

Analysis of the Numeric Water Quality Criteria Adopted by the Ten States That Border Directly on the Mississippi River

Illinois

November 2009



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That Border Directly on the
Mississippi River**

**ILLINOIS
Overview**

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The findings presented in this document are based only on what was found in final state WQS regulations as of May 1, 2009. Hence, though the existence of proposed changes to state water quality standards may be acknowledged, typically in footnotes, the contents of such potential modifications are not reflected in the various analyses contained in the report. Likewise, associated guidance documents, policy memoranda, and other state publications related to the state's WQS are not reflected in this report. As such, one limitation of this report is that it does not fully describe a given state's water quality standards program or how WQS are applied in other water quality programs.

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List of Acronyms

AWS	Agricultural Water Supply
BATEA (or BAT)	Best Available Treatment Economically Achievable
BOD	Biochemical Oxygen Demand
CAFO	Concentrated Animal Feeding Operation
CALM	Consolidated Assessment and Listing Methodology
CSO	Combined Sewer Overflows
CWA	Clean Water Act
DDT	Dichloro-diphenyl-trichloroethane
DO	Dissolved Oxygen
DU	Designated Use
DW	Drinking Water Standards
DWS	Drinking Water Supply
FC	Fish Consumption
GLI	Great Lakes Initiative
HHO	Human Health Organism
HHWO	Human Health: Water and Organism
IWS	Industrial Water Supply
LA	Load Allocation
MCL	Maximum Contaminant Level
MS4	Separate Sewage System
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
PAH	Polycyclic Aromatic Hydrocarbons
PBT	Persistent, Bioaccumulative and Toxic (EPA Program)
PCB	Polychlorinated biphenyl
PWS	Public Water System
SDWA	Safe Drinking Water Act
SRF	State Revolving Fund
SSM	Single Sample Maximum
STP	Sewage Treatment Plant
TBA	Technology-Based Approach
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TSS	Total Suspended Solids
WLA	Wasteload Allocation
WQ	Water Quality
WQBA	Water Quality Based Approach
WQBEL	Water Quality Based Effluent Limits
WQC	Water Quality Criteria
WQS	Water Quality Standards

A. Introduction

This document is one of a number of state-specific reports resulting from an Environmental Law Institute (ELI) analysis of the numeric water quality criteria (WQC)¹ component of the water quality standards (WQS) of the ten states that border directly on the main stem of the Mississippi River. In this report ELI compares the state numeric water quality criteria to recommended criteria and related standards² issued by the US Environmental Protection Agency. The findings presented in the documents produced for this report are based on the most recent version of the state's WQS regulations as of May 1, 2009. Hence, only water quality criteria contained in proposed or final state regulations were examined. Associated guidance documents, policy memoranda and other state publications related to the state's WQS are not reflected in this report. As such, one limitation of this report is that it does not fully describe a given state's water quality standards program or how standards are applied in other water quality programs.

This work was funded by a grant from the Mississippi River Water Quality Collaborative, a group of state, regional and national non-profit organizations working together to improve water quality in the Mississippi River basin.

B. Summary of Findings

The water quality criteria contained in Illinois' water quality standards (WQS) regulations³ present a mixed picture when compared to the criteria published⁴ by EPA, in terms of: 1) pollutant/use combinations⁵ covered, 2) the degree to which all key elements of criteria are clearly articulated, 3) criterion-concentrations, and 4) the level of protection likely afforded to applicable designated uses.

¹ The terms "water quality criteria," "WQC," and "criteria" are used interchangeably in this report. Water quality criteria are closely associated with "designated uses" – another key element of water quality standards (WQS) established under state law and the federal Clean Water Act. Criteria describe waterbody conditions, primarily pollutant levels, associated with full support of one or more of the designated uses (e.g., aquatic life, fish consumption, water contact recreation, drinking water supply) assigned to specific waters by a state's water quality standards regulations.

² The "recommended EPA criteria" referred to in this report are water quality criteria (WQC) issued as guidance to states, territories, and authorized tribes by the EPA under authority of the federal Clean Water Act. The "related EPA standards" are federal regulatory requirements applicable to finished (post treatment) drinking water that is delivered to homes and businesses by a public drinking water system. These standards are established by EPA under authority of the Safe Drinking Water Act (SDWA).

³ 35 Illinois Administrative Code, Part 302.100 to 302.410 and Part 302.601 to 302.669.

⁴ Throughout this report, the criteria recommended by EPA will be referred to as the EPA's "issued" or "published" criteria, interchangeably.

⁵ As used in this report, "pollutant/use combination" or "pollutant/use pair" refers to designated use and a particular pollutant or other water quality parameter. Often states have just one WQC for a given pollutant and use; however, in the case of aquatic life criteria, more than one WQC per pollutant/use combination is common. This is usually due to: 1) having both acute and chronic criteria; 2) breaking aquatic life down into a number of sub-categories (e.g., cold and warm water habitat); 3) establishment of different criteria for different ecoregions within the state; and/or 4) setting waterbody-specific WQC.

Illinois has adopted numeric WQC for a relatively small portion of the traditional⁶ pollutants for which EPA has issued aquatic life WQC. Significant is the absence of any numeric criteria for the nutrient nitrogen, and the related indicator chlorophyll a. (There is a criterion for total phosphorous that applies only to lakes and reservoirs with a surface area of twenty acres or more.) Also missing⁷ are criteria for sediment/sedimentation. On the other hand, Illinois has extra⁸ aquatic life criteria for the traditional pollutants/parameters total dissolved solids, oil and grease, temperature and dissolved oxygen.

The state has Public and Food Processing Water Supply for about half of the eight several traditional parameters for which EPA has established somewhat related⁹ standards under authority of the Safe Drinking Water Act. To protect waters designated for “public and food processing” use, the state has adopted acute WQC for 25 toxic pollutants, in contrast to the 83 chronic drinking water standards that EPA has issued under the Safe Drinking Water Act (SDWA). EPA also has issued WQC applicable to combined drinking water supply and fish consumption uses for a large number of toxic substances. At most, Illinois seems to have adopted WQC for these 2 uses in combination for only a couple of pollutants.

The state has not adopted water quality criteria (WQC) for a number of toxic¹⁰ pollutants for which EPA has published recommended criteria to protect aquatic organisms.¹¹ Among the pollutants missing aquatic life criteria are numerous pesticides and several that fall into categories that are frequently mentioned as possible endocrine disruptors.

Illinois also lacks human health-related WQC for a substantial fraction of the toxic pollutants for which EPA has issued criteria to address risks from: consumption of fish (and shellfish) tissue alone and consumption of water and fish tissue combined.¹² Among the pollutants

⁶ For purposes of this ELI report, “traditional pollutant/parameter” refers to a number of pollutants and water quality parameters that were recognized as significant contributors to and indicators of degradation of the condition of surface water well before passage of the Clean Water Act in 1972. As used in this study, “traditional pollutant” includes those pollutants/parameters referred to as “conventional” in the CWA and EPA regulations and guidance, which includes: biochemical oxygen demand (BOD), dissolved oxygen (DO), pH, total suspended solids (TSS), bacteria and other pathogens, and temperature. Also considered “traditional” in this document are several other non-toxic pollutants and parameters including alkalinity, chloride, chlorophyll a, color, dissolved solids, hydrogen sulfide, (total) nitrogen, oil and grease, total phosphorus, and turbidity, which are sometimes called “non-conventional” or “non-priority” in the EPA literature. Also, one “non-priority” toxic chemical, ammonia, is discussed under the heading “traditional pollutants/parameters.”

⁷ For the purposes of this review, “missing” criteria are those pollutant/use combinations for which the state has not officially adopted WQC, whereas EPA has published recommended WQC of the type specified.

⁸ For the purposes of this review, “extra” criteria are those pollutant/ use combinations for which the state has officially adopted criteria, but EPA has not issued corresponding criteria.

⁹ The term “somewhat corresponding” has been used because water quality criteria and drinking water standards apply to different endpoints. WQC apply to surface waters within the jurisdiction of the Clean Water Act. Some of these waters are, or might be, used as a source of “raw” water by public and private drinking water systems. When a waterbody in Illinois is designated “Public and Food Processing Water Supply,” then a certain set of WQC apply, per the CWA. There also is another set of standards that apply to the “finished” water that results from “raw” water being run through treatment processes aimed at removing contaminants.

¹⁰ In this report, “toxic pollutant” includes not only EPA’s “priority toxic pollutants” but also all those toxics called – for CWA purposes – “non-priority pollutant”; as well as all toxic chemicals falling into neither of these two EPA classifications. (The one exception is ammonia—see footnote 4 above).

¹¹ The state has published “derived criteria” applicable to aquatic life uses for 193 synthetic organic chemicals, as well as “derived” human health criteria for 75 such toxic chemicals. These have not been included in the counts of WQC in this report because they have been issued as guidance, but not made part of the state’s water quality standards regulations. Unlike formally-adopted water quality criteria included in a state’s WQS regulations, use of such guidance-only values in key CWA programs such as Section 303(d) listing, development of TMDLs, and writing of NPDES permits is not mandatory. Further discussion of these “derived criteria” can be found at the end of Section D.5 of this report.

¹² Id. at 10

without such human health criteria are a number of carcinogens, potential endocrine disruptors, and highly bioaccumulative substances.

Illinois has adopted “general use” criteria for a number of toxic pollutants – criteria that apply to several uses, among which are agricultural and industrial water supply. EPA has not issued any criteria for toxic chemicals related to these two uses.

Most of Illinois’ aquatic life criteria for traditional pollutants have criterion-concentrations¹³ that are identical, or very close to, those published by EPA, and within the same range as similar WQC adopted by the other nine states covered by this Environmental Law Institute study. One exception is the acute aquatic life criterion for temperature for Secondary Contact and Indigenous Use,¹⁴ which is considerably higher than any of the maximum temperature criteria adopted by any of the other states covered in this review.

Most of the state’s five Public and Food Processing Water Supply criteria for traditionals have pollutant concentrations identical to the concentration of the pollutant for EPA has issued Secondary Drinking Water Standards. The state’s fecal coliform bacteria criterion-concentration for this use (2000/100ml) is significantly higher than EPA’s Primary Drinking Water Standard for total coliform bacteria—level of analytic detection. For a variety of reasons, addressed later in this report, this large difference does not necessarily mean that the state’s criterion is less protective than EPA’s standard.

The concentration components of Illinois’ two fecal coliform WQC applicable to Primary Contact Recreation are identical to those of EPA’s.

Where they have been adopted, most of Illinois’ acute and chronic aquatic life criteria for toxics have criterion-concentrations that are either equal to or higher than the criterion-concentrations in the corresponding EPA values. There are also a few toxic pollutants with acute and/or chronic aquatic life criteria for which the criterion-concentrations are lower than EPA’s.

The criterion-duration¹⁵ is clearly specified in some of the state’s criteria for traditional pollutants but not for others. The majority of the state’s chronic aquatic life WQC for traditionals have fairly clear criterion-durations, while most of its acute criteria for this use do not. For instance, one of two acute aquatic life criteria for ammonia has a clearly-stated duration, while both of the chronic criteria have a minor ambiguity. Other parameters with at least one criterion that is not entirely clear are temperature and dissolved oxygen.

As with traditional pollutants, the articulation of the criterion-durations in state’s WQC for toxic chemicals is very clear in some instances, but not in others. The acute aquatic life criteria for toxics appears to be have a duration of an instant, while the criterion-duration for chronic aquatic life criteria is virtually open ended, ranging from 4 days to infinity. The Public Water Supply and

¹³ According to EPA guidance, numeric WQC consist of 3 components: 1) a criterion-magnitude, 2) a criterion-duration, and 3) a criterion-frequency. The first of these, criterion-magnitude, is usually expressed as a concentration; hence, the frequent use of “criterion-concentration” in this report. For some key water quality parameters, such as temperature and pH, quantity is not expressed as a concentration, so EPA employs the broader term “criterion-magnitude.”

¹⁴ Currently, only a handful of waters in the Chicago area are classified “Secondary Contact and Indigenous Aquatic Life”; nevertheless, there is nothing in the state’s WQS regulations stipulating that no other waters could ever be placed in this category.

¹⁵ According terminology employed in some EPA guidance, the criterion-duration component of a numeric WQC specifies the length of an “excursion” – the specified time period over which waterbody concentration of a pollutant is higher (or in the case of dissolved oxygen, lower) than the criterion-magnitude. For instance, EPA’s chronic aquatic life WQC for toxic chemicals have a criterion-duration of 4 days, which results in their being expressed as four-day average concentrations. The occurrence of one or more excursion (e.g., a four-day period in which the in-stream concentration of cyanide was higher than the criterion-concentration of 5.2 µg/L) would not necessarily represent failure to meet WQC. Only when the rate at which excursions occur is higher than that specified by the criterion-frequency has an actual exceedence of a water quality criterion occurred.

human health criteria are worded in such a way that, for the purposes of this study, a default duration of just an instant is employed. Likewise an instantaneous duration has been assumed for a set of “general use” criteria for toxics that applies to all waters, regardless of the assigned designated uses.

As for criterion-frequencies, Illinois’ criteria for traditional pollutants lack any specification of a criterion-frequency,¹⁶ with the exception of certain criteria for fecal coliform bacteria and temperature. None of the WQC for toxics addresses criterion-frequency, which implies a frequency of zero.

As for the level of protection provided by a state WQC for a given pollutant/use combination in comparison to that of EPA (or another state), this cannot be done with any degree of confidence unless all three elements of both WQC are clearly articulated. And, even when the criterion-concentration, criterion-magnitude, and criterion-frequency of each of the two WQC being compared are precisely stated, their comparative degree of protectivity can only be determined, simply by looking at the two WQC and nothing else, with certain combinations of relative criterion-concentration, concentration-duration, and combination-frequency. For instance, if a state and a comparable EPA criterion (same pollutant and same designated use) both have the same criterion-concentration, same criterion-duration, and the same criterion-frequency, they would provide equal levels of protection. If, however, the criterion-concentration of one of the two WQC were lower than the other, and the criterion-duration and criterion-frequency remained identical, then that WQC would provide the higher degree of protection. Likewise, if the criterion-concentrations are the same, the criterion-durations are identical, but one of the WQC has a lower acceptable criterion-frequency, then that criterion with the lower frequency would provide more protection. Also providing a higher level of protection would be a WQC with a shorter criterion-duration than a comparable WQC that had the same criterion-concentration and criterion-frequency. (Appendix C provides a set of tables that list all possible combinations, in relative terms, of criterion-concentrations, criterion-durations, and criterion-frequencies, indicating which represent higher, lower, and identical levels of protection.)

