]his facility meets the criteria for establishment of a formal mixing zone for thermal discharges pursuant to 35 IAC 302.102. Water quality standards for temperature listed in the table below must be met at every point outside of the mixing zone from the dates October 1 through June 14." Agency Recommendation, Att. 1. The permit does not specifically state that a mixing zone applies from June 15 through September 30.

However, from June 15 through September 30, IEPA's recommendation refers to a mixing zone in the context of the proposed alternative thermal effluent limits and the Hydrothermal Analysis (Exh. 1, App. D). IEPA states that "[w]hen the [Dresden] facility is operated in the indirect open cycle mode, the facility cannot always meet the water quality standards at the edge of the mixing zone and therefore requests alternative thermal limitations." Rec. at 2-3. Referring to the Biothermal Assessment -Predictive Demonstration (Exh. 1, App. B), IEPA's Recommendation refers to temperatures at the edge of the mixing zone. Rec. at 6, 7, 9. For the "Extreme High Temperature Scenario", the recommendation states that "the maximum temperature modeled at the end of the mixing zone was 93.2°F. Of the 12 RIS analyzed under the Extreme High Temperature Scenario, modeling suggests that bluegill, freshwater drum, black crappie, golden redhorse, and white sucker would temporarily be exposed to temperatures outside the mixing zone that exceed the upper zero growth and/or avoidance temperatures for these species." Rec. at 9.

16. *Please explain the relevance of a mixing zone to the 316(a) demonstration for compliance with an effluent limit which is to be determined at the Dresden Station discharge point.*

Response: Neither the alternative thermal limit ordered by the Board in PCB 79-134 nor the a alternate limit requested in this proceeding includes a mixing zone for measuring compliance with the thermal effluent limit in effect from June 15 through September 30. Compliance is measured at the point at which the Station's thermal effluent is discharged to the River. For that reason, a mixing zone is not directly relevant to measuring compliance with the alternative thermal effluent limit. During the balance of the year, when the Station is not subject to the alternative thermal limit, compliance with the Board's generally applicable thermal standards is measured at the edge of a 26-acre mixing zone authorized by the Station's NPDES Permit and the Board's regulations.

Even though the proposed alternate thermal limit does not include a mixing zone, the concept of a mixing zone is a useful analytical tool for assessing possible impacts to the balanced indigenous community of fish and shellfish ("BIC") associated with Dresden Station's thermal plume. The fact there are no or minimal impacts beyond the boundaries of a conceptual mixing zone is strong evidence the balanced indigenous community will be unaffected by the discharge. Likewise, even if modeling shows that temperatures beyond the conceptual mixing zone may exceed upper limits for certain species within the BIC, Illinois EPA's finding that such occurrences will be infrequent and short-term provides evidence that the BIC will be preserved.

17. *Please clarify whether, from June 15 to September 30, compliance with the alternative thermal effluent limits would be measured at the Dresden Station's discharge point into the Illinois River instead of being measured the edge of a mixing zone.*

Response: See Answer to Question 16, above.

18. *Please clarify whether "[r]eceiving 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." Draft 316(a) Technical Guidance Manual (1977) at 71.*

Response: Because a mixing zone has not been included as part of the alternative thermal limit ordered in PCB 79-134 or requested in this proceeding, the provision quoted from the 316(a) Draft Manual, by its terms, does not apply. In addition, the 316(a) Draft Manual explains that the RIS methodology does not apply to non-predictive demonstrations that address whether prior appreciable harm has resulted from past operations (see Section 3.9 at 72). Therefore, the retrospective analysis portion of the Demonstration (Appendix C), showing that past operations have not caused prior appreciable harm to the BIC, fully supports a finding that the Demonstration is successful regardless of mixing zone considerations.

