

**IN HOT WATER: CLEAN WATER ACT PROVISIONAL VARIANCES AND THEIR
RELATIONSHIP TO THE IMPACT OF HEAT WAVES AND DROUGHTS ON THE SUPPLY
AND DEMAND OF ELECTRICITY**

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INTRODUCTION

Steam is water vapor, the gaseous form of water after it has been heated to roughly 100 °C. At that point, steam is 1600 times larger in volume than room temperature water, and can be used to do mechanical work such as operating turbines for electric power generation. Steam turbines generate the majority of electric power in the United States, but the electricity generating process also transfers heat to large volumes of water. That heat must be properly dealt with, because the Clean Water Act (CWA) places limits on the temperature of water that power plants can discharge into federal waters.

Recently, the increasing occurrence of droughts, heat waves, or both has exasperated the already difficult problem thermoelectric power plants face: the need to discharge large volumes of heated water into aquatic environments without violating their CWA permits. In response to record high summer 2012 temperatures, near record droughts, and an increased summer power demand, thermoelectric power plants in Illinois requested and received provisional variances from the temperature limits in their CWA permits. As a result, natural aquatic environments have been forced to receive and dilute heated effluent during the hottest summer on record, with no relief from increased surface flows due to a lack of precipitation. The primary issues that this problem presents and that this note discusses are: (1) whether the provisional variance process in Illinois violates the CWA and whether the process affords concerned citizens an effective opportunity to comment on the process; (2) whether natural aquatic environments can tolerate large volumes of heated effluent during summer heat waves and droughts; and (3) whether the demand for power is such that thermoelectric plants must receive provisional variances or face shutting down during high summer grid demand.

Section I of this note focuses on the CWA's discharge permitting program and thermal effluent limits, Illinois' administration of the permit program, and the legality of the provisional variance process in Illinois. Section II explores the nexus, or intimate relationship between electric power generation and large-scale water withdrawal and heat transfer. Section III discusses the implications that heated effluent has for natural aquatic environments, while section IV discusses potential solutions to this issue by

primarily looking at grid demand and whether thermoelectric plants must actually supply as much power as they claim during summer heat waves.

I. SUBSTANTIVE CLEAN WATER ACT NPDES PERMIT PROGRAM LAW

The Clean Water Act, its National Pollutant Discharge Elimination System (NPDES) Permit Program, and EPA delegation of the Program to the States and their administration of it are all crucial to understanding the scope and legality of the provisional variance process in Illinois.

A. *The Clean Water Act and the National Pollutant Discharge Elimination System Permit Program*

The Federal Water Pollution Control Act (FWPCA) was enacted in 1948,¹ and in 1972 Congress passed an extensive revision of the FWPCA commonly known as the Clean Water Act (CWA)². In passing the CWA, Congress, established the National Pollutant Discharge Elimination System (NPDES) permit program.³ The 1972 amendments sought to control discharges to navigable waters through permits, as Section 301(a) of the CWA prohibits the “discharge of any pollutant” by any “person” from any “point source” into “navigable waters,” except when in compliance with sections 301, 306, 307, 318, 402, and 404 of the CWA.⁴ Section 402 of the CWA requires dischargers of pollutants into waters of the United States to obtain a NPDES permit and comply with its provisions.⁵ Section 502(12) defines “discharge” as “any addition of any pollutant to navigable waters from any point source,” while section 502(6) defines “pollutant” as “dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, *heat*...and industrial, municipal, and agricultural waste discharged into water” (emphasis added).⁶ Section 502(14) defines “point source” as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock...from which

¹ Federal Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155 (1948).

² Clean Water Act, Pub. L. No. 92-500, 86 Stat. 816 (1972).

³ 33 U.S.C. § 1342 (2012).

⁴ 33 U.S.C. § 1311(a) (2012).

⁵ 33 U.S.C. § 1342 (2012).

⁶ See 33 U.S.C. §1362(12) (discharge definition), (6) (pollutant definition) (emphasis added).

pollutants are or may be discharged.”⁷ Finally, § 502(7) defines “navigable waters” to mean “waters of the United States, including the territorial seas.”⁸ After broadly outlining what activities needed to obtain a NPDES permit in order to discharge, Congress set various requirements that permit holders must follow.⁹

1. NPDES Permit Requirements and Features

NPDES permits last for five years, and have five general provisions that permit holders must comply with including: (1) technology-based effluent limitations, (2) water-quality-based effluent limitations, (3) monitoring and reporting requirements, (4) standard conditions, and (5) special conditions.¹⁰ Technology and water-based effluent limitations are the two basic NPDES program regulatory controls and these limits largely dictate the effluent limits in NPDES permits. Technology-based effluent limitations are limits on the discharge of pollutants designed to reflect effluent quality achievable through control technology.¹¹ The United States Environmental Protection Agency (EPA) has promulgated industry-specific effluent limitations and guidelines, including for the steam electric power generating industry.¹²

2. Water Quality Criteria, Standards, and Effluent Based Limitations

While NPDES permits initially focused on implementing technology-based controls, the emphasis eventually shifted back to water-quality-based effluent limitations (WQBELs) and water quality standards (WQSs). Acting as a “backstop” to the technology-based controls, WQSs and WQBELs are designed to attain a certain level of water quality for a specific body of water, and come into play when technology-based controls do not adequately protect water quality.¹³ A body of water’s specific water quality issues act as the basis for setting WQSs in general, and WQBELs in a NPDES permit, in excess of

⁷ 33 U.S.C. § 1362(40).

⁸ 33 U.S.C. § 1362(7); *see also* 40 C.F.R. § 122.2 (defining “waters of the United States”).

⁹ 33 U.S.C. § 1342(a)(b).

¹⁰ *Id.*

¹¹ 33 U.S.C. § 1314.

¹² 40 C.F.R. § 423. The regulations breakdown varying effluent limitations that apply depending on whether a permittee must, based on the pollutants in their discharge and the age of their facility, employ Best Practicable Technology (BPT), Best Available Technology (BAT), or Best Conventional Pollutant Control Technology (BCT).

¹³ *See* 33 U.S.C. §§ 1311(b)(1)(C), 1312(a), 1313(e)(3)(A); 40 C.F.R. § 122.44(d).

the technology based levels of treatment that section 301(b) of the CWA requires.¹⁴ WQSs, which apply to any body of water on a state's section 303(d) list, must take into account the potential uses of the body of water including for public water supply, propagation of fish and wildlife, and recreational, industrial, and agricultural uses.¹⁵ States adopt WQSs and submit them to EPA for approval.¹⁶

In order to determine if technology-based controls are effective, and whether the state and dischargers must employ WQSs and WQBELs, the EPA requires dischargers to monitor their discharges, report the results in discharge monitoring reports (DMRs), and submit these reports to EPA or the state agency responsible for administering the NPDES permit program.¹⁷ DMRs are a means of enforcing permit requirements and subsequent enforcement actions if requirements are violated, but permitting authorities may also conduct periodic investigations. A discharger's NPDES permit will identify where sampling must take place and the pollutants that must be sampled, what type of sample must be taken and how often sampling must be conducted, the method of sample analysis, and how frequent the discharger must report everything to the permitting agency.¹⁸

3. State Administered NPDES Permit Programs

Under section 402(b) of the CWA, the EPA may authorize a State or Indian Tribe to administer the NPDES permit program in that state or tribal land.¹⁹ EPA grants states this authority after the state

¹⁴ 40 C.F.R. § 131.2. WQSs act as a limit on the actual level of pollutants in a specific body of water, and apply to any person discharging to that specific body of water. Total Maximum Daily Loads (TMDLs) represent the process and result of determining the maximum amount of a specific pollutant that a body of water can tolerate (a WQS), and then dividing up that amount amongst all dischargers to that body of water. Conversely, WQBELs are permit-specific water quality limits, whereby a NPDES permit holder cannot discharge a pollutant so as to cause an exceedance of a specific water quality standard in a specific body of water. Thus, WQSs apply to any person discharging to a specific body of water, whereas WQBELs only apply when they are included in an individual's permit. However, in practice there is not much difference between WQSs and WQBELs because agencies often incorporate WQSs and WQBELs into permits, and regardless, dischargers must be aware whether their effluent is contributing to changes in a specific river/lake/stream's water quality. Moreover, as discussed in section II *infra*, provisional variances grant relief from *any* permit requirement, or Illinois Pollution Control Board rule or regulation, and thus for purposes of understanding provisional variances, it is unimportant whether the relief is from a WQBEL or WQS.

¹⁵ *Id.*; 33 U.S.C. § 1313.

¹⁶ 33 U.S.C. § 1313(c)(2).

