

ILLINOIS POLLUTION CONTROL BOARD  
June 30, 1988

IN THE MATTER OF: )  
 )  
AMENDMENTS TO )  
SUBTITLE C: WATER POLLUTION. ) R85-29  
FECAL COLIFORM AND )  
SEASONAL DISINFECTION )

ADOPTED RULE

FINAL ORDER

OPINION AND ORDER OF THE BOARD (by R. C. Flemal):

The Board has long been grappling with the problem of chlorination of sewage treatment plant effluents. The problem occurs because chlorination of effluents, which is a nearly universal practice in Illinois, has a negative impact on the aquatic community of the streams and lakes to which the chlorinated effluents are discharged. For this reason prudent environmental management demands that chlorination should at least be selectively discontinued.

However, chlorination also constitutes a mechanism for the removal of pathogenic organisms from effluents. Hence, chlorination decreases the possibility of waterborne infections and disease. For this reason prudent environmental management demands that chlorination should at least be selectively continued in those circumstances where water-borne infections or disease are possible.

The principal difficulty facing the Board has been in delineating those circumstances under which chlorination should be discontinued, and those circumstances under which chlorination should be retained. Further compounding the issue are multiple questions of how the selective discontinuance of chlorination should be effectuated, which includes such matters as: Should chlorination be replaced by an alternative disinfection process? How does one determine circumstances under which risk to human health outweigh environmental damage? Can a general rule suffice to cover all possible contingencies? Etc.

Today the Board adopts amendments which, the Board believes, answers the deficiencies found in previous efforts to address the effluent chlorination problem.

ADOPTED AMENDMENTS

The instant amendments have three elements, which respectively amend the fecal coliform sections of the Board's General Use Water Quality Standards at 35 Ill. Adm. Code Part 302, Subpart B; the Public and Food Processing Water Supply Standards at 35 Ill. Adm. Code Part 302, Subpart C; and the Effluent Standards at 35 Ill. Adm. Code Part 304.

The first element, which addresses Part 302, Subpart B, limits applicability of the present fecal coliform water quality standard<sup>1</sup> to those general use waters defined as protected waters, and then only during the months May through October. Protected waters are defined within the amendments to include waters which, "due to natural characteristics, aesthetic value, or environmental significance, are deserving of protection from pathogenic organisms". Explicitly included within the definition are all waters which "presently support or have the physical characteristics to support primary contact or which "flow through or adjacent to parks or residential areas". Primary contact is itself defined at 35 Ill. Adm. Code 301.355 as "Any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing".

The Part 302, Subpart B, amendments additionally exempt from the general use fecal coliform standards, on a year-round basis, "waters unsuited to support primary contact uses because of physical, hydrologic or geographic configuration and are located in areas unlikely to be frequented by the public on a routine basis".

The second element, which addresses Part 302, Subpart C, provides an exception to the conditions of the Subpart B amendments. Specifically, it imposes a water quality standard applicable at any point where water is withdrawn for public and food processing purposes. The standard is a geometric mean of 2000 per 100 ml, based on a minimum of five samples taken over not more than a 30 day period<sup>2</sup>, applicable at all times. The

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<sup>1</sup> The geometric mean, based on a minimum of five samples taken over not more than a 30 day period, shall not exceed 200 per ml, nor shall more than 10% of the samples during a 30 day period exceed 400 per ml. 35. Ill. Adm. Code 302.202. For purpose of simplicity, this standard is hereinafter referred to as the "200/100 ml" standard.

<sup>2</sup> For purpose of simplicity, this standard is hereinafter referred to as the "2000/100 ml" standard.

2000 per 100 ml standard here identified is the same as the standard applicable to raw water supplies, as found at 35. Ill Adm. Code 604.501(c).

The net result of the Part 302 amendments sets up several classes of waters with respect to fecal coliform standards, based on the use of the water and the time of year:

	<u>Applicable Standard</u>	
	<u>May-October</u>	<u>November-April</u>
Protected Waters	200/100 ml	None
P&FP Water Supply in a Protected Water	200/100 ml	2000/100 ml
P&FP Water Supply <sup>3</sup> in other waters <sup>3</sup>	2000/100 ml	2000/100 ml
Other waters	None	None

The third element of the amendments addresses the fecal coliform effluent standard. Specifically, the amendments retain the current requirement that all effluents governed by Part 304 contain no more than 400 fecal coliforms per 100 ml, but provide for the first time that an exemption<sup>4</sup> can be obtained. To obtain the exemption, a discharger must demonstrate to the Agency that the receiving water is not a protected water or a Public and Food Processing Water Supply, and that the discharge will not cause a violation of any General Use or Public and Food Processing Water Supply standard at a downstream point. The exemptions, which are to be granted by the Agency, may be on a year-round basis or a seasonal basis, depending upon the individual circumstances. The exemption process would be carried out as part of the NPDES permitting process and would be governed by rules and appeal processes therein. Additionally, the Agency has entered into the record (P.C. #27, attachment) a copy of proposed guidelines for review of exemption petitions. It proposes to promulgate these guidelines upon completion of the instant action.

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<sup>3</sup> The Board notes that since raw water supplies are by necessity located on bodies of water of substantial size, these bodies of waters in almost all cases are likely to be protected waters. Thus, it is unlikely that public and food processing water supplies will be located on other than protected waters.

<sup>4</sup> The exemption is characterized in the amendments as an "alternative effluent standard", per a suggestion to this end by the Joint Committee on Administrative Rules ("JCAR"). See discussion following.

## HISTORY

### Institution of Fecal Coliform Standards

Widespread municipal wastewater disinfection via chlorination is a relatively recent phenomenon, dating only to the 1960's (47 PCB 554). Its intent is to kill disease-causing organisms which may have survived other steps in the effluent treatment process.

