ILLINOIS POLLUTION CONTROL BOARD
September 24, 1981

IN THE MATTER OF:)
) R76-21
AMENDMENTS TO CHAPTER 3:)
WATER POLLUTION (EFFLUENT STANDARDS)

PROPOSED OPINION OF THE BOARD (by J.D. Dumelle):

The Illinois Institute for Environmental Quality [now reorganized as the Illinois Institute of Natural Resources (INR)] filed the original proposal in this matter on November 23, 1976. The proposal was a result of a review of the Board's effluent standards by the Illinois Effluent Standards Advisory Group (IESAG), which had been formed in October, 1975 at the request of the director of the INR.

The charge to IESAG by INR was to review the technical basis upon which Illinois effluent standards have been based and such additional information as appropriate to adequately define the limits and economics of state-of-the-art industrial pollution abatement technology; to determine what concentrations of effluent pollutants can be technologically achieved and at what costs; and to assess the applicability of mass discharge standards as an alternative to, or in concert with, the present Illinois policy of concentration-based standards. During the course of its studies, IESAG restricted its considerations to the parameters of Rules 406 and 408 of Part IV of Chapter 3 of the Board Rules, and such other parameters that might be regulated under Rule 408.

The findings of IESAG took the form of two reports: Evaluation of Effluent Regulations of the State of Illinois, IIEQ Document 76/21 (Exhibit 1) and Technology and Economics of Industrial Pollutant Abatement, IIEQ Document 76/22 (Ex. 5). Many of the IESAG recommendations were incorporated into the petition for amendments to Chapter 3 which was presented to the Board by the INR.

The original INR proposal included:

1. Modification of the averaging rule [401(c)] to provide for monthly composite samples.

2. Modification of the effluent standards of Rule 408(a) with respect to the following constituents: chromium, copper, cyanide, iron, lead, mercury, pH, and selenium.

3. Deletion of Rule 408(b), the effluent standard for total dissolved solids (TDS).

4. Modification of the mercury standards of Rule 702(a) for discharges to sewers and miscellaneous amendments to the remainder of Rule 702.

Five merit hearings considering the proposal were held between March 9, 1977 and July 12, 1977.[1] As economic impact studies considering various aspects of the proposal were filed, hearings were set to consider them. Between April 18, 1978 and May 8, 1980, ten economic impact hearings were held.[2] Since trancripts of these hearings are not numbered sequentially, citations will indicate volume and page number [e.g. (4:590) indicates p. 590 of the transcript of the fourth day of hearings].

The record in this proceeding was generated by over forty participants. Motions requesting incorporation of the entire records and Opinions of three other Board regulatory proceedings are granted, and these have been considered. Eighteen public comments were filed and considered following first publication in the Illinois Register.

AVERAGING RULE

Rule 401(c) presently provides that compliance with the effluent standards of Part IV is to be judged on the basis of 24-hour composite samples, with no grab sample in excess of five times the standard. IESAG proposed to replace this with a rule in which compliance with the standards is judged on the basis of a monthly average, with no 24-hour composites in excess of two times the standard and no grab samples in excess of five times the standard. This is referred to as the "1,2,5 averaging rule."

Rule 401(c) as initially proposed required the effluent standards to be met at all times. The old 1,5 averaging rule was adopted after there was overwhelming testimony urging that averages be allowed in order to allow for the normal fluctuations inherent in any treatment process (R70-8, 3 PCB 405, January 6, 1972).

The concentration of a given parameter in an effluent exhibits variability, which can generally be described by a normal distribution curve. According to technical data presented, if a treatment plant exhibits a long term concentration of A, the probability is very small that a daily composite will exceed 2A or that a grab sample will exceed 5A (4:474, 578, 595; EcIS 16, 21).

Sources of variability may be inherent in the treatment process caused by fluctuations of the input. In an industrial treatment plant some sources of variable input are controllable by management, but not all flows and loads can be equalized (3:486, 515; 5:752). Variability may result from different levels of operation on different shifts and from changes in product

(1:202; 2:341; 3:534; 4:602). Other sources are less controllable. In a factory where a large number of small tanks are flushed at random intervals, several could be flushed coincidentally. Some waste streams may neutralize each other, while others tend to add to each other. Thus, a small change in the mixture could result in extremes in the treatment process (3:534; 4:692). Evidence of numerous sources of variability was presented, as was considerable evidence regarding the variability of specific parameters.

Due to this variability, each treatment plant must be designed on the basis of its operating ratio for a given parameter. The operating ratio is defined as the maximum expected daily average divided by the long term or thirty day average (1:173; 3:477, 488, 507; 4:576). In a sense the proposed 1,2,5 averaging rule dictates an operating ratio of two. If a plant were designed to deliver a long term average of 1.0 mg/l where the standard was 1.0 mg/l, then it would have to have an operating ratio of two or less in order to produce 24-hour composite samples less than two times the numerical standard.

The 1,2,5 averaging rule, however, does not necessarily require operating ratios of two or less. If a plant were expected to have an operating ratio greater than two, it could be "over-designed" to deliver a long term average better than the standard in order to avoid producing 24-hour composites greater than two times the standard (3:535). While USEPA has observed operating ratios from below two to five, its regulations generally reflect an operating ratio of two (4:583 and see CFR Subchapter N). Such a ratio appears generally appropriate (4:590, 598).

A number of generalizations can be made about the operating ratio. If a treatment plant is specifically designed to remove a given contaminant, the operating ratio will be lower (3:477, 507; 4:579). Physical chemical treatment such as a filter system will typically have a very low operating ratio (4:582, 599).

At the hearings the Metropolitan Sanitary District of Greater Chicago (MSD) presented data showing that its municipal treatment plants exhibit operating ratios for BOD and TSS in a range of between two and three (3:477). MSD recommended adoption of an averaging rule reflecting an operating ratio of three (3:487).

Caterpillar Tractor Company pointed out that greater variability, or a higher operating ratio, is to be expected with respect to parameters for which treatment is ineffective (3:501, 508, 516; 4:570, 610). As an example, Caterpillar's data indicated a higher variability for hexavalent chromium, for which its treatment is ineffective, than trivalent chromium (3:510, 512; 4:603, 615, 619). This will be discussed further in the chromium section, below.

One method of dealing with at least some of these difficulties would be to modify the Board's existing scheme of regulation to a method similar to that of USEPA. The existing Illinois averaging rule applies to all dischargers and to all parameters unless otherwise specifically provided. This contrasts with

USEPA's regulation by industry category, which allows greater opportunity to make allowance for unusual operating ratios observed in a given industry. However, the technical evidence presently before the Board is inadequate to adopt separate averaging rules for each parameter (1:56), and the Board declines to do so.

The Board acknowledges that general applicability of the 1,2,5 averaging rule will result in a less than optimal system. However, the Board also notes that a number of safeguards exist within the system to minimize these:

1. Where difficulty is unique to a given parameter, a special averaging rule could be proposed for that parameter;

2. Where a given facility has difficulties, a site-specific regulation or variance could be requested;

3. The IESAG has reviewed the parameters of Rule 408 in connection with its study on the assumption that the 1,2,5 rule would be adopted. Where a large operating ratio is intrinsic to the treatment for a given parameter, the recommended effluent standards for that parameter have been raised to reflect this difficulty (1:193, 203); and

4. To a certain extent a given industry may be able to design and operate to a lower long term average than required by the standard in order to meet the daily composite standard.

GRAB SAMPLES

Under existing Rule 401(c) the ratio of allowable grab samples to 24-hour composites is five to one. Under the proposed 1,2,5 rule this ratio is 2.5 to one, with a ratio of grab to monthly of five to one. No opposition to the rule on grab samples was voiced at the hearings. Data presented by Caterpillar Tractor company tended to support a grab to monthly ratio of about five to one (3:504; 4:605, 608; Exs. 18, 27).

MONTHLY AVERAGE

Wastewater treatment plants are designed to meet a long term or monthly average (1:197, 203; 4:569, 599; EcIS 19). If a plant is designed to meet a certain long term average, then daily composite averages will exceed that long term average for reasons beyond the operator's control (2:340, 3:477; 4:586; EcIS 16). Whereas the monthly average is useful in plant design, the operating ratio, as reflected in the requirement of a daily composite, is relevant to plant operation (4:569, 599). The long term mean is the best and most data-independent measure of process performance (EcIS 19), and the monthly average is a good indication of the long term average (4:576).

As the Board's rules are presently written, the effluent standards, based on 24-hour composites, do not give design engineers a direct indication of the level of performance which is to be expected (1:198, 203; 3:535; 4:599). A design engineer must first determine the operating ratio of the plant and apply this to the Board's existing standards based on daily composites to determine a lower number, the long term average, which the plant must meet in order to avoid violation. If compliance with the standard is based on a monthly average, the Board's regulations will more directly convey to the public the level of performance which is expected.

Another difficulty with the present 1,5 averaging rule is that a discharger with a small operating ratio could operate so that its discharge was constantly just below the maximum allowable for a 24-hour composite. In the long run it could lawfully discharge a much larger mass of pollutants than a similar discharger with a higher operating ratio (4:599). The environmental damage is closely associated with the total mass of a pollutant discharged, and there is no good reason for allowing a discharger with a tightly controlled system to discharge a larger mass of pollutants. By judging compliance on the basis of the thirty-day average, the distinction is reduced.

A perceived problem with the change to the 1,2,5 averaging rule is that alteration of the averaging rule from a 24-hour composite to a monthly average basis would effect a "doubling" of the Board's standards. This perception is based on the fact that if a facility is required to meet a standard of 1 mg/1 based on a 24-hour composite under the old rule, under the new rule it will have to meet a 24-hour composite of 2 mg/1 unless the present standard is changed to reflect the change in the averaging rule (1:181, 191, 193, 203).

The IESAG did not agree that this is a "doubling" of the standard (1:186). For example, consider a discharger who must meet an effluent standard of 1.0 mg/1. If it took advantage of the altered averaging rule and discharged 2.0 mg/1 for fifteen consecutive days, it would be obliged to reduce the concentration to zero for the rest of the month in order to meet the 1.0 mg/1 monthly standard, assuming flow is constant. Thus the modification in the averaging rule does not necessarily authorize any increase in mass discharged over the long run (1:176; 2:341; 3:529, 535). The EcIS also indicated that the modification in the averaging rule would not result in a "doubling" of the standards in all cases (13:71). The exact effect of the modification of the averaging rule would depend on the distribution of concentrations shown in the effluents of given discharger. A doubling of the standard would be a worst case extreme.

The IESAG reviewed the effluent parameters on the assumption that the Board would adopt the 1,2,5 averaging rule. Had the advisory group evaluated the standards on the basis of the 1,5 rule, it would in many cases have recommended that the numbers be doubled (1:181, 189, 191, 193, 199; 2:340).

The Board finds that the proposed 1,2,5 averaging rule is the best simple, general averaging rule which could be written comporting with the technical evidence. The Board will therefore adopt the 1,2,5 averaging rule. The technical evidence for the parameters will be evaluated on the basis of the modification in the averaging rule.

ECONOMIC IMPACT STUDY ON AVERAGING

As the Board has previously noted, the averaging rule is not intended as a modification of the effluent standards. Rather it is a rule of evidence which could be characterized as procedural. The issue of modification of the averaging rule centers on whether the modification produces a rule that is more understandable to the affected public and which more closely approximates the objective realities of variable discharges. Any relaxation of the standard is incidental to these purposes and should be dealt with in connection with the standards. As such, the rule itself has little or no economic impact. However, some of the conclusions of the study are worth noting and commenting upon:

1. The study concluded that there would be a negligible impact on dischargers who are presently in violation of the effluent standards, since these dischargers would have to spend money to come into compliance whether the rules were modified or not (12:10, 20, 26; EcIS 16, 31). A telephone survey of twenty-five dischargers who had two or more samples exceeding current standards for one or more of the affected parameters showed that for the most part they had corrected the problems evident during the study period, and that they would not alter their treatment process to take advantage of any relaxed standard (12:10, 25, 28; EcIS 28, 34). From a practical point of view it is likely that the industry would continue to provide the same degree of treatment since there would be no advantage in controlling to a lesser degree (EcIS 34);

2. The economic impact study also indicated that there was a possibility that a cost of the proposed modified averaging rule would be an incremental increase in the discharge of contaminants to the waters of the State which would result from the perceived "doubling" of the standard (12:9, 48; 13:76; EcIS 35). However, Rule 402 requires that effluents not cause violation of the water quality standards contained in Part II of Chapter 3. Presumably the general water quality standards determine maximum levels for the various pollutants which protect the State's waters for beneficial uses (12:60; EcIS 26, 35). Assuming the water quality standards are maintained as required, there should be no ascertainable damage;

3. The EcIS noted that standardization with other effluent regulations and USEPA guidelines was an economic benefit of the averaging rule, although it could not be quantified (1:44; 4:568, 651; 12:12, 40, 46, 50; EcIS 28, 34, 37). In addition,

there should be a small decrease in design costs if compliance with the Board's rules is primarily determined on the basis of a long term average which is more useful to design engineers. These economic impacts are negligible, as would be expected of a rule which is procedural in nature; and

4. The study also discerned a secondary cost impact in sampling and analysis costs to the Agency (EcIS 35). Should the Agency go to an industry and monitor for thirty days the cost of sampling would be an impact (12:46, 50; 13:79; EcIS 3, 37). However, the Board concludes that this would not increase the cost of enforcement for two reasons: first, a thirty-day composite may consist of as few as three daily composites; second, the averaging rules are alternatives--the Agency can base an enforcement action on grab samples or daily composites.

Thus, the Board finds that there is little or no economic impact through modification of the averaging rule.

RESPONSE TO COMMENTS ON AVERAGING

Proof of Violation: Existing Rule 401(c) speaks of "compliance" with numerical standards while proposed Rule 401(c) speaks of "proof of violation." The Agency objected to this change, contending that whereas the section is presently written to describe how a discharger demonstrates compliance, the new language is written to state what the Agency has to do in order to prove violations (PC 17).

The wording has been changed in order to correctly express the intent of Rule 401(c). "Compliance with numerical standards" seems to refer to Section 39 of the Act which requires that the permit applicant prove that it will not cause a violation of the regulations. This is not the primary intent of Rule 401(c). The averaging rule refers primarily to Section 31(c) which places the burden of showing a violation of Board rules in an enforcement action on the Agency or other complainant. Accordingly, Rule 401(c) has been changed to read "Proof of violation of the numerical standards."