¹⁷ 40 C.F.R. § 122.44(d).

¹⁸ *Id.* §§ 122.44(i), 122.48.

¹⁹ 33 U.S.C. § 1342(b).

submits a complete description of its proposed NPDES permit program, which EPA must approve.²⁰ As minimum requirements, the state or tribal permit program must ensure compliance with various CWA provisions including: (1) adequate authority for the state or tribe to issue permits, (2) a guarantee that the public and affected parties receive notice for each permit application, (3) an opportunity for public comment and hearings on permit decisions, (4) a design that diminishes permit violations, and (5) an allotment for civil and criminal penalties for enforcement purposes.²¹ After a state has been granted permit-issuing authority, it becomes the primary permit issuer, but EPA keeps oversight authority over all state permit programs. In fact, EPA may withdraw approval of state NPDES programs for a variety of reasons, including the state's failure to comply with the CWA's public participation requirement, or repeated issuance of permits that fail to meet other CWA requirements.²² The CWA requires states to forward a copy of every permit application and notice of permit action to EPA.²³ However, EPA does not review all state-issued permits, instead opting to review only permits in specific categories that are outlined in the Memorandum of Agreement (MOA) between the state and EPA. If a proposed state permit is outside CWA guidelines and requirements, the EPA Administrator may object to a state-issued permit and prevent the permit from being issued within 90 days of receiving the proposed permit's notice.²⁴ In practice, 46 states including Illinois have received EPA approval to implement their own state run NPDES permit program with most states having some EPA-imposed limitation on their program. Idaho, New Mexico, New Hampshire, Massachusetts, and the District of Columbia have not received EPA approval for a state-run NPDES program.²⁵

a. Illinois NPDES Permit Program Provisional Variances: Procedure and Practice

Even though EPA regulations and the states impose effluent limits in NPDES permits, the permit issuing agencies recognize that permit compliance is not always possible despite a regulated entity's

²⁰ 40 C.F.R. § 123.21.

²¹ 33 U.S.C. § 1342(b)(1); 40 C.F.R. § 123.21

²² 40 C.F.R. § 123.62 .

²³ 33 U.S.C. § 1342 (b)(5), (d)(1) .

²⁴ *Id.* § 1342(d)(2).

²⁵ See *National Pollutant Discharge Elimination System (NPDES), State Program Status*, U.S. ENVTL. PROT. AGENCY, <http://cfpub.epa.gov/npdes/statestats.cfm> (last updated April 14, 2003).

strong efforts towards compliance. Thus, the CWA, EPA regulations, and state NPDES permits contain provisions for granting variances from permit limits.²⁶ The CWA and Illinois regulations allow applicants to request long-term variances before permits are issued so that relief from permit requirements will become a permanent part of their permit conditions, but absent from the federal level are provisional, or short term variances that grant relief but do not become part of the permit.²⁷ Provisional variances are usually requested in response to unanticipated environmental factors such as temperature and drought that make permit compliance difficult or impossible. The use of provisional variances to grant relief from WQSs appears to be unique to a few states, and as section I(B)(3), *infra*, discusses, Illinois has recently made extensive use of provisional variances to grant relief from thermal WQSs.

i. General NPDES Thermal Variances

The CWA established national standards of performance, which control the discharge of pollutants and are to reflect the greatest degree of effluent reduction that the EPA Administrator determines to be possible by applying the best available demonstrated control technology.²⁸ In the same section of the CWA, Congress also required EPA to develop categories of sources and also effluent limitations for these sources.²⁹ However, Congress specifically gave thermal dischargers the opportunity for thermal variances in § 316(a).³⁰ If the owner or operator of the discharge, after the opportunity for public hearing, can demonstrate to the relevant permitting authority that a thermal effluent limitation imposes a more stringent limit than is necessary “to assure the...propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made...[the permitting authority] may impose an effluent limitation...that will assure...protection and

²⁶ See 33 U.S.C. § 1311(g) (allowing variance from nonconventional pollutants including ammonia, chlorine, color, iron, and total phenol); 33 U.S.C. § 1311(n) (allowing variance for “fundamentally different facility” that is different from the other facilities for which EPA has designated effluent limitations); 33 U.S.C. § 1326(a) (allowing thermal variances to protect shellfish, fish, and wildlife); 40 C.F.R. § 122.21(m) (cataloging variances available to non publicly owned treatment works (non-POTW) facilities); 40 C.F.R. § 122.45(g) (allowing variances for facilities that intake water already containing pollutants).

²⁷ See 33 U.S.C. § 1311(g), (n) (federal variances); 415 ILL. COMP. STAT. ANN. 5/35 (West 2012) (state variances); ILL. ADM. CODE tit. 35, § 180.101 et seq. (2012) (procedure in Illinois for obtaining provisional variance from any permit term or condition).

²⁸ 33 U.S.C. § 1316(a)(1).

²⁹ 33 U.S.C. § 1316(b).

³⁰ 33 U.S.C. § 1326(a).

propagation of a balanced population of...wildlife[.]”³¹ EPA regulations implementing § 316(a) require the permittee to show that the otherwise applicable thermal effluent limit is more stringent than necessary to assure protection of the waterbody’s balanced indigenous population (BIP) of shellfish, fish and wildlife.³² And to support its proposed alternate thermal effluent limit, the permittee must demonstrate that the proposed limit will assure BIP protection and also that the permittee has considered the cumulative impact of the thermal discharge with other significant impacts.³³ This process requires public notice, and a description of the methodology, studies, and data documenting that the effluent limitations will not be detrimental to the local aquatic community.³⁴ If the holder of a 316(a) variance reapplies for the variance, the discharger must use studies based on its actual operation.³⁵

ii. Provisional Variances in Illinois: The Procedure

Under the Illinois Environmental Protection Act, a provisional variance by definition is designed to grant short-term relief from conditions that make permit compliance either impossible or an arbitrary or unreasonable hardship.³⁶ The Illinois Environmental Protection Agency (IEPA) shall grant a provisional variance when it finds that short-term compliance with any Illinois Pollution Control Board rule, requirement, or regulation, or with any permit requirement would impose an arbitrary or unreasonable hardship.³⁷

The Board promulgated the procedure for obtaining a provisional variance, and the application must include *inter alia*: (1) a statement identifying the permit requirement from which the variance is requested; (2) the quantity of emissions to be discharged; (3) an assessment of any adverse environmental impacts that the variance may produce; (4) a statement explaining why compliance with the permit imposes an arbitrary or unreasonable hardship; (5) a description of the proposed method to achieve

³¹ *Id.*

³² 40 C.F.R. § 125.72.

³³ 40 C.F.R. § 125.73(a).

³⁴ 40 C.F.R. §§ 124.10, 124.57 (public notice requirement); 125.72 (a), (b) (data requirement).

³⁵ 40 C.F.R. § 125.72(f).

³⁶ 415 ILL. COMP. STAT. ANN. 5/35(b) (West 2012) states in whole: “The [Illinois Environmental Protection] Agency *shall* grant provisional variances whenever it is found, upon presentation of adequate proof, that compliance on a short term basis with any rule or regulation, requirement or order of the Board, or with *any permit requirement*, would impose an arbitrary or unreasonable hardship.” (emphasis added).

³⁷ *Id.*

compliance; (6) a discussion of alternate methods of permit compliance and the factors influencing the provisional variance choice; and (7) a statement of the period, not to exceed 45 days, for which the variance is requested.³⁸ A provisional variance applicant submits its application to the IEPA for approval, and no applicant may be granted a provisional variance or extension that totals more than 90 days in one year.³⁹ When IEPA evaluates the provisional variance application, it will give consideration to whether the applicant (1) included a definite compliance program; (2) evaluated all reasonable alternatives for compliance; and (3) demonstrated that any adverse impacts will be minimal.⁴⁰ The IEPA has 30 days to grant or deny a provisional variance, and if it grants the request, the IEPA shall promptly give the Board a copy of its decision and shall give the public notice of its decision through a press release for distribution to newspapers.⁴¹

iii. Provisional Thermal Variances in Illinois: The Practice

Thermal water quality standards in NPDES permits have been the thorn in the side of thermoelectric power plants in Illinois. The summer 2012 heat wave and drought created one of the hottest, driest summers on record for the U.S. and especially Illinois. The author's research into provisional variance applications revealed that as a result of these high temperatures, thermoelectric power plants faced the constant threat of violating thermal effluent limits in their IEPA-issued NPDES permits. Board regulations and the permits themselves prohibit any NPDES permit holder from discharging contaminants in excess of the standards and limits in their permit.⁴² And because NPDES permit holders must monitor their effluent to ensure they are not violating their permit limits, permit holders are constantly aware of their effluent's proximity to violation.⁴³ Thus, droughts and heat waves pushed water temperatures up, and permit holders were watching as the margin between compliance and

³⁸ ILL. ADM. CODE tit. 35, § 180.202 (2012).