In 1972, shortly after the organization of the Board, the Board adopted ambient water quality standards and effluent standards which had the effect of requiring effluent disinfection<sup>5</sup>. The standards did not specifically identify that disinfection had to take place, but rather limited the number of fecal coliform bacteria, an indicator of microbial contamination<sup>6</sup>, which could be discharged and which could be present in the ambient aquatic environment. However, since almost all undisinfected municipal wastewater effluents contain fecal coliform bacteria in numbers greater than the standards, the effect was to require essentially universal disinfection.

In its 1972 action the Board was following the best scientific information of the times. In this context, it is to be noted that the United States Environmental Protection Agency ("USEPA") adopted a similar fecal coliform standard in 1973.

However, conventional wisdom began to change very rapidly, occasioned by accumulating evidence that chlorination was causing more problems than it was solving. One of the consequences was that in 1976 the USEPA reversed itself and deleted the fecal coliform standards it had adopted only three years previously. Moreover, other states began to change or repeal their previously adopted fecal coliform standards, or to adopt none if they had not reacted to the earlier trend to universal chlorination.

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<sup>5</sup> In the Matter of: Effluent Criteria, R70-8, In the Matter of: Water Quality Standards R71-14, and In the Matter of: Water Quality Standards Revisions for Interstate Waters (SWB-14), R71-20. See Board Opinions and Orders at 3 PCB 755-76 and 4 PCB 3-40.

<sup>6</sup> Direct detection of disease-causing organisms is difficult. Therefore, standard practice is to set limits on, and monitor for, more easily detectable surrogate organisms whose presence indicates the possible presence of disease-causing organisms. Fecal coliform bacteria are ubiquitous inhabitants of the intestinal tract of warm-blooded animals and are not usually themselves the cause of disease.

R77-12D Proceeding

Illinois first readdressed effluent chlorination in the proceeding R77-12D<sup>7</sup>. The R77-12D proceeding produced a voluminous record, including transcripts of eight merit hearings and three economic impact hearings, 64 exhibits, and 105 public comments. The Board found that the record clearly showed that chlorination caused significant aquatic environmental damage. Among the observations weighed by the Board were: that residual chlorine stunts the growth of fish, halts or reduces spawning, and is lethal at concentrations of less than 0.1 mg/l; that fish avoid levels of residual chlorine as low as 0.01 mg/l; that estimated value of lost angling days in Illinois was then from \$2,000,000 to \$4,400,000; that chlorinated hydrocarbons produced as a result of chlorination are hazardous materials whose toxic effects are of uncertain, but likely real concern; and that chlorination may negatively impact other effluent parameters, including ammonia and dissolved oxygen (47 PCB 570-2).

The Board also reviewed an extensive record contesting the efficacy of chlorination in preventing waterborne disease (47 PCB 561-4). The Board pointed out that the record indicated that effluent chlorination is of dubious value in killing intestinal parasites and deactivating viruses. It also pointed out that there were no studies of human disease which showed that disinfection of sewage produces any measurable public health benefits related to reduction of disease.

In summary, the Board concluded:

If disinfection were first proposed for adoption today, it is quite clear that the record would not support its widespread use. Now, however, available evidence of the harmful effects and limited, at best, health benefits has greatly increased. 47 PCB 574.

In response to its findings in R77-12D, the Board on October 14, 1982 issued a final ruling encompassing these actions:

- 1) Repeal of the fecal coliform water quality standard applicable to secondary contact waters;
- 2) Repeal of the fecal coliform water quality standard applicable to general use waters; and
- 3) Repeal of the fecal coliform effluent standard

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<sup>7</sup> In the Matter of: Amendments to Chapter 3: Water Pollution (Effluent Disinfection). See Board Opinions and Orders at 43 PCB 479-80, 47 PCB 549-83, and 49 PCB 183-4.

except for those dischargers situated within 20 stream miles from a public bathing beach or a water intake used for public and food processing water supply.

The reason for addressing action to the fecal coliform bacterial standards rather than directly to chlorination is that chlorination is the accepted practice by which compliance with a fecal coliform standard is achieved. Thus, removal of the standard obviates the need to continue the offending chlorination practice.

The Board's action in R77-12D was appealed through the State Court system by the Illinois Attorney General. The First District Appellate Court upheld the Board's repeal of the fecal coliform water quality standard for secondary use waters, but overturned the Board's actions with respect to the fecal coliform standards for general use waters and effluent discharges. People of the State of Illinois v. Pollution Control Board, 119 Ill. App. 3d 561, 456 N.E. 2d 909 (1983)). The Illinois Supreme Court upheld the appellate court's actions in People of the State of Illinois v. Illinois Pollution Control Board, 103 Ill. 2d. 441, 469 N.E. 2d 1102 (1984).

The higher courts' decisions were based not on any one facet of the Board's decision, but rather on a combination of facets, including but not limited to: (a) arbitrariness of the 20-mile limit; (b) failure to provide adequate protection to primary contact waters; (c) failure to fully consider possible microbial standards other than fecal coliform bacteria; and, (d) failure to adequately consider alternative means of disinfection.

#### Instant Proceeding

The instant proceeding comes before the Board as an outgrowth of a motion filed on November 8, 1985 by the Bloomington and Normal Sanitary District ("BNSD") and the Illinois Association of Sanitary Districts ("IASD") which requested that the Board adopt an Emergency Rule providing for seasonal disinfection. Although the Board denied the motion based on failure to find that an emergency existed (67 PCB 55), the Board opened the present docket in the same Order on the prospect that the proposed BNSD/IASD rule might have merit as a permanent rule.

Following two public hearings and receipt of post-hearing comments, the Board on November 6, 1986 (74 PCB 73) sent a slightly modified version of the BNSD/IASD proposal to first notice; publication occurred at 10 Ill. Reg. 19647, November 21, 1986. An additional hearing on the BNSD/IASD proposal was held on June 4, 1987 in response to a request from BNSD.