Unfortunately, the relevance of the tables in Appendix C to Illinois’ WQC is significantly limited by the fact that, though a majority of the state’s criteria have a specified criterion-duration, the state’s WQS regulations make no mention of a criterion-frequency for any of its water quality criteria. Further complicating comparison of the level of protection afforded to applicable designated uses by a state WQC is the fact that most of EPA’s criteria for traditional pollutants lack a clearly-articulated criterion-duration and criterion-frequency.

The absence of explicit criterion-duration and or criterion-frequency in one or both of two corresponding (same pollutant/use combination) criteria, renders a determination of the absolute or relative level of protection provided by one WQC versus another an exercise fraught with uncertainty. Any such effort would, of necessity, involve making assumptions that may or may not turn out to be consistent with the duration and/or frequency intended, or eventually settled upon, by the entities that established each of the criteria. In turn, the results of attempts to compare the protection provided by a state vs. an EPA WQC would be greatly affected by whatever assumptions were made. Assumption of some short-term duration (e.g., one hour), rather than a longer term (e.g., 30 days), would tend to make a criterion more protective. Likewise, assumption of a lower

¹⁶ In EPA WQS terminology, the criterion-frequency specifies the maximum rate at which “excursions” (see footnote 10) can occur and the waterbody of concern can still fully support the designated use to which the criterion applies. For instance, EPA guidance specifies a criterion-frequency of once-in-three years for both its acute and chronic aquatic life WQC for toxic chemicals. This means that only if two or more excursions occur during any three-year period has there actually been an exceedence of the WQC in question. For example, only if the four-day average concentration of cyanide in a lake were higher than the criterion-concentration of 5.2 µg/L more than once in three years would there have been failure to meet the EPA chronic aquatic life WQC.

frequency (e.g., once in five years), rather than a higher frequency (e.g., once in two years) would have the same effect and would be more protective than if the alternative were the case.

For those Illinois WQC lacking an explicit criterion-duration and/or criterion-frequency, determination of the absolute or relative level of protection provided by Illinois versus EPA's criteria is inherently an exercise fraught with uncertainty. For example, the Illinois acute General Use WQC for cyanide has a criterion-concentration of 22 µg/L—exactly the same as EPA's acute aquatic life WQC for this chemical. The duration for the state WQC is an instant (“shall not be exceeded at any time.”) There is no mention of a criterion-frequency, so a criterion-frequency of zero is assumed. EPA's is a maximum of once in three years. The state's cyanide criterion would provide a greater level of protection than the corresponding EPA criterion, given that it has both a shorter duration (one second as opposed to one hour for EPA's acute aquatic life WQC for toxics) and a lower criterion-frequency. On the other hand, if the state's criterion-frequency were assumed to be once in six months, and the concentration and duration of the state WQC remained the same, it would be hard to know, without performing additional laboratory toxicity and/or field studies, whether the increased protection resulting from the state's shorter criterion-duration (one second as opposed to one hour) would offset the decreased protection resulting from its higher criterion-frequency (once in six months as opposed to once in three years).

Also, with regard to aquatic life WQC, there could be, state-specific, watershed-specific, or even waterbody-specific reasons (differences in water column chemistry, temperature, stream flow patterns, resident species of aquatic life) that a state criterion can have a criterion-concentration higher or lower than that for the corresponding EPA criterion and still provide aquatic life protection equal to that for which the EPA WQC were designed. (This would not, however, mean that the two criteria would provide equal levels of protection to the relevant use. If, for example, a state's criterion-concentration were higher than EPA's, while the duration and frequency for the two WQC were identical to those of the corresponding EPA WQC, then the state's criteria would provide a lower degree of protection relative to that which would be provided by application of EPA's criterion to the waterbody in question. Nevertheless, site-specific conditions would have resulted in EPA's WQC providing an even higher level of protection than that for which EPA designed it. The effect of the state's higher criterion-concentration would be to bring the level of protection back down to that intended by EPA.)

Illinois has adopted site-specific temperature WQC for several segments of the Mississippi River, as well as the Ohio River and a couple other rivers. It does have two sets of General Use dissolved oxygen WQC, one applying to a list of waters in Appendix D of part 302 of the WQS regulations, and the other set applying to all other waters. And, there also are dissolved oxygen WQC for the handful of urban waters designated Secondary Contact and Indigenous Aquatic Life.

Turning from aquatic life to human health, safe levels of pollutants tend to vary less from waterbody to waterbody. The most obvious reason is that, unlike aquatic life WQC, human health criteria address impacts on just one species, regardless of the location of the waterbody to which the WQC apply. The most common reason for need for variation in human health criteria from one locale to another is differences in patterns of human use. For example, persons in hotter climates tend to consume more water, on average, than those in cooler areas. Also, the amount of fish and other aquatic life from local waters that are caught and eaten by people can differ by an order of magnitude from place to place and/or within subpopulations of humans. Of course, patterns of swimming and other water contact recreation can change considerably depending on difference in the climate in which one waterbody versus another is located, along with the type of waterbody (river, lake, ocean beach). Illinois apparently has not taken any of these factors regarding human use patterns into account in any of its WQC. That is, it has not developed any sub-state level human health WQC.

Returning briefly to the effects of unaddressed or imprecisely-articulated criterion-durations and criterion-frequencies, in addition to making comparison of levels of protection afforded relevant uses difficult, if not impossible, such ambiguities can pose challenges to the implementation of CWA programs driven by WQS—303(d) and 305(b) reporting on the condition of a state’s waters, total maximum daily loads (TMDLs), and water-quality based effluent limits in NPDES permits. For instance, if a TMDL were being developed because of exceedances of Illinois’ chronic General Use WQC for Cr⁺⁶, the absence of a clearly-articulated criterion-duration for this WQC would create a quandary. The duration for this and other chronic General criteria for toxics is “any period of at least four days.” This wording has the effect of establishing a criterion-duration of anywhere between four days (96 hours) and infinity. What should the time-interval for the maximum loading set forth in the TMDL be? If one assumes a default criterion-duration of four days, or 96 hours, then it would seem logical to express the TMDL as a maximum load over any four-day period. On the other hand, if the criterion-duration for the WQC was assumed to be 12 months, for example, maximum twelve month total load would seem appropriate.¹⁷

C. Traditional¹⁸ Pollutants/Water Quality Parameters

1) Coverage

a) Aquatic Life / “General Use” and “Secondary Contact Recreation and Indigenous Aquatic Life”¹⁹

Illinois lacks an acute and/or chronic WQC for a substantial fraction of the traditional pollutants for which EPA has published criteria. Most of the “missing”²⁰ criteria relate to chronic exposures.

Among the missing criteria are several corresponding to published²¹ EPA criteria pertaining to effects on aquatic life of hyper-eutrophication resulting from excess loadings of nutrients –

¹⁷ In *Friends of the Earth v EPA*, 446 F.3d.145 (2006) the federal D.C. Circuit Court ruled that because of the specific reference to “daily” in the portion of Section 303(d) of the CWA that established the Total Maximum Daily Load program, all TMDLs should include, at least, a maximum daily load. Despite this ruling, maximum loads over other time spans would also be needed, in order for the TMDL to consistent with relevant WQC, when such criteria have criterion-durations other than 24 hours.

¹⁸ For purposes of this ELI report, “traditional pollutant/parameter” refers to a number of pollutants and water quality parameters that were recognized as significant contributors to and indicators of degradation of the condition of surface water well before passage of the Clean Water Act in 1972. As used in this study, “traditional pollutant” includes those pollutants/parameters referred to as “conventional” in the CWA and EPA regulations and guidance, which includes: biochemical oxygen demand (BOD), dissolved oxygen (DO), pH, total suspended solids (TSS), bacteria and other pathogens, and temperature. Also considered “traditional” in this document are several other non-toxic pollutants and parameters including alkalinity, chloride, chlorophyll a, color, dissolved solids, hydrogen sulfide, (total) nitrogen, oil and grease, total phosphorus, and turbidity, which are sometimes called “non-conventional” or “non-priority” in the EPA literature. Also, one “non-priority” toxic chemical – ammonia—is discussed under the heading “traditional pollutants/parameters.”

¹⁹ Throughout this document, generic names (e.g., “aquatic life,” and “human health: drinking water supply,” and “human health: water contact recreation”) are used in reference to certain categories of uses. When a state uses different wording to refer to one of the generic uses, the name the state employs is listed in quotation marks, following the generic use.

²⁰ For the purposes of this review, “missing ” criteria are those pollutant/use combinations for which the state has not officially adopted WQC, whereas EPA has published recommended WQC of the type specified.

chlorophyll a, total phosphorous, and total nitrogen. The state does have an acute criterion for phosphorous; however, it only applies to lakes and reservoirs that are above twenty acres in surface area. Also, this criterion applies to streams only at the point where they enter a lake or reservoir.

Illinois lacks chronic criteria for turbidity, for which EPA has published chronic criteria, as part of its set of criteria addressing excess nutrients. EPA's WQC for rivers and streams is in terms of NTUs; its criterion for lakes and reservoirs is expressed as a Secchi disk depth of visibility.

On the other hand, the state has several extra²² criteria. Illinois has numeric criteria for temperature – EPA only has narrative criteria. In addition to temperature criteria applicable to all waters falling into certain designated uses categories, Sections 303.331, 341, and 351 of the Illinois WQS regulations set forth site-specific temperature criteria for six different segments of the Mississippi river. Unlike EPA, the state also has criteria (acute) for total dissolved solids (TDS), for both “General Use” and “Secondary Contact and Indigenous Aquatic Life.” Also, Illinois has both acute and chronic aquatic life criterion for dissolved oxygen, while EPA only has an acute criterion. There is a “Secondary Contact and Indigenous Aquatic Life”²³ WQC for “oil, fats, and grease,” though there is none for “General uses” (EPA's criteria for “oil and grease” are only narrative. The state also has acute WQC aimed at aquatic life protection for sulfate, whereas EPA does not. (See Appendix A, Table 1).

b) Wildlife Protection / “General Use”

Section 302.204 through Section 302.212 of the Illinois WQS regulations provide “general use” criteria for a number of traditional pollutants/parameters – ammonia, boron, (total) chloride, (total) dissolved solids, fecal coliform bacteria, pH, dissolved oxygen, phosphorous, sulfate, and temperature. According to Section 302.202 of the state's WQS regulations, these “general use” criteria are designed to provide protection for several uses, including “wildlife.”

EPA does not have criteria for these parameters applicable to protection of wildlife.

c) Human Health: Consumption of Fish and Other Aquatic Organisms²⁴

EPA has issued chronic WQC applicable to consumption of shellfish for fecal coliform bacteria, while Illinois has not.

d) Human Health: Drinking Water Supply / “Public and Food Processing Water Supply”

Illinois has acute criteria applicable to public water supply use for chlorides, sulfates, and total dissolved solids (TDS), whereas EPA has issued chronic standards under the Safe Drinking

²¹ Throughout this report, the water quality criteria (WQC) recommended by EPA under the Clean Water Act will be referred to as the EPA's “issued” or “published” criteria, interchangeably. Unlike Primary Drinking Water Standards promulgated by the Agency according to the federal Safe Drinking Water Act, EPA WQC are not regulatory requirements; rather, they are guidance.

²² For the purposes of this report, “extra” criteria are those pollutant/use pairs for which the state has officially adopted criteria, but for which EPA has not issued corresponding criteria.

²³ Currently, only a handful of waters in the Chicago area are classified “Secondary Contact and Indigenous Aquatic Life”; nevertheless, there is nothing in the WQS regulations stipulating that no other waters could ever be placed in this category.

²⁴ Human consumption of fish, shellfish, and other types of aquatic organisms is not among the designated uses that can be assigned to waterbodies, under the Illinois WQS regulations; nor is this type of use mentioned in the definition of any of the designated uses that the state does employ. The importance of the absence of bacterial WQC related to shellfish harvesting and consumption depends upon whether or not there are any waters in the state that harbor beds of shellfish that are harvested and consumed for either recreational, subsistence, or commercial purposes.

Water Act (SDWA) for these three contaminants.²⁵ Illinois also lacks chronic Public and Food Processing Water Supply (PFPWS) S criteria for an additional four of the eight traditional pollutants/parameters for which EPA has SDWA standards. The state also has an acute criterion for oil and grease (hexane soluble), while EPA does not have a SDWA standard for this parameter (See Appendix A, Table 2).

The state's WQC for bacterial pathogens for PFPWS are for fecal coliform bacteria, while the primary drinking water standard issued by EPA is stated as total coliform bacteria. The state's PFPWS criteria differ from EPA's closest corresponding value in a second way – EPA's Primary Drinking Water Standard is acute, while the state's is clearly chronic (30 day average) criterion.

It should be noted that, with the exception of total coliforms, the EPA standards for the eight traditional parameters addressed in this section are “secondary” standards (related to taste, odor, and appearance of drinking water), rather than “primary” DW standards (related to health).

e) Human Health: Water-based Recreation / “General Use” and “Secondary Contact Recreation and Indigenous Aquatic Life”²⁶

Illinois has adopted no criteria for the bacterial indicators *E. coli* and Enterococci applicable to the drainage of the Mississippi River. EPA issued criteria for these microbes in 1986. The state continues to rely on fecal coliform criteria, based on guidance issued by EPA in the 1970s.

Also, Section 302.204 through Section 302.212 of the Illinois WQS regulations provide “general use” criteria for a number of other traditional pollutants/parameters – ammonia, boron, (total) chloride, (total) dissolved solids, pH, dissolved oxygen, phosphorous, sulfate, and temperature. According to Section 302.202 of the state's WQS regulations, these “general use” criteria are designed to provide protection for several uses, including primary and secondary contact uses. EPA has not issued WQC for any of these additional traditional pollutants for water contact recreation uses.

f) Industrial Water Supply/ “General Use”

EPA has issued industrial water supply criteria for calcium carbonate, while Illinois has not adopted such.