³⁹ ILL. ADM. CODE tit. 35, § 180.201(a) (2012).

⁴⁰ ILL. ADM. CODE tit. 35, § 180.301 (2012).

⁴¹ ILL. ADM. CODE tit. 35, §§ 180.302(a), (c) (2012). As discussed below, the Board and IEPA have almost never used more than five business days to make their decision to grant or deny a provisional variance request for relief from thermal WQSs.

⁴² ILL. ADM. CODE tit. 35, § 304.141 (2012).

⁴³ 40 C.F.R. § 122.41(i)(4). As previously mentioned, discharge monitoring reports (DMRs) are an enforcement tool for permit holders who violate their permit limits.

violation grew smaller. As a result, thermoelectric power plant NPDES permit holders resorted to obtaining provisional variances from thermal effluent limits to avoid knowingly violating their permit and the potential for stiff civil penalties.

It appears that IEPA has rarely if ever denied a request for a provisional variance from a NPDES thermal effluent standard for an electric generator, and most provisional variances for generators are granted within one to five days.⁴⁴ In 2012, the IEPA granted at least ten provisional variances from thermal effluent standards (not including provisional variance extensions), which was at least twice the number granted in 2011.⁴⁵ As previously mentioned, state regulations require applicants for a provisional variance must explain why compliance with the thermal effluent standard in their NPDES permits will be either unreasonable or arbitrary. Provisional variance applicants seeking relief from thermal WQSs reasoned that the unseasonably high summer ambient air temperatures, elevated intake water temperatures, low river flows and a lack of precipitation all combined to create an unreasonable or arbitrary burden, making compliance with thermal effluent limits in their permits difficult or impossible.⁴⁶

It is worth noting that IEPA typically grants generators NPDES permits that contain special conditions, such as less stringent adjusted thermal effluent standards (Adjusted Standard, or AS) that become relatively permanent, and excursions periods, which allow thermal WQSs to be exceeded for a specified period of time.⁴⁷ In other words, many electric generator NPDES permits *already have* relaxed

⁴⁴ See Clerk's Office Online (COOL) Search by Case, ILL. POLLUTION CONTROL BD., <http://www.ipcb.state.il.us/COOL/external/cases.aspx> (last visited Nov.10, 2012) [hereinafter IPCB COOL]. Citations to IPCB COOL refer to general trends and methods that applicants and IEPA use in applying for and granting, respectively, provisional variances from thermal standards. It appears that according to every reported IEPA provisional variance decision ever made relating to thermal effluent and posted to the Board's COOL website, IEPA *has never denied* an application for a provisional variance from a thermal effluent limit in a NPDES permit. It is unclear, however, whether IEPA forwards denials of provisional variances to the Board's website for publication. And, while current Board regulations give the IEPA up to 30 days to make its decision, IEPA typically takes 2-3 days at the most to reach a decision, sometimes making a decision on the same day the application is filed.

⁴⁵ *Id.* According to all provisional variances granted to thermoelectric power plants and reported on the Board's COOL website, IEPA apparently issued the following number of provisional variances from thermal limits in the last eight years: 2005 – 3; 2006 – 4; 2007 – 3, 2011 – 5; 2012 – 10. Additionally, variances during summer 2012 were often extended for days and weeks on end.

⁴⁶ *Id.*

⁴⁷ *Id.* Excursion periods typically limit WQS exceedances to 3-5 °F above the standard for 1% of the time in a twelve-month period, which is roughly 87.6 hours. Accordingly, exceedances above the 3-5 °F range and or for longer than 87.6 hours in a twelve-month period are a NPDES permit violation. However, IEPA typically grants

thermal standards, and generators have still needed to request variances to avoid violating their permits. Thus, it is important to realize that many electric generator NPDES permits have special conditions allowing for relaxed thermal standards and also for excursion periods to protect against summer heat spikes, but neither of these protections that are built in to the permit were adequate during heat waves and droughts to avoid violating thermal standards without the help of a provisional variance.

When generators apply for a PTV, it is typically summertime and they have used up all of their excursion hours, and may be months away from getting more. Moreover, the warm summer temps, droughts, and increased summer power demand blend to create an environment where generators may find it impossible to comply with permit limits at precisely the time of year when demand on the electric grid peaks. Typically generators must either shutdown, which is not an easy process for nuclear generating plants, or seek relief from their permits to avoid stiff civil penalties for knowing permit violations. Illinois generators, with modest exceptions where plants did not generate at full capacity, called “de-rating,” have chosen to request provisional variances, which allow them to continue to generate and sell power. During 2012 it appears that IEPA granted the most provisional variances on record.⁴⁸

Each provisional variance that is granted will likely result in millions of gallons of water being discharged into aquatic environments when these rivers and streams are already at temperatures above what a NPDES permit normally allows. And while federal and state agencies, citizens, and environmental activists may be concerned about the potential impacts that granting or denying provisional variances will have on the environment and the electric grid supply, in Illinois there is currently no opportunity for these groups to submit public comments or attend a public hearing before IEPA makes its decision.

provisional variances by giving applicants extra excursion hours, usually by doubling or tripling the excursion time from 1% (87.6 hours) to 2-3% (175.2-262.8 hours). If applicants exhaust their excursion limits, they usually apply for provisional variance extensions, which involve IEPA again adding to an applicant’s excursion hours.

⁴⁸ *Id.*

As previously mentioned, provisional variance applicants submit their applications to IEPA who reviews the application and makes a decision, typically in one to three days.⁴⁹ The analysis and reasoning in provisional variance applications and IEPA written decisions granting provisional variances is typically brief and cursory.⁵⁰ In evaluating the application, IEPA is required to give particular consideration to whether the applicant included a compliance program, evaluated all reasonable alternatives, and demonstrated that adverse impacts will be minimal.⁵¹ However, provisional variances are usually requested on an emergency basis, and relief, according to the applications, is needed almost immediately.⁵² Thus, most generators' compliance programs consist of promising to operate the plant, if at all possible, so that it will not violate its permit.⁵³ Further, when generators evaluate reasonable alternatives, the discussion focuses on either the installation of costly (upwards of \$45 million) cooling towers and other equipment, or shutting down the plant during times of high summer electricity demand. Finally, generators routinely state that all adverse impacts will be minimal, and usually back their assurance up by promising to monitor effluent areas for fish kills and adverse biological impacts. IEPA will in large part grant a generator seeking a provisional variance exactly what they ask for in their application, with the caveat that the applicant develop a response and recovery plan to address any adverse environmental impacts, and inform IEPA if any such impacts are noticed.⁵⁴

As was the case in the summer of 2012, many NPDES permit holders used up their allotted excursion hours sometimes by June and faced the prospect of needing a provisional variance in order to continue operating for the remaining summer months. According to their applications, some applicants requested provisional variances because their water intake temperature was already at or above their permit effluent limit, before the water entered their system to be heated further in generating electricity.

B. Provisional Variances and the Clean Water Act

⁴⁹ *Id.*

⁵⁰ *Id.*

⁵¹ ILL. ADM. CODE tit. 35, § 180.301(a) (2012).

⁵² IPCB COOL.

⁵³ *Id.*

⁵⁴ *Id.*

Provisional variances potentially violate the CWA. The US EPA is ultimately responsible for administering the CWA, and has the ability to review any NPDES permit before a state agency issues it. If a permitting agency wants to make changes to permit terms or conditions—such as WQSs—the US EPA has promulgated procedures and standards that the permitting agency must follow for the permit modification to take effect.⁵⁵ In a letter from US EPA Region 5 to IEPA, the US EPA made it clear that it believes that provisional variances violate the CWA because they are in effect modifications to permit terms and conditions that do not follow the proper procedure to obtain US EPA approval.⁵⁶

US EPA regulations require approval when a variance would result in a modification of a water quality or technology based standard in a NPDES permit.⁵⁷ US EPA has taken the position that “[v]ariations from water quality standards are themselves changes to water quality standards that must be submitted to EPA for review consistent with section 303(c)(2)(A) of the CWA.”⁵⁸ US EPA believes that provisional variances, perhaps due to IEPA’s extended use of them, constitute modifications to WQSs.⁵⁹ Thus, under US EPA regulations and the agency’s interpretation of those regulations, modifications to WQSs through variances are subject to US EPA approval and are open to public notice and comment; according to US EPA, because IEPA did not follow any of these procedures before issuing provisional variances, the variances violate the CWA.⁶⁰

Perhaps in response to US EPA’s position on IEPA’s use of provisional variances, the IEPA has proposed a rule to the Illinois Pollution Control Board to address procedures for issuing CWA § 316(a)

⁵⁵ See 40 C.F.R. §§ 122.62 (Modification or revocation and reissuance of permits), 122.63 (Minor modifications of permits), 124.5 (Modification, revocation and reissuance, or termination of permits), 124.10 (Public notice of permit actions and public comment period), and 124.11 (Public comments and requests for public hearings) (2012).