The averaging rule is intended primarily to protect the defendant in an enforcement action by assuring that analytical evidence is statistically significant. It establishes several methods of proving violation of the numerical standards. Rules on permit issuance belong in Part IX, not Part IV. If Rule 401(c) were a rule of permit issuance, it would apparently require that the facility actually be constructed prior to permit issuance and that it produce grab samples, daily composites and monthly averages less than the prescribed limits before a permit could be issued. This is not the proper interpretation or the Board's intent.

"Determined on the basis of one or more of the following averaging rules." There is indication that some people interpret the present averaging rule as requiring both a 24-hour composite

and a grab sample to show a violation. The language has been changed to make it clear that the averaging rules are alternatives. Thus, in an enforcement action a violation may be shown by a grab sample, a daily composite or a monthly average, according to the respective rules.

Calendar month: The IESAG proposal provided that the numerical standards would be judged on the basis of a thirty-day running average. Opposition was expressed to this because it would require dischargers to recompute their average daily. MSD proposed to judge compliance with the standards on the basis of a calendar month (1:150; Ex. 7). IESAG supported this amendment and no opposition was expressed at the hearings (1:155; 3:499; 4:612, 637, 639, 654; 5:755, 808; 12:53; 13:77; Ex. 23).

Monthly Average: Proposed Rule 401(c)(1) added a requirement to the IESAG proposal that monthly averages be based on at least three daily composites. The language proposed by IESAG was subject to the interpretation that the monthly average was determined only by averaging composite samples taken on each day of the month. There was fear that this would impede enforcement and result in imposition of this in the monitoring conditions of the permits. This would be considerably more expensive than occasional 24-hour composite samples.

On the other hand, another interpretation was offered that, if only a single grab or 24-hour composite sample were taken in a month, it would have to meet the thirty-day average (13:84). Accordingly, the proposal was modified to require at least three 24-hour composite samples before the monthly average applies.

Proposed Rule 401(c)(1) provided that the average of three or more composite samples not exceed the primary standard. Several commenters wanted to know which three samples were to be averaged (PC 1,7,9,10). Proposed Rule 401(d) answered this question by requiring that all samples be included in the average. Three commenters suggested language to the effect that "the average of all composite samples taken in a calendar month, when more than two such samples are taken, shall not exceed the prescribed numerical standard" (PC 7,9,10). The Board has adopted this suggested language in substance, although the actual averaging rule has been separated from the definition of monthly average.

Daily Composites: In connection with Rule 401(c)(3) one commenter pointed out that it is more common to form daily composites by combining aliquots than by analyzing individual grab samples (PC 9). As adopted, Rule 401(d)(2) defines a daily composite as either the numerical average of all grab samples or the result of analysis of a single sample formed by combining all aliquots taken during a calendar day. A daily composite must be based on averaging three or more analyses or a single analysis of a sample formed by combining three or more aliquots.

Flow-weighted Composites: Proposed Rule 401(c)(2) provided that no flow-weighted 24-hour composite sample exceed two times the prescribed numerical standard. Several commenters perceived this as a rule on permit issuance which would require monitoring by flow-weighted composite samples (PC 6, 11, 15). This was not the intent. Rules on monitoring and permit issuance are contained in Parts V and IX of Chapter 3. Rule 401(c) is intended to state a rule on what the complainant must show in an enforcement action (13:80).

The requirement that violation be shown only by a flow-weighted composite sample was intended to protect dischargers from enforcement based on composites which did not accurately portray the amount discharged in a day because they were taken during times of abnormal flow. However, because the affected public perceives no danger from this, the Board will delete the requirement that violation of the daily composite levels be shown by a flow-weighted composite (PC 6, 11, 15).

NPDES Limitations: In proposing Rule 401(c) the Board had intended that the Agency define composite samples in an NPDES permit. Rule 401(c)(4) provided an averaging rule which applied only in the event there was no definition of composite sample in the NPDES permit. This required at least three grab samples to form a composite and nine grab samples to form a monthly average. This rule caused considerable confusion (PC 7). The Board has adopted the Agency's comment in substance, deleted proposed Rule 401(c)(4), and added Rule 401(f), which provides that proof of violation of effluent standards contained in permits be based on the language of the permit. This is presently required by Rules 410(a) and 901.

If Rule 401(c) were to include a method of interpretation of permit conditions there would be a possibility of conflict if the permit condition did not truly reflect Rule 401(c). For the sake of certainty the Board has added Rule 401(f) requiring the permittee to follow the permit condition rather than Rule 401(c). Thus, where a permit condition is governed by a Part IV effluent standard, the permittee has the right to insist that the permit condition reflect the averaging rule of Rule 401(c). However, where the permit does not follow Rule 401(c) and the appeal period has lapsed, the permittee must obey the permit condition.

Grab Samples: Proposed Rule 401(c)(3) provided that no grab sample, whether taken individually or as an aliquot of a composite sample, shall exceed five times the prescribed numerical standard. Commenters perceived this as a requirement that individual aliquots of composite samples be analyzed (PC 1, 7, 9). This was not the intent of Rule 401(c)(3) as is made clear by proposed Rule 401(e) which provided that reporting and monitoring requirements are established by way of permit condition. To further clarify this ambiguity Rule 401(d)(3) has been added to the adopted rules providing that a grab sample is a sample taken at a single time. Aliquots of a daily composite are grab samples only if they are analyzed separately.

Reporting and Monitoring Requirements: During the hearings dischargers construed the proposal to base the standards on thirty-day averages as a proposal to require monitoring on the basis of thirty-day composites. There was industry opposition to the proposal on grounds of the cost of thirty-day composites. The EcIS interpreted the proposal as not changing the required sampling frequency (12:44, 50). The Agency presently has authority to impose monitoring by daily composites and by composites made of thirty 24-hour composites, and does not expect that the proposed version of Rule 401(c) would result in the increased use of daily composites or thirty-day composites (12:15, 42, 50; 13:86; EcIS 4).

The 1,2,5 averaging rule has been construed as requiring reporting and monitoring on the basis of thirty 24-hour composite samples for the reason that the discharger "must demonstrate compliance with the standards" (13:87). This interpretation is wrong for two reasons: first, as stated above, the averaging rule is intended primarily to protect the respondent in an enforcement case, not as a rule on permit issuance; second, the averaging rules are alternative so that a single grab sample less than five times the numerical standard "demonstrates compliance." The rule on imposition of monitoring and reporting is that the Agency may require such monitoring as is required to accomplish the purposes of the Act [Section 39(b)].

To avoid unintended interpretations the Board added proposed Rule 401(e) which stated that reporting and monitoring requirements are established by way of Rules 501 and 910(f). Commenters nevertheless continued to interpret Rule 401 as a rule on reporting and monitoring. The Board has therefore elaborated on the function of the rule in 401(e).

Rule 401(c) established a method of interpretation of the effluent standards of Part IV. The Agency is to consider it in deciding whether an applicant has demonstrated that a facility complies with the effluent standards for purposes of permit issuance and in writing effluent standards into permits.

In specifying three or more 24-hour samples to form a thirty-day composite, the Board does not mean that all NPDES permits must require at least three 24-hour composites each month; nor does it mean that the Agency is limited to no more than three 24-hour composites per month. In some circumstances the daily 24-hour composite may be appropriate, in other circumstances an annual grab sample may be appropriate.

A discharger is not limited to the number of samples specified in a permit condition. He may take as many samples as he wants in order to take advantage of averaging rules. However, he must include all samples taken to find the average (12:56).

UNIFORM STATE-WIDE BASE LEVEL EFFLUENT STANDARDS

The effluent standards of Part IV are generally applicable to municipal and industrial dischargers. IESAG found that

such uniform state-wide standards have many advantages (3:399), although an exception mechanism was felt to be necessary (1:56). Such a mechanism would allow the Board to look at unique aspects of wastewater or unusual chemical forms that might interfere with traditional treatment process efficiency (3:399), thus introducing some flexibility into an otherwise rigid system. Given that there is insufficient evidence in the record to adopt specific standards for different industrial categories, there is little alternative to continuance of the present uniform standards method which was originally adopted by the Board on January 6, 1972 (R70-8, 3 PCB 401, 421). Furthermore, it is possible to obtain variance or site-specific regulation, the Board finds such uniform standards to be reasonable.

Section 13(a) of the Act specifically authorizes the Board to adopt both water quality standards and effluent standards. This is the practice followed by USEPA, and it should be beyond question at this stage of development of pollution law. However, in connection with copper and chromuim, some commenters appear to have attacked the dual standard approach by contending that the Board cannot make an effluent standard more stringent except to protect water quality.

The water quality standards were set on the basis of protection of stream uses while the effluent standards were set at a level of treatability (R70-8, 3 PCB 401). On the basis of treatability considerations IESAG proposed relaxation or elimination of effluent standards for lead, mercury, selenium and TDS, and proposed to tighten the standards for hexavalent chromium, copper and pH. Citizens For a Better Environment (CBE) and others objected to relaxation of standards without consideration of environmental effects on the merits. Industry supported the principle of treatability with respect to relaxation of standards, but demanded consideration of environmental effects when standards were made more restrictive. Industry argued that, in the absence of improvement in water quality, the Board would act arbitrarily to require increased treatment for its own sake.

There are a number of reasons why dual regulation is desirable. In the first place it allows dischargers with ample dilution to treat to one level, but requires water quality limited dischargers to treat to a tighter level. This avoids unnecessary treatment burdens where there is ample dilution, but does not compromise environmental quality. Secondly, uniform state-wide effluent standards prevent monopolization of stream dilution and assimilative capacity by existing dischargers (R70-8, 3 PCB 401, 408). If the Board regulated only on the basis of water quality standards, dischargers would tend to locate near rivers where ample dilution is available. They would have to treat only to avoid violation of water quality standards and would tend to treat so as to barely avoid doing so. New industry seeking to locate in the same area would then have to treat to meet the water quality standards, which would not always be technologically feasible. Uniform state-wide effluent standards, on the other hand, impose a duty on each discharger to treat to a technologically feasible level, thereby preserving stream assimil-

ative capacity for future dischargers. This is a beneficial use which should not be abused by allowing existing dischargers to impose excessive treatment costs on future dischargers.

GOOD CONVENTIONAL TECHNOLOGY

IESAG evaluated Rule 406 and 408 effluent standards against the technology and economics of industrial pollution abatement (1:58). It identified a level of technology called "good conventional treatment" and reviewed the parameters to determine what levels could reasonably be achieved by such treatment. This is the same standard as was used in setting the existing standards and lies somewhere between BAT (Best Available Control Technology Economically Achievable) and BPT (Best Practicable Control Technology Currently Available).

Good conventional treatment refers to treatment technology. Therefore, IESAG generally did not review industrial processes, but rather restricted itself to a review of end of pipe treatment in order to define a uniform minimum discharge which is readily achieved by use of conventional technology, assuming reasonably careful operation and maintenance (1:38, 58, 89, 205; 2:373, 393; Ex. 5). As a result, its recommendations are based on affordability rather than a balancing of economic against environmental damage (1:89; 2:278). The Board finds this approach to be a reasonable one on which to base effluent limitations.

At the final hearing the Agency was asked to evaluate whether the technological evidence received at the merit hearings was still valid in 1980 (15:183). The Agency responded affirmatively in a letter to the Board.

EXCEPTION PROCEDURE

On March 31, 1977 Richard J. Kissel filed a proposal for an "exception" procedure. This would provide a procedure whereby individual dischargers could obtain permanent, site-specific effluent standards from the Agency without following the procedures of Section 27 of the Act and Part II of the Procedural Rules. This proposal was taken from the IESAG proposal to the INR, but was not included in the INR proposal to the Board (1:56, 72, 75, 78, 80; 3:410; 4:641; 5:806), although IESAG continues to support it (3:399).

The Board declines to adopt a procedure which, in effect, would delegate to the Agency the power to grant permanent variances. Furthermore, existing procedures for variances and site-specific regulations should be adequate to resolve the problems which the exception procedure addresses in this case. While site-specific regulatory procedures are somewhat more cumbersome than those proposed, the Board notes that H.B. 1816, which has recently been passed by the legislature, would streamline those procedures by eliminating the necessity for an economic impact study in appropriate cases. The concept

of an exception procedure with suitable Board determined limitations is, however, an interesting approach to regulations which the Board may determine to be acceptable in future regulatory proceedings.

NEW SOURCE PERFORMANCE STANDARDS

The U.S. Environmental Protection Agency (USEPA) is in the process of promulgating mass limitation regulations which as a class are more stringent than those required by Illinois' effluent standards. In writing an NPDES permit the Agency must incorporate the more stringent of the federal or the state limitations. Because Illinois standards give no credit for process changes which result in a low mass discharge, the Illinois standard could still be viewed as more stringent and be incorporated into the permit instead of the new source performance standards.

As an example, consider the case of a discharger who expends considerable amounts of money building a low discharge facility to conform to new source standards of performance. His discharge will usually contain a much lower mass of contaminants per unit of production than a comparable existing facility. However, if the New Source Performance Standards (NSPS) do not require end of pipe treatment, USEPA regulations may permit the discharge of a low volume, concentrated waste stream. The effect of the Illinois effluent standards would be to require end of pipe treatment in addition to the process changes which have been instituted. Requiring the discharger to comply with both strategies of control could be very expensive, more expensive than either of the Board regulations or USEPA regulations contemplated.

Based on the above considerations the Board has proposed to adopt new Rule 412. This is intended to provide complete exemption from the effluent standards for facilities which are based on new source performance standards. In situations where Illinois regulates a contaminant which is not regulated under USEPA guidelines applicable to the facility, then the Illinois effluent standards will be applicable.

This exception is intended to apply only to the numerical standards. Rule 403 concerning offensive discharges will continue to be applicable. Likewise, Rule 402 will apply. Illinois regulations will function where necessary to protect water quality.

The Agency commented adversely concerning Rule 412 (PC 17), citing a number of objections: the record does not support adoption of Rule 412; NSPS always become bogged down in litigation after promulgation; and, Rule 910(a)(2) provides a sufficient basis for inclusion of federal new source performance standards on a case by case approach.

Rule 412 was not proposed during the merit hearings. However, it attempts to address some of the same problems the exception procedure addresses. The public has made known a problem with the Board's regulations and the Board has proposed

a solution. The matter has been exposed to notice and comment as required by the Administrative Procedure Act and none of the affected public have commented.