USEPA " Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements (DRAFT)".May l, 1977 (316(a) Manual)

Section 3.3.1: Phytoplankton

For phytoplankton, Section 3.3.1.3 of the 316(a) Manual states that, [a]t a minimum, the data collected should include:

1. *The standing crops of organisms per volume of water;*
2. *Identification of numerically dominant taxa (i.e., 5% or more by number) and nuisance organisms; and*
3. *Delineation of the euphotic zone, preferably with a submersible photometer. 316(a) Manual at 20.*

Exhibit 1 cites to phytoplankton studies, surveys, and observations made during fish and benthic monitoring. Pet. Exh. 1 at 19-20; App. A at A-26; App. C at C-5 - C-6; App. E at E-4 - E-5.

Exhibit 1 states that EA found that the data address the criteria for phytoplankton under Section 3.3.1.1 in the 316(a) Manual in order for a demonstration to be judged successful. Exh. 1. at 19-20.

19. *Please clarify whether the data collected included the Section 3.3.1.3 items and whether such data was used to arrive at the conclusions EA made regarding the Section 3.3.1.1 criteria on page 20 of Exhibit 1.*

Response: The section in 316(a) Draft Manual that precedes Section 3.3.1.3 is Section 3.3.1.2. Section 3.3.1.2 , titled "Low Potential Impact Areas for Phytoplankton (Open Ocean and Most Riverine Ecosystems)" states:

> Areas of low potential impact for phytoplankton are defined as open ocean areas or systems in which phytoplankton is not the food chain base. Ecosystems in which the food web is based on detrital material, e.g., embayments bordered by mangrove swamp, salt marshes, fresh water swamps, and most rivers and streams, are in this category.

Section 3.3.1.2 then states that these areas will not be considered areas of low potential impact only if there was evidence that:

> 1. The phytoplankton contribute a substantial amount of primary photosynthetic activity supporting the community;
>
> 2. A shift toward nuisance species may be encouraged; or
>
> 3. Operation of the discharge may alter the community from a detrital to a phytoplankton based system.

The evidence supports a finding that the Dresden Station discharge receiving waters are areas of low potential impact for phytoplankton. Regarding item 1, although phytoplankton are part of the aquatic community in the Illinois River near the Dresden Station discharge, because of the riverine nature of the receiving waters, phytoplankton are not the primary factor supporting the community through photosynthetic activity. Rather, river flow and associated mixing play a significant role in oxygenating the water, along with photosynthetic activity of the abundant macrophytes (see Appendix A, Figure A-2) and periphyton in the River. These conditions are not expected to change as a result of the proposed alternative thermal limits.

Regarding possible nuisance species concerns, over the course of the Dresden Station environmental monitoring program that spans more than 40 years, a shift toward nuisance phytoplankton species has not been observed. The requested alternative thermal limits are not expected to cause or encourage a shift toward nuisance species.

Finally, the Dresden Station thermal discharge does not pose a risk of altering the community from a detrital-based to a photosynthetic-based system. To the contrary, the Station's discharge provides additional flow and mixing to the Illinois River.

Thus, based on an evaluation of these criteria, the Illinois River in the vicinity of the Dresden Station's discharge qualifies as a low potential impact area for phytoplankton.

Section 3.3.2: Zooplankton and Meroplankton

Section 3.3.2.1 includes three decision criteria for zooplankton and meroplankton. The third criterion states that, "[t]he thermal plume does not constitute a lethal barrier to the free movement (drift) of zooplankton and meroplankton." 316(a) Manual at 20. Exhibit 1 addresses the first two criteria under Section 3.3.2.1. Exh. 1. at 23.

20. *Please address the third criterion or point to the section(s) of the petition in which it is already addressed.*

Response:

The conclusion that the Dresden Station thermal plume does not constitute a lethal barrier to zooplankton and meroplankton drift is supported by the spatial distribution patterns of zooplankton near Dresden Station and general known temperature tolerances of the zooplankton community. Results from historical zooplankton studies reflect distinct assemblages in the Des Plaines and Kankakee Rivers and the Dresden Cooling Lake (see Appendices A and E of the Demonstration). The river communities are dominated by rotifers, which is typical of riverine communities, whereas copepods and cladocerns are more abundant in the cooling lake. The cooling lake assemblage influences the composition at the Dresden Station discharge location in the Illinois River and further downstream. However, when the influence of the cooling lake contribution is accounted for, zooplankton composition at the discharge and downstream closely resembles the Kankakee River assemblage, supporting the conclusion that the thermal plume does not constitute a barrier to zooplankton.

