ILLINOIS POLLUTION CONTROL BOARD
February 15, 1979

IN THE MATTER OF:	)	
	)	R75-5
PROPOSED AMENDMENTS TO CHAPTER	)	R74-2
2, PART II, SULFUR DIOXIDE	)	CONSOLIDATED
EMISSIONS.	)	

OPINION OF THE BOARD (by Mr. Goodman):

On March 7, 1974, the Board initiated inquiry hearings, docketed R74-2, into the validity of the Air Pollution Regulations (Chapter 2 of the Board's Rules and Regulations) as they pertain to sulfur dioxide (SO_2) emissions. The Board conducted eight public inquiry hearings on R74-2 throughout the State in 1974. On December 5, 1974, the Board ordered the Environmental Protection Agency (Agency) to analyze two of the Board's sulfur dioxide regulations affecting sources outside the major metropolitan areas (MMA's) as to their effect on air quality. On January 9, 1975, a Board member proposed an amendment to Rule 204, and the Board authorized the proposal for hearing. The proposal, which was docketed number R74-2, was published in the Board's Environmental Register number 97.

On March 31, 1975, the Agency filed a proposal to amend certain of the Board's sulfur dioxide regulations. The Board docketed the proposal R75-5 and, on April 10, 1975, ordered that it be set for hearing. The R74-2 and R75-5 proceedings were consolidated for hearing. The Agency submitted revisions to its R75-5 proposal on April 30, 1976, August 3, 1977, and January 6, 1978, and the various proposals were published in the Board's Environmental Register numbers 101, 120, 163 and 172. Public hearings were held in the following locations:

June 24, 1975	Edwardsville
June 30, 1975	Chicago
July 15, 1975	Peoria
July 29, 1975	Carbondale
August 12, 1975	Chicago
September 16, 1975	Chicago
October 21, 1975	Chicago
March 30, 1976	Chicago
May 4, 1976	Chicago
May 25, 1976	Chicago

The Board wishes to express its appreciation for the excellent work done in this matter by: Roberta Levinson, Administrative Assistant and Hearing Officer herein; Carolyn Hesse, Technical Assistant; and Ken Kirkpatrick, Administrative Assistant.

In accordance with Section 6 of the Environmental Protection Act (Act), the Illinois Institute for Environmental Quality (now the Illinois Institute for Natural Resources) on November 11, 1977, filed IIEQ Document No. 77/36, the economic impact study of the proposed sulfur dioxide amendments. Economic impact hearings were held in the following locations:

January 10, 1978	Springfield
January 17, 1978	Chicago

The record was kept open in this matter for 45 days after the final hearing to allow for submittal of public comments.

On May 11, 1978, and again on August 24, 1978, the Board proposed final draft Orders which modified the Agency's proposal and subsequent revisions in several respects. Pursuant to Section 5 of the Illinois Administrative Procedure Act, Ill. Rev. Stat., Ch. 127, §1001 et seq., the proposed final drafts were published in the Illinois Register on June 16, 1978 and September 29, 1978. The public comment period extended through November 14, 1978.

Having considered the public comments and re-examined the record, we have modified our proposed draft Order in certain respects. Based upon the voluminous record, exhibits and public comments received, the Board on December 14, 1978 adopted these amendments to certain of our sulfur dioxide regulations.

Before beginning our analysis, we note that legislation on the state and federal level had a significant impact on the history and outcome of these amendments. On the state level, the Illinois legislature in 1975 amended the Environmental Protection Act (Act) to include Section 10(h), which required the Board to adopt regulations prescribing the conditions under which existing sources may use intermittent control systems (ICS's) in lieu of compliance with SO_2 standards. On the federal level, Congress in 1977 adopted amendments to the Clean Air Act, 42 U.S.C. §7401 et seq.(1977), many of which impose new requirements which must be incorporated into the State Implementation Plans required by Section 110 of the Clean Air Act. The impact of both of these pieces of legislation will be discussed in the course of this Opinion.

HISTORY OF THE REGULATIONS

Section 109 of the Clean Air Act as amended in 1970 required the Administrator of the United States Environmental Protection Agency to promulgate primary and secondary national ambient air quality standards (NAAQS) for certain pollutants, including sulfur dioxide. The primary national ambient air quality standard is defined as the standard requisite to protect the public health. The U.S. Environmental Protection Agency

promulgated a primary annual SO_2 standard of 80 ug/m^3 (0.03 ppm) and a short term (24 hr.) standard of 365 ug/m^3. The Board adopted primary ambient air quality SO_2 standards identical to these federal standards in Rule 308 of Chapter 2. Section 110 of the Clean Air Act requires each state to submit to the U.S. Environmental Protection Agency a State Implementation Plan (SIP) which includes emission limitations insuring attainment and maintenance of the NAAQS.