⁵⁶ See Letter from Tinka G. Hyde, Director, Water Division, US EPA, to Marcia T. Willhite, Chief, Bureau of Water, IEPA (Feb. 25, 2013) (on file with author) [hereinafter US EPA Letter]. “A change to a permit term or condition must be implemented in accordance with 40 C.F.R. § 122.62, § 122.63, and § 124.10 or more stringent state regulations.”

⁵⁷ See 40 C.F.R. §§ 122.62, 124.5.

⁵⁸ US EPA Letter at 1.

⁵⁹ See US EPA Letter at 1.

⁶⁰ See *Id.*; 40 C.F.R. §§ 123.25 (Requirements for permitting), 124.5 (Modification, revocation and reissuance, or termination of permits), 124.6 (Draft permits), 124.10 (Public notice of permit actions and public comment period), and 124.11 (Public comments and requests for public hearings).

thermal variances.⁶¹ However, IEPA's proposed rule does not facially address provisional variances, and instead outlines a procedure to obtain a thermal variance for the life of a permit, and potentially longer.⁶² It is unclear whether the proposed rule will remedy the potential conflict between what US EPA believes is the proper method for modifying WQSs and IEPA's use of provisional variances.

After US EPA's clear rebuke of IEPA's provisional variance practice, if IEPA continues to grant provisional variance relief without following the procedure for modification, US EPA may deny those generators' permits when they are up for renewal, or it may revoke IEPA's ability to administer the NPDES permit program in Illinois.⁶³ While a removal of NPDES permit authority is a harsh and virtually unprecedented remedy, the IEPA's proposed rule may remedy the conflict over whether provisional variances are illegal under the CWA. If the rule is adopted, IEPA may refuse to grant provisional variances and instead refer electric generators to its new § 316(a) variance procedure. A CWA § 316(a) variance is specifically approved in the CWA, and thus a US EPA challenge to IEPA's rule creating the procedure for implementing the § 316(a) variance program would be less likely to succeed than if US EPA challenged IEPA issuing provisional variances like usual.

As a result, the ball is in IEPA's court. The agency's proposed rule seems to be a step in the right direction. However, if temperatures rise this or any other summer, IEPA must determine as an agency whether it will abandon the use of provisional variances to address electric generators' non-compliance with thermal limits. Or, IEPA may decide that it disagrees with US EPA's interpretation of the CWA, and may instead just issue provisional variances like usual, setting up a potential challenge from US EPA, and possible blockage of NPDES permits or revocation of NPDES permitting authority in Illinois.

C. The Electricity-Water Nexus

⁶¹ See ILL. ADM. CODE tit. 35, § 106 Subpart K: Alternative Thermal Effluent Limitations Pursuant to Section 316(a) of the Clean Water Act and 35 Ill. Adm. Code 304.141(c) (IEPA proposed rule filed with Pollution Control Board; on file with author) [hereinafter IEPA Proposed Rule]; 33 U.S.C. § 1326(a) (outlining option for NPDES permit holder to pursue alternate thermal standard if applicable state/federal standard is proved to be too stringent for protection of balanced indigenous community).

⁶² IEPA Proposed Rule.

⁶³ 40 C.F.R. § 123.63.

Michael Faraday is credited as the first to discover electromagnetic induction, the process of using mechanical power to move a magnetic field past coils of wire to generate voltage.⁶⁴ Since Faraday's discovery, electromagnetic induction remains the primary method for generating electricity. Electricity generation, the process of generating electric energy from other forms of energy, is accomplished by using kinetic energy to move a magnet around a set of coils. Currently, heating water until it becomes steam is the source of kinetic energy used in electricity generation. Common heat sources used to create steam include nuclear fission and the combustion of fossil fuels including coal and natural gas. Thus, the entire process of electricity generation begins with removing large quantities of water from a source, heating this water until it becomes steam, then using this steam to rotate a magnet around a coil (a steam-driven turbine generator) to finally produce electric energy. This process illustrates the electricity-water nexus, which is the closely linked relationship that thermoelectric power plants create between large quantities of freshwater, electricity generation, and the residual heat that this process creates, which requires proper disposal.

Thermoelectric power plants in the United States consume a staggering quantity of water in order to generate electric energy from primary energy sources. According to the United States Geological Survey (USGS), in 2005 thermoelectric power plants consumed approximately 201,000 million gallons per day (or 201 billion gallons per day), while the nation as a whole consumed about 401,000 million gallons per day.⁶⁵ Thermoelectric water withdrawal was the single largest water withdrawal use and accounted for 49% of total U.S. water use, with irrigation (31%) and public supply (11%) a distant second and third.⁶⁶ In 2005, thermoelectric power plants' net power generation with self-supplied thermoelectric power water withdrawals was 3,190,000 gigawatt-hours.⁶⁷ Thus, on average thermoelectric plants

⁶⁴ *Electromagnetic Induction*, ALL ABOUT CIRCUITS, http://www.allaboutcircuits.com/vol_1/chpt_14/5.html (last accessed May 21, 2014).

⁶⁵ Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., *Estimated use of water in the United States in 2005*, U.S. GEOLOGICAL SURVEY CIRCULAR 1344, at *1 (2009).

⁶⁶ *Id.* at 5.

⁶⁷ *Id.* at 38.

required about 23 gallons of water to produce 1 kilowatt-hour of energy.⁶⁸ Illinois withdrew the largest volume of freshwater of all states at 12,300 million (12.3 billion) gallons per day.⁶⁹ The USGS data illustrates that thermoelectric plants across the country and in Illinois use an immense volume of water to generate electricity. It is equally important that all of this water is heated during generation, and as previously discussed in section I *supra*, under the CWA the heat added to water must be dealt with as an environmental pollutant.

The CWA places temperature limits on thermoelectric power plant effluent that is discharged into waters of the United States in order to prevent the deleterious effects this heated effluent may have on shellfish, fish, and wildlife.⁷⁰ To attempt to achieve compliance with thermal WQSs, thermoelectric power plants cool the large volumes of water they withdraw before discharging it back into natural bodies of water, typically using one of three primary water cooling systems: (1) once through or “open-loop” systems; (2) recirculation or “closed-loop” systems; and (3) dry cooling systems.⁷¹ Once through cooling, as its name implies, passes water through a condenser one time to absorb heat before discharging the water.⁷² In 2005 once through cooling systems processed approximately 92% of all water withdrawn for thermoelectric power plants; in Illinois once through systems processed almost 95% of all withdrawn water.⁷³ Once through or “open-loop” systems require large volumes of water, but do not consume much of this water because most is not lost through evaporative heat loss, but instead returned to surface water through discharges.⁷⁴ Consequently, open-loop systems do not significantly deplete surface water resources, but the water returned to natural surface water systems is not as cool as the water from closed-loop systems.

⁶⁸ *Id.* For reference, one kilowatt-hour is enough energy to power one 100-watt light bulb for ten hours, or enough energy to power a heater rated at 1000 watts for one hour. 1 kW·h = 1000 watt hours = 3.6 megajoules.

⁶⁹ *Id.* at 39.

⁷⁰ 33 U.S.C. § 1326.

⁷¹ Kenny et al., *supra*, at 38.

⁷² *Id.* at 38.

⁷³ *Id.* at 41.

⁷⁴ *Id.* at 38.