Section 302.204 through Section 302.212 of the Illinois WQS regulations provide “general use” criteria for a number of traditional pollutants/parameters – ammonia, boron, (total) chloride, (total) dissolved solids, fecal coliform bacteria, pH, dissolved oxygen, phosphorous, sulfate, and temperature. According to Section 302.202 of the state's WQS regulations, these “general use” criteria are designed to provide protection for several uses, including industrial water supply.”

EPA does not have criteria that are applicable to protection of industrial water supply for these parameters.

²⁵ EPA lacks actual drinking water supply criteria for traditional pollutants – specification of the levels of contaminants in surface waters being used as a raw water supply by public drinking water systems. The only EPA standards aimed at ensuring safe levels of contaminants in drinking water apply to “finished” water – that which results from raw source water being passed through a treatment system aimed at removing contaminants to the maximum degree practicable. Like its WQC issued per the CWA, EPA's Drinking Water Standards for traditionals are guidance, except for the standard for coliform bacteria, which is a regulatory requirement.

²⁶ Currently, only a handful of waters in the Chicago area are classified “Secondary Contact and Indigenous Aquatic Life”; nevertheless, there is nothing in the state's WQS regulations stipulating that no other waters could ever be placed in this category.

g) Agricultural Water Supply/"General Use"

Section 302.204 through Section 302.212 of the Illinois WQS regulations provide "general use" criteria for a number of traditional pollutants/parameters – ammonia, boron, (total) chloride, (total) dissolved solids, fecal coliform bacteria, pH, dissolved oxygen, phosphorous, sulfate, and temperature. According to Section 302.202 of the state's WQS regulations, these "general use" criteria are designed to provide protection for several uses, including "agricultural use."

Illinois also has recently adopted a chronic WQC specifically applicable to waters from which "water is withdrawn or accessed for purposes of livestock watering. It has no acute criterion for this use.

Among these, EPA has issued WQC related to agricultural water supply (irrigation) criteria only for boron.

2) Criterion-Concentrations²⁷, Compared to EPA's

a) Aquatic Life / "General Use" and "Secondary Contact Recreation and Indigenous Aquatic Life"

Most of Illinois' aquatic life criteria for traditional pollutants have criteria-concentrations that are identical, or very close to, those published by EPA, and within the same range as similar WQC adopted by the other nine states covered by this Environmental Law Institute study.

EPA has adopted waterbody type (streams, lakes, etc.) WQC for the four parameters (total N, total P, chlorophyll a, and turbidity) covered by the Agency's "nutrient criteria," specific to the two ecoregions present in Illinois – Ecoregion VI (Corn Belt and Northern Great Plains) and Ecoregion IX (Southeastern Temperate Forested Plains and Hills). Illinois has not adopted nor proposed criteria for total N, chlorophyll a, or turbidity; here, comparison with EPA WQC is moot. The state has, however, adopted a phosphorous criterion with a criterion-concentration of 0.05 mg/l that applies only to reservoirs and lakes with a surface area of twenty acres or more. By comparison, EPA's criterion for total phosphorous for lakes and reservoirs in the Corn Belt and Northern Great Plains has a criterion-concentration of 0.037 mg/L and that for Southeastern Forested Plains and Hills is between 0.010 mg/L and 0.062 mg/L. The state's criterion-concentration falls within the upper end of this range.

It is also instructive to compare the WQC for a given pollutant that apply to the two use categories that specifically mention protection of aquatic life—"General Use" and "Secondary Contact and Indigenous Aquatic Life."²⁸ For total dissolved solids, the criterion-concentration for "general use" is 1,000 mg/L, as opposed to a "secondary contact and indigenous aquatic life" criterion-concentration of 1,500 mg/L. The acute (instantaneous minimum) WQC for dissolved oxygen for these two Illinois categories of designated uses have a criterion-concentration of 5.0 mg/l and 4.0 mg/l, respectively. The pH range for "general use" is 6.5 to 9.0 units, while for "secondary contact and indigenous aquatic life," it is a slightly broader 6.0 to 9.0 units.

As for temperature, there are three criteria that apply to waters designated as "general use":

- 1) "The maximum temperature rise above natural temperatures shall not exceed 2.8° C (5°F)";

²⁷ According to EPA guidance, numeric water quality criteria (WQC) consist of 3 components: 1) a criterion-magnitude, 2) a criterion-duration, and 3) a criterion-frequency. The first of these—criterion-magnitude is usually expressed as a concentration; hence, the frequent use of "criterion-concentration" in this report. For some key water quality parameters, such as temperature and pH, quantity is not expressed as a concentration, so EPA employs the broader term "criterion-magnitude."

²⁸ Id. at 26

- 2) “water temperature at representative locations in the main river²⁹ shall not exceed the maximum limits in the following table during more than one percent of the hours in the 12 month period ending with any month”:
 - a) April through November – 32°C (90°F)
 - b) December through March – 16°C (60°F)
- 3) “Moreover, at no time shall the water temperature at such locations exceed the maximum limits....”
 - a) April through November – 33.7°C (93°F)
 - b) December through March – 17.7°C (63°F)³⁰

There are two temperature criteria applicable to the “Secondary Contact and Indigenous Aquatic Life” use category:

- 1) “Temperature...shall not exceed 37.8°C (100°F) at any time.”
- 2) “Temperature...shall not exceed 34°C (93°F) more than 5% of the time.

The maximum instantaneous temperature for “Secondary Contact and Indigenous Aquatic Life” waters is 4.1° C (7° F) higher than that for “General Use” waters. Also, the “percentage of time” criterion for “Secondary Contact and Indigenous Aquatic Life” has a higher criterion-magnitude (34°C or 93°F) compared to highest of the two seasonal “General Use” criterion-concentrations (32°C or 90°F) as well as a higher criterion-frequency (5% versus 1%).

In summary, the state’s temperature criteria indicate that the uses associated with “secondary contact and indigenous aquatic life” can be fully supported at higher waterbody temperatures than can the uses associated with “general use.”

The state has two sets of WQC for dissolved oxygen: 1) a default set, that applies to all waters except those specifically listed in Appendix D of the state’s WQS regulation, and 2) a set that applies only to waters named in said Appendix D. Within each of these two sets, there are two sub-sets: a) one that applies from March through July, and b) another that applies August through February. For the first “season” (March through July) there is an acute and a chronic criterion, while during the remainder of the year, there is an acute, chronic, and a longer term chronic WQC (Criterion-durations of an instant, 7 days, and 30 days, respectively). Hence, the state has a total of 10 different numeric WQC for this important water quality parameter.

Both the acute and chronic dissolved oxygen WQC for the March through July period have a higher criterion-concentration than the corresponding WQC for August through February. (There are no March-July long-term chronic criteria.) Also, most of the WQC for Appendix D waters have slightly higher criterion-concentrations than the corresponding dissolved oxygen applicable to the rest of the waters in the state.

Illinois also has different criteria for ammonia for each of these two use categories. Comparison is complicated by the “general use” WQC being expressed as total ammonia-nitrogen, while the “secondary contact and indigenous aquatic life” WQC is expressed as Ammonia Un-ionized (as N).³¹ Another difference in the ammonia criteria for these two use categories is that the

²⁹ Section 302.104 explains, “Main river temperatures are temperatures of those portions of a river essentially similar to and following the same thermal regime as the temperatures of the main flow of the river.” The reference in Section 302.211(e) only to temperatures in “the main river” suggests that the temperature WQC set forth in this subsection do not apply to ponds, lakes or reservoirs.

³⁰ In contrast with the General Use temperature criteria, which break the calendar year down into just two portions, the site-specific temperature criteria for the Mississippi, Ohio, and several other rivers specify different criteria for ten different portions of the year.

³¹ There are several other chemicals, all toxics, having their WQC for “general use” being expressed in one form, e.g. “dissolved iron,” whereas the “secondary contact and indigenous aquatic life” criterion is stated as another form, e.g., “total iron.”

criterion-concentration for the former varies with waterbody pH and temperature, while that for the latter does not.

The state has recently adopted revised WQC for sulfates, pertaining to aquatic life protection, replacing a single concentration value with WQC whose criterion-concentration varies depending on two factors: a) hardness (measured as CaCO₃), and b) chloride levels.

b) Human Health: Consumption of Fish and Other Aquatic Organisms

Not applicable. Illinois has no criteria for traditional pollutants specifically applicable to fish consumption.

c) Human Health: Drinking Water Supply / “Public and Food Processing Water Supply”

Illinois’ criterion-concentrations for chloride, sulfates, and total dissolved solids (TDS) applicable to their “Public and Food Processing Water Supply” use are identical to the concentrations in EPA’s secondary drinking water standards for those substances

The criterion-concentration of the state’s *fecal* coliform criterion for “Public and Food Processing Water Supply” is 2000/100 ml, while EPA’s corresponding value for a bacterial indicator (*total* coliform bacteria) of possible presence of pathogenic microbes is, in effect, a much lower concentration: the level of analytic detection.³²

d) Industrial Water Supply/ “General Use”

Not applicable. There are no pollutants for which both EPA and the state have criteria pertaining to industrial water supply.

e) Agricultural Water Supply/ “General Use”

Not applicable. There are no pollutants for which both EPA and the state have criteria pertaining to agricultural water supply.

f) Water-based Recreation / “General Use” and “Secondary Contact Recreation and Indigenous Aquatic Life”

Illinois has an “acute”/fecal coliform criterion – no more than 10% of samples collected in any 30 day period shall surpass 400 per 100 ml.³³ There is an identical EPA WQC, dating to the 1970s.

Likewise, the state’s chronic criterion (30 day average) for fecal coliform bacteria has the same criterion-concentration (200 organisms/100 ml) as EPA’s chronic (also a 30 day average) criterion for this bacterial indicator.

3) Articulation of Criterion-Duration³⁴

³² Though the large difference in the relevant concentration might initially suggest that the state’s criterion provides considerably less protection than the comparable EPA standard, for a variety of reasons mentioned in Subsection C(5) below, this may not be the case.

³³ Technically, this is not a water quality criterion, as it does not stipulate conditions in a waterbody; rather, it is an assessment methodology, in that it describes the characteristics of a set of samples taken from a waterbody. A true WQC would read something like, “The density of bacteria in surface waters shall be higher than 400/100 ml, no more than 10% of the time.”

Some of Illinois' WQC for "traditional" pollutants have clearly articulated criterion-durations, while others do not.

a) Aquatic Life / "General Use" and "Secondary Contact Recreation and Indigenous Aquatic Life"³⁵

Illinois' acute criterion for ammonia for "general use" addresses concentrations that "shall not be exceeded at any time" – a clearly stated "instantaneous concentration never to surpass" criterion. There are also such criteria for dissolved oxygen and temperature, applicable to general and/or indigenous aquatic life uses.

On the other hand, the criterion for ammonia applicable to "secondary contact and indigenous aquatic life" is stated as "concentration...shall not exceed..." This is one of several criteria that would seem to have a duration of an instant, though the wording is not entirely clear. For example, pH should be "within the range of 6.0 – 9.0." Criteria for chlorides, sulfate, oil and grease, and total dissolved solids are also expressed as "not to exceed" values. In these cases, there is no indication that the cited values are anything other than levels not to be surpassed ever, for even a second – even though the regulations do not exactly say this.

Most of Illinois' chronic criteria for aquatic life have fairly well articulated criterion-durations. For instance, there are both a four-day and a 30-day average criterion for ammonia. There is some ambiguity as to whether "day" is supposed to mean "one calendar day" or "any consecutive 24 hour period." A calendar day would be presumed to be the period between 12:00 AM (midnight) and 11:59 PM. The latter interpretation might also be characterized as a "rolling 24 hour average." For the same reason, the exact meaning of the duration for chronic criteria ("30 day average") is also not entirely clear.

There is a WQC for temperature that appears to have a duration of one hour, but there is some ambiguity: "shall not exceed the maximum limits in the table below during more than 1 percent of the hours in the 12 month period ending with any month." This report assumes that the above language is intended to mean that the one-hour average temperature should not exceed the values in the referenced table, in more than one out of every 100 hours. It could, however, be taken to mean the highest temperature reached at any time, during any calendar hour, should be no higher than the level specified in said table, in more than one in 100 hours. Also, as with any criterion expressed as a percentage of time, actual exposure events longer than the stated criterion-duration

³⁴ According to terminology employed in some EPA guidance, the criterion-duration portion of a numeric WQC specifies the length of an "excursion"—the time period over which waterbody concentration of a pollutant is higher (or in the case of dissolved oxygen, lower) than the criterion-magnitude. For instance, EPA's chronic aquatic life WQC for toxic chemicals have a criterion-duration of four days, which results in their being expressed as four day average concentrations. The occurrence of one or more excursion (e.g., a four-day period in which the instream concentration, for example, of cyanide was higher than the criterion-concentration of 5.2 µg/L) would not necessarily represent failure to meet WQC. Only when the rate at which excursions occur is higher than that specified by the criterion-frequency has an actual exceedence of a water quality criterion occurred.

³⁵ Throughout this document, generic names (e.g. "aquatic life," "fish consumption," and "drinking water supply") are used in reference to certain categories of uses. When a state uses different wording to refer to the same use, the name the state employs is listed in quotation marks. Illinois has two designation categories addressing aquatic life protection. Waters designated "general use" are to "protect for...aquatic life...wildlife, agricultural...and most industrial uses..." Waters in this category are also protected for primary contact recreation if the water's physical configuration permits such use; otherwise secondary contact uses are protected. There is also a category of waters designated "Secondary Contact Recreation and Indigenous Aquatic Life." The regulations do not make the differences in the ecological characteristics of "general" aquatic life waters and "indigenous aquatic life waters" clear. Currently, only a handful of waters in the Chicago area are designated "Secondary Contact Recreation and Indigenous Aquatic Life."

could occur, and still be consistent with the wording of the criterion. For instance, there are 8,760 hours in a year, so 1% of the hours in a year equal 8.7 hours. Though one might assume that the “allowed” 8.7 hours are scattered evenly over a 12-month period, they could also occur consecutively, in one 8.7-hour block, and still be consistent with the wording of the WQC.