The Board recognizes that nothing in the Illinois Environmental Protection Act or Clean Water Act (CWA) requires adoption of Rule 412. The Board also recognizes that some NSPS may be less stringent than the Chapter 3 effluent limitations. This is the intended result of Rule 412. Rather than deal with this one industry at a time by lengthy site-specific regulation, the Board prefers to defer to USEPA's judgment.

The Board recognizes the potential difficulty if NSPS is tied up in litigation following USEPA promulgation. However, Rule 412 is triggered only if and when the new source performance standard is incorporated into the NPDES permit. Where enforcement of the new source performance standard has been stayed following litigation, it should not be incorporated into permits. Rule 412 will be inapplicable and the Agency will apply the more stringent of the Part IV limitations or the applicable Best Available Technology economically available (BAT) or Best Practical Control Technology currently available (BPT) limitation.

The Board also recognizes that Rule 910(a)(2) provides a sufficient basis for the inclusion of new source performance standards on a case by case basis when the new source performance standard is more stringent than the Part IV effluent limitation. The intent of Rule 412 is to incorporate the NSPS even where it is less stringent than the effluent limitation of Part IV.

CHANGES IN FORMAT

The Board proposes to make a number of changes in the format of the effluent standards in this rulemaking. These are in part in anticipation of codification of Chapter 3 in compliance with regulations promulgated by the Secretary of State (Ill. Rev. Stat. ch. 127, Sections 4 and 7; 1 Ill. Admin. Code Parts 120 and 160).

The Board proposes to split Part IV into two subparts: subpart A will contain effluent standards of general applicability, while subpart B will contain site-specfic rules and special exceptions to the effluent standards.

The Agency endorsed the format change, but recommended that Rule 411(d) be placed into subpart B because it is a general exception to the mercury effluent standard. The Agency has misunderstood the distinction between subpart A and subpart B. Subpart B is intended to contain site-specific regulations and specific exceptions. General exceptions belong in subpart A.

A general exception to the effluent regulations is one which is potentially applicable to any person in the state. A special exception is applicable to one person or a definitely ascertainable number of existing people. These could include

site-specific rules, rules applicable to named persons, or rules applicable only to existing persons who are described and who are known by name. The persons who are the beneficiaries of site-specific and special exceptions of subpart B should usually be participants in future regulatory proceedings to adopt rules in subpart B. They should have individual notice that there is a rule applicable to them.

The word total has been deleted from most of the parameters in Rule 408(a). Rule 408(b) has been added which provides that unless otherwise indicated concentrations refer to the total amount of the constituent present in all phases whether solid, suspended or dissolved, elemental or combined, including all oxidation states. Where constituents are commonly measured as other than total, such as chromium and iron, the word "total" is inserted for clarity.

Rule 408 has been added to provide cross-references to other parameters regulated in Part IV. The Agency commented that the cross-reference table should be a footnote rather than part of the body of the rule. The Board acknowledges that this is technically correct. However, there are practical difficulties in placing a table as a footnote. The introductory language, "the following table is provided for cross-referencing purposes," has been carefully chosen so as not to be construed as a rule limiting the scope of Part IV (PC 17).

The Board has created two new rules, Rule 411, Mercury, and Rule 413, pH. pH has been separated from the body of Rule 408 since pH is not subject to the averaging rule and has both an upper and lower limit, unlike the other parameters. Removal of pH makes the rule easier to state and eliminates a footnote.

Much of the discussion in the record in this proceeding centered on mercury. There were proposals and counterproposals all of which were too complicated to clearly state as a footnote to Rule 408. Accordingly, mercury has been moved to Rule 411.

Existing footnote 3 contains a site-specific effluent standard for the Calumet treatment plant of Metropolitan Sanitary District of Greater Chicago. This has been moved and renumbered as Rule 450. The special averaging rule for cyanide contained in existing footnote 3 is substantially the same as proposed Rule 401(c). The special averaging rule will, therefore, be deleted.

MSD commented concerning whether the averaging rule applies to Rule 450. The Board has accordingly modified Rule 450 to reference the averaging rules of 401(c) (PC 15).

Rule 451 concerning chloralkali mercury discharges in St. Clair County is presently stated as Rule 702(f), an exception to Rule 702. It is also an exception to old Rule 408 and new Rule 411. Although it would be possible to include Rule 451

in a section of a subpart B to Part VII, it appears preferable to lump it into subpart B of Part IV. Rule 451 has also been modified to include metric equivalents of the mass discharge limitations which are presently in English units only.

OIL (HEXANE SOLUBLE OR EQUIVALENT)

The change in designation of the parameter oil (hexane soluble or equivalent) and STORET numbers were recommended by the IESAG. Oil is presently subject to footnote 2. The special averaging rule for oil is essentially the same as the newly adopted averaging rule of 401(c). Accordingly the special averaging rule is deleted.

CHROMIUM

Chromium is a transition metal which has two common oxidation states: trivalent and hexavalent. Other oxidation states are subject to atmospheric oxidation or disproportionate to Cr(III) and Cr(VI). Total chromium includes all forms of chromium.

Chromium is usually measured as Cr(VI), while determination of Cr(III) is indirect. Cr(VI) is determined on one half of a split sample. Cr(III) is oxidized to Cr(VI) in the other half. Cr(TOT) is determined by measuring Cr(VI) in the oxidized half. Cr(III) is inferred from the difference between Cr(TOT) and Cr(VI) in the original sample (Standard Methods for Examination of Water and Wastewater, 14th edition, p. 153).

The Board presently regulates effluents in terms of Cr(III) and Cr(VI). IESAG recommended that the Board drop the standard of 1.0 mg/l Cr(III) and adopt a standard of 1.0 mg/l Cr(TOT). IESAG also recommended that the Board tighten its Cr(VI) standard from the existing 0.3 mg/l to 0.1 mg/l.

SOURCES OF CHROMIUM

Chromium is rarely found in natural waters. Nationwide, the background is about 0.0097 mg/l (EcIS 8). Elevated chromium levels are associated with industrial discharges (EcIS 8), and it is widely used in metal plating and coating. Chromic acid is used to clean metal surfaces prior to plating and other coating operations. Hexavalent chromium is commonly found in and used in the manufacture of inks, dyes and pigments. It is also used in leather tanning and in wood preservative treatment (EcIS 29; Ex. 5, p. 69).

Another major use of hexavalent chromium is to prevent corrosion and microbial growth in cooling systems. This, along with rinse water from coating and plating operations, results in a high volume, low concentration wastestream which presents difficulties in treatment. Concentrated baths are not generally dis-

charged and rinses are recycled. Chromium sources in plating operations are almost exclusively accidental, including overflows, leaks, pipe rupture, spills and drippage (EcIS 53). Although many industries employ chromates in cooling towers, few categories have guidelines for chromium.

Industries which employ Cr(III) directly involve glass, ceramics, photography, inorganic pigments, textile dyeing and animal glue manufacture. Cr(III) is being substituted for Cr(VI) in plating baths with some success (Ex. 5, pp. 93, 107). Cr(III) may be present in wastewater as a result of reduction of Cr(VI) in either a manufacturing or treatment process (Ex. 5, p. 107).

CHROMIUM TREATMENT TECHNOLOGY

There are a large number of treatment schemes for chromium, and many full scale applications achieve Cr(VI) levels of less than 0.005 mg/l (Ex. 5, p. 75, 77). Where ferrous sulfate is used as a reducing agent, Cr(VI) levels of 0.01 mg/l have been achieved (Ex. 5, p. 79). Ion exchange applications have yielded levels as low as 0.025 mg/l (Ex. 5, p. 87). The most common treatment for Cr(III) is alkaline precipitation (2:243; Ex. 5, p. 109). Levels as low as 0.02 mg/l have been achieved (Ex. 5, p. 114).

USEPA sampled dicharges from seventy-three electroplating operations with chromium reduction facilities. The average of thirty-day averages was 0.09 mg/l Cr(VI) and 1.6 mg/l Cr(TOT) (EcIS 33).

The proposed standard of 1.0 mg/l Cr(TOT) is somewhat more stringent than the present standard of 1.0 mg/l Cr(III), since chromium wastestreams usually contain both Cr(III) and Cr(VI). Under the proposal a chromium wastestream may lawfully contain as much as 0.1 mg/l Cr(VI). Because Cr(VI) is included in Cr(TOT), Cr(III) must be lowered to 0.9 mg/l to meet the proposed standard. No opposition was expressed at the hearings either to going to Cr(TOT), or to the proposed Cr(TOT) standard. There was, however, opposition to the tightened Cr(VI) standard.

The recommendation to abandon the separate standard for Cr(III) is based on several considerations. As noted above, chromium is usually analyzed as Cr(VI) and Cr(TOT), with Cr(III) inferred from the difference. This tends to amplify analytical errors. Furthermore, the most common treatment is reduction/ precipitation. Cr(VI) measures the success of reduction, while Cr(TOT) measures the overall efficiency of chromium removal. Moreover, USEPA guidelines and published technical literature are mostly expresses as Cr(VI) and Cr(TOT) (2:241).

CHROMIUM AVERAGING

Under the proposed averaging rule the monthly standard for Cr(VI) would be 0.1 mg/l, the allowable daily average

would be 0.2 mg/l and grab samples would be 0.5 mg/l. As stated above, these limitations are based on an operating ratio of 2.

However, Charles M. Cook of USEPA presented variability data concerning two dischargers which treated for Cr(VI) (4:570; Ex. 21). He testified that ratios of 2 to 3 were common (4:582, 590, 596, 603, 617). His data indicated an operating ratio of 2.8 for a well operated plant treating for Cr(VI)(4:596).

Inspection of USEPA effluent guidelines indicates that chromium effluent guidelines do not always follow the 2.0 operating ratio which is characteristic of most parameters. A number of these reflect operating ratios of 2.8 to 3.0 (see 40 CFR, §413.14 and 415.124)(8:868; 9:904).

If operating ratios of three are intrinsic to Cr(VI), dischargers will have to deliver long term average performance of less than 0.07 mg/l to meet the 0.2 mg/l daily composite standard. However, the record in this rulemaking does not indicate that a monthly average less than 0.1 mg/l can be consistently achieved with good conventional technology.

The Board has accordingly added footnote two to Rule 408(a) providing a special averaging rule for chromium. Compliance with the primary standard of 0.1 mg/l will be judged on the basis of a monthly average. Daily composites shall not exceed 0.3 mg/l and grab samples shall not exceed 1.0 mg/l Cr(VI).

ENVIRONMENTAL IMPACT OF CHROMIUM

There is considerable uncertainty concerning the environmental effects of chromium (EcIS 7, 17, 46). Acute toxicity to humans is not very great (9:901), but Cr(VI) is known to cause lung cancer and other serious disorders when breathed (EcIS 4). It is also known to irritate mucous linings (EcIS 4, 7). Cr(III) toxicity to aquatic life is not well documented (EcIS 4), although it is known to increase mucous secretions on gills (EcIS7). Toxic effects have been noted at as low as 3.3 mg/l in soft water and as high as 72 mg/l in hard water (8:870; 9:902, 916; EcIS 6).

Actual acute toxicity levels for chromium have not been set for aquatic life. Lethal levels to fish are reported from 17 to 118 mg/l. Levels as low as 0.032 to 0.05 mg/l, however, have been reported as lethal to algae and aquatic invertebrates (8:870; 9:902, 917). Chromium also accumulates in sediments. Worms and clams tend to have levels the same as the sediment. The Illinois River has chromium in sediments as high as 17 ppm (17 mg/kg) (8:866; EcIS 7).

One Cr(VI) control strategy involves replacement of chromates in cooling systems with other chemicals to control corrosion. Many of these, such as those which contain phosphonates, also have adverse environmental effects. Phosphonates would provide

nutrient phosphorus pollution and would necessitate the use of biocides in cooling systems. To the extent the proposal would encourage the use of these alternative chemicals, there is an adverse environmental impact offsetting any benefit from decreased Cr(VI) discharges (9:907; EcIS 15).

The EcIS concluded that the proposal would reduce chromium loading of Illinois streams by about 8.7 pounds per day (8:857; EcIS 13). This would result in significant improvement of water quality in several receiving streams (EcIS 13, 17). Several small receiving streams which would receive dramatic improvement are identified (8:857; EcIS 14).

COST/BENEFIT ANALYSIS FOR CHROMIUM

Fifty-four sources discharge some level of chromium (8:858). The EcIS identified eleven dischargers out of compliance with the proposed standard for Cr(VI) or Cr(TOT). This included three municipalities and eight industries (EcIS 24). Because all three municipalities violated both the existing and proposed standards, and none have chromium removal equipment, no compliance costs were assigned to them (8:883; EcIS 29). If installation were required, it would cost essentially the same to meet the existing or proposed standard. In all three cases the noncompliance is caused by industrial dischargers. The municipalities would be in compliance if pretreatment were required.

The EcIS identified dischargers only by letter. Of eight industrial dischargers, five used chromium in metal finishing and plating operations (B, C, D, E and J) (8:857). Two used chromium only for cooling water (A, I). One used chromium both for metal finishing and cooling water (K) (EcIS 24, 34). Therefore, of the eight potentially impacted dischargers, six have chromium in process streams and three have chromium in cooling water. The EcIS evaluated treatment costs differently for process and cooling water (EcIS 34).

Of the six process dischargers, one will comply with the proposed Cr(VI) standard when its treatment facility is fully operational (C). No costs were assigned to this discharger (EcIS 34). One discharger has equipment for chromium removal, but will incur additional operating costs (J).

Some of these dischargers may not actually be impacted by the proposal since Rule 402 requires that effluents not cause violation of water quality standards, and the Rule 203(f) standard of 0.05 mg/l Cr(VI) in the receiving stream may be the limiting factor. Three industries discharge to streams having a 7-day, 10-year low flow of 0 (A, C and J). One discharges to a low flow of 1.3 MGD (D) (8:881; EcIS 14). The first three, and possibly the fourth, are probably water quality limited. Since existing water quality standards appear to impose more stringent requirements than the proposal (8:868, 874, 881; 9:916, 918), they would apply. The EcIS did not acknowledge this and evaluated costs. A, C and J were expected to incur

$5800 in increased annual expenses (EcIS 39, 40). The Board will eliminate these costs from the final estimates.

The EcIS rejected as too expensive the alternative of separate treatment for small Cr(VI) sources (8:878; EcIS 57). At 0.11 mg/l discharger K is essentially in compliance with the proposed standard. Treatment of one or two of its twenty small process sources should bring it under 9.1 mg/l (8:885, 887; Ex. 18). This would be far less expensive than treatment of 4 MGD.