Concurrently with these activities, the Illinois Department of Energy and Natural Resources undertook a study expressly targeted to this docket and titled Assessment of Wastewater Disinfection Technologies ("AWDT Study"). This study was filed with the Board on September 1, 1987 as P. C. #22. It considers many facets of disinfection, including the rationale for wastewater disinfection, different disinfection technologies, costs of disinfection, public health and environmental benefits and costs, and a discussion of regulatory strategies. By Order of September 10, 1987 the Hearing Officer set a special comment period on the AWDT Study. Four comments were received (P.C. #23-#26).

On February 4, 1988 the Illinois Environmental Protection Agency ("Agency") filed an alternative proposal, which forms the framework for today's adopted rules. The Agency had not previously been a proponent in the instant matter, but had actively participated in the hearings. The Agency filed the proposal in the spirit of offering a cure to some of the objections raised to the earlier BNSD/IASD proposal<sup>8</sup>. The Agency's proposal was sent to first notice pursuant to an Order of the Board of February 4, 1988, with publication occurring at 12 Ill. Reg. 4305, February 26, 1988.

On May 5, 1988 the Board adopted the Agency proposal for second notice after consideration of additional public comment received. On June 14, 1988 JCAR issued a certification of no objection to the proposed amendments. However, JCAR made certain recommendations for changes in the regulatory language; these are discussed later in this Opinion.

In total, forty-two public comments and two supplemental public comments, representing 23 different individuals, organizations, or governmental entities, have been received in this matter. Of these, the latter fifteen (P.C. #28-#42) have been filed in response to first notice of the Agency proposal. With two exceptions, both filed by Illinois American (P.C. #33 and #41), the public comments express support for the Agency proposal. Professor Charles Hass, who had earlier expressed objection to the BNSD/IASD proposal (P.C. #2, #3, #14), endorses

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<sup>8</sup> The Agency's proposal differs from the BNSD/IASD proposal principally in that the BNSD/IASD proposal would have retained the 200/100 ml fecal coliform standard during May through October for all general use waters irrespective of whether primary use was likely to occur. Additionally, the earlier proposal would have granted a blanket exemption to the 400/100 ml effluent standard during the months of May through October, rather than providing for the site-specific exemption demonstration required by the current rule.

the Agency proposal (P.C. #28). The AG, who had also expressed objection to the BNSD/IASD proposal (P.C. #11; S.P.C. #2), has not commented on the Agency proposal.

### ENVIRONMENTAL IMPACT

#### Aquatic Life

The principal argument presented in favor of discontinuing universal disinfection by chlorination is that chlorination causes significant environmental damage. The damage is largely focused on the aquatic community, which suffers as a consequence of exposure to residual chlorine and to a variety of chlorine reaction products, many of which are toxic organochlorine compounds.

Total residual chlorine ("TRC") refers to the sum of unreacted free chlorine plus chlorine which has reacted with ammonia to produce chloramines ( $\text{NH}_2\text{Cl}$ ,  $\text{NHCl}_2$ , and  $\text{NCl}_3$ ). It is well established through laboratory studies that TRC is toxic to a wide variety of aquatic organisms at relatively low concentrations. The literature on TRC toxicity, plus its components, is extensively summarized in Exhibit 22, pages 6-18<sup>9</sup>. It is also noted that chloramines have been discharged from Illinois sewage treatment facilities at concentrations as high as 1.05 to 5.17 mg/l; many fish species cannot tolerate chloramine levels above 0.1 mg/l, and even more tolerant fish species are killed at levels above 1.2 mg/l<sup>10</sup>.

In addition to chloramines, reaction products are produced when chlorine reacts with organic substances in the wastewater stream or the receiving body of water. These include such recognized toxicants as methyl chloride, chloroform, trichloroethylene, tetrachloroethylene, and dichlorobenzenes (Ex. 22).

Field demonstrations of environmental damage to aquatic life due to chlorination are many. Among these are a three-year study conducted on Sugar Creek below the BNSD outfall, which showed a marked decline in intolerant fish species, fish species

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<sup>9</sup> "Environmental Impact and Health Effects of Wastewater Chlorination", by Gary R. Brenniman, ENR Document 81/27, July, 1981.

<sup>10</sup> "Wastewater Disinfection: A Review of the Technical and Legal Aspects in Illinois", The Metropolitan Sanitary District of Greater Chicago, Report No. 84-17. This document has been admitted into the record as Exhibit 6.



diversity, and total number of individual fish within the zone of total residual chlorine persistence downstream from the BNSD outfall (R. at 22-3; Exh. 19).

One of the more extreme cases presented in this record concerns the East Branch of the DuPage River. The Northeastern Illinois Planning Commission ("NIPC") notes that the East Branch "once supported a game fishery, including large mouth bass and northern pike", but is now characterized "as very poor, being dominated by carp and suckers" (P.C. #7, p. 1). Modeling studies of the effect of various toxicants in the East Branch indicate that residual chlorine is a major contributor to the poor character of the aquatic community<sup>11</sup>. Based on these results, NIPC has concluded that even with the advent of advanced wastewater treatment at all East Branch treatment plants, "fish toxicity will still be a problem due to the presence of residual chlorine" and that it is only when chlorine is eliminated that "toxicity drops to tolerable levels throughout much of the river" (Id. at 5). In summary, NIPC notes that "if present chlorination practices continue, it will be impossible to achieve a high quality fish community in much of the East Branch even when advanced wastewater treatment is implemented" (Id. at 6).