Illinois has a criterion for temperature expressed as “The maximum temperature rise above natural temperatures shall not exceed 2.8C° (5C°).” This is an example of what this report refers to as a “quasi-numeric” criterion – that is, ones expressed in terms of a certain change from background conditions. Unlike the case of typical numeric WQC, determination of whether such criteria have been exceeded requires knowledge of both current and past water quality, and/or conditions in more than one location (e.g., upstream and downstream of a discharge pipe.) Also, there is no indication as to what duration(s) of time the “no change” criterion is intended to apply. It would presumably apply to the overall natural background pattern of temperature, over time and space. This would require paying attention to not only to the instantaneous minimum temperature levels, but also to average temperatures over various periods of time (minutes, hours, days, etc.).

All of the state’s dissolved oxygen WQC have a clearly specified criterion-duration.

b) Human Health: Consumption of Fish and Other Aquatic Organisms

Not applicable. Illinois has no criteria for traditional pollutants for this use.

c) Human Health: Drinking Water Supply / “Public and Food Processing Water Supply”

Illinois’ criteria for chloride, oil and grease, total dissolved solids and sulfate applicable to “Public and Food Processing Water Supply” (Section 302.304) are stated as “not to exceed” concentrations, which, as explained in the discussion of criterion-durations per aquatic life criteria in Subsection C(3)(b) of this report, is assumed to mean levels not to be surpassed at any time, even for an instant for the purposes of this study.

The fecal coliform criterion for this use has a criterion-duration of up to 30 days. (Samples collected “over not more than a 30 day period...shall not exceed a geometric mean of 2000 per 100 ml...” This wording would allow the criterion-duration to be any period of time between an instant and 30 days.

d) Industrial Water Supply/ “General Use”

All of Illinois’ criteria that are applicable to industrial water supply are assumed to be “instantaneous, never to surpass.” (See the discussion of criterion-duration for “general use/aquatic life” criteria in Subsection C(3)(a), above.)

e) Agricultural Water Supply/ “General Use”

All of Illinois’ criteria that are applicable to agricultural water supply are assumed to be “instantaneous, never to surpass.” (See discussion of the criterion-duration for “general use/aquatic life” criteria Subsection C(3)(a), above.)

f) Water-based Recreation / “General Use” and “Secondary Contact Recreation and Indigenous Aquatic Life”

Illinois' acute criterion for fecal coliform bacteria is stated as "nor shall more than 10% of all samples collected in any calendar month exceed ____." ³⁶ The criterion-duration for this WQC would appear to be a second or instant. This is because of the reference to a percentage of samples. Most ambient monitoring for bacteria takes the form of "grab" sampling—collecting and a series of single aliquots of water, by manual or mechanical means. It takes only a second to reach into the water and grab each of these individual measurements; hence, the assumption that the duration of concern is an instant/second.

Both EPA's and Illinois' chronic criteria for fecal coliforms pertaining to recreational use have a duration of 30 days.

4) Articulation of Criterion-Frequency³⁷

Most of Illinois' WQC for "traditional" pollutants lack any statement regarding a criterion-frequency, in which case a default frequency of zero is indicated. The exceptions are criteria for fecal coliform bacteria and for temperature, which are stated as levels not to be surpassed in more than a certain percentage of the set of samples. This implies that the levels in the waterbody from which said samples were taken should not surpass the specified levels more than the specified fraction of the time. The percentage/frequency applicable to pathogens is ten percent (10%); for temperature, one criterion has a frequency of 1 percent (1%) and the other 5 percent (5%).

5) Discussion: Traditional Pollutants/Parameters³⁸

Illinois has adopted numeric WQC for a relatively small portion of the traditional pollutant/use combinations for which EPA has issued WQC. On the other hand, for a few pollutants, the state has "general use" criteria that apply to uses (particularly agricultural and industrial water supply) for which EPA has no criteria.

³⁶ Technically, this is not a water quality criterion because it describes the characteristics of a set of samples taken from a waterbody, rather than the desired condition of the waterbody itself. A true WQC would state something along the line of: "The density of fecal coliform bacteria in surface waters shall be higher than 2000organisms/100 ml. no more than 10% of the time." What is presented as a WQC appears to be more like a waterbody assessment methodology—a proscribed means of interpreting data collected from a waterbody in order to infer the true (but never completely knowable, with current technology) condition of the waterbody over time and space.

³⁷ In EPA water quality standard terminology, the criterion-frequency specifies the maximum rate at which "excursions" can occur and the waterbody of concern can still fully support the designated use to which the criterion applies. For instance, EPA guidance specifies a criterion-frequency of once in three (3) years for both its acute and chronic aquatic life WQC for toxic chemicals. This means that only if two or more excursions occur during any 3-year period has there actually been an exceedance of the WQC in question. For example, only if the 4 day average concentration of cyanide in a lake were higher than the chronic criterion-concentration of 5.2 µg/L more than once in three years would there have been failure to meet the EPA chronic aquatic life WQC.

³⁸ For purposes of this ELI report, "traditional pollutant/parameter" refers to a number of pollutants and water quality parameters that were recognized as significant contributors to and indicators of degradation of the condition of surface water well before passage of the Clean Water Act in 1972. As used in this study, "traditional pollutant" includes those pollutants/parameters referred to as "conventional" in the CWA and EPA regulations and guidance, which includes: biochemical oxygen demand (BOD), dissolved oxygen (DO), pH, total suspended solids (TSS), bacteria and other pathogens, and temperature. Also considered "traditional" in this document are several other non-toxic pollutants and parameters including alkalinity, chloride, chlorophyll a, color, dissolved solids, hydrogen sulfide, (total) nitrogen, oil and grease, total phosphorus, and turbidity, which are sometimes called "non-conventional" or "non-priority" in the EPA literature. Also, one "non-priority" toxic chemical, ammonia, is discussed under the heading "traditional pollutants/parameters."

Most significant as to coverage for traditional pollutants is the absence of numeric criteria for the nutrient nitrogen. There is a criterion for phosphorous, but it only applies to lakes and reservoirs with 20 or more acres of surface area. Furthermore, the state lacks numeric criteria for total nitrogen, as well as the related response indicator chlorophyll a, which reflects levels of algae in a waterbody.

Despite lacking numeric criteria relevant to eutrophication for many of its waters, the state has included on its 303(d) list of impaired waters 675 waters for “nutrients.” These listings reflect the willingness of the state to put waters on the 303(d) list based on conditions considered inconsistent with one or more *narrative* WQC. Nevertheless, the adoption of a more complete array of numeric nutrient WQC would likely eventually result in the identification of additional nutrient-impaired waters. “Nutrients” are among the five most frequently mentioned causes of impairment for waters on state 303(d) lists nationwide, along with “sediments/sedimentation,” pathogens, and mercury and metals other than mercury.³⁹

Illinois lacks numeric criteria for turbidity, and other sediment-related parameters such as total suspended solids. Nevertheless, it has identified turbidity as the reason for placing 306 waters on its 303(d)-list, along with 219 waters due to “sediment.”

Although Illinois has numeric WQC for temperature, the way Section 302.211(e) refers to “locations in the main river,” the temperature criteria may actually not apply to ponds, lakes, reservoirs, and perhaps smaller streams. Though this was probably not the intent of those drafting the regulations, an amendment clarifying this point could be helpful.

Illinois lacks a bacterial criterion for human consumption of shellfish. The significance of the lack of such criteria depends upon whether or not any of Illinois’ waters harbor beds of shellfish that are harvested and consumed, for either recreational or commercial purposes.

The criterion-concentrations in the WQC for traditionals that Illinois has adopted are similar, and sometimes identical, to the criterion-concentrations in corresponding EPA criteria, as well as those of nearby states covered in this Environmental Law Institute study.

A sizeable portion of Illinois’ criteria for traditional pollutants, lack any mention of a criterion-duration and/or averaging period. Likewise, most of the state’s WQC for traditional pollutants do not specify a criterion-frequency. The same is true of a number of EPA’s WQC for traditional pollutants.

Such lack of clarity regarding criterion-duration and/or criterion-frequency renders any attempt to determine the absolute level of protection afforded to the applicable designated use(s) an exercise with an inherent high degree of uncertainty. Obviously, any attempt to perform such comparisons would require making assumptions that may or may not turn out to be consistent with the duration and/or frequency intended, or eventually decided upon, by the state. The results of attempts to compare the protection provided by a state as opposed to EPA would, of course, be greatly affected by whatever assumptions were made. Assumption of some fairly long-term duration (e.g., 90 days), rather than a short-term (e.g., one hour), would tend to make a criterion less protective. Likewise, assumption of a higher frequency (e.g., once in six months), rather than a lower frequency (e.g., once in five years) would have the same effect, which is more protective than the alternative.

For example, both Illinois and EPA have WQC for pH that set a lower bound of 6.5 units and an upper bound of 9.0 units. Neither one specifies a criterion-duration or a criterion-frequency. For purposes of this report, when no duration is provided, a criterion-duration of an instant is assumed; likewise, if there is no mention of a criterion-frequency, then a frequency of zero has been assumed. If these two assumptions are correct, then the state’s and EPA’s WQC would provide

³⁹ EPA National Section 303(d) List Fact Sheet: Causes of Impairment. Available at: http://iaspub.epa.gov/waters/national_rept.control#TOP_IMP.

equal levels of protection to aquatic life in any given waterbody. But, if different assumptions were made, the two WQC could provide different degrees of protection. What if the “true” criterion-duration for the EPA were 7 days, while the “true” duration for the state’s pH WQC were indeed an instant? Then, the state’s WQC would be more protective than EPA’s (assuming the criterion-frequencies was identical). Furthermore, what if the state WQC had a criterion-frequency of once per 365 day, but EPA’s were indeed zero? It would be hard to determine, without performing additional laboratory and/or field studies, whether the state WQC was more or less protective than the EPA criterion. That is, to what degree would the more-protective effect of the shorter state criterion-duration be offset by the tendency toward less protection resulting from a higher frequency.

Further complications arise when seeking to ascertain the comparative degree of protection afforded to humans by state and EPA criteria and standards related to drinking water. For example, Illinois’ criteria applicable to public water supply for chlorides, sulfates, and total dissolved solids apparently apply to acute (instantaneous) conditions, while EPA’s Safe Drinking Water Act standards are applied to chronic scenarios (four rolling calendar quarters/365 days.) Given that the state’s and EPA’s criterion-concentrations for each of these contaminants are identical, the (apparently) much shorter duration for the state’s WQC, compared to EPA’s standard, would make the state’s criterion considerably more protective. For instance, the Illinois Public and Food Processing Water Supply criterion for chlorides would limit concentrations to 250 mg/100 ml or less at all times, whereas EPA’s standards would allow numerous instances with concentrations above 250 mg/L, so long as the 365 day average concentration was 250 mg/L or less. This assumes that both the state and EPA criteria have a criterion-frequency of zero.

Another reason to suggest that the state’s chloride criteria for Public and Food Processing Water Supply provides greater protection than EPA’s Secondary Drinking Water Standard is that the state’s water quality criterion applies to “raw” source water, such as water in a stream or lake that is withdrawn from the waterbody and ultimately distributed to homes and businesses by a public water supply system. Safe Drinking Water Standards, however, apply to “finished” drinking water—raw water that has undergone treatment to remove contaminants. If the state’s criterion and EPA’s standard were identical (same magnitude, duration, and frequency), then attainment of the state WQC would very likely result in contaminant levels in finished drinking water lower than the EPA drinking water standard. Only if the drinking water treatment system had the very unusual effect of increasing levels of a given pollutant found in the raw water supply, rather than achieving the reductions for which the treatment is intended, would there be any chance that raw water meeting state water quality criteria would end up providing finished water that failed to meet EPA drinking water standards.

Taking another of the state’s Public and Food Processing Water Supply criteria—that for fecal coliform bacteria, a first glance of the criterion concentration (2000/100 ml) would suggest it is far less protective than the comparable Safe Drinking Water Act standard, which has a de-facto concentration equal to whatever is the level of detection for total coliform bacteria using current analytic techniques. But, because the state WQC applies to raw, untreated source water whereas the EPA drinking water standard applies to finished (treated) drinking water, one needs to consider the very real possibility that traditional drinking water treatment could lower the levels of indicator bacteria from a 30 day average of 2000/100 to the point where the indicator bacteria would be below level of detection 95% of the time. Comparison of the state’s and EPA’s values is further complicated by the fact that the state’s WQC applies to fecal coliform bacteria, while the EPA standard applies to total coliform bacteria, of which fecal coliforms are a subset.

Comparison of the state's "general use" criteria to those for "secondary contact and indigenous aquatic life"⁴⁰ reveals that Illinois' regulations specify lower levels of water quality for the latter use category, with regard to dissolved oxygen and total dissolved solids. Also, the temperature criteria for "secondary contact and indigenous aquatic life" are consistent with higher temperatures over a greater percentage of the time than the corresponding "general use" criteria. This suggests that the state may have intended its "general use" and "secondary contact and indigenous aquatic life" designations to be de facto "warm water habitat" and "warmer water habitat" designations. This would be a conceptual parallel to the "cold water" and "warm water" aquatic life designations employed by other states, which implies that "general use" waters are those which are, in their natural state, inhabited by organisms adapted to somewhat lower temperatures than the inhabitants of "secondary contact and indigenous aquatic life." This could explain the higher dissolved oxygen levels specified for "general use" waters, as dissolved oxygen levels in water decrease as temperature goes up. The Illinois WQS regulations, however, provide no such explanation—Section 302.202, setting forth the purpose of the "general use" standards simply mentions "aquatic life" among several other uses that this set of WQC are to protect. And the only elaboration on the term "indigenous aquatic life," found in Section 302.402, states "waters...capable of supporting an indigenous aquatic life limited only by the physical configuration of the water, characteristics and origin of the water, and presence of contaminants in amounts that do not exceed the water quality standards listed in Subpart D (i.e., the WQC applicable to "secondary contact and indigenous aquatic life")."