Zooplankton generally experience brief and transient thermal changes as they are entrained in a plume. Those transient exposures are generally not of a duration to be lethal, even when discharge temperatures are high. Data that are available regarding thermal endpoints for zooplankton indicate that lethal temperatures can range from 95°F to 104°F, depending on acclimation temperature and duration of exposure (Environment Canada 2014, Environmental Effects Assessment of Freshwater Thermal Discharges. http://www.ec.gc.ca/ee-ea/default.asp?lang=En&n=E8FBACCA-1&offset=11&toc=show).

These factors explain the presence of only near-field and short-term differences in the historical zooplankton data collected in the vicinity of Dresden Station. Likewise, the absence of long-term and far-field differences in the historic Dresden Station zooplankton data indicates that the Station's discharge allows free movement and drift of the zooplankton and does not represent a lethal barrier.

Section 3.3.4: Shellfish/Macroinvertebrates

Exhibit 1 states that, "[o]f the transects located immediately downstream of the discharge along the left descending bank, the transect located within the warmest portion of the plume contained the greatest number of mussels." Exh. 1 at 26. The 2014 mussel survey states that "(t]he largest concentration and highest densities of mussels occurred along the right descending bank opposite and downstream of the DNS discharge, near the typical path of the DNS thermal plume." Exh. 1, App. H at H-8.

21. *Please clarify whether the transects along the descending bank referred to above are denoted as Group C or F in Figure H-4 of App. H.*

Response: Transects "located immediately downstream of the discharge along the left descending bank…" constitute Group F transects in Appendix H, Figure H-4 of the Demonstration. Transects with the "…highest densities of mussels occurred along the right descending bank opposite and downstream of the DNS discharge…" constitute Group C transects in Figure H-4 of Appendix H.

22. *Please clarify whether the transect with the largest concentration and highest densities of mussels occurred in the warmest part of the plume.*

Response: The largest concentration and highest densities of mussels within the study area occurred in Group C transect samples (10-meter segments) and qualitative timed searches completed along the right descending bank opposite and downstream of the Dresden Station discharge. Mussels encountered within Group C transects and during qualitative searches in this area along the right descending bank are located within the flow path of the elevated temperatures in the thermal plume. As shown in Table 4 of Attachment 14, under extreme thermal and low flow conditions, the flowpath of the plume tends to travel from the left bank discharge to the right bank. Evaluation of the transects located immediately downstream of the discharge along the left descending bank (Group F transects) reveals that Transect 23, located within the warmest portion of the plume, contained the greatest number of mussels compared to the remaining Group F transects.

Both Exelon and IEPA note factors mitigating effects of exposure to thermal discharges: fluctuation from day to night in discharge temperature, short-term nature of exposure, capability of organisms to avoid stressful temperatures, and availability of thermal refuge. Exh. 1, App. B at B-26 - B-35; Agency Recommendation at 7, 9.

23. *Please identify and discuss mitigating factors applicable to mussels that are not able to seek thermal refuge.*

Response: Adult and juvenile mussels can be endobenthic and/or epibenthic depending on environmental conditions such as river flow, photoperiod, and temperature. Although unionid mussels can be particularly susceptible to ecosystem stress due to their relatively limited mobility during juvenile and adult life stages, they are capable of behavioral and physiological stress-avoidance responses. Particularly during short-term exposure to acute stressors, unionid mussels exhibit stress-avoidance responses such as tightly closing valves, mucus excretion, reduction of siphoning and mantle display behaviors, and burrowing. Besides these stress-avoidance responses, as discussed with Bob Szafoni of IDNR during the April 30, 2015 meeting to discuss the results of the Demonstration, mussels are relatively tolerant of temperatures up to and, for some species, beyond 95°F. Results of the 2014 Dresden Station mussel survey support the conclusion that both the stress-avoidance responses and thermal tolerance effectively protect freshwater mussels from occasional extreme thermal conditions that may result from the proposed alternative thermal limits.