Noncompliance by discharger K is largely with the daily maximum rather than the long term average (8:887, 890; EcIS 24). This is also the difficulty cited by Caterpillar Tractor Company (3:510; Ex. 18). The Board has addressed this by providing for greater variability for chromium discharges. This, coupled with greater control of operations, spills, leaks and maintenance, should allow Caterpillar to avoid violation of the daily maximum without installing additional treatment (9:911). If the long term average remains above the standard, treatment of some process wastestreams should suffice.

The EcIS evaluated the economic impact of an alternative to the IESAG proposal. This alternative provided a monthly standard of 0.15 mg/l with a daily value of 0.3 mg/l. The alternative eliminated most of the cost of the proposal, including discharger K (EcIS 39). The study author indicated that the principal purpose of changing the primary standard to 0.15 mg/l was to provide a higher daily maximum (9:905). The alternative eliminated all costs to discharger K. Since the Board is proposing to adopt a special averaging rule for chromium which allows a daily value of 0.2 mg/l, the costs found in this study are actually more applicable.

Discharger D is an electroplater with a monthly average of 0.06 mg/l and a daily maximum of 0.24 mg/l Cr(VI) (EcIS 24). Treatment costs are estimated at an investment of $5000 to $10,000 and annual costs of $900 (EcIS 39, 54). These costs will also be eliminated by the alternative averaging rule.

Discharger B is an electroplater with monthly averages of about 0.22 mg/l and daily maximum of about 1.3 mg/l Cr(VI) (EcIS 24). Increased treatment costs of $1300 per year are estimated.

Discharger E is an electroplater which claims to be in compliance with both the existing and proposed regulations. Agency data indicates it is not in compliance with either. Increased annual costs of $3200 are included for discharger E (EcIS 24, 39, 54).

The remaining cost of the proposal centers on discharger I, who has cooling tower blowdown only. The study found an investment of $1,000,000 and $160,000 annualized costs (EcIS 39, 54). This assumes treatment by ion exchange. Discharger I has chromium levels of about 0.2 mg/l and apparently would not

be affected by the relaxed averaging rule (EcIS 24). There is no explanation as to why discharger I must treat rather than employ the cheaper substitution of chromates in cooling towers. The EcIS relied on the discharger's own estimates (8:876, 886; 9:899).

The impacted population thus consists of dischargers B, E and I. The first two discharge process water, the third cooling water blowdown. Overall costs are estimated at an investment of $1,000,000 and annual operating costs of $164,500 (EcIS 39, 40).

RESPONSE TO COMMENTS ON CHROMIUM

Two persons commented on Cr(VI). Caterpillar Tractor Company states that it has now installed a state of the art system consisting of two-stage pH adjustment, sulfur dioxide reduction, precipitation, coagulation and sedimentation (PC 10). It states that the proposal will not increase the amount of pollutants removed but will result only in a 10% increase in the frequency of noncompliance. The Board has modified the proposal to provide a looser averaging rule which should bring Caterpillar's rate of noncompliance into line.

Allied Chemical Company stated its general opposition to tightening the Cr(VI) standard (PC 3). Allied appeared at the merit hearings and expressed no opposition to the proposal with regard to Cr(VI) (1:95), but now bases its opposition on the lack of additional environmental benefit. The EcIS details environmental improvements associated with the proposal (8:857), and the Board has determined that chromium poses a threat to the environment and has resolved to deal with it through both water quality and effluent standards (R79-8, R71-14, R71-20, 3 PCB 401, 404, 413).

The Board concludes that regulation of Cr(VI) and Cr(TOT) is preferable to regulation on the basis of Cr(VI) and Cr(III). Good conventional treatment is capable of achieving effluent levels of less than 0.1 mg/l Cr(VI) and 1.0 mg/l Cr(TOT) on a monthly basis, and adoption of a modified averaging rule for Cr(VI) will prevent spurious out-of-compliance reports by dischargers in compliance with the monthly average but in violation of daily limits. This will lessen compliance costs without significantly increasing chromium discharges.

COPPER

Copper exists in two common oxidation states: Cu(I) and Cu(II). Cu(II) is stable, while Cu(I) is subject to atmospheric oxidation and tends to disproportionate to Cu and Cu(II), but is sufficiently stable to be found in wastewater (EcIS 5, 17; Ex. 5, 0. 138). Both Cu(I) and Cu(II) readily form complexes with a wide variety of ligands. These can interfere in treatment. Total copper includes all forms of copper.

IESAG recommended that the Board make its copper effluent standard more stringent, from 1.0 to 0.5 mg/l (1:117, 2:246).[4]

SOURCES OF COPPER

Illinois streams show average levels of copper far in excess of the general use water quality standard of 0.02 mg/l (EcIS 9). All river basins show averages less than 0.1 mg/l with the following exceptions: Mississippi-South Central Basin, 0.177 mg/l; and the Upper Ohio Subbasin, 0.143 mg/l. The former is the East St. Louis Area which is heavily industrial, with at least two major copper dischargers: Olin (East Alton) and the Village of Sauget. The Upper Ohio is mostly the Saline River basin which is heavily impacted by coal mining.

Copper is introduced into the atmosphere from combustion of fossil fuels containing copper (EcIS 7). Copper in rainwater is estimated to average 0.031 mg/l, in excess of the general use water quality standard. Acid rain may leach additional copper from soils and rock. Atmospheric copper loading of Illinois streams and other non-point sources are thought to result in a background of about 0.0086 mg/l (EcIS 11).

Copper is widely used in industry. Most of the sources for which there are effluent guidelines are industries involved in the production of copper, copper compounds or copper plated products. Copper plumbing is widely used in industry and residences and contributes a significant amount of copper to wastewater, especially where it carries soft water (EcIS 6). Cooling tower blowdown and boiler cleaning wastewater may contain copper. Copper or copper compounds are used as catalysts in textiles, tanning, photographic process, engraving, inks, dyes, pigments and wood preservatives (EcIS 6; Ex. 5, p. 127).

COPPER TREATMENT TECHNOLOGY

The most common treatment for copper is precipitation of the hydroxide or oxide (Ex. 5, p. 132). This is usually accomplished by addition of calcium hydroxide to an acidic wastestream. Optimal pH is between pH 9.0 and 10.3, where copper has a solubility of about 0.01 mg/l. In the absence of complexing agents precipitation is able to achieve final effluent levels well under 0.5 mg/l (Ex. 5, 0. 133, 151; 1:17; 2:245; 4:623, 632).

Copper precipitation is sensitive to pH. Where alkaline wastestreams are treated without pH regulation, pH fluctuations may be the cause of episodic high effluent copper levels (Ex. 5, p. 151).

Keystone Industries appeared at the merit hearings and objected to both the copper and pH proposals. As noted, efficient copper removal requires precipitation at pH 9 to pH 10.3. If the alkaline pH standard is tightened from pH 10 to pH 9,

reacidification prior to discharge will almost always be necessary. A number of comments centering on this difficulty have been received (PC 2, PC 3, PC 8, PC 9, PC 10). The Board will discuss this problem in connection with the pH proposal (Rule 413).

In the presence of chelating agents, precipitation yields final effluent levels of three to four mg/l copper (4:623). Such agents are commonly contained in fluxes used for copper or brass soldering (4:623) and plating baths (Ex. 5, p. 127). Segregation of wastestreams containing these agents or chelated copper is usually the best practice. These smaller volumes of complexed waste can then be given special treatment, which may be far more cost-effective.

Starch xanthate and sodium borohydrate treatment may be effective against chelated copper. These had not been employed on a full scale in 1977 (4:623). The Board has since been advised that starch xanthate has been employed for wastestreams of up to 0.2 MGD achieving effluent levels as low as 0.05 mg/l copper [Olin (East Alton) v. IEPA, PCB 80-170, December 18, 1980, May 1, 1981].

Other treatment processes for copper include evaporative recovery, ion exchange, electrolytic recovery, cementation and reverse osmosis. Evaporative recovery has been practiced for over twenty years for copper recovery (Ex. 5, p. 143). Ion exchange is useful, especially with dilute copper, and is effective against ammonia complexes. Final effluent levels as low as 0.03 mg/l have been reported (Ex. 5, p. 144). Ion exchange is rather expensive, but can produce a concentrated copper output which may be valuable for copper recovery. Other processes are also available.

USEPA concentration-based effluent limitations range from 0.15 to 0.25 mg/l for direct dischargers for base and precious metals, ferroalloy ores and secondary copper recovery categories. These are considerably more stringent than proposed here. Any industries subject to these guidelines will have NPDES permit conditions based on federal regulations.

Dr. Patterson of IESAG computed concentration based equivalents of process weight standards using flow figures for industry categories (Ex. 28, p. A-2). Conversion indicates that electroplaters are required by USEPA to meet thirty-day average copper levels of 0.5 mg/l based on BPT (Ex. 28, p. A-27).

IESAG concluded that a thirty-day average copper standard of 0.5 mg/l was justified on the basis of reported performance data. This level can be achieved without significant incremental increase in treatment cost associated with the present standard of 1.0 mg/l, based on a twenty-four hour composite.

ENVIRONMENTAL IMPACT OF COPPER

As noted above, the general use water quality and water supply standards of 0.02 mg/l are violated throughout the state. Lowering the copper effluent standard from 1.0 to 0.5 mg/l could lower the incidence of violation of the water quality standard and would benefit water users.

Copper has been shown to be toxic to fish at levels of less than 0.04 mg/l. It is especially toxic to young fish. However, most fish studies have been done on species not common in Illinois waters (EcIS 25). Estimates of safe levels to Illinois fish are around 0.011 to 0.018 mg/l for soft water and 0.015 to 0.033 mg/l for hard water (EcIS 26). Background copper levels in excess of these estimates are common throughout Illinois (EcIS 10, 39).

Although mature game fish can survive levels of copper in excess of the noted levels, their reproduction is inhibited at low levels. Copper also limits organisms beneath game fish in the food chain. Toxicity to fresh water invertebrates has been reported at levels of 0.015 to 0.028 mg/l copper at hardness levels of 35 to 55 mg/l calcium carbonate (EcIS 24). Plankton have shown toxic effects at around 0.04 mg/l copper and hardness of 100 to 119 mg/l (EcIS 25). These hardness levels are encountered in Illinois, although they are somewhat below average (EcIS 39). Even if the only purpose of the water quality standards were protection of fish, it is impossible to maintain the desirable species in an environment missing the bottom of the food chain.

The EcIS reviewed twenty point source dischargers with one or more copper analysis in excess of 0.5 mg/l during 1975 or 1976 (EcIS 32). For several sources there was inadequate data to attempt to evaluate any effect of copper downstream (EcIS 31). For others there was a diverse aquatic community. This was attributed to adequate dilution of the wastestream (EcIS 33). A third class discharged into receiving streams without adequate dilution. There was noticeable degradation of aquatic life. However, there were many factors to which the stream condition could be attributed, and it is doubtful that merely reducing the copper levels would result in significant improvement (EcIS 33, 47).

COST/BENEFIT ANALYSIS FOR COPPER

The EcIS was not able to quantify any costs or benefits associated with the proposal (EcIS 54). Because copper levels in Illinois waterways are near or above the water quality standard and at levels which have been shown to be toxic to aquatic life, any reduction in copper loading should have a beneficial effect. The Board, however, is not able to estimate the dollar value of this.

Of the twenty dischargers with at least one copper sample in excess of 0.5 mg/l during 1975 or 1976 (EcIS 32, 49), seven of these

discharge into a sewer system, and in some cases the sewage treatment plant discharge is also identified as a potential violation. Pretreatment by the industry would likely solve the municipal problem. The following is a summary of the potentially impacted population:

Plating Companies	9
Metal Product Manufacture	5
Municipal Wastewater Treatment Plants	3
Steel Production	2
Printing	1

The Board finds that the impacted population would not be this large. Of the listed dischargers, two inject copper wastes into wells (EcIS 31) and would be unaffected by this rule change. Sixteen are presently out of compliance and costs are likely to be similar for upgrading to meet the present or the proposed rule. Furthermore, the EcIS ignored the effect of the proposed averaging rule in determining the impacted population (12:98; EcIS 48). Thus, some may be able to meet the proposed standard without making any changes in treatment. Some of the dischargers are to small receiving streams such that water quality standards may be limiting rather than effluent standards (see EcIS 34 and Rules 203(f) and 402). Others may be subject to more stringent federal standards.

The proposal probably impacts only direct industrial discharges to streams with adequate dilution to avoid violations of the water quality standard. These are American Nickloid Company and the Village of Sauget. There may be additional impacted dischargers, but they cannot be determined from the record. Many of the named copper dischargers have participated in this rulemaking, were sent direct notice of hearings, yet none attended the EcIS hearings (14:90; 15:153). Although the EcIS may have deficiencies, the affected public did not avail itself of opportunities for challenging it. It should be noted that Keystone Consolidated Industries Inc. of Peoria was the only opponent of the proposal at the merit hearings (4:623). It was not identified in the EcIS, did not attend the EcIS hearings and has not commented, although it has received notice.

The Board agrees with the EcIS that the proposal may impose additional treatment costs on some dischargers in the state. The Board has not been able to determine with certainty who will be affected or what their costs will be. The Board finds, however, that the proposal has benefits in the form of improved water quality, and that it may have uncertain costs in the form of additional treatment.

RESPONSE TO COMMENTS

Central Illinois Public Service Company (CIPS) is faced with the construction of new treatment facilities (PC 13). Its objection is based on perceived difficulties in meeting the proposed standard through precipitation and sedimentation. It will obviously have to destroy the chelate for this to be successful

at meeting either the 0.5 or 1.0 mg/l standard. Since CIPS must construct and maintain the same unit processes to meet either the 0.5 or 1.0 mg/l standard, the cost to treat will be essentially unchanged. The regulation should, therefore, have no impact in excess of the existing standard on new sources or old sources without treatment which must treat a wastestream in excess of the old standard.

COPPER SUMMARY

In reviewing the EcIS the Board has considered the environmental benefits of the proposal. However, protection of beneficial uses is not the basis of effluent standards. The Board has concluded that copper is a contaminant which poses a menace and that it should receive the best degree of treatment consistent with technical feasibility and sound engineering judgment (Rules 203, 401, and 402; 3 PCB 401). While this may not produce dramatic environmental benefits, it should aid in reducing the number of water quality violations.