Because EPA has never issued numeric temperature criteria, comparison of Illinois' and EPA's criterion-magnitudes is not possible. Nonetheless, comparison of this state's temperature criteria with those adopted by the other nine states abutting directly on the Mississippi is instructive. While Illinois' "general use" temperature criteria are comparable to the generic and/or warm water aquatic life criteria of the other states, its "secondary contact and indigenous aquatic life" temperature criteria are set several degrees higher than those of the other states. For example, Illinois "secondary contact and indigenous aquatic life [criterion] for temperature is: "shall not exceed 37.8°C (100°F) at any time." The highest instantaneous maximum temperature considered supportive of aquatic life by any of the other states is 32.2°C (90°F).

Also, with regard to aquatic life WQC, there could be state-specific, watershed-specific, or even waterbody-specific reasons that a state criterion can have a criterion-concentration higher or lower than that for the corresponding U S EPA criterion and still provide aquatic life protection equal to that for which the EPA WQC were designed.⁴¹ Of course, if the criterion-duration and criterion-frequency for a state and corresponding EPA criteria are the same (for example, if duration is 24 hours and frequency is zero) and the state's criterion-concentration were higher than EPA's, then the state's criterion would indeed provide less protection to aquatic organisms in the waterbody or set of waterbodies than would EPA's, in relative terms. However, due to site-specific or watershed-specific conditions, the state's WQC would provide the same absolute level of protection as that for which the EPA WQC were designed, while use of the recommended EPA WQC in such waters would actually provide greater protection than that which EPA intended.

Lack of clearly-stated criterion-durations and criterion-frequencies also can render considerably more challenging the implementation of CWA programs that are driven largely by WQC (Section 303(d) and 305(b) assessment and reporting, TMDLs, and water quality-based NPDES permitting programs). Clearly, it would be difficult for someone implementing one of these

⁴⁰ Currently, only a small number of waters in the Chicago region are designated for this use.

⁴¹ Possible reasons include differences in waterbody chemistry and in species present in a given type of aquatic ecosystems, compared to what were used in studies on which EPA's criteria were based.

“downstream” CWA programs to deal with a WQC having a criterion-concentration reading, “not too high” or “levels no greater than approximately 40 µg/L - 60 µg/L.”

Though perhaps less immediately obvious, imprecisely-stated criterion-durations and criterion-frequencies can pose similar challenges to those presented by missing or vaguely-stated criterion-magnitudes. For example, if over some 30 day period, four “grab” samples had been collected, analyzed for levels of a certain pollutant, and screened according the state’s quality assurance/quality control protocol, and one of those samples had a concentration higher than a relevant criterion-concentration, the answer to “Has this pollutant exceeded this WQC?” would differ depending on the criterion-duration and criterion-frequency. If the duration were “instantaneous” and the frequency “zero,” the WQC would have been exceeded, without question.⁴² But, if the duration were 30 days and the frequency remained at zero, the mere fact that one out of four instantaneous measurements surpassed the criterion concentration would not prove that an exceedance had occurred. Rather, only if the average of the concentrations in the four samples were higher than the criterion-concentration would there be strong evidence of an exceedance of WQC in the water from which said samples were collected. And, if the criterion-frequency were “two or more times per year,” then one might not conclude that WQC exceedance had occurred based on the above evidence.⁴³

D. Toxic Chemicals⁴⁴

1) Coverage

a) Aquatic Life/ “General Use: Aquatic Life” / ”General Use”

Acute Toxicity

Illinois has established acute criteria for 22 toxic substances, mostly metals. (These WQC appear in Sections 302.208(e) and 302.208(g) of the Illinois regulations.) However, the state has not adopted criteria for nineteen pollutants, or 61%, of the 31 toxic pollutants for which EPA has issued⁴⁵ *acute* criteria for the protection of freshwater aquatic life (Appendix B, Table 1) pursuant to Section 304(a) of the CWA. These “missing” pollutants are mostly synthetic organic substances, including many organophosphate and organochloride pesticides.

⁴² This statement assumes that all four of the samples passed the state’s quality assurance/quality control (QA/QC) tests.

⁴³ The phrase “might not conclude” was chosen because it would be contrary to the laws of probability to conclude that no additional excursions (30 day periods with average bacterial concentrations about the criterion-concentration) had occurred during any 12 month period encompassing the 30 days in which the four grab samples had been collected, based on the information presented herein. In fact, if these four individual samples were the only ones gathered during a given twelve month period, then it is quite likely that additional excursion did occur. The reason for this conclusion is that , given that there are 336 thirty “rolling” 30-day periods in any twelve month period, the odds of having randomly chosen to collect samples during the only 30-day period in which an excursion occurred are very low (several times lower than randomly selecting a card from a well-shuffled deck of 52, and having that card turn out to be one named in advance).

⁴⁴ In this report, the term “toxic pollutant” includes not only EPA’s “priority” toxic pollutants but also all those toxics called, for CWA purposes, “non-priority” pollutants, as well as all toxic chemicals falling into neither of these two EPA classifications. The one exception is ammonia, which is addressed under “traditional pollutants” in this report..

⁴⁵ Throughout this report, the criteria recommended by EPA will be referred to as the EPA’s “issued” or “published” criteria, interchangeably. The terms “established” or “promulgated” are not used because EPA’s WQC are not regulations, but just guidance.

On the other hand, Illinois has adopted acute criteria for the “protection of aquatic organisms” covering 9 toxic pollutants for which the EPA has not issued corresponding Section 304(a) criteria. (Appendix B, Table 2).⁴⁶

Chronic Toxicity

Illinois has established chronic aquatic life WQC for fifteen toxic substances, while it also has not adopted criteria for 25 pollutants, or 71%, of the 35 toxic pollutants for which EPA has issued chronic criteria for the protection of freshwater aquatic life (Appendix B, Table 1). They are a combination of organophosphate pesticides, organochloride pesticides, and toxic metals.

On the other hand, Illinois has adopted chronic criteria for the protection of aquatic organisms for five pollutants for which EPA has not published corresponding Section 304(a) criteria (Appendix B, Table 2).⁴⁷

b) Human Health: Aquatic Life/ “Indigenous Aquatic Life & Secondary Contact Recreation”

In addition to the “general use” and “aquatic life protection” criteria that address risks to aquatic life, Illinois has established another set of criteria for the combined designated uses of “indigenous aquatic life” protection and secondary contact recreation. These criteria cover ammonia and seventeen toxic pollutants, most of which are toxic metals (Appendix B, Table 2). EPA has not adopted WQC to cover toxic pollutants for this particular combination of designated uses.

c) Human Health: Consumption of Fish and Other Aquatic Organisms

Section 302.208(f) of the Illinois regulations lists Human Health Standards for two toxic pollutants: mercury and benzene.⁴⁸ Because a definition for the Illinois “Human Health Standard” (“HHS”) is absent in the State’s water quality standards regulations, it is impossible to know which health-related use, or combination of uses, these criteria are supposed to address. Hence, it is not clear whether Illinois has adopted any WQC that correspond directly to EPA’s “Human Health: Consumption of Organisms Only” criteria. EPA has adopted “HHO” criteria for 106 pollutants for this use.

⁴⁶ As noted in footnote 11, Illinois has developed and published “derived criteria” applicable to aquatic life for nearly 200 toxic chemicals. They are not included in the counts of aquatic life criteria for toxic chemicals in this section of the report because they have been issued in the form of guidance, but not been incorporated as official WQC in the state’s WQS regulations. For more information on “derived criteria,” see Section D.5 (“Discussion: Criteria for Toxic Chemicals”).

⁴⁷ In addition to its formally adopted WQC, Illinois has developed and published “derived” aquatic life WQC for 193 synthetic organic compounds. The document containing these “derived criteria” says that these values are sometimes used to set water quality-based effluent limits in NPDES permits. These criteria have not been included in the analysis for this report because, unlike formally adopted WQC, their use in other CWA programs (303(d), TMDLs, NPDES) is optional.

⁴⁸ In addition to its formally adopted WQC, Illinois has developed and published “derived” human health WQC for 75 synthetic organic compounds. The document containing these “derived criteria” says that these values are sometimes used to set water quality-based effluent limits in NPDES permits. These criteria have not been included in the analysis for this report because, unlike formally adopted WQC, their use in other CWA programs (303(d), TMDLs, NPDES) is optional. (See Section D.5 for more on “derived criteria.”)

Also Section 302.208(g) of the Illinois WQS regulations lists “general use” criterion-concentrations for seven toxic chemicals.⁴⁹ These have not been included in the above counts because neither “human health,” nor “fish consumption” were among the uses that the WQS regulations said these criteria were aimed at protecting. Three of the pollutants with such generic “general use” criteria—manganese, phenols, and selenium—are pollutants for which EPA has issued human health: [consumption of aquatic] organisms [HHO] WQC.

d) Human Health: Consumption of Water & Organisms

Because a definition for the Illinois “Human Health Standard” (“HHS”) is absent in the state’s water quality standards regulations, it is not clear whether Illinois has adopted any WQC that correspond directly to EPA’s “Human Health: Consumption of Water & Organisms” criteria. The state has adopted a “Human Health Standard” for two pollutants, mercury and benzene, for its “general use” waters. Unlike Illinois, EPA currently does not have a human health criterion for mercury in the water column. EPA has, however, adopted a criterion for methyl mercury in fish tissue. EPA has adopted criteria for a total of 113 toxic pollutants for this combination of designated uses.

Also Section 302.208(g) of the Illinois WQS regulations lists “general use” criterion-concentrations for seven toxic chemicals⁵⁰. These have not been included in the above counts because neither “human health,” “fish consumption,” nor “drinking water supply” were among the uses that the WQS regulations said these criteria were aimed at protecting. Five of the pollutants with such generic “general use” criteria—barium, iron, manganese, phenols, and selenium—are pollutants for which EPA has issued human health: water and organisms [HHWO] WQC.

The state has also adopted criteria in Section 302.504 for eight (8) pollutants for all waters in the Lake Michigan Basin. Because they do not address waters flowing into the Mississippi River, they are not included in this review.

e) Human Health: Public Water Supply/ “Public and Food Processing Water Supply”

Illinois has adopted acute “not to be exceeded” criteria applicable to “Public and Food Processing Water Supply” for 23 toxic pollutants (Appendix B, Table 2). All of the 83 standards (primary and secondary) for finished drinking water that EPA has issued for toxics under the Safe Drinking Water Act (SDWA)⁵¹ are based on chronic conditions. Thus, if the universe of pollutants for which Illinois has issued “Public and Food Processing Water Supply” criteria is to be compared to those for which EPA has issued SDWA criteria, the conclusion could be that Illinois has no chronic drinking water supply criteria but that it does have “extra” acute public water supply criteria for 253 pollutants.

However, for purposes of this report, the differences in the durations of the Illinois WQC and EPA drinking water standards have been ignored. This results in the state missing Public and Food Processing Water Supply criteria for 58 pollutants, and having extra criteria for five contaminants.

f) Wildlife Protection / “General Use”

⁴⁹ The pollutants are: barium, fluoride, iron, manganese, phenols, selenium, and silver.

⁵⁰ The pollutants are: barium, fluoride, iron, manganese, phenols, selenium, and silver.

⁵¹ EPA lacks actual drinking water supply criteria for traditional pollutants – specification of the levels of contaminants in surface waters being used as a raw water supply by public drinking water systems. The only EPA standards with regard to ensuring safe levels of contaminants in drinking water apply to “finished” water – that which results from raw water being passed through a treatment system aimed at removing contaminants to the degree practicable.

Section 302.208(g) of the Illinois WQS regulations lists “general use” criterion-concentrations for seven toxic chemicals. According to that section, “general use” criterion values are designed to provide protection for several uses, including wildlife protection.

g) Industrial Water Supply / “General Use”

Section 302.208(g) of the Illinois WQS regulations lists “general use” criterion-concentrations for seven toxic chemicals. According Section 302.202 of the Illinois WQS regulations, these “general use” values are designed to provide protection for several uses, including industrial water supply. EPA has not adopted any WQC to regulate toxic pollutants for the “industrial water supply” designated use specifically.

h) Agricultural Water Supply / “General Use”

Section 302.208(g) of the Illinois WQS regulations lists “general use” criterion-concentrations for seven toxic chemicals. According Section 302.202 of the Illinois WQS regulations, these “general use” values are designed to provide protection for several uses, including agricultural water supply. EPA has not adopted any WQC to regulate toxic pollutants for the “agricultural water supply” designated use specifically.

i) Water-based Recreation/ “General Use”

According to Section 302.202 of Illinois’ WQS regulation, the state’s “general use” water quality criteria for toxic pollutants are applicable to “water for aquatic life...wildlife, agricultural use, secondary contact use and most industrial uses.” Illinois has adopted “general use” criteria for 9 toxic pollutants. In addition, Section 302.407 of the Illinois WQS regulations establishes “secondary contact” (and “indigenous aquatic life”) criteria covering 18 toxic pollutants to protect “those waters not suited for general use activities but which will be appropriate for all secondary contact uses and which will be capable of supporting an indigenous aquatic life...” EPA has not adopted any WQC to regulate toxic pollutants for uses that would directly correspond to these particular categories of uses.

2) Criterion-Concentrations,⁵² Compared to EPA’s

a) Aquatic Life/ “General Use: Aquatic Life”

Acute Toxicity

Of the 24 toxic pollutants for which Illinois has adopted *acute* criteria for the protection of aquatic organisms in Section 302.208(e) of its WQS regulations, 11 pollutants have criteria that

⁵² According to EPA guidance, numeric water quality criteria (WQC) consist of three components: 1) a criterion-magnitude, 2) a criterion-duration, and 3) a criterion-frequency. The first of these—criterion-magnitude is usually expressed as a concentration; hence, the frequent use of “criterion-concentration” in this report. For some key water quality parameters, such as temperature and pH, quantity is not expressed as a concentration, so EPA employs the broader term “criterion-magnitude.”

correspond to EPA's recommended criteria⁵³. Within this subset, five (5) pollutants have acute freshwater aquatic life criteria for which the criterion-concentrations are the same as the corresponding EPA values. Four (4) pollutants have criteria for which the criterion-concentrations are higher than the corresponding EPA values (Appendix B, Table 3), and two (2) pollutants have criteria for which the criterion-concentrations are lower than the corresponding EPA values (Appendix B, Table 4).