Field studies have also demonstrated that the elimination of chlorination can lead to a restoration of the health of an aquatic community. A particularly pertinent study, carried out in Illinois in 1983 by Drs. Roy C. Heidinger and William M. Lewis<sup>12</sup>, found that in three central Illinois streams temporary discontinuation of chlorination by sewage treatment plants resulted in the rapid restoration of what had been extremely poor fish communities. Restoration was to the level characteristic of ambient areas above the outfalls, and could be directly attributed to reductions in residual chlorine (Exh. 3 at 88). As a general conclusion, Heidinger and Lewis determined that "the elimination of residual chlorine from good quality secondary sewage effluents derived primarily from domestic wastes will result in quantitative and qualitative improvement of the fish communities in most Illinois streams" (Id. at 88-9).

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<sup>11</sup> Dennis W. Dreher, "Study of Fish Toxicity in the East Branch DuPage River", Northeastern Illinois Planning Commission Staff Paper, June 1981. This document has been admitted into the record as part of P.C. #7.

<sup>12</sup> Heidinger and Lewis, "Relative Effects of Chlorine and Ammonia from Wastewater Treatment Facilities on Stream Biota". This document has been admitted into the record as Exhibit 3.

In a separate submission to the record Professor Heidinger points out that many fish species, including endangered and threatened species, live or spawn in headwater streams where they are subject to TRC toxicity. He concludes that he wishes to "make it very clear that from the fisheries standpoint the best solution is to stop chlorination altogether or to dechlorinate" (P.C. #8 at 2).

The Metropolitan Sanitary District of Greater Chicago ("MSDGC") has also undertaken a study of comparative fish populations under chlorination/non-chlorination regimes. In April, 1984, MSDGC ceased chlorinating effluent discharged from its North Side Sewage Treatment Works pursuant to deletion of the secondary use fecal coliform standard. The effluent had received continuous chlorination prior to that time. During fish sampling conducted in each of the seven preceding years and carried out 0.7 to 1.7 miles downstream from the outfall, a total of 20 individual fish representing six species had been collected. In contrast, a collection made in that same area on November 5, 1984, seven months after cessation of chlorination, totalled 115 individual fish representing 9 species (R. at 112-3).

Concerns over environmental damage associated with chlorination have persuaded other states to reduce requirements for chlorination. Among these are the neighboring states of Ohio, Indiana, Minnesota, Iowa, and Missouri, each of which has instituted seasonal chlorination (R. at 14; Ex. 1). Wisconsin recently adopted a program similar to the instant proposal in that it provides for year-round disinfection where protection of public drinking water supplies is required, seasonal disinfection where only protection of recreational uses is required, and elimination of disinfection in other circumstances (AWDT Study at 94). A Wisconsin official has estimated that under this program about half of the municipal dischargers are not required to disinfect at all, about 40 percent are required to seasonally disinfect, and about 10 percent are required to disinfect year-round (Id.).

The U.S. Environmental Protection Agency ("USEPA") is also on record as endorsing a reduction in universal wastewater chlorination. Commenting in a letter written by the chief of USEPA's Technical Support Section to an official of the BNSD, the USEPA noted that it:

encourages the reduction in disinfection by the use of chlorine where aquatic life protection is a desired use, and public health requirements do not outweigh this consideration. EPA encourages seasonal disinfection as a reasonable way to avoid chlorine discharges when justified. (Ex. 2).

Finally, the Agency also concludes that "reduction in the amount of chlorine released to the environment in Illinois can be expected to have a positive impact on the aquatic communities (R. at 190).

#### Human Health

The two long-standing arguments in opposition to any curtailment of disinfection concern possible health impacts on downstream water supplies and human recreational use of waters. The problem of impact on downstream public water supplies has been capsulized by Mr. James Park, representing the Agency:

The Agency is concerned ... about the possible impact of existing and the potential impact of new discharges of wastewater containing high counts of fecal coliform in the immediate vicinity of public water supply intakes ... While public water supply clarification, filtration and chlorination facilities can effectively deal with a relatively wide range of raw water quality, the elevated and fluctuating bacterial levels associated with unchlorinated secondary effluent do have the potential to overwhelm public water supply chlorination facilities if the natural mitigating effects of dilution and instream die-off do not have a chance to operate. (R. at 188-9).

Mr. C. A. Blanck of Illinois-American Water Company, which provides public water supply for one million Illinois residents, has also noted the following concerns:

Disinfection at the source ... provides the initial barrier to the transmission of waterborne disease. The removal of this barrier simply transfers an additional burden to the potable water perveyor.

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Disinfection of the effluent assures some minimal level of protection for downstream users and at least reduces the levels of microbiological contamination during periods when plants are not operating properly.

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Any quality degradation in the water supply caused by the cessation in disinfection will probably create increased chlorine requirements at the downstream water treatment plants. This will increase the trihalomethane levels formed by chlorination of the

raw water, since they are directly related to chlorine dosage.

R. at 428-430

Accordingly, Illinois-American Water Company urges the Board to allow modification of existing chlorination rules only to the extent that such modification does not increase the health risk to public water supply users (P.C. #41 at 2).

Human health impacts have also been the principal focus of public comments by the AG and Professor Haas. The AG points out that phenomena such as the survival of viruses and bacteria at low temperatures and viral shedding during late summer and early fall require consideration of year-round disinfection of effluent discharges located upstream of public water supplies or recreational areas (P.C. #11 at 3-4). The AG additionally contends that treatment of drinking water is "an imperfect process" which "is not immune from operational problems which allow bacteria and viruses to pass through to the users" (Id. at 5). Given this circumstance, the AG urges continued disinfection where its absence would otherwise "eliminate an important barrier protecting the health of drinking water users" (Id.).