Based on the results of the 2014 survey, elevated water temperatures within the study area are not prohibiting mussel colonization and recruitment within the study area. As discussed in the Demonstration and Response 28 below, extreme thermal conditions near Dresden occurred in 1999 and 2012. Despite these conditions, results show the presence of a diverse mussel

assemblage upstream and downstream of the Dresden Lock and Dam. The right descending bank upstream of Dresden Island Lock and Dam is located within the flowpath of elevated temperatures and contained the highest sample densities (Group C transects) of mussels within the survey area. Juvenile and adult mussels were encountered within Group C transects and qualitative searches between Group C transects. The mussel community within this area of elevated temperatures consisted of 90% adult mussels (ages 5-18) and 10% juveniles (ages ≤4). Therefore, it does not appear that the historical (≤18 years) temperature regime or the extreme temperature conditions of 1999 and 2012 have prevented the establishment of a diverse mussel community, with recruitment, within the study area.

Section 3.5.2: Development of Representative Important Species Rationale

Under the development of a Representative Important Species (RIS) rationale, the 316(a) Manual states that, "[o]fficially listed 'threatened or endangered species' are automatically 'important.'" 316(a) Manual at 36. Threatened and endangered fish and mussel species were collected in the vicinity of the Dresden Station: river redhorse, greater redhorse, pallid shiner, western sand darter, banded killifish, purple wartyback, and blank sandshell. IDNR's EcoCAT tool indicated other endangered and threatened species present in the vicinity of Dresden Station. Exh. 1, App. A at A-34, App. H at H-4, Agency Recommendation at 12.

The RIS did not include threatened or endangered species. For the threatened river redhorse and endangered greater redhorse, Exelon's demonstration states that "[g]olden redhorse (Moxostoma erythrurum) was selected as a surrogate RIS because the incidental occurrence of both the state-listed redhorse species precluded evaluation of thermal effects on these species." Exh. 1, App. A at A-34.

The Predictive Demonstration states that lower trophic levels including benthic macroinvertebrates "were not selected as RIS because of a general lack of thermal endpoint data and historical § 316(a) studies have shown only localized thermal effects on lower trophic levels that have not resulted in adverse harm." Exh. 1, App. B at B-7, citing Duke/Fluor Daniel, North Oak Creek Power Plant 316(a) Demonstration (1992). The Predictive Demonstration further states that "[o]nly fish species were selected as RIS for the DNS thermal evaluation . . . because their overall wellbeing shows that the lower trophic levels are supporting the trophic levels occupied by the RIS." Exh. 1, App. B at B-7.

24. *Please clarify whether the RIS selected are representative of all the listed threatened and endangered species known to be present in the vicinity of the DNS discharge.*

Response: The list of RIS for the Dresden Station was presented to Illinois EPA and USEPA Region 5 as part of the study plan evaluation. Illinois EPA approved the list of RIS with a few changes and USEPA offered no objections. The RIS list includes species that are representative of the fish community diversity in Dresden Island Pool, including listed threatened and endangered fish. As discussed in the Demonstration, thermal effects data are scarce for many threatened and endangered species. Consequently, species with similar habitat and thermal requirements are typically selected for evaluation in a predictive analysis for a 316(a) Demonstration. In the case of the Dresden Station, the following table summarizes the surrogate relationship between the selected RIS and listed threatened and endangered fish species.

T&E Species	RIS	Habitat/Trophic requirements	T&E collected near Dresden[a]
River Redhorse	Golden Redhorse	Demersal, riffles wit hard and sand/gravel substrate	7 years prior to 2003; avg 3/yr
Greater Redhorse	Golden Redhorse	Demersal, runs with hard substrate and structure	4 years prior to 2001; 1 each year
Pallid Shiner	Emerald shiner	Pools and aquatic vegetation; forage species	Each year since 2001; avg 78/yr
Western Sand Darter	Logperch	Demersal, riffles, hard and sand/gravel substrate; forage species	1 in 2003 and 2006
Banded Killifish	Emerald shiner	Pelagic, pools and backwater with aquatic vegetation; forage species	2 in 2013

[a] Sampling was conducted during 19 years between 1991 and 2013

Eastern sand darter and American eel are state-listed species also purported to occur in the general vicinity of Dresden Station, but neither species was collected from 1991 through 2013.