For those toxic pollutants for which the state has adopted "general use" criteria Section 302.208(g), there are two pollutants with criterion-concentrations that correspond to EPA's values: selenium and silver. The Illinois criterion-concentration for silver is higher than EPA's and the Illinois criterion-concentration is not numerically comparable to EPA's.

Chronic Toxicity

Of the fifteen toxic pollutants for which Illinois has adopted chronic criteria for the protection of aquatic organisms Section 302.208(e) of its WQS regulations, ten pollutants have criteria that correspond to EPA's recommended criteria.⁵⁴ Within this subset, the chronic freshwater aquatic life criteria for three pollutants have the same criterion-concentrations as the EPA's. Four pollutants have criteria for which the criterion-concentrations are higher than the corresponding EPA values (Appendix B, Table 3), and three pollutants have criteria for which the criterion-concentration's are lower than the corresponding EPA values (Appendix B, Table 4).

b) Aquatic Life/ "Indigenous Aquatic Life and Secondary Contact Recreation"

As EPA has not published any criteria for the specific use combination of indigenous aquatic life and secondary contact recreation, there is no basis for comparing the criterion-concentrations in these state criteria relative to any EPA value.

c) Human Health: Consumption of Fish and Other Aquatic Organisms

It is not clear whether state has adopted any numeric criterion that directly corresponds to EPA's "Human Health: Consumption of Organisms Only" criteria.

d) Human Health: Consumption of Water & Organisms

Illinois has adopted "Human Health Standard" for two pollutants, mercury and benzene, for its "general use" waterbodies. The state's criterion-concentration for benzene is higher than the corresponding EPA value. EPA has not issued a "Human Health: Consumption of Water & Organisms" criteria for mercury. The Agency has, however, adopted such a criterion for methyl mercury.

The state has also adopted "Human Health Standard" for eight pollutants for waterbodies in the Lake Michigan Basin. The criterion-concentrations for these standards were not included in this review because this report deals with waters of the Mississippi River Basin.

⁵³ The remaining pollutants are selenium and twelve pollutants for which the EPA has not issued acute freshwater aquatic life criteria. Because the EPA criterion for selenium is expressed in the form of an equation and because the Agency is in the process of developing a more stringent criterion for selenium, direct quantitative comparison of EPA's selenium WQC to Missouri's selenium WQC was not undertaken in this review.

⁵⁴ The remaining five pollutants are those for which the EPA has not issued chronic freshwater aquatic life criteria.

e) Human Health: Public Water Supply/ “Public and Food Processing Water Supply”

Illinois has “Public and Food Processing Water Supply” criteria for 25 toxic pollutants. Of these, there are 19 pollutants for which EPA’s has established primary drinking water standards under the Safe Drinking Water Act. Of these, the state’s and EPA’s criterion-concentrations for three contaminants are identical. Nine of the state’s criterion-concentrations are higher than EPA’s, and seven have lower criterion-concentrations.

f) Wildlife Protection/ “General Use”

Because EPA has not adopted any WQC to regulate toxic pollutants for the “wildlife protection” designated use, there is no EPA criterion against which to compare the criterion-concentrations of those “general use” criteria for which that Illinois has adopted for nine pollutants in Section 302.208(g) of its WQS regulation.

g) Industrial Water Supply/ “General Use”

Because EPA has not adopted any WQC to regulate toxic pollutants for the “industrial water supply” designated use, there is no EPA criterion against which to compare the criterion-concentrations of those “general use” criteria (which “will protect for which that Illinois has adopted for nine pollutants in Section 302.208(g) of its WQS regulation.

h) Agricultural Water Supply/ “General Use”

Because EPA has not adopted any WQC to regulate toxic pollutants for the “wildlife protection” designated use, there is no EPA criterion against which to compare the criterion-concentrations of those “general use” criteria for which that Illinois has adopted for nine pollutants in Section 302.208(g) of its WQS regulation.

i) Water-based Recreation

Because EPA has not adopted any WQC to regulate toxic pollutants for the “water-based recreation” designated use, there is no EPA criterion against which to compare the criterion-concentrations of those “general use” and “secondary contact use” criteria for which that Illinois has adopted Section 202.208(g) and Section 302.407 of its WQS regulation.

3) Articulation of Criterion-Duration⁵⁵

Some of Illinois’ numeric WQC for toxic chemicals have clearly stated criterion-durations

⁵⁵ According terminology employed in some EPA guidance, the criterion-duration portion of a numeric WQC specifies the length of an “excursion”—the time period over which waterbody concentration of a pollutant is higher (or in the case of dissolved oxygen, lower) than the criterion-magnitude. For instance, EPA’s chronic aquatic life WQC for toxic chemicals have a criterion-duration of four days, which results in their being expressed as four-day average concentrations. The occurrence of one or more excursion (e.g., a four-day period in which the instream concentration, for example, of cyanide was higher than the criterion-concentration of 5.2 µg/L) would not necessarily represent failure to meet WQC. Only when the rate at which excursions occur is higher than that specified by the criterion-frequency has an actual exceedence of a water quality criterion occurred.

while others do not.

a) Aquatic Life/ “General Use” and “Secondary Contact Recreation and Indigenous Aquatic Life”

Acute Toxicity

Illinois’ acute criteria for toxics applicable to aquatic life are clearly stated instantaneous, never to surpass values: “The acute standard (AS) for the chemicals listed in subsection (e) shall not be exceeded at any time” (Section 302.208(a)).

Chronic Toxicity

The criterion-duration for chronic criteria for toxics and aquatic life is unclear, and could be anywhere from four (4) days to infinity. Relevant regulatory language reads, “The chronic standard (CS) for the chemical constituents listed in subsection (e) shall not be exceeded by the arithmetic average of ...samples collected over any period of at least four days” (302.208 (b)). Such language makes the applicable criterion-duration dependant upon how many years worth of ambient water quality data is available for a given waterbody.

A duration of 7 days could perhaps be inferred from the 7Q10 stream design low flows parameter specified in Section 302.103: “Stream Flows—Except as otherwise provided in this Chapter, the water quality standards in this Part shall apply at all times except during periods when flows are less than the average minimum seven day low flow which occurs once in ten years.”

b) Human Health: Consumption of Fish and Other Aquatic Organisms

Illinois has no criteria for toxic chemicals aimed specifically at protecting human consumers of finfish, shellfish or other aquatic life harvested in the waters of the state.

c) Human Health: Public Water Supply/ “Public and Food Processing Water Supply”

A default criterion-duration of an instant has been assumed, for purposes of this study, based on the following regulatory language: “The following levels of chemical constituents shall not be exceeded” (Section 302.304).

d) Human Health: General

Section 302.208 of the Illinois WQS regulations stipulates General Use Water Quality Standards, and subsection (f), titled “Numeric Water Quality Standards for the Protection of Human Health,” lists criterion-concentrations for two pollutants-mercury and benzene. Language pertaining to these values appears in subsection (c) of 302.208, “The human health standard [HHS] for the chemical constituents listed in subsection (f) shall not be exceeded when the streamflow is at or above the harmonic mean flow...”

This wording suggests that a default to a criterion-duration of “instantaneous” would be in order. That is, if the concentration in a river went above the criterion-concentration for even an instant, at any time when the stream flow was equal to or greater than the harmonic mean. (This particular construct is quite unusual. Far more common is reference to using the harmonic mean flow as the “design flow” when developing TMDLs and/or water quality-based NPDES permit limits, which would imply a criterion-duration of a long-term average.)

e) Wildlife Protection

Section 302.208(g) of the Illinois WQS regulation lists “general use” criterion-concentrations for several toxic chemicals. According 302.202 Illinois WQS regulation, these “general use” values are designed to provide protection for several uses, including wildlife protection. The first sentence in 302.208(g) says, “Concentrations of the following chemical constituents shall not be exceeded...” Based on this wording, a criterion-duration of “instantaneous” is assumed to apply.

f) Industrial Water Supply/ “General Use”

Section 302.208(g) of the Illinois WQS regulation lists “general use” criterion-concentrations for several toxic chemicals. According 302.202 Illinois WQS regulation, these “general use” values are designed to provide protection for several uses, including industrial water supply. The first sentence in 302.208(g) says, “Concentrations of the following chemical constituents shall not be exceeded...” Based on this wording, a criterion-duration of “instantaneous” is assumed to apply.

g) Agricultural Water Supply/ “General Use”

Section 302.208(g) of the Illinois WQS regulation lists “general use” criterion-concentrations for several toxic chemicals. According Section 302.202 Illinois WQS regulation, these “general use” values are designed to provide protection for several uses, including agricultural water supply. The first sentence in 302.208(g) says, “Concentrations of the following chemical constituents shall not be exceeded...” Based on this wording, a criterion-duration of “instantaneous” is assumed to apply.

h) Water-based Recreation/ “General Use”

Section 302.208(g) of the Illinois WQS regulation lists “general use” criterion-concentrations for several toxic chemicals. According to that section, “general use” values are designed to provide protection for several uses, including primary and/or secondary contact recreation. The first sentence in Section 302.208(g) says, “Concentrations of the following chemical constituents shall not be exceeded...” Based on this wording, a criterion-duration of “instantaneous” is assumed to apply.

It may be that the criteria-concentrations for mercury and benzene listed in 303.208(f) Illinois WQS regulation are also intended to apply to water-based recreation, since all values listed in 303.208 are “general use” criteria. As noted above, the criterion-duration for these values is taken to be “instantaneous,” by default.

4) Articulation of Criterion-Frequency⁵⁶

⁵⁶ In EPA water quality standard terminology, the criterion-frequency specifies the maximum rate at which “excursions” can occur and the waterbody of concern can still fully support the designated use to which the criterion applies. For instance, EPA guidance specifies a criterion-frequency of once in three years for both its acute and chronic aquatic life WQC for toxic chemicals. This means that only if two or more excursions occur during any three-year period has there actually been an exceedence of the WQC in question. For example, only if the four-day average

None of Illinois' numeric WQC for toxic chemicals has clearly stated criterion-frequencies. In the absence of such specificity in the state's WQS regulation, this study assumes a default criterion-frequency of zero.

A frequency of once-in-10 years could perhaps be inferred from the 7Q10 stream design low flows parameter specified in Section 302.103 Illinois WQS regulation: "Stream Flows – Except as otherwise provided in this Chapter, the water quality standards in this Part shall apply at all times except during periods when flows are less than the average minimum seven day low flow which occurs once in ten years."

5) Discussion: Criteria for Toxic Chemicals

Criteria Related to Aquatic Life Protection

Illinois lacks water quality criteria (WQC) for approximately 61% of the pollutants for which EPA has adopted acute aquatic life criteria, and for approximately 71% of the pollutants for which EPA has adopted chronic aquatic life criteria. Among those pollutants without WQC are organochloride pesticides (e.g., dieldrin, gamma-BHC, chlordane, and pentachlorophenol), organophosphate pesticides (parathion, chlorpyrifos, and diazinon), and toxic metals (e.g. arsenic and selenium). Many of these substances, including DDT and PCBs, fall into categories that are frequently mentioned as possible endocrine disruptors.

Where they have been adopted, most of Illinois' acute aquatic life criteria for toxics have criterion-concentrations that are either equal to or higher than the criterion-concentrations for the corresponding EPA values. There are also a few toxic pollutants with acute aquatic life criteria for which the criterion-concentrations are lower than EPA's. A similar pattern holds for the state's chronic aquatic life criteria. Because some of Illinois' numeric WQC for toxic chemicals have clearly stated criterion-durations while others do not, and because none of the state's numeric WQC for toxic chemicals have clearly stated criterion-frequencies, comparing the state's criterion-concentrations to those of EPA's is not a reliable means of determining the relative protectiveness of their WQC.

Section 302.208(g) of the Illinois WQS regulations also lists "general use" criteria for several toxic pollutants. These "general use" criteria, as stated in Section 302.202, "will protect the State's water for aquatic life..., wildlife, agricultural use, secondary contact use and most industrial uses..."

Besides the "general use" criteria listed in Section 302.208 (g) and the "aquatic life protection" criteria listed in Section 302.208(e), Illinois has also specified another set of "secondary contact and indigenous aquatic life" criteria in Section 302.407 of its WQS regulations. The distinction between these "secondary contact and indigenous aquatic life" criteria and the "general use" criteria is unclear. In setting forth on their purpose in Section 302.402, the regulations merely state that "secondary contact and indigenous aquatic life" criteria are "intended for those...waters...capable of supporting an indigenous aquatic life limited only by the physical configuration of the water, characteristics and origin of the water, and presence of contaminants in amounts that do not exceed the water quality standards listed in Subpart D" (i.e., the WQC applicable to "secondary contact and indigenous aquatic life"). It provides no distinction between those aquatic organisms that are characteristic of "general use" waters and those aquatic organisms

concentration of, say, cyanide in a lake were higher than the chronic criterion-concentration of 5.2 µg/L more than once in three years would there have been failure to meet the EPA chronic aquatic life WQC.

that are characteristic of waters designated for “secondary contact and indigenous aquatic life.” This ambiguity in the Illinois WQS regulations could be eliminated or minimized by clearly defining all designated uses for which WQC have been adopted, and in particular, specifying differences, to the extent that they exist, in the meaning of such terms as “aquatic organisms,” “aquatic life,” and “indigenous aquatic life.” It would also help for the state’s WQC derivation methodology for each of the designated uses should be provided, as either components of the regulation itself or guidance. And where water individual uses have been combined into larger categories or classes, (e.g., Illinois’ “general use” category and its “secondary contact and indigenous aquatic life” category), it would be informative for the WQS regulations explain how criteria accounting for these use combinations should be derived.

The criterion-durations for Illinois’ acute criteria pertaining to aquatic life are clear (an instant); however, the criterion-duration for the chronic criteria is not clear.

The state’s criteria relating to aquatic life lack any indication of an applicable criterion-frequency; hence, for purposes of this report, a default frequency of zero has been assumed.