Professor Haas emphasizes that:

It is necessary for any proposed revisions of wastewater disinfection regulations to recognize the need for year-round disinfection of those effluents in proximity to intakes and/or in low dilution receiving waters. Without this recognition, any relaxation of effluent disinfection is technically unsupportable. (P.C. #3, p. 3)

At hearing and in P. C. #12, BNSD offered rebuttal of the position that adoption of uniformly-applicable seasonal disinfection would adversely impact downstream water supplies. Among other matters, BNSD notes that existing regulations require water suppliers utilizing surface water as a raw water source to employ coagulation, clarification, rapid sand filtration, and continuous post-chlorination. BNSD contends "that each of these treatment processes in themselves are bacteriocidal and virucidal" and that when "employed in a series treatment scheme they provide adequate protection of the public health" (P. C. #12 at 1-2). BNSD also provided documentation from other states where seasonal chlorination is the accepted practice which notes that no known human health problems have been associated with seasonal chlorination. Additionally, BNSD contests the applicability to Illinois of the studies cited by the AG in support of his contention of winter bacterial and viral survival, contending that the studies are old and were conducted on Alaskan streams very different both physically and chemically from those in Illinois (Id. at 8-15).

ECONOMIC REASONABLENESS

The Illinois Department of Energy and Natural Resources ("ENR") concluded on September 26, 1986, that a formal economic impact study ("EcIS") is not necessary in the proceeding, noting that this declaration is appropriate based on the statutory criteria in Ill. Rev. Stat., ch. 96<sup>1/2</sup> par. 7404(d)(2). The Economic Technical Advisory Committee ("ETAC") concurred in this determination on October 10, 1986.

It is to be noted that the proposal before ENR and ETAC was the BNSD/IASD proposal of May 1986 rather than the Agency-sponsored proposal which the Board adopts today. Section 27(b) of the Act, however, in addition to requiring that economic impact studies be prepared, also allows the Board to modify and subsequently adopt any proposed regulations without additional economic study by ENR if the modification does not significantly alter the intent and purpose of the proposed regulation which was the subject of ENR's determination. The Board finds that the proposal considered today is not significantly altered in intent or purpose from the May 1986 proposal. The Board consequently believes that no additional determination by ENR regarding the necessity of an EcIS is required.

The AG has objected (P.C. #11, p. 9-11) to this matter proceeding on the basis of an alleged necessity of conducting a EcIS pursuant to Section 27(b) of the Environmental Protection Act (Ill. Rev. Stat., ch. 111<sup>1/2</sup> par. 1027). The AG contends that the record before the Board is insufficient to allow the Board to reach a determination on the economic reasonableness of the proposed amendments. Aside from the determination of ENR and ETAC that an EcIS is not necessary, the Board notes that an EcIS was conducted in R77-12D, and that the same has been admitted into the current record as Exhibit 21<sup>13</sup>. Moreover, the AWDT Study (P.C. #22), which was filed subsequent to the AG's objection, contains substantial new and updated economic information. The Board finds that the significant information contained in the R77-12D EcIS remains pertinent, and that this, in combination with the record developed in the current proceeding, provides information sufficient for the Board to make its mandatory economic determination.

The record identifies two economic benefits and three costs. The benefits are related to decrease in cost associated with disinfecting wastewaters and increase in quality of the

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<sup>13</sup> "The Economic Analysis of Health Risks and the Environmental Assessment of Revised Fecal Coliform Effluent and Water Quality Standards", Illinois Institute of Natural Resources, Document No. 81/15, March 1981.

aquatic environment. The costs are related to possible increased incidence of waterborne disease to a) primary contact users and b) consumers of water withdrawn for human consumption, and increased costs of treatment of water withdrawn for human use.

The R77-12D EcIS determined that the more than 1,400 municipal, industrial, and commercial treatment facilities in Illinois which are required to disinfect their final effluents spend over \$4 million annually doing so<sup>14</sup>. These are annual operational costs, and do not include amortization of chlorination equipment (Ex 21, p. 158). Under the assumption that approximately halving the time period when chlorination would be required would approximately halve total operational costs, the expected savings associated with the current proposal would be on the order of \$2 million annually. This figure is consistent with a 1985 IASD study, which showed that 22 large municipal plants serving a population of 2 million people spend \$960,000 annually to disinfect final effluents (R. at 12).

The AWDT Study provides estimates of 1987 disinfection costs based on treatment plant capacity. For disinfection via chlorination, expressed in \$1,000s, these estimates include (P.C. #22 at 28, 31):

	<u>Plant Capacity (mgd)</u>			
	<u>0.1</u>	<u>1.0</u>	<u>10.0</u>	<u>100.0</u>
Basic Construction	40.0	88.0	340.0	1400.0
Annual Operations	4.6	16.8	78.7	589.5

Those facilities that would be allowed to cease chlorination entirely as a consequence of these amendments would realize savings for full operational costs and any costs associated with equipment replacement. Those facilities which would be required to maintain seasonal chlorination would realize a savings of a portion of their annual operations costs.

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<sup>14</sup> The annual cost of disinfection in Illinois as cited in Exhibit 21 was approximately \$6.9 million (Table 6-3, p. 159). Included in that sum was the amount spent annually by MSDGC, approximately \$2.8 million. Since MSDGC's plants discharge only to secondary contact waters, the plants are no longer required to provide disinfection and MSDGC has ceased the practice of chlorination. The best estimate of current disinfection costs is therefore the State total minus the MSDGC cost, expressed in the dollars current for the Exhibit 21 study.