The Board finds that good conventional treatment is sufficient to meet the proposed standard of 0.5 mg/l copper. In view of the existence of copper in Illinois waterways in excess of the water quality standards and at levels near toxic to aquatic life, any increase in treatment costs is offset by improvements in water quality. The Board proposed to adopt the 0.5 mg/l standard.

DISSOLVED IRON

Dissolved iron may be present in the ferrous [Fe(II)] or ferric state [Fe(II) is rapidly oxidized to Fe(III) by atmospheric oxygen under ordinary wastewater conditions]. Fe(III) as Fe^{+3} is soluble under strongly acidic or basic conditions. However, at neutral pH it forms ferric hydroxide and oxide which are quite insoluble. Because of this, Fe(III) is frequently used in water and wastewater treatment to aid in precipitation of suspended materials (Ex. 5, p, 217).

The Board presently has standards for both Fe(DISS) and Fe(TOT). IESAG recommended that the Board delete the Fe(DISS) and regulate only on the basis of Fe(TOT) (1:18; 2:249).[5] Iron is the only parameter regulated on a dissolved basis, other than TDS, and according to testimony received, no other state or USEPA regulates Fe(DISS) (2:249). This, however, is no longer true of USEPA.

Treatment for iron is by neutralization, atmospheric oxidation and precipitation. This is capable of meeting the standards for Fe(DISS) and Fe(TOT) (Ex. 5, p. 233). The Fe(DISS) standard was adopted with little opposition largely because industry has no difficulty meeting it (EcIS 7).

Fe(II) is similar to cupric copper. Its toxicity to aquatic life is similar (EcIS 17, 19). However, it seems unlikely that much could live under anaerobic conditions necessary to maintain a significant concentration of Fe(II) without violating the Fe(TOT) standard. Precipitated Fe(III) can be toxic by coating the bottom of waterways and clogging gills (EcIS 17) High levels of dissolved, unchelated Fe(III) are usually encountered only in very acidic waters where acidity is probably the limiting factor rather than iron.

The EcIS was unable to identify any costs or benefits associated with the proposed deletion of the Fe(DISS) standard. Few permits in fact contain the standard or require monitoring of Fe(DISS) apart from Fe(TOT) (EcIS 9). Based on this, the Board will delete from Rule 408(a) the standard for dissolved iron.

LEAD

Lead is a familiar base metal which exhibits many oxidation states, the most common of which are Pb(II) and Pb(IV). Both form stable, soluble complexes and chelates which can result in difficulties in treatment by precipitation. Pb(IV) also forms a number of organic lead compounds. Total lead includes all forms of lead. IESAG has proposed that the Board relax its effluent lead standard from 0.1 to 0.2 mg/l.[6]

SOURCES OF LEAD

Illinois waterways exhibit background levels of lead of 0.041 mg/l, ranging from 0.003 through 0.086 mg/l. Elevated levels in the Ohio and Big Muddy River Basins are associated with increased lead solubility in waters made more acid by coal mine drainage (EcIS 27), while elevated levels in the Chicago area and northern Illinois are believed associated with fallout from use of tetraethyllead in automobile gasoline (EcIS 10, 30).

Lead is widely used in industry for such things as automobile batteries, fuel additives, solder, ammunition and explosives (Ex. 5, p. 265). It is plated onto bolts and bearings as a protective coating and used in chlorine manufacture.

LEAD TREATMENT PROCESSES

Precipitation followed by filtration is capable of meeting the 0.1 mg/l lead standard. However, clarification by sedimentation is capable of achieving only 0.2 mg/l lead (1:18; EcIS 5; Ex. 5, p. 270). Because of the expense involved in filtration, IESAG recommended increasing the lead effluent standard to this 0.2 mg/l level.

ENVIRONMENTAL IMPACT OF LEAD

Lead is toxic to plants and animals and has no known beneficial nutritional effects. It accumulates in animal tissues and sediments, and is subject to biomagnification. There is evidence of chronic lead poisoning in a significant fraction of the human population (EcIS 7).

Toxicity of lead to aquatic life depends on water hardness. USEPA aquatic life criteria for hardness levels encountered in Illinois (14:142, 144; EcIS 50) establish maximum acceptable lead concentrations ranging from 0.04 mg/l at a hardness of 28 mg/l to 5.8 mg/l at a hardness of 780 mg/l. 24-hour average acceptable lead concentrations vary from 0.005 to 0.8 mg/l over the same hardness range. The EcIS found that if either the proposed or existing effluent standard were enforced, there would be no violations of the aquatic life criteria for lead in streams receiving lead discharges (EcIS 50).

COST/BENEFIT ANALYSIS FOR LEAD

Relaxation of the lead standard to 0.2 mg/l could increase the concentration of lead in the receiving waterways with a detrimental effect on water users. The EcIS examined the effect on human health, aquatic life, industrial water use, wildlife, shellfish, recreation and other beneficial uses of water (EcIS 50), but was unable to quantify any detrimental effect, in part because point sources account for only a small percentage of the lead load on Illinois waterways (EcIS 3).

The EcIS estimated cost savings associated with relaxation of the effluent standard. Since many affected industries meet neither the existing nor the relaxed standard, the cost savings are associated with construction needed to bring effluent levels to 0.2 rather than 0.1 mg/l. This savings is usually the cost of filtration less the cost of sedimentation, which is largely a function of flow (EcIS 59). Minimum values are based on the assumption that dischargers having a single violation can meet the standard without treatment.

Cost Savings	Minimum	Maximum
Construction	$7,435,000	$16,725,000
Annualized Construction	934,000	2,101,000
Annual Operation and Maintenance	171,000	682,000
Total Annual	$1,105,000	$2,783,000

The EcIS also estimated costs for the thirty-five municipal plants reporting lead in excess of 0.1 mg/l. The maximum estimates are based on treatment by all thirty-five, while minima assume that only the thirteen with multiple samples in excess of 0.1 mg/l require treatment (EcIS 64). The following

is a summary of municipal cost savings from relaxation of the lead effluent standard (ExIS 62, 72):

Cost Savings	Minimum	Maximum
Construction	$13,340,000	$29,985,000
Annualized Construction	1,259,000	2,831,000
Annual Operation and Maintenance	482,000	722,000
Total Annual	$ 1,741,000	$ 3,553,000

The study notes that municipal plants may need advanced secondary treatment to comply with federal and state regulations concerning BOD and TSS. It is likely that this would result in compliance with the lead standard (EcIS 64). Federal grant money may be available for this upgrading. Whether it is or not, the full cost of upgrading is not attributable to the need to meet the lead standard. Further, it is extremely unlikely that a single violation is indicative of the need for treatment. It is more likely to be a bad analysis or an episode such as a spill. Thus, the minimum savings is probably a better estimate than the maximum, and the actual costs would be even less if some multiple violations represent bad housekeeping.

The Board has received no public comment concerning modification of the lead standard, but industry has expressed general support. At the merit hearings CBE opposed relaxation of the lead effluent standards on the grounds of adverse environmental impact (2:254), and objected to the argument that the merit hearings should center on treatment technology, with consideration of environmental impact reserved to the hearings on the EcIS. However, the Agency provided water quality data (Exs. 29, 31, 36) at the merit hearings. CBE did not appear at the EcIS hearings and has not commented.

The Board finds that good conventional technology is able to meet a standard of only 0.2 mg/l lead and that requiring filtration prior to discharge would impose an excessive burden on dischargers. Considering the limited adverse environmental consequences, the Board has proposed to relax the effluent standard for lead from 0.1 to 0.2 mg/l.

SELENIUM

Selenium is similar to sulfur, with which it is often found associated in nature. Example compounds are selenious acid, selenic acid, hydrogen selenide and selenium dioxide. In wastewater selenium tends to occur as elemental selenium, selenite or selenate. Selenite is oxydized by atmopheric oxygen under normal stream conditions, although this can take some time (2:315; EcIS 9).

IESAG recommended that the Board delete the selenium effluent standard. Selenium would be regulated through USEPA

effluent guidelines and through application of the Illinois water quality standards pursuant to Rule 402.[7]

SOURCES OF SELENIUM IN WATER

Selenium is widely distributed in soils and rock at levels of about one part per million (ppm). This probably results in background selenium levels below 0.01 mg/l (EcIS 9, 18, 20). Selenium is present in petroleum and coal at levels of up to several ppm, and there is evidence of selenium fallout resulting from combustion of coal and oil (EcIS 11, 24). There are detectable levels of selenium in waters in southern Illinois which may result from strip mining of coal (EcIS 11, 21), but waters in northwestern Illinois, where lead and zinc sulfide are mined, have no detectable selenium (EcIS 23, 37).

Major sources of effluent selenium are the mining and refining of copper and zinc from sulfide ores and the refining of petroleum, especially where associated with elemental sulfur recovery (2:309). Seven petroleum refineries with detectable selenium effluents were identified (EcIS 35). The worst, Marathon Oil Company in Robinson, is associated with detectable levels of selenium in Sugar Creek (EcIS 16, 35, 58, 64). The selenium discharges, which are believed to come from the crude oil which is processed, are less than the effluent standard.

Industrial use of selenium is rapidly expanding. It is used in many electronic devices and to form the light sensitive surface in electrostatic photocopying machines (EcIS 29). It is also used in pharmaceuticals, as an additive to animal feed, and in glass manufacture, pigments and some alloys (EcIS 29).

SELENIUM TREATMENT TECHNOLOGY

Precipitation or coagulation treatment technologies cannot meet the present 1.0 mg/l standard with any assurance (Ex. 5, p. 525). Efficient removal can be achieved with a strong acid-weak base ion exchange system, but this is non-selective and entails simultaneous removal of other ions, rapidly increasing the cost of treatment for dilute selenium wastestreams (Ex. 5, p. 530). IESAG concluded that there are major uncertainties associated with defining reliable treatment technology or economics for selenium control (1:20; 2:310, 314). IESAG therefore recommended deletion of the selenium effluent standard from Rule 408(b).

SELENIUM ENVIRONMENTAL IMPACT

Selenium is a toxic material which may also be an essential nutrient at low levels. Chronic and acute livestock poisoning occurs from drinking seleniferous water or eating selenium accumulation plants. Selenium poisoning, known as "alkali

disease" and "blind staggers," is common in western states (EcIS 49). Toxic effects to humans and animals have been reported at levels as low as 0.05 mg/l in water (EcIS 520). Because it is usually found as an anion, it is less likely to associate with sediments (2:315), and it is not known to accumulate in them.

SELENIUM COST/BENEFIT ANALYSIS

The EcIS was unable to identify any costs or benefits of deletion of selenium effluent standard (EcIS 71). There are no recorded instances of violation of the standard (EcIS 62). There are no dischargers considering installation of treatment equipment. Although elimination of the standard could raise the selenium loadings of Illinois waterways, the EcIS was unable to quantify any damage (EcIS 71).

The EcIS assumed deletion of the selenium effluent standard would lead to reduced selenium monitoring (EcIS 73), but this is not necessarily true. Monitoring is not governed by Rule 408, but rather is covered by permit condition [Rules 501 and 910(a)]. In deleting the selenium standard the Board does not intend to alter the law on reporting and monitoring of selenium. This may be required where necessary to accomplish the purposes of the Act [Section 39(b)].

Because of lack of proved control technology and the ambiguous evidence of environmental damage in Illinois, the Board will delete the selenium effluent standard from Rule 408(a). Selenium will be controlled through NPDES permit conditions pursuant to effluent guidelines, Rule 910(a)(6) and the water quality standards of Part II.

TOTAL DISSOLVED SOLIDS

Total dissolved solids (TDS) is the filterable portion of the total residue on evaporation. ROE (total) is a measure of the nonvolatile material in a liquid sample. TDS typically contains the following ions: sodium, potassium, magnesium, calcium, chloride and sulfate. Most of the other common ions will precipitate as insoluble salts under usual conditions at the concentrations necessary for them to form a significant fraction of the TDS load.

Existing Rule 408(b) provides that no effluent shall exceed 3500 mg/l TDS and that no person shall add to background levels more than 750 mg/l TDS. There is an exemption for direct dischargers to the Mississippi River (R75-6, 25 PCB 77, March 3, 1977; 25 PCB 163, March 17, 1977; 26 PCB 105, June 28, 1977; Ex. 40; 5:777). IESAG has proposed that the Board delete the TDS effluent standard altogether (1:20; 4:640).[8]

SOURCES OF TDS

There are both point and non-point sources of TDS. Northeast Illinois has high background levels due to soluble materials leaching from the soil. Abandoned strip mines, largely in southern Illinois also produce high background levels. Other diffuse sources include road deicing, irrigation return flows, and urban stormwater runoff.

An important source of concentrated TDS is from ion exchange or water softening backwash (2:228; Ex. 8). Zeolite water softening is used by 150 municipalities, 87 of which discharge backwash directly to waters of the state (Ex. 8; 2:228; EcIS 24). Power plants, industrial process and even pollution control equipment sometimes produce high TDS streams (4:460; 4:481; 5:738; and see Borden v. IEPA, PCB 78-269, 34 PCB 71, June 22, 1979).

USEPA concluded that there was no demonstrated control technology for TDS (4:658), and it does not regulate effluent TDS (2:319). There are also no BAT or BPT standards for TDS (2:326). Illinois is the only state which has a TDS effluent standard (2:319; 4:659, 711; and Ex. 28, Directory of Federal and State Water Pollution Standards, IIEQ Doc. No. 77/06, March 1977).

TDS TREATMENT TECHNOLOGY

Availability of treatment technology depends upon whether the TDS is precipitable (Ex. 5, p. 554). Metals which are associated with hardness may be precipitated, yielding a reduction in TDS. Hardness is commonly removed through lime softening, in water treatment plants (4:664). Although this technology is within reach, it is doubtful whether sufficient benefit would result in many cases to justify the cost of removal of hardness from wastewater.

Technology for removal of non-precipitatable TDS from wastewater is essentially that applied for desalinization of seawater to provide fresh water supplies or demineralization of industrial water supplies (2:319). The major process include reverse osmosis, electrodialysis, distillation and ion exchange (2:231; Ex. 5, p. 554). These are very expensive and consume large amounts of energy. In addition to deionized water they characteristically produce a waste stream of concentrated brine (2:320, 326). If this is discharged, the net result will be at best the same as discharging the original wastestream. The other alternatives, landfilling and deep well injection, also pose serious environmental problems (2:325; 4:666, 669).