Because of differences in the criterion-duration and criterion-frequency for Illinois acute aquatic life criteria (instantaneous and zero, respectively) and the duration and frequency in EPA’s corresponding criteria (one hour and once in three years respectively), assessment of the relative degree of protection afforded by the state’s criteria versus EPA’s criteria simply by comparing their respective criterion-concentrations would not always provide a reliable answer. On the one hand, given that the state’s duration is shorter than EPA’s (one instant vs. one hour) and the state’s frequency is apparently lower (zero vs. no more than once in three years), it appears safe to assume that Iowa’s criteria for the six toxic pollutants for which the criterion-concentration are equal to or lower than that of the corresponding EPA criterion provide greater protection for aquatic life than do EPA’s. As to the four pollutants with criteria having criterion-concentrations higher than EPA’s, it is difficult to tell whether the effect of the higher concentration for a given criterion would or would not be offset by the combination of the shorter criterion-duration and shorter criterion-frequency.

Comparison of the criterion-concentrations in the state’s “general use” criteria versus the criterion-concentrations in its “indigenous aquatic life & secondary contact recreation” criteria indicates that most of Iowa’s “general use” criteria pertaining to toxic metals are equally or slightly less protective than its “indigenous aquatic life & secondary contact recreation” criteria for toxic metals. For the only organic compound covered, phenol, the state’s “general use” criterion seems to be more protective than its “indigenous aquatic life & secondary contact recreation” criterion. This analysis is based upon the assumption that the criterion-durations, as well as the criterion-frequencies for acute and chronic conditions are the same for each of these two categories of aquatic life use.

Criteria Related to Human Health Protection

With regard to addressing human health risks, Illinois lacks WQC for almost all of the toxic pollutants for which EPA has issued criteria to address risks associated with human consumption of fish (and shellfish) tissue alone and of water and fish tissue combined. Indeed, other than the criteria labeled as “Human Health Standards” in Section 302.208(f) for mercury and benzene and those listed for eight other pollutants that are applicable only to waterbodies in the Lake Michigan Basin, the state has not adopted “human health: fish consumption” or “human health: water and fish consumption” criteria applicable to “general use” waters for any other toxic pollutant. Where they have been adopted, Illinois’ human health criteria are applicable only when stream flow is at or above the harmonic mean flow.

Among the pollutants without human health-related criteria are a number of carcinogens (e.g., pentachlorophenol, parathion, chrysene, etc.), highly bioaccumulative substances (e.g., methoxychlor, dieldrin, nitrosamines, etc.), and potential endocrine disruptors (e.g., PCBs, DDT, chlordane, endosulfan, etc.). Lacking state equivalents to EPA's "human health: organisms only" and "human health: water & organism" criteria are also benzo-a-pyrene and several other polycyclic aromatic hydrocarbons (PAHs), which are not only carcinogenic and bioaccumulative but are also commonly found in urban stormwater. Like many phthalate esters, for which Illinois lacks human health-related criteria, PAHs are among chemicals that may act as endocrine disruptors.

To protect waters designated for public and food processing use, the state has adopted WQC for 25 toxic pollutants. The state's criteria are apparently applicable to acute conditions (default criterion-duration of an instant) whereas all of the 83 drinking water standards for toxics that EPA has issued under the Safe Drinking Water Act (SDWA) are based on chronic conditions, in that compliance with SDWA standards is based upon the average concentration over any consecutive four calendar quarter period. Neither Illinois nor EPA made any explicit statement about a criterion-frequency, which leads to a default frequency of zero, for purposes of this report. Because of the uncertainty surrounding the criterion-durations and criterion-frequencies in the Public and Food Processing Water Supply WQC for Illinois, comparison of the relative degree of protection afforded for a given toxic pollutant by the state's criterion versus EPA's drinking water standards carries considerable uncertainty. However, assuming that the criterion-frequency applicable to the state and EPA are both zero and the criterion-duration for the state human health criteria is an instant and for the EPA drinking water standards is four calendar quarters, it would appear safe to assume that the ten state criteria having equal or lower criterion-concentrations than the corresponding EPA standards would provide equal or greater levels of protection than EPA's. As for the state WQC with higher criterion-concentrations than EPA's, it would be difficult to ascertain the relative degree of protection, in that the degree to which the higher criterion-concentration for a specific contaminant would offset the much shorter (one instant vs. 365 days) state criterion-duration.

The picture is further complicated by the fact that state water quality criteria for public water supply (Public and Food Processing Water Supply, in Illinois' case) apply to the untreated water from a river or lake that is used as a "raw" water supply for a public drinking water system, while EPA's standards established under the Safe Drinking Water Act (SDWA) apply to "finished" drinking water at the tap, which usually has undergone some form of treatment to remove contaminants. Hence, for a given pollutant, a drinking water supply water quality criterion with a concentration higher than that specified in a drinking water standard could actually provide equal, or even greater, protection to consumers of finished drinking water, if the drinking water treatment process to which the raw water is subjected succeeded in removing a substantial percentage of the contaminant found in the raw water.

As noted previously, it is unclear whether Illinois has any WQC for toxic chemicals aimed at protecting the health of persons who consume fish and other aquatic organisms taken from waterbodies in the state.⁵⁷ If the state did have such WQC it would be important to note that EPA's human health criteria dealing with fish consumption (Human Health: Organisms and Human Health Water and Organisms criteria) assume a per-person daily intake of 17.5 grams of fish and other aquatic organisms. This estimate is based on national data, and represents the average rate of fish consumption. However, there are subpopulations that consume locally caught "fish" at considerably higher rates. (Native Americans, Cajuns, immigrants from Southeast Asia, and low income persons of all ethnic racial backgrounds are widely-recognized examples.) For such

⁵⁷ Having criteria for "fish consumption" use is important for persistent bioaccumulative toxics (PBTs), such as mercury, dioxin, PCBs, DDT, dieldrin, and certain polycyclic aromatic hydrocarbons (PAH).

subsistence fisherpersons, the EPA estimates that the fish consumption rate can be as high as ten times the 17.5 g/day national average. If a state simply adopts the EPA HHO and HHWO criteria for a waterbody that is used by subsistence fishers, those people will face a higher risk of illness than that upon which EPA's human health criteria are based. In order to compensate for this situation, the criterion-concentrations for the HHO and HHWO criteria need to be set at lower levels than that which has been set by EPA.

It does not seem that such differences in fish consumption patterns have been taken into account in establishing any of Illinois' WQC for toxics related to human health. For these kinds of WQC, there is no difference in the criterion-concentrations from one waterbody to another; that is, the criterion-concentration for a given toxic substance is the same for all waterbodies in the state.

Derived Water Quality Criteria

In addition to those criteria specified in the Illinois WQS regulations, the state has also published a set of numeric "derived water quality criteria" values for a substantial number of pollutant/use combinations. The state has developed both acute and chronic "derived" aquatic life criteria for 193 synthetic organic pollutants. It also has 75 "derived" criteria addressing human health for such compounds.

According to the state, these "derived water quality criteria" serve to "protect aquatic life, human health or wildlife," and have been used on occasion to limit discharges of substances in NPDES permits. The state notes, however, "some criteria have been derived from a less than ideal data set...and may not be suitable for use in a regulatory setting."⁵⁸ This statement on the sufficiency of available data would seem to apply to all of the nearly two hundred toxic pollutants for which the state has developed "derived" criteria for aquatic life. EPA has published aquatic life criteria for none of this long list of pollutants, presumably because currently available data on the effects of each of these pollutants does not cover enough forms of aquatic life to meet EPA's minimum dataset requirements. As for human health criteria, lack of sufficient toxicological studies does not seem to fully explain why the state chose to publish "derived" criteria as guidance values, as opposed to adopting them as official water quality criteria that appear in their WQS regulations. Well over half of the pollutants for which Illinois has issued "derived" human health criteria are ones for which EPA has published human health criteria. Perhaps the state has set higher data quantity and/or data quality requirements for establishing legally-binding human health WQC than EPA set for its recommended human health criteria. Another possible reason for a state choosing not to officially adopt a water quality criterion for a pollutant is lack of evidence of the presence of the pollutant in the state's waters or in discharges to the state's waters. For at least 26 of the pollutants for which Illinois has "derived" rather than official human health criteria and for which EPA has corresponding criteria, the state's listing of "derived" criteria indicates that water quality-based effluent limits (WQBELs) have been set for one or more NPDES permittees using a derived criterion. It is unusual for an NPDES program to require dischargers to meet WQBELs for a pollutant unless the pollutant has been detected in the facility's effluent.

Documents reviewed for this study did not explain the decision rules the Illinois NPDES program employs when deciding whether or not to use a "derived" water quality criterion (be it aquatic life or human health) as the basis for setting WQBELs. Nor was any indication provided as to whether, and if so, in what circumstances, Illinois' derived criteria would be used in other Clean Water Act regulatory programs that are driven by water quality standards — the Section 303(d) listing process and the total maximum daily load program.

⁵⁸ See <http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html>.

Appendix A

Missing and Extra Criteria for Conventional Pollutants: ILLINOIS

Table 1 - Aquatic Life

i) MISSING⁵⁹ POLLUTANTS

	<u>ACUTE</u>	<u>CHRONIC</u>
Aquatic life (general) ⁶⁰	chlorides calcium carbonate	chlor a chlorides (dissolved) gases hydrogen sulfide nitrogen (total) phosphorous (total)* ⁶¹ turbidity (NTU) turbidity (Secchi)
Indigenous aquatic life	chlorides	calcium carbonate chlor a chlorides (dissolved) gases hydrogen sulfide nitrogen (total) phosphorous (total)* turbidity (NTU) turbidity (Secchi)

⁵⁹ For the purposes of this review, “missing pollutants” are those pollutants for which EPA has issued WQC while the state has neither officially proposed nor adopted corresponding criteria. In situations where a state has adopted and submitted to EPA a set of state-adopted changes, but EPA has either not acted on the changes or has disapproved the changes, this fact is noted in this document.

⁶⁰ Illinois does not have separate use classifications and/or WQC for warm water versus coldwater aquatic life. It does have a set of “general use” criteria which “will protect the State’s water for aquatic life...” (Section 35. 302.202 of the Illinois WQS regulations) and another set of “Secondary Contact Recreation and Indigenous Aquatic Life” criteria. Waters assigned the latter DU “will be capable of supporting an indigenous aquatic life limited only by the physical configuration of the water” (Section 35. 302.403 of the Illinois WQS regulations). In the absence of a “cold water aquatic life” designated use, and given the fact that the maximum instantaneous temperature criteria for these two use categories are equal to or greater than the warm water aquatic life temperature criteria adopted by the other nine states covered in this study, this report assumes that both Illinois’s “general” and “indigenous” aquatic life criteria are for warm water habitats. Most of EPA’s WQC pertaining to aquatic life protection do not distinguish between warm and cold water habitat, nor does EPA have a set of WQC applicable to “indigenous aquatic life,” as opposed to aquatic life in general. There is no reason to think that EPA’s aquatic life WQC would not be relevant to the protection of “indigenous aquatic life”; hence, listings of “missing” and “extra” criteria have been provided for both “general” and “indigenous” aquatic life.

⁶¹ Illinois does have a criterion for phosphorous; however, it applies only to a certain sub-set of the waters of the state.

ii) **EXTRA⁶² POLLUTANTS**

	<u>ACUTE</u>	<u>CHRONIC</u>
Aquatic life (general)	sulfate temperature	(dissolved) oxygen temperature ⁶³
Indigenous aquatic life	oil, fats and grease (total dissolved) solids temperature	temperature

Table 2 - Drinking Water Supply⁶⁴

i) **MISSING POLLUTANTS**

<u>ACUTE</u>	<u>CHRONIC</u>
total coliform ⁶⁵	color chlorides foaming agents odor pH (total dissolved) solids sulfate

ii) **EXTRA POLLUTANTS**

<u>ACUTE</u>	<u>CHRONIC</u>
chlorides oil and grease sulfate (total dissolved) solids	fecal coliform

⁶² For the purposes of this review, “extra pollutants” are those pollutants for which the state has adopted a criterion while EPA has not. In situations where a state has adopted and submitted to EPA a set of state-adopted changes but EPA has either not acted on the changes or has disapproved the changes, this fact is noted in this document.

⁶³ This criterion is expressed as a temperature not to be surpassed more than a certain percentage of the time. Because of the manner in which it is expressed, it could be seen as either an acute or chronic criterion. Given that Illinois has an acute criterion (“at no time shall...exceed...”) for temperature for this use, the “percentage” criterion has been listed in the “chronic” column.

⁶⁴ EPA lacks actual drinking water supply criteria for conventional pollutants – specification of the levels of contaminants in surface waters being used as a raw water supply by public drinking water systems. The only EPA standards with regard to ensuring safe levels of contaminants in drinking water are applicable to “finished” water – that which results from raw water being passed through a treatment system aimed at removing contaminants to the degree practicable.

⁶⁵ Though Illinois lacks an acute WQC for *total* coliform bacteria, it does have a chronic value for *fecal* coliform bacteria. EPA’s SDWA standard is expressed as total coliform bacteria, and also could be considered either an acute or chronic criterion – stated as “no more than 5% of samples of finished drinking water shall have detectable levels of total coliform bacteria.” For counting purposes in this report, the state is shown as “missing” an acute value for total coliform, but having an “extra” chronic criterion for fecal coliform.

Appendix B

(**Note:** The following tables account only for toxic pollutants for which Illinois has actually adopted, and gotten EPA approval of, numeric WQC, in its WQS regulations. Illinois has published separate tables of “Derived Criteria” for both aquatic life and human health. There are such values for 193 pollutants pertaining to aquatic life and values for 75 pollutants that address human health-related uses of surface waters. Though the state has used these values on a number of occasions, because they are not EPA-approved values, their use in water quality-driven CWA programs such as 303(d) listing, TMDLs and NPDES permits is not required.)