The AWDT Study also provides estimates of the marginal charges to the user of a chlorination disinfection system per 1000 gallons of wastewater flow (P.C. #22 at 40). For three different chlorination situations these are:

	<u>Plant Capacity (mgd)</u>			
	<u>0.1</u>	<u>1.0</u>	<u>10.0</u>	<u>100.0</u>
No Disinfection	\$0.00	\$0.00	\$0.00	\$0.00
Six-Month Disinfection	\$0.29	\$0.07	\$0.03	\$0.02
Year-Round Disinfection	\$0.34	\$0.09	\$0.03	\$0.02

The second principal economic benefit to be expected as a consequence of a reduction in chlorination consists of improvement in the aquatic environment. Unfortunately, this is a historically difficult benefit to quantify. One of the methods which has been used is estimation of the increase in angling days occasioned by increased fish populations. This was estimated in the R77-12D EcIS under the condition of elimination of all disinfection. The magnitude of the benefit under the current proposal is not likely to be accurately estimated by halving the R77-12D figure of \$2.0 to \$4.4 million per annum. Nevertheless, the determination that seasonal chlorination would contribute to the health of the aquatic community implies that some benefit in angling potential could be expected to accrue.

The only cost associated with chlorination cessation as determined in the R77-12D EcIS was a small increased risk of viral disease. For a proposal which included protection of downstream water supplies and recreational areas, as does today's proposal, the estimated annual cost was \$11 to \$1200 (Ex. 21, p. 169).

The AWDT Study concludes that a reduction in required chlorination might produce a greater increase in the incidence of gastrointestinal illness among swimmers than was found in the R77-12D EcIS (P.C. #22 at 53); the principal increase is associated with swimming during April and November. However, this conclusion is challenged by MSDGC (P.C. #23 at 2-3) and the Agency (P.C. #27 at 2) on the basis of use of a questionable model and questionable input data. The AWDT Study itself cautions that the model developed therein "is subject to considerable uncertainty" (AWDT Study at 51). The MSDGC contends that the uncertainties are so large "that the predictions derived from the model cannot be meaningful" (P.C. #23 at 2). The Agency further contends that the contact recreational use rates employed in the model "seem far too high" and that the use rates "suggest bathing beaches" (P.C. 27 at 2). The Agency continues with the observation that "[i]t would be highly improbable to find total immersion anywhere during April and November" (*Id.*) as postulated in the AWDT model. The Board notes that much of the question of

the validity of the AWDT Study's estimates of gastrointestinal illness becomes irrelevant if, as is the case here, reduction in chlorination is only permitted upon demonstration that no significant primary contact use (swimming included) occurs.

The additional issue of whether the amendments would cause water treatment plants operating downstream of sewage treatment plant effluents to incur increased costs in chlorinating their finished water was addressed at hearing. Dr. Lue-Hing of the MSDGC testified that such would not be expected to occur, as the processes used prior to chlorination in the water treatment process are effective in removing particulate material, including bacteria. Therefore, Dr. Lue-Hing concluded that water treatment plants would not have to use additional chlorine during their treatment operations as a result of the proposed regulations. This issue also becomes irrelevant if, as is the case here, upstream effluent dischargers who significantly impact downstream water supplies are required to maintain continuous chlorination.

#### CONCLUSIONS

The arguments presented in favor of a reduction in chlorination, where such can be accomplished without impacting human health, are similar to those presented to the Board in R77-12D. The Board found these arguments compelling in R77-12D, and does so again here. If anything, the passage of time since the Board's action in R77-12D has provided even more compelling reason to conclude that chlorination as a disinfection process causes significant environmental damage.

The higher courts found in R77-12D, among other matters, that the Board went too far in repealing the need to disinfect in all circumstances. In particular, the higher courts found that a bacterial standard, and thereby disinfection, must remain when there is reasonable prospect that there will be primary human contact with the waters in question; under this circumstance, the concern for human health outweighs the negative aspects of chlorination.

The Board believes that the present amendments cure this aspect of the higher courts' concern. Under the adopted rule the present fecal coliform water quality standard would be retained for all protected general use waters during that time of year when primary contact can be expected to occur. Protected waters are not only those which "presently support or have the physical characteristics to support primary contact recreation" (302.202(a)(1)), but also those which otherwise "flow through or adjacent to parks or residential areas" (302.202(a)(2)). A protected water is thus more encompassing than the primary contact waters.



The rationale for extending the protection afforded by a fecal coliform standard to streams which flow through or adjacent to parks or residential areas is succinctly expressed by the Agency:

Year-round relief [from disinfection] would not be allowed in streams that flow through residential neighborhoods and certain recreational areas. These streams may often invite public contact simply due to their accessible locations without regard to their suitability for primary contact recreation. Streams in such locations would be treated as if primary contact were possible. P.C. #27 at 3.

During the remaining six months, when human contact is expected to be minimal or non-existent, the prime concern would shift to addressing the damaging aspects of chlorination. The Board also believes that this perspective is consistent with the holding of the higher courts which upheld the Board's repeal of the fecal coliform standard for secondary use waters<sup>15</sup>.

The most common objection to earlier efforts to limit chlorination was failure to fully weigh the impact of nondisinfection on downstream water withdrawal uses, particularly withdrawal for human consumption. This is a concern that the Board itself has shared throughout both the R77-12D and current proceedings. In R77-12D the Board attempted to address this issue by requiring continuous chlorination at all facilities located within twenty-miles upstream of a public water supply intake. However, the higher courts reversed the Board on this issue, finding that the twenty-mile limit was arbitrary and capricious since it was incorporated without any scientific justification.

Today's amendments incorporate an alternative remedy, which consists of maintaining an ambient water quality standard for fecal coliform at sites where water is withdrawn for public and food processing water supply, as set forth in proposed Section 302.306. The Board believes that this element of the proposal addresses the concern for downstream public water supplies expressed in the R77-12D and current records, and also addresses the concern expressed by the higher courts.

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<sup>15</sup> Secondary contact is defined in 35 Ill. Adm. Code 301.380 as "Any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating and any limited contact incident to shoreline activity."