The Clean Air Act as amended in 1977, in Section 107(d)(1), requires each State to identify which air quality control regions or portions thereof in the State do not meet a national primary air quality standard for SO_2. For those areas designated non-attainment, the State must by July 1, 1979, revise its SIP to assure attainment of the SO_2 standard by December 31, 1982. For those areas designated attainment, Part C of the Clean Air Act, entitled "Prevention of Significant Deterioration of Air Quality," applies. The Board notes that the portion of the State covered by these amended regulations includes only one designated non-attainment area, Massac County (43 Federal Register 8987-8988 (March 3, 1978)).

In 1972, the Board adopted its Air Pollution Regulations, which were submitted by the Illinois Environmental Protection Agency to the U.S. Environmental Protection Agency and approved as Illinois' State Implementation Plan. Included in those regulations was Rule 204(e), which provided a formula by which owners of fuel combustion sources were to determine the total amount of SO_2 per hour which could be emitted from all sources owned by them and located within a one-mile radius. The formula was aimed at preventing violation of the short-term sulfur dioxide standard. The Air Regulations also included Rule 204(c)(1)(B), which required sources located outside the Chicago, Peoria and St. Louis (Illinois) MMA's to meet an emission standard of 6.0 pounds of SO_2 per million btu of heat input. This standard was based upon the washability of Illinois coal and was aimed at eliminating easily avoidable emissions at relatively low cost. See In the Matter of Emission Standards, R71-23, Opinion of the Board, 4 PCB 298 (April 13, 1972).

The regulations adopted by the Board herein amend both Rules 204(e) and 204(c)(1)(B) as well as adding new paragraphs to Rule 204. Rule 204(e) has been limited to sources outside the Chicago, St. Louis (Illinois) and Peoria MMA's and the formula has been amended in Rule 204(e)(1) to more accurately correlate allowable emissions with prevention of the short-term ambient air quality standard. The Rule 204(e)(1) formula is based on a conservative set of worst-case meteorological and physical parameters. However, because these assumptions may be overly conservative for some sources, we have provided a mechanism in Rule 204(e)(3) whereby a source may determine its own alternate emission limitation through a program of modeling and monitoring its emissions. Rule 204(e)(2) retains the old mass emission limitation and "grandfathers in" those sources which have in good faith complied with the old formula but would have been thrown

into non-compliance with the new formula. Finally, although the new formula and the alternate emission limitation provision could in some cases allow sources to increase their emissions to a level above that allowed by the old formula, no source may do so without first proving it will not violate the prevention of significant deterioration increment (PSD Increment) determined by Section 163 of the Clean Air Act and Regulations adopted thereunder. Also, Rule 204(i) precludes any source from meeting the Rule 204(e) formulas by the use of dispersion enhancement techniques.

The Board has eliminated the prior Rule 204(c)(1)(B) requirement that the sources located outside the three large MMA's, in addition to meeting the mass emission limitation, meet a SO_2 standard of 6.0 lbs./MBTU. However, sources burning less than 250 MBTU have been given their choice of complying with the Rule 204(e) formulas or a standard of 6.8 lbs./MBTU.

ANALYSIS OF THE REVISED REGULATIONS

During the hearings, Gary Melvin of the Agency testified that in his opinion the new formula found in Rule 204(e)(1) protects the short-term standards better than the old formula (R.123)*, which "...has technical inadequacies and ignored certain site-specific information" (R.1011). Although there are differences between the old and the new formulas for determining a source's mass emission limitation, they do have several points in common. Both formulas are based on the Gaussian dispersion equation for point sources, which has been generally accepted to adequately describe dispersion over short distances (Ex. 5, ref. 29). Both formulas also average all the stacks within a one-mile radius of the center of the source, as though all the emissions from the source were from one stack.