Perhaps in response to CWA thermal effluent limitations, thermoelectric plants began using recirculating or closed-loop cooling systems to recycle water, resulting in smaller water withdrawals, but also consuming more water in the process.⁷⁵ Closed-loop systems withdraw water, circulate it through heat exchangers, cool it in collection ponds or towers, and then recirculate it through the plant.⁷⁶ However, closed-loop water must usually be treated before discharge because it naturally accumulates salts and solids as a result of frequent water evaporation.⁷⁷ In 2005 closed-loop systems withdrew only 8% of all thermoelectric water withdrawals, and in Illinois closed-loop systems withdrew less than 5% of the state's withdrawals. Dry cooling, which is the least-relied on water cooling system, cools water through cooling towers that depend entirely on air, and works best in cold weather and arid environments.⁷⁸ The differences between the three systems are highlighted in their respective average water use rates: USGS-compiled data indicates that average water use rates for open-loop systems are 50-65 gallons/kWh, 1-2 gallons/kWh for closed-loop systems with cooling towers, and 14-24 gallons/kWh for closed-loops systems with collection ponds or canals.⁷⁹ Additionally, the same data indicates that consumptive use (net loss of withdrawn water) ranges from a tiny percentage of total withdrawals at open-loop plants, to roughly 70% of withdrawal at closed-loop plants with cooling towers.⁸⁰

The increased use of closed-loop cooling systems is potentially reflected in long-term trend data for total U.S. water withdrawals.⁸¹ Closed-loop cooling systems decrease a plant's water withdrawal requirements, and were perhaps the electric power generators' response to limited water resources and the advent of CWA thermal effluent limitations.⁸² USGS historical water use records shows an increase in thermoelectric power plant water withdrawals from 1950 until 1980, followed by a slight decrease then

⁷⁵ *Id.*

⁷⁶ US Estimated Use of Water at 41.

⁷⁷ Dr. Benjamin K. Sovacool, *Running on Empty: The Electricity-Water Nexus and the U.S. Electric Utility Sector*, 30 ENERGY L. J. 11, 17 (2009). Water is withdrawn when it is sucked up into a plant, whereas water is consumed when it is lost through evaporative heat loss or otherwise permanently removed from its natural surface body of water.

⁷⁸ *Id.*; See also US Estimated Use of Water at 43 (indicating dry cooling makes up less than 1% of US generating capacity).

⁷⁹ US Estimated Use of Water at 43.

⁸⁰ *Id.*

⁸¹ *Id.*

⁸² *Id.* at 42.

gradual uptick, with 2005 withdrawals still less than the 1980 peak.⁸³ Indeed, recent data indicates that roughly 43% of US electric generating capacity employs open-loop cooling, while 42% uses closed-loop recirculation with cooling towers, which may have been the driving force behind the decrease in withdrawals since 1980.⁸⁴ The ratio of total water withdrawals to produced energy has decreased from 63 gallons/kWh in 1950 to 23 gallons/kWh in the most recent 2005 data.⁸⁵

D. Environmental Impacts of Provisional Waivers For Thermal Water Quality Standards

Provisional variances from thermal WQSs potentially have short and long term implications for the aquatic environment where generators discharge. However, there is a lack of short and long-term data to form any strong conclusion as to the impacts—or lack thereof—from repeated violations of thermal WQSs. Specifically, the IEPA usually requires provisional variance recipients to monitor effluent temperature and do visual inspections for fish kills, but nothing in the way of detailed inspections or long-term studies. Thus, a discussion of the potential impact that elevated water temperatures may have is useful to frame the importance of the provisional variance issue.

a. Circumstances Leading to Electric Generators' Need for Provisional Variances

The USGS' National Water Quality Assessment (NAWQA) program was established to assess the status and trends of the Nation's water quality.⁸⁶ A primary NAWQA program goal is to study the effect of natural and human factors on surface water quality, including human factors such as land use, urbanization, and hydrologic modifications.⁸⁷ To accomplish its goals, the NAWQA program created regional study units that encompass watershed areas and represent a significant part of the nation's surface and ground water resources.⁸⁸ The Upper Illinois River Basin (UIRB) is a NAWQA program study unit that USGS, in collaboration with other state and federal agencies, has studied to assess the

⁸³ *Id.* at 43.

⁸⁴ US Estimated Use of Water at 42-43.

⁸⁵ *Id.* at 43.

⁸⁶ Terri L. Arnold, et al. *Environmental Setting of the Upper Illinois River Basin and Implications for Water Quality*. Water Resources Investigation Report 98-4268, at 56. U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY. 1999 [hereinafter UIRB Env. Setting].

⁸⁷ *Id.* at 50.

⁸⁸ *Id.*

UIRB's surface and ground water quality and biology.⁸⁹ The UIRB drains a 10,949 square mile area upstream from Ottawa, Illinois in northeastern Illinois, southeastern Wisconsin, and northwestern Indiana.⁹⁰ The UIRB study unit is useful for obtaining environmental and water quality information because it contains many of the same stretches of rivers that Illinois thermoelectric power plants discharge into, and by implication the bodies of water for which IEPA grants provisional variances.⁹¹

Illinois thermoelectric power plants consume and discharge large amounts of surface freshwater resources in a regional area subject to increasing population and urbanization and thus growing water demands, and in a climate subject to large temperature and precipitation fluctuations.⁹² Thermoelectric power generation is the single largest use of water in the UIRB.⁹³ While surface water is recharged through precipitation, the UIRB's climate is humid continental and thus subject to large daily oscillations in temperature and precipitation, meaning recharge is not guaranteed and instead can be weakened through high temperatures and droughts.⁹⁴ For the majority of June through September 2012, Illinois was experiencing severe to extreme drought.⁹⁵ Droughts result from persistent climate patterns and produce less precipitation than normal and may last for years.⁹⁶ Consequently, a variety of factors in the UIRB lead to either a decrease in surface water volume or an increase in surface water temperature or both, leading to a smaller and or warmer volume of surface water in local ecosystems for diluting heated effluent from power plants.

Thermoelectric power plants use large volumes of water to generate steam and cool power generating equipment, and the plants must discharge their heated effluent to avoid overheating. When

⁸⁹ *Id.*

⁹⁰ *Id.*

⁹¹ UIRB Env. Setting at 4; *see also NPDES Facilities in Illinois*, ILL. ENVTL. PROT. AGENCY, <http://www.epa.state.il.us/water/permits/waste-water/npdes-statewide.pdf> (accessed 9-28-12). The UIRB is comprised of seven river basins that are completely or partially within Illinois including the Upper Fox River, Lower Fox River, Chicago River, Des Plaines River, Kankakee River, Iroquois River, and Upper Illinois River.

⁹² UIRB Env. Setting at 26, 28 (population change), 50 (consumption of surface water), 56. Surface freshwater is referring to the entire width and depth of rivers and streams, as compared to groundwater, which is interstitial water found in soil. Surface water should not be interpreted to include only the water on the surface of a river or stream.

⁹³ *Id.* at 50.

⁹⁴ *Id.* at 56.

⁹⁵ Brian Fuchs, U.S. DROUGHT MONITOR, <http://droughtmonitor.unl.edu/> (accessed 9-28-12) [hereinafter Drought Monitor].

⁹⁶ UIRB Env. Setting at 38.

ambient air and water temperatures are not at summer time highs, and surface water is being replenished by precipitation, heated effluent from thermoelectric power plants is more easily discharged because receiving bodies of water are generally larger and cooler, and can thus better dilute the effluent. However, summer heat waves that increase water temperature in receiving bodies of water, in combination with droughts, aggravate a power plant's ability to discharge heated effluent because the heated effluent is discharged into a body of water that is smaller and warmer than usual. Warm surface waters and droughts, and the potential desire to satisfy peak summer power demands make it difficult for thermoelectric power plants to generate power and abide by thermal WQSs in their NPDES permits. Thus, many generators resorted to obtaining provisional variance relief from thermal WQS, with relatively unknown consequences on aquatic environments.

b. Environmental and Ecological Impacts of Provisional Variances

NPDES permits restrict the temperature of effluent that power plants may discharge into navigable waters, and the permits also restrict the temperature of the navigable waters themselves (WQSs), all out of concern for the effect that the heated discharge may have on local aquatic environments. Bodies of surface water that receive heated effluent must be able to dilute large volumes of hot water or risk raising their ambient temperature. Thermal ecology, which is the study of the structure and function of ecosystems influenced by temperature, has identified detrimental and beneficial effects that heated power plant effluent can have on ecosystems.⁹⁷ Elevated water temperatures can affect plant and animal species on the individual physiological level, as a species, and as an ecological community, and also acutely from short-term temperature spikes and chronically over long-term exposure.⁹⁸

i. Effects of Heated Discharges on Individual Members of a Species

⁹⁷ J. Whitfield Gibbons & Rebecca R. Sharitz, *Thermal Ecology: Environmental Teachings of a Nuclear Reactor Site*. BIOSCIENCE Vol. 31 No. 4 April 1981, 293-298 [hereinafter *Thermal Ecology*].

⁹⁸ *Id.* at 294-97.