In view of the very limited amount of thermal effects data available for mussel species, no mussels were included in the predictive analysis of the Dresden Station thermal discharge. However, a comprehensive mussel survey was conducted in 2014, which was used in the biothermal assessment to demonstrate no prior appreciable harm has been caused as a result of Dresden Station operations. The mussel survey was conducted 2 years after the extreme high temperature and low flow ambient conditions of July 2012. The highest densities of mussels were collected on the opposite side of the Illinois River from the DNS discharge in areas where higher thermal plume temperatures are typically distributed. Successful reproduction and recruitment were evident throughout the study area with juveniles (1-4 years old) accounting for approximately a third of the individuals collected. A significant number of the mussels collected were more than 10 years old, indicating that they had survived the extreme weather and ambient temperature conditions observed during July 2012. Both of the state-listed mussel species referenced in the Board's question were encountered during this survey; purple wartyback (*Cyclonaias tuberculata*) and black sandshell (*Ligumia recta*). Five adult *C. tuberculata* (mean age = 9.6 years) were collected and four adult *L. recta* (mean age = 9.3 years) were collected.

25. *For these threatened and endangered species, please address any adverse effects that may result from the requested alternative thermal effluent limitation and clarify how the thermal demonstration shows that the alternative limitation will assure protection and propagation of a balanced, indigenous population.*

Response: As mentioned above, for the predictive assessment, the threatened and endangered fish species are adequately represented by the RIS species accepted by IEPA and reviewed without objection by USEPA Region 5. The predictive assessment demonstrated that under typical high ambient temperatures, most of the cross-section of the Illinois River between the Dresden Station discharge and the Dresden Island Lock and Dam was predicted to provide temperatures below the upper chronic mortality limit for most of the RIS. Even under the

extreme high ambient temperature conditions that occurred in July 2012, the RIS, which have been shown to avoid potentially lethal temperatures, would have had adequate refuge with cooler water temperatures upstream of Dresden Station in the Des Plaines and Kankakee Rivers. Field observations conducted in July 2012 when Dresden Station operated under a provisional variance, found no evidence of fish kills in lower Dresden Island Pool. A year after the extreme conditions of July 2012, fish sampling in 2013 showed that the characteristics of the fish community were similar upstream and downstream of Dresden Station, and were similar to historical sampling of the fish community over the previous 23 years.

The lock and dam system of the Upper Illinois Waterway (UIW) including Dresden Island Lock and Dam, supports commercial barge traffic, but has permanently altered the natural aquatic habitat available in this reach of the Des Plaines, Kankakee, and Illinois Rivers. Changes to the aquatic habitat include inundating riffle/run habitat and resulting sedimentation in extensive areas of the pools associated with each dam. These habitat conditions are less than optimal for various species represented by the darter and sucker families, which require riffle habitat and hard sand and gravel substrate for spawning. The RIS that would be adversely affected by these habitat changes include logperch, white sucker, and golden redhorse. Despite these conditions, golden redhorse and logperch were considered relatively common in the Dresden Island Pool and were collected in the vicinity of Dresden Station during every sampling year. Both species are demersal and, under most operating conditions would have limited potential exposure to the warmer portions of the buoyant Dresden Station thermal plume. Under extremely warm conditions, the demersal threatened and endangered species (river redhorse, greater redhorse, and western sand darter) represented by golden redhorse and logperch, would have access to cooler bottom temperatures upstream of the Dresden Station discharge. Overall, the distribution of these species in the vicinity of Dresden Station is affected to a greater degree by the distribution of preferred benthic substrate and higher water velocities than by thermal plume temperatures.