Since the purpose of Rule 204(e) is to protect the short-term ambient air quality standards, adverse meteorological conditions which could lead to violations of the short-term standards are used in the derivation of the formulas. According to Agency witness Melvin, the old formula (now in 204(e)(2)) was presumably derived in order to protect the 3-hour secondary sulfur dioxide standard (Ex. 4, ref 3). Unstable stability conditions and a reference windspeed of 6.56 feet per second, (2 meters per second), which did not vary according to stack height, were used. Trapping conditions due to an inversion were not assumed. The new formula in Rule 204(e)(1) was derived to protect the primary 24-hour SO_2 standard during the following "worst-case" meteorological conditions (R.78):

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* All references to exhibits and pages in the record will refer to R75-5, unless R74-2 is specified.

1. The plume from the source is trapped between the ground and a stable layer aloft such that the height of the inversion base (lid) is equal to the effective stack height. (The effective stack height is equal to the sum of the actual stack height and the height of the plume rise; it is the height at which the plume essentially becomes level.) In general, trapping conditions with the height of the inversion lid equal to the effective stack height would be the most restrictive since these conditions would allow the least amount of vertical mixing. If the lid were situated above the effective stack height, the mixing depth would be greater and, consequently, concentrations of pollutant would be less; if the lid were situated well below the effective stack height, the plume could punch through the lid and be held aloft by the inversion layer and not touch the ground.

2. Class B stability (unstable) is assumed to occur below the inversion. Although class D stability (neutral) is much more prevalent during limited mixing situations, class B stability can occur and would result in higher ground level concentrations due to uniform vertical mixing occurring closer to the source.

3. The average surface wind speed is equal to 14.44 feet/second (4.4 meters/second (m/s)) at a height 32.81 feet (of 10 meters) and varies according to the following power law, which provides for increases in wind speed as stack height increases: $U=U_{32.81}(H_A/32.81)^{0.11}$, where U = average wind speed at stack height H_A, in feet, and $U_{32.81}$=14.44 feet/sec. ($U= U_{10}(H_A/10)^{0.11}$, where U = average wind speed at stack height H_A, in meters, and U_{10} = 4.4 m/s).

4. Persistent plume trapping occurs for six hours which would result in a maximum hourly SO_2 concentration, which should not be exceeded, equal to 1460 ug/m^3 (micrograms per cubic meter). (365 ug/m^3 x 24 hr. $\div$ 6 hr. = 1460 ug/m^3)

Meteorological data collected at Springfield, Moline, and Vandalia indicate that unstable atmospheric conditions with persistent winds (for 6 hours or more) at a given compass point occur from 0 to 5 times per year (R.80). Hence, the new formula may be considered to be conservative in the sense that there are more prevalent meteorological conditions than those which it assumes (R.86). However, it should be noted that in order to protect a short-term standard, the worst-case conditions, which may give rise to violations, even though infrequent, should be considered.

The old and the new formulas also differ with respect to the site-specific parameters which are used in calculating a given source's emission limitation. The new formula utilizes the following weighted-average stack parameters which are specific to that facility: stack diameter, exit velocity of stack gases, exit temperature of stack gases, and actual stack height. The weighting factor for a given stack is based on the percentage of total emissions that are emitted from that stack. For example, if a source has two stacks with stack A emitting 40% of the source's emissions and stack B emitting 60%, then the stack A parameters would be weighted by a factor of 0.4 and the stack B parameters would be weighted by a factor of 0.6.

The firing rates to be used for determining the weighting factor P, exit gas temperature T, and exit gas velocity V are based on the boilers' name plate ratings (R.2115), which are the operating conditions that presumably result in maximum emissions. In the old formula, on the other hand, the average actual stack height was the only site-specific parameter used. (The stack heights were weighted by percentage of total emissions.) The allowable emissions from a given source were obtained through a comparison of the average actual stack height of that source with the average actual stack height of a reference source for which an allowable emission limitation had been calculated. The reference stack had the following parameters: an actual stack height equal to 300 feet, an exit gas temperature equal to 500°F, a stack diameter equal to 7 feet, and an exit gas velocity equal to 60 feet/sec. (Ex. 4, ref. 3).