Thermal alteration of natural environments can create measurable effects on the growth and size of individuals because temperature has a basic influence on metabolic processes.⁹⁹ Studies have shown an increase in growth and body condition for certain fish and turtle species, like largemouth bass living in heated environments.¹⁰⁰ Higher fish and turtle growth rates may be as a result of increased aquatic plant growth, also because of increased water temperatures, essentially creating a larger food base that other consumers can exploit.¹⁰¹ However on the negative side, if fish species experiencing a higher metabolic rate and growth rate are unable to seek shelter in deeper, cooler water, these fish may not take in enough food to keep pace with their metabolic rate, resulting in emaciated fish with low intracoelomic fat reserves that have a higher chance of showing external lesions and higher cortisol levels.¹⁰²

ii. Effects of Heated Discharges on a Species' Local Community

Thermally elevated aquatic environments may cause changes in the genetics, dispersion, and abundance of a species' local population, leading to community level responses.¹⁰³ Fish species incapable of adapting to warmer water will tend to migrate away from heated effluent discharge areas, whereas those species that can adapt may remain.¹⁰⁴ Over just a few years, fish species have shown genetic adaptations in response to warmer water temperatures through different allelic frequencies when compared to fish of the same species living in colder environments.¹⁰⁵ As thermal effluent's impacts on individuals and species mount, aquatic communities may be affected by altered species composition,

⁹⁹ *Id.* at 294-95.

¹⁰⁰ *Id.* at 295.

¹⁰¹ *Id.*

¹⁰² See MERRIAM WEBSTER ONLINE DICTIONARY, <http://www.merriam-webster.com/dictionary/coelom> (accessed 11-11-12). "Coelom: the usually epithelium-lined space between the body wall and the digestive tract of metazoans above the lower worms." Thus, "intracoelomic fat reserves" refers to the fat within or between the layers of the coelom; Thermal Ecology at 295.

¹⁰³ Thermal Ecology at 295-96.

¹⁰⁴ *Id.*

¹⁰⁵ *Id.* at 296. An allelic frequency change between two distinct fish populations in heated and non-heated environments, respectively, may indicate adaptation to the warmer environment through genetic selection and rapid-rate evolution. See also Wallace E. Holland et al. *Thermal Tolerances of Fish from a Reservoir Receiving Heated Effluent from a Nuclear Reactor*, PHYSIOLOGICAL ZOOLOGY, Vol. 47, No. 2 April 1974, at 110-118. [hereinafter Thermal Tolerances] (discussing warm-water fish species' ability to adapt to elevated aquatic temperatures by increasing temperature tolerance through genetic selection, but also warning that some local populations of fish face extinction if extreme reverse temperature shock is experienced, such as through addition of cold domestic sewage effluent).

abundance, and diversity.¹⁰⁶ Warmer water temperatures near effluent discharge areas in concert with other thermal reactor impacts like flooding and siltation have altered the species composition of aquatic macrophytes, trees, and animal groups, and have reduced animal species diversity in aquatic insects, fishes, waterfowl, ostracods (seed shrimp) and internal parasites.¹⁰⁷

Drastic spikes in water temperatures may alone kill large numbers of fish.¹⁰⁸ And increased surface water temperature may also lead to decreased dissolved oxygen levels and anoxic aquatic environments, altered pH, and toxic algal blooms, all of which may also kill many fish.¹⁰⁹

iii. Effect of Heated Discharges on Threatened and Endangered Species

The Illinois habitats of threatened and endangered species may overlap with thermoelectric power plant effluent discharge areas.¹¹⁰ The Braidwood, Dresden, and La Salle Nuclear Generating Stations are located in Will, Grundy, and La Salle counties,¹¹¹ respectively, and the Illinois Department of Natural Resources (IDNR) has listed various surface water species as threatened or endangered in the same counties.¹¹² Furthermore, some of the conditions possibly responsible for the extirpation or decimation of many fish populations in Illinois streams are found in the UIRB including desiccation through drought, industrial, domestic, and agricultural pollution, as well as increased water temperature.¹¹³ Under the

¹⁰⁶ *Id.*

¹⁰⁷ See MERRIAM WEBSTER ONLINE DICTIONARY (accessed 11-11-12). “Macrophyte: a member of the macroscopic plant life especially of a body of water.”; Thermal Ecology at 297.

¹⁰⁸ See Thermal Tolerances at 117.

¹⁰⁹ See JACOB KALFF, LIMNOLOGY (2d ed. 2001).

¹¹⁰ *Illinois Threatened and Endangered Species by County*, ILLINOIS DEPARTMENT OF NATURAL RESOURCES (January 2008), http://dnr.state.il.us/orc/list_tande_bycounty.pdf (last accessed May 21, 2014) (on file with author) [hereinafter IDNR T&E by County] (Illinois Department of Natural Resources listing of threatened and endangered species by county as of 2008); see also EXELON CORPORATION: ILLINOIS, <http://www.exeloncorp.com/community/locations/illinois.aspx> (last accessed 10-5-12) [hereinafter Exelon Nuclear] (listing address and county where all six Illinois nuclear power plants are located).

¹¹¹ Exelon Nuclear, *supra* note 110.

¹¹² See IDNR T&E by County, *supra* note 110, at 16-17, 28-29, 59-60: for Will County listing the Bald Eagle, River Redhorse (freshwater fish found in rivers and streams), Northern Harrier, Black-crowned Night-Heron, and Spotted Turtle as either threatened or endangered; for Grundy County listing the Blandings Turtle, Northern Harrier, Sandhill Crane, and River Redhorse as threatened or endangered; for La Salle County listing the Bald Eagle, Blandings Turtle, and River Redhorse as threatened or endangered.

¹¹³ UIRB Env. Setting, *supra* note 86, at 43, citing P.W. Smith, *Illinois streams—A classification based on their fishes and an analysis of factors responsible for the disappearance of native species*, 76 ILL. NAT. HIST. SURV. BIOLOGICAL NOTE 1 (1971).

federal Endangered Species Act¹¹⁴, the presence of federal threatened or endangered species or their habitat requires the Secretary of the Interior, in consultation with all other federal agencies, to collectively use their authority to carry out programs for the conservation of the threatened or endangered species.¹¹⁵ Agencies are required to ensure that any federal action will not jeopardize the species continued existence.¹¹⁶ Thus, if any species that IDNR has listed as threatened or endangered becomes federally listed, or if any current federally listed species is found in thermal effluent discharge areas, generators must do all that they can or face serious enforcement actions and potential penalties.¹¹⁷

In summation, variations in water temperatures may cause many negative effects on local aquatic environments, making it important to study provisional variances' potential for causing permanent alterations before these variances become a common tool used for NPDES permit compliance.

E. Potential Solutions to the Provisional Variance Issue in Illinois

Hot weather and droughts lead to conditions that create high demand for electricity yet also result in water temperatures that make it difficult if not impossible for electric generators to abide by thermal WQSs in their NPDES permits. The status quo for thermoelectric power generators in Illinois has been to request provisional variances from IEPA. Based on the author's research of provisional variance applications and agency decisions, generators have been largely successful in leveraging arguments in their favor to convince IEPA to grant them these variances. Generators contend that unseasonably high temps and droughts make their thermal effluent limits impossible to comply with, and that IEPA must grant them a variance or they will be forced to shut down and deprive electricity customers of crucial summertime power. IEPA makes its decisions to grant variances on a very quick, almost emergency basis, engaging in the same cursory environmental impacts analysis that the applicants do. When writing its decision to grant a variance, IEPA essentially parrots the applicant's words from its variance application. In its haste to grant a generator a variance, IEPA seems concerned with maintaining an

¹¹⁴ 16 U.S.C. § 1531 et seq. (2012).

¹¹⁵ 16 U.S.C. § 1536 (2012).

¹¹⁶ 16 U.S.C. § 1536(a)(2).

¹¹⁷ *Id.*; 16 U.S.C. § 1540 (2012).

adequate supply of electricity to the grid during peak summer demands, but in the process agency and citizen input along with environmental concerns appear to be swept aside.

A proper and balanced solution to this problem, to either shut down an electricity generating plant or keep the plant running at the expense of transparency, citizen involvement, and the environment, must be multi-faceted if it is to be successful. First, citizens and other agencies must be able to participate in the provisional variance process from the beginning to the end. Second, demand side management and electricity efficiency programs must be introduced immediately. Third, regional transmission organizations (RTOs) and independent system operators (ISOs) should be in consultation with IEPA during the variance decision-making process, and generators, IEPA, RTOs, and ISOs must work together to ensure a competitive wholesale electricity marketplace. Finally, the environmental impacts that heated effluent may have on aquatic environments must be studied in order to accurately assess any negative impacts, if any, they may have on these environments.

a. Transparent Citizen Involvement in the Provisional Variance Process

Currently, anyone interested in the process and outcome of a provisional variance proceeding may not even know about such a proceeding until after IEPA has made its decision. This is because the agency is not required to publish anything during a provisional variance proceeding until it decides to grant a provisional variance. And as previously mentioned, the entire process from application submittal to approval typically takes only a few days, or may even be completed in a single day. The timeframe and lack of transparency in a provisional variance proceeding forecloses any meaningful outside input and scientific analysis. Thus, IEPA should work together with generators and the public to develop conspicuous opportunities for public input and prolonged scientific study during the provisional variance application process.