The endangered pallid shiner was not collected prior to 2001, but has been collected every year since and is represented by emerald shiner on the RIS list. Similar to the pallid shiner, the threatened banded killifish inhabits pools and backwater areas with beds of aquatic vegetation, and is represented by emerald shiner on the RIS list; however, banded killifish have been reported from the Dresden Station vicinity only in 2013 (two specimens) and 2014 (eight specimens). Although banded killifish are apparently declining from their clear glacial lakes native range in Illinois, based on recent observations in the UIW and Illinois River, their numbers are rapidly increasing from upstream to downstream. The reason for the sudden presence and increase of this state-listed species is unknown but suggests that the Dresden Station discharge is not an impediment to the survival or range expansion of banded killifish. In addition, the predictive assessment found that the Dresden Station discharge was not likely to result in appreciable harm to the emerald shiner population in the vicinity of Dresden Station, even under the extremely warm and low flow conditions of July 2012. As illustrated in the Demonstration, vegetated backwater habitat is common upstream of Dresden Station, but is very limited between the Dresden Station discharge and the Dresden Island Lock and Dam; therefore, habitat frequented by pallid shiner and banded killifish is expected to have minimal exposure to the DNS thermal plume.

As discussed in Response 24, there are very little data on thermal tolerance of mussels for a predictive assessment. Juvenile and adult mussels are sedentary and could be more vulnerable to occasional exposure to higher plume temperatures because they are unable to avoid these

temperatures and move to cooler habitat. However, as discussed in Response 23, the potential exposure to higher plume temperatures is minimized because the plume is buoyant and higher temperatures are closer to the water surface, while mussels reside on the bottom. Also, the sediment into which these infaunal species have burrowed, is slightly cooler than the water at the bottom, which would buffer them from occasional periods under extremely warm conditions when higher plume temperatures contact the bottom. The highest densities of freshwater mussels in the vicinity of Dresden Station have been observed in areas occasionally influenced by higher temperatures in the thermal plume, on the right descending side of the Illinois River, opposite the Station's discharge.

Based on the integrated retrospective and predictive biothermal assessments, no material effects of the Dresden Station thermal plume on the aquatic community, including threatened and endangered species of fish and mussels, have been observed or are expected.

Section 3.5.3: Engineering and Hydrological Data for Type II Demonstration

The petition states that, during indirect open cycle mode from June 15 to September 30, "flow regulating gates divert all cooling water from the cold canal to the Illinois River via the discharge canal." Pet. at 9-10. A previous variance describes a "diffuser pipe" and a "slot-jet discharge structure." See Commonwealth Edison Company v. Environmental Protection Agency, PCB 73- 359, slip op. at 4 (Jan. 17, 1974).

26. *Please specifically describe the current outfall configuration where the discharge canal meets the Illinois River.*

Response: The description of the outfall that is included in the Demonstration, Appendix D at D-2 is accurate. There is no diffuser pipe or slot-jet discharge structure. Flow regulating gates divert all cooling water from the cold canal to the Illinois River via the discharge canal, which is simply an open canal that flows directly into the Illinois River.

Exelon's demonstration states that "DO concentrations in the discharge canal and thermally-influenced locations in the Dresden Pool averaged 0.5 to 1.4 ppm lower than outside that influence of the discharge. DNS [Dresden Nuclear Station) operations have not been shown to impact dissolved oxygen levels in the upper Illinois River Basin." Exh. 1, App. A at A-10. Referring to the Dresden Station discharge location, IEPA's Recommendation states that "[t]he Illinois River, Waterbody Segment, D-10, is listed on the draft 2014 Illinois Integrated Water Quality Report and Section 303(d) List. Aquatic life uses are fully supported. This segment of the Illinois River is subject to enhanced dissolved oxygen standards." Rec. at 2.

Stream segments for enhanced dissolved oxygen protection are listed at 35 Ill. Adm. Code 302. Appendix D, and the only segment identified in the Illinois River is Segment 236.