ENVIRONMENTAL IMPACT OF TDS

The study estimated that enforcement of the present TDS effluent standard would reduce TDS concentrations an average of 0.6 mg/l throughout the state (EcIS 45). The mean TDS level

is 303 mg/l, which is well under the 1000 mg/l water quality standard of Rule 203(f). Potential impacts of TDS include impacts on residential and industrial water supplies, fishing, irrigated crops and livestock (EcIS 41). The 1000 mg/l TDS water quality standard should protect the state's waters at a level where there will be no measurable damage for most of these from increased TDS loadings (4:674).

TDS and associated hardness cause considerable damage to residential and industrial water supplies from corrosion, scale and increased soap use. The annual TDS damage from treated surface waters in Illinois is estimated to be about $85,100,000 (1978 dollars) (EcIS 40). Deregulation is estimated to increase this total by approximately $231,000.

BENEFITS OF TDS DEREGULATION

Dischargers who are presently in violation of the TDS effluent standard stand to gain from repeal of Rule 408(b). The EcIS identified eighty-seven municipalities which discharged zeolite water softening backwash directly to waters of the State (EcIS 27). Fourteen power plants discharge either water softening backwash or ash pond overflow. The EcIS did not estimate savings to them (EcIS 26). Nineteen other miscellaneous dischargers could incur savings in treatment costs. The following is a summary of the reduction in treatment costs resulting from deletion of Rule 408(b) assuming that brine would be landfilled (EcIS 33):

	Capital	Annual Cost
Water treatment plants	$ 870,000	$7,690,000
Miscellaneous	6,600,000	540,000
Total	$ 7,470,000	$8,230,000

PROPOSED ACTION

The Board has proposed to delete Rule 408(b), since there is no available technology for reduction of TDS in wastewater, and the environment is adequately protected by the effluent standards of Rule 203(f).

The Board has proposed to add Rule 976, TDS Reporting and Monitoring. Since this rule is primarily aimed at direct, or NPDES, dischargers, it would be more appropriate in Subpart A of Part IX of Chapter 3. Accordingly it will be renumbered as Rule 918 in the Final Rules.

Section 39(b) of the Act authorizes the Agency to impose such NPDES permit conditions as may be required to accomplish the purposes of the Act. The TDS reporting and monitoring rule requires TDS reporting and monitoring unless the Agency finds it not required.

Effluent TDS monitoring provides a check on possible violation of the TDS water quality standard. It provides a check on monitored as well as unmonitored parameters because unexplained fluctuations in TDS levels could indicate errors in analysis or changes in an unmonitored parameter.

pH

pH is the negative logarithm of the hydrogen, or hydronium, ion activity in an aqueous system. Acidity and alkalinity are closely related terms which are not to be confused with pH. Acidity is the amount of strong base which must be added to a solution to bring it to a neutral pH. Alkalinity is the amount of acid which must be added. In an unbuffered system, such as a strong acid or base in deionized water, pH is easily related to acidity or alkalinity. In a buffered system acid or base may be added with smaller changes in pH.

IESAG recommended that the Board tighten its effluent range from pH 5 to pH 10 to pH 6 to pH 9. Because pH is measured in different units than the other parameters of Rule 408 and is not subject to the averaging rule, the Board has proposed to adopt Rule 413 and delete pH from Rule 408.[9]

SOURCES OF ACIDIC OR ALKALINE WATER

pH of natural waters in Illinois shows a south to north trend of increasing pH. Background levels of pH 8.4 to pH 9.0 are common in northeastern Illinois. This is attributed to high mineral content in soils. Background pH in southern Illinois tends to be more acidic. Coal mines, both active and abandoned, produce acid drainage which adds to the naturally acid waters in southern Illinois (EcIS 18). Coal mines are not subject to Chapter 3 effluent standards and are already subject to a pH range of 6.0 to 9.0 [Rule 606 of Chapter 4; 40 CFR §434.32(a)].

Point sources of wastewater more acidic than pH 6 are mostly associated with failures of existing treatment equipment (EcIS 12). Point sources with alkaline discharges greater than pH 9.0, however, represent identifiable long term problems. The most important alkaline source is caused by algae blooms in treatment lagoons (8:831). Some dischargers have water supplies in excess of pH 9. There are industrial dischargers who violate the proposed standard because of industrial or wastewater treatment processes, including addition of alkali to precipitate heavy metals (EcIS 12, 34). Most industrial categories have USEPA effluent limitations for pH and these are almost always in the range of 6.0 to 9.0.

TREATMENT FOR pH

Treatment for pH is simple and inexpensive. Chemicals are among the cheapest available, and equipment is inexpensive even if fully automated. Treatment consists of addition of an acid or base to a wastestream. Sulfuric and hydrochloric acids are most common, although by-product carbon dioxide is sometimes used. Sodium hydroxide solution is the most common base, even though it is more expensive than alternatives which include sodium carbonate, lime and dolomite (Ex. 5, p. 468; ECIS 39).

ENVIRONMENTAL IMPACT OF pH EXTREMES

The EcIS evaluated water use impacts caused by changes in pH. Aesthetics, domestic water use, navigation and power generation were thought to be not impacted. Agriculture, commercial fishing, human health, industrial and municipal water supply and water contact and non-contact recreation were impacted (EcIS 22), but the water quality standard of Rule 203(b) was found adequate to protect these uses (EcIS 23).

Fish exposed to pH levels below 6.0 show signs of chronic stress, although it is difficult to isolate low pH from the conditions that usually accompany it, such as changes in free carbon dioxide and increased solubility of metals (EcIS 28).

Alkaline pH increases the concentration of free ammonia in water, making it more toxic than the ammonium ion which is prevalent under acidic conditions. This toxicity is increased even more at high temperatures. However, simple dilution with water of neutral pH produces a large reduction in free ammonia levels (8:827).

COST/BENEFIT ANALYSIS FOR pH

The EcIS identified benefits of a tightened pH range, but they were described as negligible. To determine the costs of such tightening, the EcIS reviewed Agency pH monitoring data of three hundred and thirty-one dischargers who had at least one violation of the proposed standard. Two hundred and forty-four had more than 10% of their pH monitoring data outside the proposed range of pH 6 to 9. The EcIS took this rate as indicative of actual noncompliance; it assumed a lower rate could be corrected without cost (EcIS 34; 8:834).

The largest group of non-complying dischargers operated lagoons as part of their wastewater treatment process. This group included 164 of the 244 affected dischargers. There were 125 municipal, 36 commercial and private lagoons and 3 manufacturing facilities which operated lagoons and which did not conform to the proposed limit (EcIS 35). These dischargers violate the pH 9.0 maximum because of algae blooms in the lagoon during summer months, which is thought to be related to consumption of carbonate and bicarbonate by the algae (8:831). The EcIS estimated that

treatment would involve an investment of $3,104,000 to $4,910,000 and an annual operating cost of $302,300 to $463,900 (EcIS 44). This was the largest cost of the original R76-21 pH proposal.

Early in the hearings the Agency noted this difficulty and proposed an amendment providing an exception to the pH limit if the excursion were "attributable entirely to natural causes." The Board incorporated this as proposed Rule 413(d) which is intended to cover the algae bloom situation (Exs. 4, 9; 1:31, 36; 3:348). The costs noted above are thereby avoided (EcIS 43).

Of the 244 affected dischargers, the noncompliance with the proposed standard by 80 was attributed to causes other than algae blooms. This group consisted of 25 commercial and private dischargers, 44 manufacturing facilities, 4 municipalities and 7 utilities. Investigation revealed that in 55 cases the pH problem was either nonexistent or had already been corrected without installation of control equipment (EcIS 35).

The EcIS also included a category of 6 manufacturing facilities with background pH above 9.0 in raw water (EcIS 35). The study found capital expenses of $160,000 to $170,000 and annual operating expenses of $43,700 to $45,000 for this group (EcIS 45).

The natural causes exception of proposed Rule 413(d) is not intended to cover this situation. However, existing Rule 401(b) provides an exception for contaminants caused entirely by background levels. The study assumed this was inapplicable. The Board regards the background exception as applicable where high pH surface water is passed through a process with additions of only traces of alkali. However, it is doubtful whether this would apply to well water discharged to the surface because the well water content is not "background" with respect to the surface water content.

The EcIS computed compliance costs for five dischargers with insufficient treatment and for five with frequent failures of existing equipment. These included 2 commercial and private dischargers, 6 manufacturing facilities, 1 municipality and 1 utility (EcIS 35, 36, 44). The municipal violation was caused by insufficient treatment in the public water supply system (EcIS 36). Capital costs were estimated at $210,000 to $510,000 with annual expenses of $207,000 to $246,400.

The overall cost estimates eliminate costs to dischargers out of compliance because of algae blooms and costs for treatment systems already installed. The costs are estimated for sixteen dischargers with insufficient treatment, with frequent treatment system failures and with high pH water sources. The EcIS estimated capital outlays of $370,000 to $680,000 with annual expenses of $250,700 to $291,400 (8:838).

RESPONSE TO COMMENTS

Five comments concerned proposed Rule 413(c), the averaging rule for pH (PC 3, PC 7, PC 9, PC 10, PC 14). The existing Rule 408(a) range of pH 5 to 10 is not subject to averaging. At the merit hearings Allied Chemical and Caterpillar Tractor suggested that some sort of averaging rule should be adopted with the tightened range (1:95; 3:523; 4:694). In the proposed Order the Board put out for comment Rule 413(c), an averaging rule based on 99% compliance with the tightened ranges, as suggested by Caterpillar (3:524).

Effluents which are monitored so as to provide a permanent, continuous pH record may be outside the listed range for a total of not more than fifteen minutes in any day provided the excursion is accidental and less than one pH unit above or below the listed range. This rule is similar, though not identical to, a recently proposed USEPA rule which would be applicable to Agency-issued NPDES permits where it is more stringent than the state rule (40 CFR §401.17; 45 FR 81, 182, Dec. 9, 1980).

Two commenters suggested that the Board withhold action on the pH averaging rule until final action by USEPA (PC 7 and PC 9). Others suggested that the Board adopt averaging rules more like those proposed by USEPA or requested more complex rules than either proposed Rule 413(c) or §401.17 (PC 3, PC 10, PC 14). The Board declines to follow either suggestion. This rulemaking is nearly five years old and should not be further delayed. The proposed pH averaging rule is supported on the existing record. If it appears that a more complex rule is needed or if it appears desirable to adopt USEPA's final rule, affected persons may propose modification of Rule 413 in a new rulemaking.

Four commenters complained of the difficulty of meeting the tightened pH range while improving copper treatment efficiency to meet the proposed copper standard (PC 2, 7, 8, 10). Typically, to remove copper a base is added to cause precipitation. Optimum removal is at a pH of 9 to 10 (Ex 5, p. 151). The Village of Sauget STP maintains pH 8.7, while Olin Corporation (East Alton) operates at pH 9 to pH 10 (PC 7 and PC 8).

Precipitation results in a sludge and a clarified wastewater stream which has a pH approximately equal to the pH to which the wastewater was adjusted to cause precipitation. If this were in excess of the limitation on maximum pH it would have to be reacidified prior to discharge. Although the cost would be small compared to other treatment, reacidification entails addition of a unit operation. Malfunction could result in violation of the minimum pH standard, with greater potential for environmental harm (4:625).

Only copper dischargers have complained about the pH 9 limitation. The Board notes, however, that treatment for the following parameters frequently involves elevated pH: barium, cadmium, chromium, copper, lead, manganese and zinc (Ex. 5, pp. 27, 48, 109, 133, 270, 294, 588).

Accordingly the Board has proposed to add Rule 413(d)(2), an exception providing that the pH 9 maximum limitation may be exceeded if the elevated pH level:

> . . . is caused by the addition of alkali in the wastewater treatment process to cause precipitation of barium, cadmium, chromium, copper, lead, manganese, zinc or other similar contaminants, in which case the upper limit shall be pH 10 and subsection (c) shall not apply to the upper limit.

The exception only applies where alkali is added as part of the treatment process. If a listed contaminant is treated by some other method, the exception does not apply: i.e. the mere presence of a listed contaminant does not excuse compliance with the pH standard. The rule lists the Rule 408(a) contaminants commonly treated by elevating pH. If other similar contaminants are treated by addition of alkali to cause precipitation, the exception will also apply, whether they are regulated by Rule 408 or not.

One commenter requested modification of the "natural causes" exception to cover "causes beyond the control of the discharger, specifically including, but without thereby limiting the generality of the foregoing, process upsets, equipment failure, strikes of operating personnel and Acts of God" (PC 8). As noted above, the "natural causes" exception was intended to cover only algae blooms in treatment lagoons. The Board declines to extend the exception. The Board further notes that Rule 413 would be applicable under the listed circumstances, although prompt notification of the Agency and reasonable corrective measures would be considered in mitigation of any penalty under Section 33(c) of the Act.

Because the "natural causes" exception is apparently being misunderstood, the Board will modify it in the proposed rules, second notice Order. Rule 413(d)(1) will provide that the pH 9 maximum may be exceeded if the elevated pH level is caused entirely by algae in treatment lagoons. Natural causes seems to infer such things as high background pH and Acts of God, and does not really describe algae blooms very well. Although the algae are natural enough, the lagoon is an artificial impoundment receiving partially treated sewage. The combination of circumstances leading to the violation is very unnatural.

The term "excursion" has also been deleted from Rule 413(d). This is usually used to indicate a short-term violation. There is evidence that the algae-related pH violations show a diurnal cycle with daytime excursions and falling pH at night (8:832). However, the Board intends the lagoon exception to apply even if elevated pH persists for days or weeks.

The Agency objected to inclusion of a definition of pH in Rule 413. The Board has in the past been criticized for unexplained abbreviations and finds that it is preferable to include the definition.

The Agency also objected to inclusion of proposed Rule 413(c), the pH averaging rule. The Agency was particularly concerned about the impacts on the aquatic community of small fluctuations in stream pH, even if within the water quality standards. The Board declines to delete the pH averaging rule. The effluent standards are set on the basis of technological feasibility. There is ample evidence that it is not feasible to maintain pH within the 6-9 range 100% of the time. Furthermore, most Illinois streams have adequate buffering capacity to damp out small swings in effluent pH.

In conclusion, the Board finds that good conventional treatment is capable of meeting the range of pH 6 to 9 when allowance is made for averaging, algae blooms and the necessity of treatment for some parameters at elevated pH. The Board proposes to adopt Rule 413 with the modifications discussed above.