The old and the new formulas also utilize different plume rise formulas for calculating the height that the plume rises from the top of the stack before leveling. The new formula utilizes the "2/3 power law" formula developed by Briggs and promoted by the U.S. Environmental Protection Agency (Ex. 4, ref. 9, p. 15). Although no one plume rise formula applies to all conditions, "buoyant plumes have been found to follow the 2/3 law for transitional rise for considerable distance downwind, regardless of stratification" (Ex. 5, ref. 30, p. 57). Several references (Ex. 5, ref. 30; Ex. 4, ref. 16; Ex. 4, ref 9; Ex. 5, ref. 31) noted that the bulk of plume rise data fit this formula. However, it should be noted that the Briggs formula tends to over-predict plume rise for large stacks and consequently underestimates ground-level concentrations (Ex. 4, ref. 5). The old formula does not utilize the Briggs plume rise formula.

It also appears that the Briggs formula is more accurate for facilities that have a single stack than for facilities that have multiple stacks near each other. During one experiment to verify the plume rise formula, it was found that during stable conditions the observed plume rise from two nearby stacks was somewhat greater than the plume rise that would occur from the stacks individually or for a calculated average stack, weighted by the SO_2 emission rate (Ex. 4, ref. 14, p. 1051).

Neither the old nor the new rule provide for background concentrations of sulfur dioxide (R.86). For more detail on the derivation of the old and the new formula, see reference 3 of exhibit 4 and reference 26 of exhibit 5, respectively.

Various witnesses testified as to shortcomings of the new formula. Most of the criticism was directed at modeling emissions from numerous stacks as if they came from one stack with parameters (e.g. height, diameter) equal to the average of the parameters from the other stacks. In particular, Kontnik and Davidson, testifying for the U.S. Industrial Chemical Company, argued the formula in Rule 204(e)(1) does not model the effects of multiple sources realistically (R.443). They testified that when multiple stacks are involved, each site must be considered individually so that the following characteristics can be considered: three-dimensional spacing of each source (vertical and horizontal spacing), heat contents of the plumes and any structures that are near the stacks (R.444). For example, the plumes from a tall stack with a large plume rise and a short stack with a small plume rise may never interact (R.446).

T.J. May, testifying for Illinois Power (starting on R.683), stated that the proximity of the three tall stacks at a plant like the Baldwin Plant could lead to enhanced plume rise. This would be due to the hot flue gases combining and tending to reduce the total amount of air to flue gas interface, which would reduce plume cooling, allowing higher plume rise and increased dispersion.

Polcaliyka, with Sargent and Lundy, also testified for Illinois Power that the method of converting all stacks within a one-mile radius into a single average stack is overly conservative (R.694). In particular, he stated that the worst-case meteorology for stack A is not necessarily the worst-case for stack B and will not be the worst-case for the average stack derived from stacks A and B. According to this witness, in order to be fair and realistic in a multiple stack situation, one must consider the distance between stacks and their alignment with respect to each other and the prevailing wind direction. For example, he recommended that, if the stacks are separated by large distances and/or are dissimilar in design, each stack be considered separately and the ground-level concentrations be added. On the other hand, if the stacks are close enough together to get plume interaction which would involve increased plume rise, that condition should be considered also.

It was also pointed out by Fancher of Commonwealth Edison (starting on R.1093) that for some sources, especially short sources, plume trapping by an inversion may not be the worst-case condition. Plume coning, looping, inversion break-up and fumigation may result in higher ground-level concentrations. Another weakness in the new formula is that it assumes that the maximum emission rate results in maximum ground-level concentrations, which is not always true (P.C. #52).

Despite the Board's recognition that the Rule 204(e)(1) formula may indeed have certain shortcomings, the Board finds that it is a state-of-the-art formula and describes the worst-case (most restrictive) meteorological conditions for many, though not all, sources. However, sources who are able to prove to the Board that operating, meteorological, and/or plume dispersion conditions other than those found in Rule 204(e)(1) would be the limiting worst-case conditions may obtain a site-specific alternate emission limitation pursuant to Rule 204(e)(3). In addition, sources who by April 1, 1978, complied with the old formula but do not comply with the new Rule 204(e)(1) formula, may continue to comply with the old formula, pursuant to Rule 204(e)(2).

As stated, in order for a source to qualify for a Rule 204(e)(3) alternate emission standard, it must prove site-specific limiting worst-case conditions different than those in Rule 204(e)(1). An example of a situation in which an alternate operating condition could be more appropriate would be a common stack servicing several units. Under high volume conditions, it may perform well (R.703). However, if the load is reduced to 30%, the stack may not function as well due to a decrease in exit gas volocity which would cause a decrease in plume rise and may lead to downwash.