27. *For Illinois River Segment 236, please elaborate on EA's conclusion that "DNS operations have not been shown to impact dissolved oxygen levels in the upper Illinois River Basin."*

Response: The intent of the statement "DNS operations have not been shown to impact dissolved oxygen ("DO") levels in the upper Illinois River Basin" was to state that the Dresden Station discharge has not caused or contributed to DO concentrations falling below the Illinois State Water Quality Standards. The instantaneous August to February General Use standard of

3.5 ppm was erroneously cited in the Demonstration instead of the 4.0 ppm Enhanced Dissolved Oxygen Protection limit that is listed for Illinois River Segment 236. DO concentrations below the standards have occurred in the Des Plaines and Kankakee Rivers, upstream of the Dresden Station discharge. However, based on sampling during the Dresden Station long-term monitoring program, DO concentrations downstream of the Dresden Station discharge have been consistently above the General Use and Enhanced Dissolved Oxygen Protection limits. These data demonstrate that the Dresden Station discharge has not resulted in DO concentrations lower than the water quality standards for Segment 236 of the Illinois River Basin.

28. *Please also address the impact of the proposed alternative thermal effluent limitation in Segment 236 under the enhanced dissolved oxygen standards.*

Response: The extreme conditions observed during the 1999 DNS monitoring program provide a good reference to the relationship between DO and extreme temperature conditions (in excess of what could result from the proposed alternative thermal limits).

During the summer and fall of 1999, Dresden Station operated under multiple provisional variances due to extreme ambient conditions that caused the water temperature at the Station intake to exceed 90°F. Routine sampling as part of the Dresden Station long-term monitoring program was supplemented by special studies required by the provisional variances. The special studies included, additional biological sampling effort and associated physicochemical water quality measurements (Appendix A in Attachment 14). In addition, supplemental temperature and DO profile data were collected at multiple locations in the vicinity of DNS on July 30 and September 17, 1999 (Table 4 in Attachment 14).

Results of the 1999 monitoring effort show that during the warmest period, while temperatures at the Kankakee River intake ranged from 88.5°F to 94.1°F, the temperature at the Dresden Station discharge was as high as 96.6°F. Despite the elevated thermal condition of the Des Plaines, Kankakee, and Illinois Rivers, DO levels within and downstream of the Station discharge were consistently above 5.0 ppm (Attachment 14). These data support the conclusion that, even under extreme thermal conditions, the proposed alternative thermal limits will not reduce DO levels below prescribed standards.

For the current alternative thermal effluent limitation, testimony stated that "(i]ndirect open cycle operation benefits water quality in the Illinois River by . . .adding dissolved oxygen. . . ." In the Matter of 410(c) Petition for Dresden Nuclear Generating Station, PCB 79-134, slip op. at 3(July 9, 1981).

29. Please comment on the applicability of this earlier testimony regarding dissolved oxygen to the pending petition.

Response: Exelon believes the testimony to which the Board's Order is referring is the testimony of Dr. Ben Ewing, who, at the time, was Professor of Environmental Engineering at the University of Illinois. Based on a review of Dr. Ewing's testimony (Attachment 15, hereto), Dr. Ewing was opining that during periods of low flow in the Kankakee River, much of the flow

into the Illinois River would be from the Des Plaines River which has lower DO levels than the Kankakee. On such occasions the contribution of DO from cooling pond water discharged during indirect open cycle operations would actually serve to increase DO concentrations in the Illinois River.

Dated: October 16, 2015

Respectfully submitted,

EXELON GENERATION LLC

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter Of:	)	
	)	
EXELON GENERATION LLC,	)	
Petitioner,	)	
	)	
v.	)	PCB NO. 2015-204
	)	
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent.	)	

CERTIFICATE OF SERVICE

I, the undersigned, certify that I have filed Exelon Generation LLC's Responses to the Board's Questions with:

Office of the Clerk of the Illinois Pollution Control Board
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Chicago, Illinois 60601

A copy of this filing was served on the following by Messenger:

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A copy of this filing was also served on the following by Federal Express:

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Dated: October 16, 2015

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