Environmental regulation has a strong reputation of citizen involvement and input, yet concerned and interested citizens may not even have a chance to find out about provisional variances until after

IEPA grants them to generators.¹¹⁸ When each extra hour that IEPA allows a generator to exceed thermal WQs may mean that millions of gallons of super heated water will be discharged into potentially fragile aquatic ecosystems, it is imperative that scientists, other federal and state agencies with relevant information, and the public be able to learn of and participate in such a decision *before* it is made. Instead, IEPA makes these decisions without outside input, which may have profound environmental and social impacts depending on whether variances are granted or denied. The agency seems to solely rely on generator-supplied information when making its decision. IEPA does not appear to make site visits for provisional variance applications, and other agencies or citizens who may have meaningful information to share are denied the opportunity.

To foster the governmental transparency that environmental regulation is known for, IEPA and the Board, together with generators and the public should re-tool the provisional variance process through the Board's power of administrative rulemaking, making sure to include a public input element into the application process. Despite the fact that a provisional variance is designed to be a short-term remedy, it may have long-term impacts, and IEPA has granted an increasing number of provisional variances over the last few years. Thus, a provisional variance application should be made public through online publication immediately upon receipt by IEPA. Furthermore, the public should be able to submit written comments to the IEPA, and if necessary the public should be able to, upon proper showing of potentially serious environmental impacts, seek an emergency injunction to force a Board hearing on the provisional variance application. While this paper focuses on provisional variances from CWA NPDES thermal WQs, the Illinois provisional variance procedural requirements apply to all permits or Board rules, and thus public input into the provisional variance process may benefit the entire permit and rule process, whether for air, water, or land issues.

b. Demand Side Management and Efficiency Improvements

¹¹⁸ The Clean Water Act (CWA), Clean Air Act (CAA), National Environmental Policy Act (NEPA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and Endangered Species Act (ESA) all include some level of citizen comment and public hearing requirement regarding permitting, and many include the ability for citizens to initiate suit upon permit violation.

Demand for electricity is typically inelastic, meaning customers will purchase it no matter what its price because it is essential for life. When customers consume electric power during the summer's peak demand, even though they may not know it until they see their bill at the end of the month, they are using the year's most expensive power. Electricity costs the most when its demand soars during the summer months, and the uptick in demand and price may be leading generators to request provisional variances. However, if consumers simply use less power during peak summer demand and in general, either through behavior modification or efficiency upgrades or both, the burden on generators will be alleviated. This in turn will help to prevent the need for provisional variances.

If consumers are aware of the day-to-day, hour-to-hour cost of their electricity, it will allow them to decide if consuming electricity at its current price is beneficial to them. If electricity distributors provide customers with a current rate, the consumer can decide if running their air conditioner during the summer months on the hottest days is affordable and desirable. This is one form of demand side management (DSM), which is defined as the design and implementation of programs aimed at influencing customer electricity use in order to change the generator's pattern and magnitude of load.¹¹⁹ DSM includes encouraging customers to use off-peak service and to generally conserve electricity.¹²⁰ Working in tandem with DSM, increased efficiency measures focus on reducing the electricity consumed in activities that consumers carry on every day, such as running a refrigerator, and heating or cooling a home. Weatherization programs, the use of energy star appliances, and light bulb replacement programs are examples of increased efficiency measures.¹²¹ DSM and increased efficiency programs may lead to decreased electricity demand, which may lead to less of a need for generators to secure provisional variances.

Furthermore, both DSM and efficiency efforts can lead to decreases in reserve requirements, further lowering the demand for electricity generation. One megawatt hour (MWh) saved is more

¹¹⁹ Ass'n. of Bus. Advocating Tariff Equality v. Mich. Pub. Serv. Comm'n, 522 N.W.2d 140, 143 (Mich. Ct. App 1994).

¹²⁰ *Id.*

¹²¹ *See Sovacool, supra note 77, at 41.*

valuable than one MWh generated.¹²² If, for example, an Independent System Operator (*see* section C *infra*) sets a reserve criterion of 20% during peak demand, each 1.0 MWh of peak demand that customers avoid through energy efficiency and decreased demand means that utilities can subtract 1.20 MWh of total capacity needed from the required reserve criterion; the reserve criterion shrinks because it is a percentage of the total demand, which has shrunk due to DSM and efficiency measures.¹²³ Thus, a MWh saved through DSM and efficiency creates a drop in required reserve criterion and is less load, wear, and maintenance on a generator, and also less hot water that is discharged to the environment. And customers save money on top of it all, while being able to implement this strategy immediately.

c. RTO/ISO Roles and Consultation with IEPA

Currently, wholesale electric power is sold on a competitive market. Independent System Operators (ISOs) and Regional Transmission Operators (RTOs), which were designed and implemented to ensure grid reliability and open-access to transmission services, were intended to create competitive wholesale electricity markets. Electricity distributors can now purchase wholesale electric power through open access exchanges, and can compare the price and availability of electricity from generators across entire regions. If one generator's supply is not available, or becomes too expensive for the market to support, wholesale electricity purchasers can purchase power from other generators. Thus, generators may not be totally justified in asserting that IEPA must grant them a provisional variance in order to avoid power outages and interruptions to the grid during peak demand. Furthermore, IEPA is not equipped, legally and otherwise, to be making any determination about adequate power supply to the grid, because RTOs and ISOs instead must make this determination. Finally, by granting variances out of fear over interrupted or decreased power supply, IEPA is giving thermoelectric power generators a potentially unfair advantage in the wholesale electricity market over renewable and other power generators that do not require thermal discharge permits to generate electricity.

¹²² *Id.* at 40.

¹²³ *Id.*

While ISOs and RTOs deserve further independent study to fully grasp their functions and impact on the wholesale electricity marketplace, their essential elements can be distilled for a useful discussion of the provisional variance issue.¹²⁴ In an effort to increase competition, transparency, and grid reliability, and also decrease consumer rates, the Federal Energy Regulatory Commission (FERC) issued Order Number 888.¹²⁵ Order 888, as its title implied, essentially forced utilities that owned transmission lines to provide open-access to their transmission services, in order to allow a competitive market to form.¹²⁶ Historically, vertically integrated utilities were companies that owned generation, transmission, and distribution equipment, and operated under a grant of monopoly from state and federal governments in exchange for rate regulation. Compare this with the current market structure, where a generator is separate from transmission and distribution, and instead must sell their generated capacity on a wholesale electricity market, and must have access to transmission services to deliver power to its purchaser. The ISOs and RTOs are non-profit government-created entities that FERC approves, and they are designed to ensure open-access to transmission services. RTOs and ISOs thereby allow every generator in a region to offer their generated capacity for sale on the wholesale market, and then provide for that capacity to be sent to its purchaser, and eventually end-user. RTOs and ISOs constantly monitor and coordinate grid supply, demand, and transmission. It is thus the ISO and RTO's responsibility, *not* IEPA's, to ensure there is adequate supply to meet market demand and avoid shortages during peak summertime demand.¹²⁷

IEPA is neither technically nor legally equipped to determine whether wholesale electricity supply is adequate to meet current grid demand. Instead, this is the RTO and ISO's job; In Illinois the PJM ISO serves northern Illinois, and the Midwest ISO (MISO) serves the rest of the state.¹²⁸ Furthermore, generators who apply for provisional variances cannot make the argument that Illinois, or

¹²⁴ See FRED BOSSELMAN et al. *ECONOMICS AND THE ENVIRONMENT*, 609-721 (3d ed. 2010).

¹²⁵ 75 F.E.R.C. ¶ 61,080 (1996), 18 C.F.R. §§ 35 and 385 (2012), Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities.

¹²⁶ *Id.*

¹²⁷ While technically different in their scope, RTOs and ISOs perform essentially the same function. References to ISOs are to both ISOs and RTOs unless otherwise mentioned.

¹²⁸ See REGIONAL TRANSMISSION ORGANIZATIONS (RTO)/INDEPENDENT SYSTEM OPERATORS (ISO) <http://www.ferc.gov/industries/electric/indus-act/rto.asp> (last updated May 6, 2013).

anywhere else for that matter needs the generator's supply of electricity to 'keep the lights on.'¹²⁹ Instead, if a generator is unable to generate power for whatever reason, the wholesale electricity marketplace allows purchasers to buy power from other wholesalers, and the ISO will ensure a reliable open-access transmission service. For example, if a coal plant in Illinois is about to exceed its thermal WQSs and must shut down or cease generating at maximum capacity, wholesale electricity purchasers will be able to purchase power from other generators on the market, such as a natural gas plant in Ohio, or eventually a wind farm in Lake Michigan, which does not need a NPDES discharge permit in order to generate power.