MERCURY

Elemental mercury is a well-known dense, volatile metallic liquid, having two other common oxidation states, mercurous and mercuric. Volatile organic alkylmercury (II) compounds are formed in natural systems. Mercury changes oxidation states readily and moves freely between solid, liquid and gaseous phases. This is an important factor in the extreme environmental danger associated with mercury (EcIS 22, 29, 37). Total mercury includes organic, inorganic and metallic forms (2:301).

IESAG originally proposed to relax the effluent standard and the sewer discharge standard for mercury from 0.0005 to 0.003 mg/l.[10] Four amendments to the proposal were made at the merit hearings. The first Agency amendment concerned existing Rule 702(d) which proscribes discharges to the sewer system which cause violations of water quality standards (Ex. 4, 9). The Agency suggested addition of language making it clear that Rule 702(d) covered only discharges to sewers and proscribed conduct by a discharger to the sewer which caused violation of water quality standards by the treatment plant. As stated, Rule 702(d) appears to cover all discharges and to require application of water quality standards to the water in the sewer. The clarifying language was acceptable to all participants but was inadvertently omitted from the proposed Order of February 19, 1981. The Board will adopt this as Rule 702(d) (3:361).

The second Agency amendment sought to add to a footnote Rule 408(a) applicable to the mercury standard (Ex 11). This provided:

> **If the Agency determines that levels above 0.0005 mg/l are the result of additions that cannot be removed from the wastewater influent or eliminated from the manufacturing process, effluent levels up to 0.003 mg/l will be allowed.

An MSD amendment incorporated elements of the first Agency amendment and proposed some minor editorial changes in Rule 702 (3:460). It added to Rule 408(a) a footnote with the following language:

> **Compliance with the numerical standard by private treatment works that treat only domestic wastes and publicly owned treatment works shall be determined on the basis that within any monthly period the daily 24-hour composite samples shall meet said standard no less than 70% of the time.

IESAG stated its opposition to the Agency and MSD amendments. Instead it suggested the following alternative (4:639; Ex. 23):

> **Mercury is to be eliminated from use or contained at the source whenever feasible. If the Agency determines that total containment or elimination is not feasible, effluent mercury shall not exceed 0.003 mg/l.

SOURCES OF MERCURY

Because of its unique properties, mercury is widely used in electrical equipment and other instruments. Contact with wastewater is usually not attendant with use. However, much of this mercury probably winds up in wastewater as a result of breakage or disposal. Dental work probably introduces some mercury into wastewater during preparation (2:293; EcIS 35; Ex. 5, p. 313). Mercury is used in the chlor-alkali industry and in electrodes, as well as in pesticides, paints, pharmaceuticals and cosmetics (EcIS 39; Ex. 5, p. 312). It is also released in mining and smelting operations, as a catalyst in industrial reactions and Kjeldahl nitrogen assays (EcIS 35; Ex. 5, pp. 312, 314; PC 4). Fossil fuel burning causes some mercury fallout (EcIS 37) and even laundry products contain some (4:432; 5:800; EcIS 38).

Mercury is naturally widely distributed in the lithosphere at a level of about 1 ppm (EcIS 29). Illinois sediments normally contain about 0.5 ppm mercury, and Chicago area sediments are 0.2 to 3.5 ppm (4:437). Mercury does not long remain in solution but associates with sediments (2:295; 5:729; Exs. 29B, 31B, 33, 34, 35, 36B).

Most mercury in streams arises from domestic sources and various non-point sources (1:167; 2:304). MSD found an inverse correlation between mercury and the level of industrialization in areas tributary to its plants. The lowest levels come from its most industrial area, around Calumet, while the highest were from newly constructed, non-industrial suburbs (3:430; Exs. 15, 16). This is attributed to washing compounds, soiled clothing, food, water supplies, water softening chemicals, road deicing chemicals, atmospheric fallout, soil and debris in stormwater (1:159; 3:412, 432; 5:770, 800).

MERCURY TREATMENT TECHNOLOGY

Because of the extreme environmental hazards associated with mercury, IESAG recommended that the Board base its mercury effluent and sewer discharge criteria on best available technology rather than good conventional technology (1:89; 2:279, 285). This represents a unique departure from the Board's approach to the other effluent standards.

The most common treatment method for mercury is precipitation of the sulfide. This is very efficient in removing mercury, but it will achieve levels of only around 0.010 mg/l. Mercuric sulfide is more soluble at pH levels greater than pH 9. Excess sulfide can produce complex ions which interfere with treatment efficiency (2: 277; Ex. 5, p. 317).

Different ion exchange processes are effective against inorganic and organic mercury. Inorganic mercury is usually converted to a mercuric chloride complex prior to treatment with an anionic exchange resin. This is the predominant species present in chlor-alkali wastestreams. Cationic exchange resins are also available. Methyl mercury acetate has been removed by ion exchange. Treatment of inorganic mercury is effective to levels of 0.001 to 0.005 mg/l.

Coagulation with aluminum or iron salts or lime is capable of lowering mercury levels to as low as 0.0005 mg/l (2:279, 297, 300; Ex. 5, p. 322). Adsorption on activated carbon yields levels less than 0.00025 mg/l for dilute wastestreams. Adsorption has been shown to be effective against organic mercury as well as inorganic (2:279; Ex. 5, p. 324).

Sulfide precipitation, ion exchange and coagulation have been employed full scale; other treatment methods considered by ISEAG have been done only on a pilot scale (2:277). IESAG identified ion exchange and coagulation as the best available technology (2:279; 3:398).

ENVIRONMENTAL IMPACT OF MERCURY

The environmental effects of mercury are well known and detailed in the study (EcIS 21, 88, 140). Dischargers conceded that it was extremely dangerous and no one argued against employing best available technology at a minimum. (1:164; 3:522; 5:770, 800; PC 12).

Mercury is extremely insoluble in natural waters. Elevated concentrations do not long persist. The mercury precipitates or is adsorbed onto suspended matter which settles. However, the mercury does not remain in the sediments but is cycled back into the environment. This is in part due to conversion of solid, insoluble forms to organic mercury compounds, such as dimethyl-mercury. Mercury also accumulates in tissues. Levels tend to be higher in creatures which are higher on the food chain. Chronic mercury poisoning can result in man (EcIS 23).

COST/BENEFIT ANALYSIS FOR MERCURY

The proposed relaxation of the mercury effluent standard could result in a slight increase in mercury in the environment. The EcIS concluded that this cost would be negligible (EcIS 131). On the other hand, it identified substantial benefits in the form of reduced treatment costs.

The EcIS identified seven industries, five municipal wastewater treatment plants, seven educational institutions and three miscellaneous dischargers potentially affected by the mercury proposal (EcIS 62, 72, 75, 79). Estimates of cost were about $166,100,000 to treat to 0.0005 mg/l and $1,830,000 to treat to 0.003 mg/l. This would have resulted in a net annual savings of $164,300,000 if the original IESAG proposal had been adopted (EcIS 82).

The proposed Order of February 19, 1981 was not identical to the proposal and amendments considered by the EcIS. There is, however, sufficient information in the EcIS to estimate the costs of the Board's proposal which grants the relaxed effluent standard only under certain conditions. To qualify, a discharger must eliminate use of mercury in most cases. Other conditions such as mercury ordinances or inspection programs can be met with minimal expense. Only the Vandalia Correction Center uses mercury in a manner which is inconsistent with qualification for the relaxed standard and all others are expected to qualify. Even that facility will probably elect to cease its mercury use. If not, treatment is expected to cost $294,400 per year (EcIS 80). This amount will be deducted from the savings.

The savings must also be adjusted to delete all savings associated with Monsanto Company and the Village of Sauget, since they now operate under a site-specific rule and would not be impacted by the proposed relaxation. These costs are $18,251,000 and $733,000 per year to treat to 0.0005 and 0.003, respectively (EcIS 80).

Making these adjustments, the net savings from the proposal should be $146,500,000 per year.

DISCUSSION AND RESPONSE TO COMMENTS--MERCURY

IESAG originally proposed a standard of 0.003 mg/l mercury based on best available technology (EcIS 2). Objections to the relaxation of the standard were raised at the hearing by CBE, the Attorney General and the Agency (1:164, 171, 218; 2:283). Most dischargers in the State are presently in compliance with the 0.0005 mg/l standard. Although best available technology is always able to achieve 0.003 mg/l mercury, it is often able to achieve lower levels (Ex. 5, p. 319). The absolute relaxation in the standard could offer an incentive to existing and potential dischargers to increase levels of mercury to above that which they could reasonably achieve. This is unacceptable in view of the extreme hazards of mercury.

As noted above, amendments were proposed by the Agency, MSD and IESAG (Exs. 2, 4, 9, 11, 12, 23). These focused on elimination and containment of mercury (1:164; 2:279, 286, 305). The Board has combined the amendments with other suggestions made in the hearing to develop a proposal. Only a single general objection was received (PC 12). Other comments centered on details of the proposal. These will be discussed with the general discussion of the proposed language.

Simply stated, those who comply with the elimination and containment provisions will be required to apply best available technology. Those who do not, in particular those who make unnecessary use of mercury, will be required to treat to 0.0005 mg/l. The Board recognizes that this may be very expensive. However, the cost is justified in view of the hazard.

Rule 411(a) sets a standard of 0.0005 mg/l for effluent discharges of mercury. This is subject to two exceptions contained in Rule 411(b) and 411(c). Each of these essentially allows discharge levels of 0.003 mg/l if the other stated conditions are met [Rules 411(b)(2) and 411(c)(3)] (3:356). The exception of Rule 411(b) is applicable to all dischargers while Rule 411(c) is an alternative applicable only to publicly owned or publicly regulated sewage treatment works [Rule 411(c)(1)].

Rule 411(b)(1) provides as a condition for the relaxed effluent standard that "mercury is not used by the discharger, or mercury is used and its use cannot be eliminated" (1:164; 2:286; 3:353, 355, 448). The Board intends that persons who make unnecessary use of mercury in such a manner that it comes into contact with wastewater should be obliged to devise some means of treating mercury to 0.0005 mg/l. The Board is not aware of any existing direct industrial dischargers of mercury who would not satisfy this condition. It is directed against dischargers who might choose to locate in the State in the future (3:449).

Rule 411(b)(2) sets as a condition of the relaxed standard that the effluent mercury concentration is less than 0.003 mg/l. This is essentially an alternative effluent standard. A specific reference has been made to the averaging rule of Rule 401(c). The exception applies if the monthly average is less than 0.003, daily averages less than 0.006 and grab samples less than 0.015 mg/l (2:280).

Rule 411(b)(3) provides as a condition to the relaxed standard that the discharger is "providing the best degree of treatment consistent with technological feasibility, economic reasonableness and sound engineering judgment" (3:355). This language is taken from Rule 401(a), and is intended to cover a situation where, for example, a discharger is capable of achieving 0.001 mg/l either through treatment or housekeeping practices. The Board does not intend to allow such a discharger to relax his vigilance and raise his monthly average to 0.003 mg/l (3:448).

Rule 411(b)(3) specifically provides that a discharger may meet the condition without treatment for mercury. In the context

of a permit application, the Agency may review the discharger's operation for whether it meets the conditions of Rule 411(b). The Agency may determine that no treatment would amount to the best degree of treatment within the meaning of Rule 411(b)(3).

Proposed Rule 411(b)(4) provides as a condition to the relaxed effluent standard that the discharger have an inspection and maintenance program likely to reduce the level of mercury discharges. In connection with the similar proposed Rule 702(b)(4) one commenter suggested that language be added to specifically cover the case where an inspection and maintenance program has already been successful in reducing the level of mercury discharges (PC 4). Accordingly, the Board will insert language into Rule 411(b)(4) so that it reads, "likely to reduce or prevent an increase in the level of mercury discharges."

The Agency commented that Rule 411(b)(4) should be deleted and that it should be required only by way of permit condition (PC 17). The intent of Rule 411(b)(4) is to firmly establish the Agency's authority to require this permit condition. In the context of permit issuance, if the Agency determines that minimal vigilance is sufficient, it may so state in the permit.

Rule 411(c) is an exception to the 0.0005 mg/l mercury effluent standard which is applicable only to publicly owned or regulated sewage treatment works. Rule 411(c)(2) provides as a condition that mercury is not used by the discharger (1:164; 4:645). This is similar to Rule 411(b)(1), except that there is no allowance for use which cannot be eliminated. The Board is aware of only one use of mercury in municipal wastewater treatment: trickling filter seals. This use is known to contribute mercury to wastewater. Mercury seals have been removed from all treatment plants in Illinois except the Vandalia Correction Center treatment plant. The Board intends to require full treatment of mercury by any municipal plants which employ these mercury seals.

Rule 411(c)(3) is essentially an effluent standard of 0.003 mg/l applicable to dischargers who otherwise meet the conditions of Rule 411(c). The averaging rule is referenced, so that this level must be met on a monthly basis.

The Agency noted that proposed Rule 411(c)(3) was ambiguous as to whether the daily, grab sample or some combination must be met 70% of the time (PC 17). Rule 411(c)(3) is derived from the second MSD amendment (1:155; 3:349, 426, 440; Exs. 12, 15, 16). This provided that "24-hour composite samples meet said standard no less than 70% of the time." The specification of daily composite was inadvertently omitted from the proposed language. Accordingly, the Board has modified Rule 411(c)(3) so that the condition reads: "The effluent mercury concentration is less than 0.003 mg/l, as determined by application of the averaging rules of Rule 401(c), provided, however, that daily averages may exceed 0.006 mg/l 30% of the time." The monthly limit of 0.003 mg/l and grab limit of 0.015 mg/l are unaffected (1:161; 4:446). There is no concentration ceiling on daily maxima, only a percentage distribution limit (3:443).

Municipal type treatment plants provide treatment which is generally ineffective for mercury removal (3:358). The broader variability allowed by Rule 411(c)(3) is justified by the fact that treatment plant variability is mostly a function of variability in input to the plant. Rules 411(c)(4) through 411(c)(8) address the municipal dischargers' duties with respect to controlling the myriad of small sources of mercury.