Under existing regulations, the raw water used by public and food processing water suppliers is subject to the 200/100 ml fecal coliform limit on a year-round basis. The limit exists because, pursuant to Section 302.301, Public and Food Processing Water Supply Standards are cumulative with General Use Standards. That is, the General Use Standards apply, in addition to the Public and Food Processing Water Supply Standards, at all points where water is withdrawn for public and food processing supply purposes.

Under the adopted rule, absent Section 302.306, there would be no fecal coliform standard during November through April at points of water withdrawal for public and food processing supply purposes. The inclusion of Section 302.306 rectifies this matter by retaining the essential status quo of a fecal coliform standard at such points.

The Board believes that retention of a fecal coliform standard applicable at points of water withdrawal for public and food processing supply addresses much of the concern which has been expressed, and which the Board has shared, about curtailment of disinfection. With the inclusion of Section 302.306, upstream facilities would not be permitted to discontinue disinfection if failure to disinfect caused the water at a downstream withdrawal point to exceed the 2000 per 100 ml standard. Although the number of thusly affected effluent dischargers is expected to be small (R. at 189), and the expected human health gain has not been demonstrated to be large, the Board nonetheless believes that the substantial expression of concern in this area warrants prudence at this time.

Section 302.306 includes the 2000 per 100 ml standard rather than the 200/100 ml standard which currently exists in the General Use Standards. The latter number is inappropriate because it is based on protection of human contact and recreational uses, which are not at issue here. The selection of 2000 per 100 ml is based on the same rationale employed in the promulgation of 35 Ill. Adm. Code 604.501(c), which sets raw water quality standards for Public Water Supplies. That rationale is that 2000 per 100 ml is "determined as a level required to yield a safe supply after normal treatment" (In the Matter of Public Water Supplies, R73-13, 15 PCB 103, 146, January 3, 1975).

The Board is well cognizant of the equation of disinfection with chlorination which has permeated both this and the R77-12D proceeding. The Board is also cognizant of the prospect that disinfection might be achievable by means other than chlorination, as is clearly recognized in the AWDT study and has been pointed out by the AG (P.C. #11). The Board in fact strongly encourages STW operators and their associations to continue to actively explore disinfection alternatives. It is

only when chlorination is completely replaced by an environmentally-sound alternative that the full "chlorination problem" will have been addressed. However, given the present de facto synonymy of chlorination with disinfection, the Board must now address "the chlorination problem" by those means at hand and to the degree that technology and economics allow. Having recognized the egregious nature of chlorination, the Board would be remiss if it failed to do otherwise.

CHANGES FROM FIRST AND SECOND NOTICE

The proposal which the Board today adopts is unchanged in substance and intent from that proposed at first notice. However, at first notice there were several nonsubstantive language changes intended to provide greater clarity to the rule, as well as other nonsubstantive language changes in response to JCAR recommendations at second notice.

The first change consists of the rewording of Subsection 304.121(b). At first notice this section read:

- b) The Agency shall exempt a discharger from this standard only in accordance with the protection status of waters pursuant to Section 302.209.
  - 1) The discharger must provide documentation to show that:
    - A) The receiving stream does not meet the definition of a protected water (Section 302.209),
    - B) The discharge will not cause downstream protected waters to exceed water quality standards.
  - 2) Exemptions to the standards may be issued on a year-round or seasonal basis.

As adopted by the Board for the purposes of second notice, this subsection included changes proposed by the Agency in public comment #29 and read:

- b) The Agency shall exempt a discharger from this standard only in accordance with the requirements of Sections 302.209 and 302.306.
  - 1) The discharger must demonstrate and document the following:

- A) The character of the receiving waters pursuant to Sections 302.202, 302.209, and 302.306.
  - B) The discharge will not cause downstream waters to exceed the applicable fecal coliform water quality standards.
- 2) The Agency shall grant exemptions to the standards on a year-round or seasonal basis consistent with the documentation provided by the discharger.

In support of the these changes the Agency commented:

1. Section 304.121(b): The amendment substitutes reference to "the requirements of Sections 302.209 and 302.306" for "the protection status of waters" to eliminate possible confusion that the scope of the exemption process is limited to "protected waters" of Section 302.209(a). The addition of the reference to Section 302.306 makes explicit the Agency's intention to provide protection for public and food processing water supplies under this proposed exemption proceeding.
2. Section 304.121(b)(1): Amendments were made to stress the demonstration and documentation requirements of the discharger and to modify the language to ensure grammatical consistency with the changes below.
3. Section 304.121(b)(1)(A): The Agency has by this amendment eliminated the inference that all protected waters would be required to meet the year-round fecal coliform effluent limitation of Section 304.121(a), notwithstanding the demonstration that the discharger is entitled to seasonal disinfection. In addition, the Agency has changed the reference of "stream" to "waters" to broaden the scope of downstream bodies to lakes and other surface waters and has delineated the means and methods for evaluating receiving streams by the addition of Sections 302.202 and 302.306 water quality and specific use criteria.

4. Section 304.121(b)(1)(B): The reference to "protected" has been eliminated to avoid the confusion that this proceeding is restricted to "protected water" requirements of Section 302.209(a). In addition, the Agency has included "fecal coliform" to the water quality standard reference to ensure that the focus of this exception proceeding will be on the applicable fecal coliform water quality standard of Subtitle C.
5. Section 304.121(b)(2): This subparagraph has been amended to make explicit the nature of the Board directive of administrative responsibilities to the Agency.