When IEPA grants a generator a provisional variance because it is concerned about adequate electricity supply, it is essentially placing its finger on the scale and tipping it towards a particular generator, removing an element of competition from the supposed competitive wholesale electricity market. Not only does this distort what is supposed to be a competitive wholesale market by giving variance applicants an unfair advantage, it also disadvantages other generators who do not seek or do not need variances such as nuclear plants with closed loop cooling systems or renewable energy generators.

By the logic of a coal or nuclear generator seeking a provisional variance, a renewable energy generator should be able to argue that it too should be granted a variance from obtaining a required Endangered Species Act (ESA) incidental take permit so that it can ensure adequate electricity supply to the grid during peak demand.¹³⁰ For example, a current hurdle for off-shore Lake Michigan wind development is the requirement to obtain an incidental take permit from U.S. Fish & Wildlife service because of the potential for off-shore wind turbines to kill endangered species of birds. If IEPA is willing to grant thermoelectric generators a variance because it is concerned about supply to the grid, then logically wind energy companies should also be granted a waiver from seeking ESA incidental take permits, also out of concern for grid supply. However, instead of allowing various generators to distort

¹²⁹ However, nuclear plants are considered "base-load" plants that continually operate at or near maximum capacity. These plants typically provide around 20% of the US' supply of electricity.

¹³⁰ 16 U.S.C. § 1539(a)(1)(B) (2012): Incidental take permits essentially allow the permittee to continue their operation despite the fact that threatened or endangered species or their habitat may be incidentally killed or damaged in the process. Incidental take permits typically require the permittee to construct or provide for the species' habitat in other areas away from the permittee's area of operation.

the competitive market through government-issued variances and waivers, a better solution that protects competition would require IEPA to deny provisional variances over grid concerns, and instead allow the competitive marketplace to accurately account for a thermoelectric generator's actual operating cost. And if adequate electricity supply becomes an issue in a particular region, either the PJM ISO or MISO should make the appropriate consultation with IEPA, instead of IEPA making this determination on its own absent any grid alerts from the ISO.

Only by consultation with the entities responsible for maintaining grid supply and reliability can IEPA accurately determine whether its decision to grant or deny a provisional variance will actually impact grid supply. If an ISO determines that wholesale supply is declining because a plant is offline for maintenance or because demand is peaking, it should be able to communicate this to IEPA when IEPA faces the decision to grant or deny a provisional variance. Then IEPA will be able to make an informed decision about whether to issue a variance, and concerned citizens can also offer their input under the new citizen participation element of the provisional variance process. Consumers would also be made aware that their consumption could soon have environmental impacts if they do not reduce demand. Grid supply and demand change on an hour-to-hour and minute-to-minute basis, and ISOs are constantly aware of the grid supply and demand, and any transmission related issues that may further exacerbate supply issues. Thus, during peak demand in the summer, ISOs should be in constant contact with IEPA's NPDES permit department, apprising them of grid supply, demand, and transmission issues so that IEPA may make an informed decision whether to grant or deny a provisional variance.¹³¹

Further, PJM ISO, MISO, thermoelectric generators, FERC, and IEPA should work together to develop an effective method to finance cooling towers and other water cooling technology that will allow thermoelectric generators to upgrade their cooling systems and not go bankrupt in the process. Currently, thermoelectric generators are allowed to distort the competitive market by receiving variances from thermal WQSs for up to 90 days a year, and IEPA, as of the date of this publication, appears to have never

¹³¹ Additionally, IEPA should attempt to use a fairness mechanism, where if the agency grants or denies any form of variance to one generator, it gives other generators equal treatment in an effort to preserve market competition.

denied a provisional variance application. Thus, thermoelectric power generators have no incentive to invest in cooling towers and other upgraded cooling systems such as closed loop recirculating systems.

Instead of constantly giving these generators a pass from their permit requirements, the aforementioned agencies should work together to create a tariff or tax that will pay for cooling technologies in exchange for benefits to the consumers. Nuclear generating plants are known as “base load” plants, meaning they are typically the plants that run continuously because they are reliable and difficult to de-rate quickly. As a result, these plants use tremendous amounts of water, but also provide a reliable portion, up to 20%, of American generation capacity. Thus, nuclear generators should be able to charge market rates for their wholesale power, in exchange for an across the board tax that is imposed on all wholesale market participants that finances cooling tower equipment for these plants, which may cost in the tens of millions of dollars for a single plant. Under this scenario, nuclear plants get to continue operating while they work on lessening their heated effluent discharges through market-financed cooling measures, while the consumers receive the benefit of reliable, almost always-available power. Market participants receive the benefit of stable market prices for nuclear generators, allowing other market participants to attempt to lower their prices to outcompete nuclear plants.

Conversely, if these agencies are unable to develop a fund or tax that will finance cooling towers and closed loop systems, then it may be time to let the market decide whether it prefers more expensive (and reliable) thermoelectric power or renewable energy. If IEPA refuses to grant provisional variances when temperatures rise and droughts are present, this will force thermoelectric generators to either ramp down, shut down, or face the issue of how to actually comply with WQSs in their permits. If a nuclear generator chose to install improved cooling equipment, the investment will likely raise their cost of generation, but this may not matter. Nuclear plants are almost always generating at full capacity, meaning even if their power is more expensive, it is always available which is not always true of coal and natural gas plants. If nuclear generators make the investment in cooling technology now, they will protect against the need to obtain provisional variances in the future. And nuclear generators will be showing

other generators that the market may support wholesale electricity that includes the cost of environment compliance.

IEPA has its finger on the pulse of the wholesale electric market in the Illinois region. However, if the agency receives the information it needs to determine grid supply and demand, and also recognizes its ability to affect wholesale market rates through granting or denying provisional variances, it must use this knowledge to reach a balance between protecting the environment and doing its part to ‘keep the lights on.’ While renewable energy may receive other subsidies that thermoelectric power generators do not, IEPA should take a step in the right direction by refusing to grant unfair advantages to thermoelectric power generators. Let the market determine whether renewable resources or more expensive thermoelectric power will be the energy supply of the future. It is likely that both will play a role, but the extent of each remains to be determined, through market functions and agency decisions.

d. Chronic Environmental Impacts Analysis

Unless the chronic impact that thermal discharges may have on aquatic ecosystems is qualified and quantified, the lack of baseline and trend analysis will make assessing provisional variance environmental impacts difficult. This may allow thermoelectric generators to continually argue that their thermal discharges are not contributing to adverse environmental impacts in the short and long term, regardless of whether there is evidence to support such a claim. Unless scientific study is begun immediately, there will be no voice to agree or disagree with the provisional variance applicants when they claim that discharges are not negatively affecting aquatic environments.

In order to get the ball rolling, IEPA and the Board can add a ‘research fee’ to NPDES permits whenever IEPA grants a special permit condition for thermal effluent discharges. The research fee would be used to create a thermal impact research branch, which could be part of IEPA’s water permit division. The thermal research branch should study both chronic and acute environmental impacts in the aquatic environments where thermoelectric generators discharge. As previously mentioned, there are already significant research efforts underway at other nuclear power plants that are studying the long-term impacts of thermal discharges on specific species. With the new thermal research branch in place, if a

generator needs a provisional variance, it will craft its application in consultation with and approval from the thermal research branch, removing any need for IEPA to solely rely on generator supplied data or cursory analysis. IEPA's water permits division would then be able to rely on its own group of experts to determine whether water temps are peaking, what the long-term weather forecast will be, and whether aquatic environments are tolerating the increased water temperatures and or low surface flows over short and long-term time periods, in addition to consultation with ISOs.

CONCLUSION

The need for provisional variances will almost assuredly continue due to increasing climate and drought trends, and the potential impacts of global climate change. Thus, it is time that IEPA recognize that the provisional variance has been stretched beyond its useful short-term life, and instead is being used to remedy a much larger issue than short term non-compliance with thermal effluent limits. IEPA must involve the public in the provisional variance process, consumers must conserve power, and IEPA must consult with ISOs when deciding to grant or deny a provisional variance. But even more important, IEPA must work with other players to develop a long-term solution to the thermal effluent problem. If it does not, fragile aquatic ecosystems may be irreversibly damaged when Illinois rivers and streams are forced to swallow millions of gallons of hot water. And if no scientist documents and studies these rivers near effluent discharge areas, there will be no evidence of the presence or absence of environmental harm.