Table 1

	Aquatic Life Protection - Freshwater	
	<i>Acute</i>	<i>Chronic</i>
EXTRA POLLUTANTS: Pollutants for which Illinois Has Adopted WQC where the EPA Has Not	<u>“Criteria for the Protection of Aquatic Organisms” [Sec. 302.208(e)]</u> Arsenic (III) Ethylbenzene Benzene Toluene Xylene <u>General Use Criteria that “protect the State’s water for aquatic life” [(Section 302.208(g)]</u> Barium Fluoride Manganese Phenol	<u>“Criteria for the Protection of Aquatic Organisms” (Sec. 302.208(e))</u> Arsenic (III) Benzene Ethylbenzene Toluene Xylene <u>General Use Criteria that “protect the State’s water for aquatic life” [(Section 302.208(g)]</u> --

Table 2

	Aquatic Life Protection - Freshwater	
	<i>Acute</i>	<i>Chronic</i>
MISSING POLLUTANTS: Pollutants for which Illinois Has Adopted WQC where the EPA Has Not	4,4'-DDT Aldrin alpha-Endosulfan Aluminum Arsenic ⁶⁶ beta-Endosulfan Chlordane Chlorpyrifos Diazinon Dieldrin Endrin gamma-BHC Heptachlor Heptachlor Epoxide Nonylphenol Parathion Pentachlorophenol Toxaphene Tributyltin	4,4'-DDT alpha-Endosulfan Aluminum Arsenic ⁶⁷ beta-Endosulfan Chlordane Chlorpyrifos Demeton Diazinon Dieldrin Endrin Guthion Heptachlor Heptachlor Epoxide Iron Malathion Methoxychlor Mirex Nonylphenol Parathion Pentachlorophenol PCBs Selenium Toxaphene Tributyltin

⁶⁶ Although Illinois has both an *acute* and a *chronic* aquatic life criterion for arsenic (III), these criteria were not compared to EPA's criteria for arsenic in this review because the EPA criteria are applicable to total arsenic. While Illinois has provided a multiplier to convert its numeric criterion-concentration for dissolved arsenic III to total arsenic, we were unable to take advantage of it in this review.

⁶⁷ Id. at 8

Table 3

Human Health Organisms Only/ "Human Health – Fish"			
MISSING POLLUTANTS : Pollutants for which EPA Has Adopted WQC where Illinois Has Not	1,1,2,2-Tetrachloroethane	Benzidine	Fluoranthene
	1,1,2-Trichloroethane	Benzo(a)Anthracene	Fluorene
	1,1-Dichloroethylene	Benzo(a)Pyrene	gamma-BHC
	1,2,4-Trichlorobenzene	Benzo(b)Fluoranthene	Heptachlor
	1,2-Dichlorobenzene	Benzo(k)Fluoranthene	Heptachlor Epoxide
	1,2-Dichloroethane	beta-BHC	Hexachlorobenzene
	1,2-Dichloropropane	beta-Endosulfan	Hexachlorobutadiene
	1,2-Diphenylhydrazine	Bis(2-Chloroethyl)Ether	Hexachlorocyclo-hexane-Technical
	1,2-Trans-Dichloroethylene	Bis(2-Chloroisopropyl)Ether	Hexachlorocyclopentadiene
	1,3-Dichlorobenzene	Bis(2-Ethylhexyl)Phthalate	Hexachloroethane
	1,3-Dichloropropene	Bromoform	Ideno(1,2,3-cd)Pyrene
	1,4-Dichlorobenzene	Butylbenzyl Phthalate	Isophorone
	2,3,7,8-TCDD (Dioxin)	Carbon Tetrachloride	Methyl Bromide
	2,4,6-Trichlorophenol	Chlordane	Methylene Chloride
	2,4-Dichlorophenol	Chlorobenzene	Methylmercury
	2,4-Dimethylphenol	Chlorodibromomethane	Nickel
	2,4-Dinitrophenol	Chloroform	Nitrobenzene
	2,4-Dinitrotoluene	Chrysene	Nitrosamines
	2-Chloronaphthalene	Cyanide	Nitrosodibutylamine,N
	2-Chlorophenol	Dibenzo(a,h)Anthracene	Nitrosodiethylamine,N
	2-Methyl-4,6-Dinitrophenol	Dichlorobromomethane	Nitrosopyrrolidine,N
	3,3'-Dichlorobenzidine	Dieldrin	N-Nitrosodimethylamine
	3-Methyl-4-Chlorophenol	Diethyl Phthalate	N-Nitrosodi-n-Propylamine
	4,4'-DDD	Dimethyl Phthalate	N-Nitrosodiphenylamine
	4,4'-DDE	Di-n-Butyl Phthalate	Pentachlorobenzene
	4,4'-DDT	Dinitrophenols	Pentachlorophenol
	Acenaphthene	Endosulfan Sulfate	Phenol
	Acrolein	Endrin	Polychlorinated Biphenyls PCBs
	Acrylonitrile	Endrin Aldehyde	Phenol
	Aldrin	Ether, Bis(Chloromethyl)	Pyrene
	alpha-BHC	Ethylbenzene	Selenium
	alpha-Endosulfan		Tetrachlorobenzene,1,2,4,5-
	Anthracene		Tetrachloroethylene

	Antimony		Thallium
	Arsenic		Toluene
			Toxaphene
			Trichloroethylene
			Trichlorophenol,2,4,5-
			Vinyl Chloride
			Zinc
Total # of Pollutants		104	

Table 4

Human Health Water and Organisms / "Human Health – Water & Fish"			
MISSING POLLUTANTS: Pollutants for which EPA Has Adopted WQC where Illinois Has Not	1,1,2,2-Tetrachloroethane	Barium	Fluoranthene
	1,1,2-Trichloroethane	Benzene	Fluorene
	1,1-Dichloroethylene	Benzidine	gamma-BHC
	1,2,4-Trichlorobenzene	Benzo(a)Anthracene	Heptachlor
	1,2-Dichlorobenzene	Benzo(a)Pyrene	Heptachlor Epoxide
	1,2-Dichloroethane	Benzo(b)Fluoranthene	Hexachlorobenzene
	1,2-Dichloropropane	Benzo(k)Fluoranthene	Hexachlorobutadiene
	1,2-Diphenylhydrazine	beta-BHC	Hexachlorocyclo-hexane-Technical
	1,2-Trans-Dichloroethylene	beta-Endosulfan	Hexachlorocyclopentadiene
	1,3-Dichlorobenzene	Bis(2-Chloroethyl)Ether	Hexachloroethane
	1,3-Dichloropropene	Bis(2-Chloroisopropyl)Ether	Ideno(1,2,3-cd)Pyrene
	1,4-Dichlorobenzene	Bis(2-Ethylhexyl)Phthalate	Iron
	2,3,7,8-TCDD (Dioxin)	Bromoform	Isophorone
	2,4,6-Trichlorophenol	Butylbenzyl Phthalate	Manganese
	2,4-Dichlorophenol	Carbon Tetrachloride	Methoxychlor
	2,4-Dimethylphenol	Chlordane	Methyl Bromide
	2,4-Dinitrophenol	Chlorobenzene	Methylene Chloride
	2,4-Dinitrotoluene	Chlorodibromomethane	Nickel
	2-Chloronaphthalene	Chloroform	Nitrates
	2-Chlorophenol	Chlorophenoxy Herbicide (2,4,5,-TP)	Nitrobenzene
	2-Methyl-4,6-Dinitrophenol	Chlorophenoxy Herbicide (2,4-D)	Nitrosamines
	3,3'-Dichlorobenzidine	Chrysene	Nitrosodibutylamine,N
	3-Methyl-4-Chlorophenol	Copper	Nitrosodiethylamine,N
	4,4'-DDD	Cyanide	Nitrosopyrrolidine,N
	4,4'-DDE	Dibenzo(a,h)Anthracene	N-Nitrosodimethylamine
	4,4'-DDT	Dichlorobromomethane	N-Nitrosodi-n-Propylamine
	Acenaphthene	Dieldrin	N-Nitrosodiphenylamine
	Acrolein	Diethyl Phthalate	Pentachlorobenzene
	Acrylonitrile	Dimethyl Phthalate	Pentachlorophenol
	Aldrin	Di-n-Butyl Phthalate	Phenol
	alpha-BHC	Dinitrophenols	Polychlorinated Biphenyls PCBs
	alpha-Endosulfan	Endosulfan Sulfate	Pyrene
	Anthracene	Endrin	Selenium
	Antimony	Endrin Aldehyde	Tetrachlorobenzene,1,2,4,5-

	Arsenic	Ether, Bis(Chloromethyl)	Tetrachloroethylene
	Asbestos	Ethylbenzene	Thallium
			Toluene
			Toxaphene
			Trichloroethylene
			Trichlorophenol,2,4,5-
			Vinyl Chloride
			Zinc
Total # of Pollutants	111		

Table 5

	Drinking Water Supply
<p>EXTRA POLLUTANTS: Pollutants For Which Illinois Has Not Adopted Public and Food Processing Water Supply WQC and for which EPA Has Not Adopted Primary Drinking Water Standards Under the SDWA, (<i>Note: EPA has not issued, under authority of the CWA, water quality criteria for drinking water supply, or food processing water supply, or the combination thereof.</i>)</p> <p>Note: All of Illinois' Public and Food Processing Water Supply criteria address acute (instantaneous, in this case) exposure, while the EPA Primary Drinking Water Standards are expressed as chronic (12 month average) values.</p> <p>Hence, it could be said that all 23 of the state's Public and Food Processing criteria for toxics are "extra," but then all of these WQC would also be counted as "missing."</p> <p>The counts in this report do not take the differences in the durations of the Illinois criteria and the EPA standards into account. Hence, if Illinois had any, be it acute or chronic, Public and Food Processing Water Supply Criteria for a given pollutant and there was not a EPA standard for that pollutant, then the Illinois WQC Was counted as "Extra."</p>	Aldrin DDT Dieldrin Parathion Phenols

Table 6

	Drinking Water Supply		
<p>MISSING POLLUTANTS: Pollutants for which EPA Has Adopted Primary Drinking Water Standards Under the SDWA, but For Which Illinois Has Not Adopted Public and Food Processing Water Supply WQC (<i>Note: EPA has not issued, under authority of the CWA, water quality criteria for drinking water supply, or food processing water supply, or the combination thereof.</i>)</p> <p>Note: All of Illinois' Public and Food Processing Water Supply criteria address acute (instantaneous, in this case) exposure, while the EPA Primary Drinking Water Standards are expressed as chronic (12 month average) values.</p> <p>Hence, it could be said that all 23 of the state's Public and Food Processing criteria for toxics are "extra," but then all of these WQC would also be counted as "missing."</p> <p>The counts in this report don't take the differences in the durations of the Illinois criteria and the EPA standards into account. Hence, if Illinois had no Public and Food Processing Water Supply Criteria for a given pollutant and there was not a EPA standard for that pollutant, then the Illinois WQC Was counted as "Missing."</p>	1,1,2-Trichloroethane	Endothall	
	1,1-Dichloroethylene	Ethylbenzene	
	1,2,4-Trichlorobenzene	Ethylene dibromide	
	1,2-Dibromo-3-chloropropane	Fluoride	
	1,2-Dichloroethane	Glyphosate	
	1,2-Dichloropropane	Haloacetic acids (HAA5)	
	cis-1,2-Dichloroethylene	Hexachlorobenzene	
	Atrazine	Hexachlorocyclopentadiene	
	Benzene	Mercury	
	Benzo(a)pyrene (PAHs)	Nitrite	
	Beryllium	o-Dichlorobenzene	
	Beta particles & photon emitters	Oxamyl (Vydate)	
	Bromate	PCBs	
	Carbofuran	p-Dichlorobenzene	
	Carbon tetrachloride	Pentachlorophenol	
	Chloramines	Picloram	
	Chlordane	Radium 226 and Radium 228 (combined)	
	Chlorine	Simazine	
	Chlorine dioxide	Styrene	
	Chlorite	Tetrachloroethylene	
	Chlorobenzene	Thallium	
	Chromium (total)	Toluene	
	Cyanide (as free cyanide)	Total Trihalomethanes	
	Dalapon	trans-1,2-Dichloroethylene	
	Di(2-ethylhexyl) adipate	Trichloroethylene	
	Di(2-ethylhexyl) phthalate	Uranium	
	Dichloromethane	Vinyl chloride	
	Dinoseb	Xylenes (total)	
	Dioxin (2,3,7,8-TCDD)		
	Diquat		
	Total # of Pollutants	58	

Table 7

	Aquatic Life Protection - Fresh Water	
	<i>Acute</i>	<i>Chronic</i>
	Pollutants with a state criterion-concentration higher than EPA's	Cadmium Copper Lead Silver Mercury

Table 8

	Aquatic Life Protection - Fresh Water	
	<i>Acute</i>	<i>Chronic</i>
	Pollutants with a state criterion-concentration lower than EPA's	Chromium (III) Nickel

APPENDIX C

SITUATIONS IN WHICH STATE WQC ARE CLEARLY LESS PROTECTIVE THAN EQUIVALENT EPA WQC

	Concentration	Duration	Frequency
State vs. EPA ⁱ	higher	longer	higher
“ “ “	equal	longer	higher
“ “ “	higher	equal	higher
“ “ “	higher	longer	equal
“ “ “	higher	equal	equal
“ “ “	equal	equal	higher
“ “ “	equal	longer	equal

SITUATIONS IN WHICH STATE WQC ARE CLEARLY MORE PROTECTIVE THAN EQUIVALENT EPA WQC

	Concentration	Duration	Frequency
State vs. EPA	lower	shorter	lower
“ “ “	equal	shorter	lower
“ “ “	lower	equal	lower
“ “ “	lower	shorter	equal
“ “ “	lower	equal	equal
“ “ “	equal	equal	lower
“ “ “	equal	shorter	equal

SITUATIONS IN WHICH COMPARATIVE LEVEL OF PROTECTION CANNOT BE DETERMINED BY SIMPLY LOOKING AT THE TWO CRITERIA

	Concentration	Duration	Frequency
State vs. EPA	lower	shorter	higher
“ “ “	equal	shorter	higher
“ “ “	lower	equal	higher
“ “ “	lower	longer	equal
“ “ “	higher	equal	lower
“ “ “	higher	shorter	equal
“ “ “	equal	longer	lower

ⁱ The state WQC's component (e.g. duration) compared to the component for corresponding EPA WQC.

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