During second notice, JCAR recommended further changes to Section 304.121 and other sections in this rulemaking. For Sections 302.209(b) and 302.121(b), JCAR desires that the language parallel and refer to the NPDES Permit Program of 35 Ill. Adm Code 309, Subpart A, which the Agency will utilize in administering the exemption process. To implement these suggestions, JCAR requests that the Board insert a reference to the NPDES Permit Program with citation to 35 Ill. Adm. Code 309, Subpart A in Subsection 302.209(b) and to insert that same citation in 304.121(b); and further to substitute "alternative effluent standard process" for "exemption process" in Subsections 304.121(b) and (B)(2). These changes were also made in order to clarify that the Agency is required to apply the applicable fecal coliform water quality standards and effluent limitations as part of the NPDES Permit Program. The discharger has the obligation of providing information required by Section 304.121(b) to the Agency which will then determine the appropriate fecal coliform water quality standards and effluent limitations. This permit determination is reviewable pursuant to Section 40 of the Act and 35 Ill. Adm. Code, Part 105. The Board accepts these recommended changes, such that Sections 302.209(b) and 304.121 now read:

Section 302.209 Fecal Coliform

\* \* \* \*

- b) Waters unsuited to support primary contact uses because of physical, hydrologic or geographic configuration and are located in areas unlikely to be frequented by the public on a routine basis as determined by the Agency at 35 Ill. Adm. Code 309.Subpart A, are exempt from this standard.

Section 304.121 Bacteria

- a) Effluents discharged to all general use waters shall not exceed 400 fecal coliforms per 100 ml unless the Illinois Environmental Protection Agency determines that an alternative effluent standard is applicable pursuant to subsection (b).
- b) The Agency shall, as part of the NPDES Permit Program under 35 Ill. Adm. Code 309.Subpart A, determine the applicable standard only in accordance with the requirements of Sections 302.209 and 302.306.
  - 1) The discharger must demonstrate and document the following:
    - A) The character of the receiving waters pursuant to Sections 302.202, 302.209, and 302.306.
    - B) The discharge will not cause downstream waters to exceed the applicable fecal coliform water quality standards pursuant to Sections 302.209 and 302.306.
  - 2) Alternate effluent standards consistent with Sections 302.209 and 302.306 shall be applied on either a year-round or seasonal basis consistent with the documentation provided by the discharger.

JCAR further requests that the Board insert the full name of the Agency in Subsection 304.121(a), and in Subsection 304.121(b)(1)(B) insert a citation to Sections 302.209 and 302.306 to clarify the reference to the applicable fecal coliform standards contained therein. JCAR also suggests the addition of a new Subsection 302.209(c) to further clarify the Agency's role as indicated in Section 304.121. The Board accepts each of these suggestions, with the new subsection reading:

- c) The Agency shall apply this rule pursuant to 35 Ill. Adm. Code 304.121.

The full text of the amendments as adopted today by the Board is contained in the Board Order below.

ORDER

The Clerk of the Pollution Control Board is directed to submit the following adopted rule to the Secretary of State for final notice:

PART 302  
Water Quality Standards  
Subpart B: General Use Water Quality Standards

Section 302.202 Purpose

The general use standards will protect the State's water for aquatic life, wildlife, agricultural use, ~~primary~~ and secondary contact use and most industrial uses and ensure the aesthetic quality of the State's aquatic environment. Primary contact uses are protected for all general use waters whose physical configuration permits such use.

Section 302.209 Fecal Coliform

- a) During the months May through October, Bbased on a minimum of five samples taken over not more than a 30 day period, fecal coliform (STORET number 31616) shall not exceed a geometric mean of 200 per 100 ml, nor shall more than 10% of the samples during any 30 day period exceed 400 per 100 ml- in protected waters. Protected waters are defined as waters which, due to natural characteristics, aesthetic value or environmental significance are deserving of protection from pathogenic organisms. Protected waters will meet one or both of the following conditions:
- 1) presently support or have the physical characteristics to support primary contact;
  - 2) flow through or adjacent to parks or residential areas.
- b) Waters unsuited to support primary contact uses because of physical, hydrologic or geographic configuration and are located in areas unlikely to be frequented by the public on a routine basis as determined by the Agency at 35 Ill. Adm. Code 309.Subpart A, are exempt from this standard.
- c) The Agency shall apply this rule pursuant to 35 Ill. Adm. Code 304.121.

SUBPART C: PUBLIC AND FOOD PROCESSING WATER  
SUPPLY STANDARDS

Section 302.306 Fecal Coliform

Notwithstanding the provisions of Section 302.209, at no time shall the geometric mean, based on a minimum of five samples taken over not more than a 30 day period, of fecal coliform (STORET number 31616) exceed 2000 per 100 ml.

PART 304  
EFFLUENT STANDARDS  
SUBPART A: GENERAL EFFLUENT STANDARDS

Section 304.121 Bacteria

No effluent governed by this Part which discharges to general use waters shall exceed 400 fecal coliform per 100 ml.

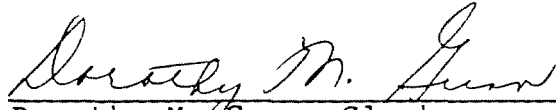
- a) Effluents discharged to all general use waters shall not exceed 400 fecal coliforms per 100 ml unless the Illinois Environmental Protection Agency determines that an alternative effluent standard is applicable pursuant to subsection (b).
- b) The Agency shall, as part of the NPDES Permit Program under 35 Ill. Adm. Code 309.Subpart A, determine the applicable standard only in accordance with the requirements of Sections 302.209 and 302.306.
  - 1) The discharger must demonstrate and document the following:
    - A) The character of the receiving waters pursuant to Sections 302.202, 302.209, and 302.306.
    - B) The discharge will not cause downstream waters to exceed the applicable fecal coliform water quality standards pursuant to Sections 302.209 and 302.306.
  - 2) Alternate effluent standards consistent with Sections 302.209 and 302.306 shall be applied on either a year-round or seasonal basis consistent with the documentation provided by the discharger.

IT IS SO ORDERED.

Chairman Jacob D. Dumelle concurred.



I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 30<sup>th</sup> day of June, 1988, by a vote of 7-0.

  
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Dorothy M. Gunn, Clerk  
Illinois Pollution Control Board