Rule 411(c)(4) provides as a condition to the relaxed standards that the discharger have enforceable ordinances or contract provisions whereby it limits the use of mercury by dischargers and discharge of mercury into its sewage system (3:445, 457). Rule 411(c)(5) requires that these limitations be at least as strict as those provided in Rule 702. Rule 411(c)(6) requires a surveillance program with a reasonable likelihood of determining mercury dischargers to a sewage system (1:165). Rule 411(c)(7) requires the discharger to take all lawful steps to eliminate known mercury discharges to its sewage system which contribute to levels in excess of those allowed by Rule 702 (3:448). Rule 411(c)(8) requires dischargers to report all known violations of Rule 702 to the Agency.

The Agency requested that Rule 411(c) be made a site-specific rule applicable only to MSD (3:455; PC 17). However, the data presented by MSD appears to be typical of variability associated with other publicly owned treatment works. Accordingly the Board will adopt a general exception applicable to all publicly owned treatment works.

The Agency also requested deletion of the conditions concerning control of mercury added by dischargers to the sewer [Rule 411(c)(4) through 411(c)(8)] (PC 17). The Agency stated that MSD already complied with these conditions. However, keeping these as conditions will establish a regulatory underpinning for permit conditions requiring these actions. If MSD already complies with these conditions, it will have no difficulty complying with the permit conditions (1:165). The Board intends that similar permit conditions be imposed upon municipal dischargers who have mercury problems and desire to have the 0.003 mg/l standard apply.

Rule 411(d) provides that "use of mercury" does not include analytical use in laboratory or other equipment where reasonable care is taken to avoid contamination of wastewater. Mercury is commonly used in electronic equipment and in laboratory instruments. Wastewater contamination ordinarily occurs only because of breakage or improper use. The Board does not intend this sort of use to result in imposition of the stricter mercury standard. However, the discharger must take reasonable care to avoid the contamination of wastewater. This will usually involve at a minimum an employee instruction program concerning use of the equipment and steps which must be taken to clean up spills.

The Agency objected in general to the specificity of the conditions of the exception of Rule 411(c) (PC 17). The Agency stated that the Board's role is to set standards and it is MSD's responsibility to use available means to meet these standards.

The Board acknowledges that MSD could of its own accord require these things of dischargers to its system and that the Agency could impose these permit conditions in the absence of a Board rule. However, it appears that this has not always been done in the past. Incorporating this into a Board rule may promote its more frequent use.

In connection with Rule 702 one commenter noted that mercury is frequently used as a catalyst in Kjeldahl nitrogen assays (PC 4). The Board intends that this use not prevent application of the exceptions. However, the user must provide a means of recovering the mercury from the samples and must provide an ongoing employee training program in order to take reasonable care to avoid contamination of wastewater.

Rule 411(e) provides that for purposes of the permit issuance the Agency may consider the application of the exceptions in Rule 411 to determine compliance. The Agency may impose permit conditions necessary or required to assure continued application of the exception. When paragraph (b) applies, the Agency may impose an effluent limitation in the permit which allows the discharge of a concentration of mercury greater than 0.0005 mg/l but not more than 0.003 mg/l.

The source of Rule 411(e) is the second Agency amendment (3:348, 350, 353; Ex. 11). This sought to add a footnote to the mercury standard stating that, "if the Agency determines that levels above the 0.0005 mg/l are the result of additions which cannot be removed from the wastewater influent, or eliminated from the manufacturing process, effluent levels up to 0.003 mg/l will be allowed." At hearings it was not clear that the Agency intended that the standard be either 0.0005 or 0.003, or whether the Agency was to be conferred the authority to set a number between these two limits (3:450, 353, 386). The IESAG amendment was intended to confer authority on the Agency to set an intermediate standard (4:639). The Board has proposed to expressly authorize the Agency to set an intermediate number. The standard for the Agency's action is found in Rule 411(b)(3), which requires as a condition to the exception that the discharger provide the best treatment consistent with technological feasibility, economic reasonableness and sound engineering judgment (3:355).

The Board has adopted an effluent standard of 0.0005 mg/l for mercury and created exceptions which would authorize discharges up to 0.003 mg/l under specified circumstances. One of these circumstances requires the application of a certain kind of treatment. In permit issuance the Agency must make factual findings pursuant to Section 39 of the Act, including a finding as to the level of treatment which meets Rule 411(b)(2). This number is to be incorporated into the permit as the effluent limitation.

Rule 451 sets a site-specific limitation applicable to chlor-alkali facilities in St. Clair County. This is derived from existing Rule 702(f). It is applicable to Monsanto and the Village of Sauget.

Proposed Rules 702(a) and 702(b) closely follow Rules 411(a) and 411(b). Rule 702 is applicable only to discharges to publicly owned or publicly regulated sewer systems while Rule 411 is applicable to effluent discharges to waters of the State. One commenter objected to having Rules 411 and 702 separated (PC 1). However, the two rules apply to two different groups of people which have very little overlap.

Rule 702(b)(4) has been modified pursuant to comment (PC 4). This sets as a condition the relaxed effluent standard that the discharger have an inspection and maintenance program likely to reduce the level of mercury discharges. This has been modified to provide that the discharger may qualify if an inspection program is likely to "prevent an increase" in the level of mercury discharges. This follows the changes in Rule 411(b)(4).

The Agency asked that Rule 702(a) be modified to set a primary mercury standard for dischargers to the sewer which is the same as the treatment plant limitation (PC 17). The treatment plant limitation should be set according to Rule 411(a) and (c). The Board declines to follow this suggestion. Under it a discharger who is diligent in eliminating mercury could be forced to nonetheless treat in the event the sewage treatment plant declined to take the steps necessary to qualify for the relaxed effluent standard of Rule 411(c). The sewer discharger has little control over the treatment plant operation.

The Agency also suggested that Rule 702(b) be moved to subpart B of Part VII which would contain site-specific rules and exceptions (PC 17). The Board declines to follow this suggestion. Rule 702(b) is a general exception potentially applicable to any sewer discharger. It should be placed next to the general rule.

Existing Rule 702(b) has been deleted. This created an exception to Rule 702(a) which by its own terms expired June 1, 1974. Existing Rule 702(c) has been modified to remove references to old Rule 702(b), to replace roman with arabic numerals to conform with codification, to state metric quantities to promote consistency with the metric effluent limitations, and to remove chemical symbols.

The Board originally proposed only very minor editorial changes to Rule 702(d). No comments have been received on Rule 702(d). The Board has noted, however, that the second Agency amendment proposed additional editorial changes which were overlooked in drafting the proposed rule, first notice Order (3:348; Ex. 11). The Board proposes to adopt the Agency's proposed language in substance.

Rule 702(d) presently reads "no discharge of mercury shall be permitted." This has been changed to, "no person shall cause or allow any discharge of mercury to a publicly owned or publicly regulated sewer system." Rule 702(d) is thus stated in prohibitory language which parallels proposed Rule 702(a) and is clarified to state that it covers only discharges to sewers. The Board has also specified that it refers to violations "by the sewer plant discharge." The existing language of Rule 702(d) is subject to an

unintended interpretation that it proscribes violations of water quality standards within the sewer rather than within the stream receiving the sewer treatment plant discharge. The Board has also replaced the numerical reference with a reference to the water quality standards "of Part II for mercury applicable in the receiving stream." This further clarifies Rule 702(d). It also would accommodate the possibility of a change in the water quality standard without a change in the effluent standard.

Rule 702(e) parallels Rule 411(e). This states the Agency's authority to consider the application of the requirements of the exception of Rule 702(b) in permit issuance. The Board notes that its rules do not in general require sewer discharge permits (Rule 951 et seq.). Permits are required only for certain types of facilities. Rule 702(e) is not intended to impose an additional permit requirement. In cases of unpermitted facilities, Rule 702(a) applies as well as the exception of Rule 702(b). Where no permit is required, the operator of the facility must satisfy himself as to whether he qualifies for the exception. He may request interpretation from the Agency or from the local sewage treatment plant. In the event of an enforcement action based on Rule 702(a) he may interpose Rule 702(b) as a defense.

Existing Rule 702(e) provides an exemption for discharge of mercury by commercial laundries. The Board has proposed to delete this provision which expired by its own terms on September 30, 1977. A proposal is pending before the Board to extend this exemption (R79-1). The deletion of the expired exemption is an editiorial change only and does not reflect any decision on the other rulemaking.

In response to comments the Board has added Rule 702(f) governing analytical use of mercury to the proposal; this essentially restates Rule 411(e) as applied to sewer discharges. It was inadvertently left out of the proposal (PC 4).

Old Rule 702(f) has been removed to Rule 451. This is the site-specific rule for Sauget and Monsanto.

The Board finds that because of the extreme environmental hazard of mercury discharges, best available technology should be applied to reduce mercury levels where the discharger has eliminated unnecessary use of mercury and taken other steps specified in proposed Rules 411 and 702. The Board finds that best available technology is capable of achieving consistent levels of 0.003 mg/l mercury. The Board will not relax the effluent standard for dischargers who refuse to eliminate unnecessary use of mercury or comply with the other conditions specified in Rules 411 and 702. The Board proposes to adopt these rules as modified pursuant to comments.

TDS REPORTING AND MONITORING

As is discussed in connection with the proposal to eliminate the TDS standard of old Rule 408(b), the Board proposes to adopt

a rule stating its intent not to prohibit the Agency from requiring TDS reporting and monitoring. This will be numbered Rule 918 rather than Rule 976.

Several commenters perceived the TDS reporting and monitoring rule as requiring control of TDS or as conferring authority on the Agency to establish TDS limitations in permits (PC 1, 7, 9). This is not intended. The Agency may establish permit conditions pursuant to existing authority to establish water quality related effluent standards [Rules 203, 402 and 910(a)].

This Opinion supports the Board's proposed rule, first notice Order of February 19, 1981 and the proposed rule, second notice Order of August 20, 1981.

FOOTNOTES

[1] Merit hearings were held as follows:

Date	Location	Parameter	No.	Pages
March 9, 1977	Chicago		1	1-223
March 10, 1977	Chicago		2	225-343
April 7, 1977	Springfield		3	346-562
June 14, 1977	Carbondale		4	563-712
July 12, 1977	Springfield		5	713-816

[2] Economic Impact hearings were held as follows:

April 18, 1978	Chicago	Mercury	6	1-187
April 25, 1978	Springfield	and Selenium	7	189-224
August 22, 1978	Chicago	pH, Chromium	8	818-894
August 23, 1978	Springfield	and Iron	9	895-922
February 6, 1979	Springfield	TDS	10	1-40
February 8, 1979	Carbondale	TDS	11	43-65
April 21, 1980	Chicago	Averaging	12	1-67
April 25, 1980	Springfield	Averaging	13	68-89
May 6, 1980	Springfield	Copper	14	91-171
May 8, 1980	Chicago	and Lead	15	158-168

[3] BOARD REGULATIONS CONCERNING CHROMIUM

Rule	Parameter	Type	Standard (mg/l) Present	Proposed
408(a)	Cr(III)	Effluent	1.0	---
408(a)	Cr(TOT)	Effluent	---	1.0
408(a)	Cr(VI)	Effluent	0.3	0.1
203(f)	Cr(III)	Water Quality	1.0	1.0
203(f)	Cr(VI)	(General Use)	0.05	0.05
204(b)	Cr(TOT)	Water Quality (Water Supply)	0.05	0.05
205(e)	-------	Water Quality (Secondary Contact)	Reference to Rule 408 Standards	

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BOARD REGULATIONS CONCERNING COPPER

Rule	Type	Standard (mg/l)
408(a)		
Present	Effluent	1.0
Proposed	Effluent	0.5
203(f)	Water Quality (General Use)	0.02
204(a)	Water Quality (General Use)	(Rule 203(f) by reference, exception for algicides applied pursuant to permit)
205(e)	Water Quality (Secondary Contact)	(Rule 408 by reference)

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BOARD REGULATIONS CONCERNING IRON

Rule	Parameter	Type	Standard mg/l Present	Proposed
408(a)	Fe(TOT)	Effluent	2.0	2.0
	Fe(DISS)	Effluent	0.5	---
606(b)*	Fe(TOT)	Effluent	3.5	3.5
203(f)	Fe(TOT)	Water Quality (General Use)	1.0	1.0
205(e)(6)	Fe(TOT) Fe(DISS)	Water Quality (Secondary Contact)	(408(a) standard by reference)	

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BOARD REGULATIONS CONCERNING LEAD

Rule	Type	Standard (mg/l)
408(a)		
Present	Effluent	0.1
Proposed	Effluent	0.2
203(f)	Water Quality (General Use)	0.1
204(b)	Water Quality (Water Supply)	0.05
205(e)	Water Quality (Secondary Contact)	(Reference to Rule 408 standards)

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* Rule 606(b) of Chapter 4: Mine Related Pollution

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BOARD REGULATIONS CONCERNING SELENIUM

Rule	Type	Standard
408(a)	Effluent	
Present	Effluent	1.0 mg/l
Proposed	Effluent	--------
203(f)	Water Quality (General Use)	1.0 mg/l
204(b)	Water Quality (Water Supply)	0.01 mg/l

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BOARD REGULATIONS CONCERNING TDS

	Rule	Effluent	Rule	Water Quality
TDS				
Existing	408(b)	3500 mg/l	203(f)	1000
Proposed		-----	203(f)	1000
Mine Waste TDS*	606	-----	605	Rule 203 stds.
Chloride	---	-----	203(f)	500
Sulfate	---	-----	203(f)	500

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BOARD REGULATIONS CONCERNING pH

Rule	Type	pH standard Minimum	pH standard Maximum
Rule 408(a) (present)	Effluent	5	10
Rule 413 (proposed)	Effluent	6	9
Rule 203(b)	Water Quality (General Use)	6.5	9.0
Rule 204	Water Quality (Water Supply)	Reference to Rule 203(b)	
Rule 205(b)	Water Quality (Secondary Contact)	6	9

*Chapter 4: Mine Related Pollution; pursuant to Rule 605.1 coal mines are partially exempt from TDS water quality standards through July 1, 1983.

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BOARD REGULATIONS CONCERNING MERCURY

Rule	Type	Standard (mg/l)
408(a)		
Existing	Effluent	0.0005
Proposed	Effluent	0.003
702(a)		
Existing	Sewer Discharge	0.0005
Proposed	Sewer Discharge	0.003
203(f)	Water Quality (General Use)	0.0005
204	Water Quality (Water Supply)	Rule 203(f) by reference
205	Water Quality (Secondary Contact)	Rule 408 and Part IV by reference

Mr. Goodman concurred.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion was adopted on the 24th day of September, 1981 by a vote of 4-0.

Christan L. Moffett

Christan L. Moffett, Clerk
Illinois Pollution Control Board