Since large isolated sources may not threaten the annual standard but may cause short-term elevated concentrations due to fumigation, high winds, limited mixing, atmospheric stagnation, and/or poor stack design, modeling emissions under those conditions is essential (R. 1584). In determining an alternate emission limitation, the following adverse meterorological conditions should be considered, unless a facility has monitored the site-specific meteorological conditions for at least three years (in that case, the most adverse meteorological conditions for that site should be modeled (Ex. 64):

1. Trapping conditions with the mixing height equal to the maximum height of plume rise, wind speed equal to 14.44 ft./sec. (4.4 m/s) at a height of 32.81 ft. (10 meters) above ground level, and atmospheric stability equal to B (unstable).

2. Neutral stability with moderate to high winds (at the wind speed which produces the maximum ground-level concentration), mixing height equal to 3937 ft. (1200 meters) and stability class equal to D (neutral).

3. Atmospheric stagnation with the mixing height equal to 1640 ft. (500 meters,) atmospheric stability equal to D (neutral), and the wind speed equal to 4.43 mi./hr. (2 m/s) at a height of 32.81 feet (10 meters) above ground-level.

4. Inversion break-up fumigation with the mixing height located at ground-level at the beginning of the three-hour period, rising at a rate of 16.01 ft./min. (4.88 meters/minute); an atmospheric stability class of E (stable) above the height of the inversion and B (unstable) below the inversion; and a wind speed of 14.44 ft./sec. (4.4 m/s) at a height of 32.81 feet (10 meters) above ground-level.

5. Any other meteorological conditions experienced in the vicinity of the subject facility which might reasonably be expected to produce maximum ground-level SO_2 concentrations in excess of those calculated under the above four conditions.

In all cases, background concentrations of SO_2, which are contributed by other sources, should be considered, and the calculations should be made with the wind from the direction which would align the emission sources to maximize the ground-level concentration for the actual source configuration.

In determining an alternate emission formula, it is necessary to model emissions and monitor the ambient air qualtiy in the vicinity of the source in question. Modeling is necessary because it is impractical to have enough monitors in the vicinity of the source to be confident that all violations are identified (R.1446). Monitoring data is essential in order to validate and calibrate the model being used.

Rule 204(e)(2) "grandfathers in" sources who had come into compliance with the Rule 204(e) formula in effect prior to these amendments but who are not in compliance with the new formula. Because the Board has determined that it is economicallly unreasonable to require such sources to spend the additional funds necessary to meet the new formula (see the discussion on "Technical Feasibility and Economic Reasonableness"), we have allowed such sources to choose between the two formulas. As noted previously, all areas of the state covered by Rule 204(e), with the exception of Massac County, have been designated as having attained the ambient air quality standards for SO_2 (43 Federal Register 8987-8988 (March 3, 1978)) (or have been designated as "cannot be classified"). Allowing sources who have met the old standard to continue to meet that standard should not, therefore, prevent maintenance of the standard. Nevertheless, the Board notes that Rule 102 prohibits any source from preventing the attainment or maintenance of any applicable air quality standard, regardless of whether the source is in compliance with a specific emission limitation.

Rule 204(i) prohibits sources from complying with the mass emission limitations determined by Rule 204(e)(1), (2), or (3) by means of dispersion enhancement techniques, which the Rule defines generally. Such techniques merely dilute the emissions over a larger area without actually decreasing the emissions. Prohibition of dispersion enhancement techniques as a means of complying with an emission limitation is specifically mandated by Section 123 of the Clean Air Act Amendments of 1977.

All sources located outside the three largest MMA's were previously required to comply with a pounds per million btu SO_2 standard of 6.0 in addition to the pounds per hour standard determined by Rule 204(e). As mentioned previously, this rule was based on the washability of Illinois coal. This requirement has been eliminated because the record indicated it is not technically or economically feasible for all sources to meet the standard by washing Illinois coal (R.8, Ex.23; R74-2, R.1504). However, the Board has retained a pounds per million btu standard of 6.8 for small sources (with heat input less than 250 MBTU/hr.) and has allowed such sources to choose between this limit and the pounds per hour standard determined by Rule 204(e). Changing the standard from 6.0 to 6.8 lbs./MBTU approximately doubles the amount of Illinois coal that can be burned without control and still meet the standard (R74-2, Ex.56(c)). Considering the minor impact of these sources and the general attainment of the SO_2 ambient standards in the areas involved, this change should not affect air quality.

Each of the Agency's proposals included a rule which would have prohibited sources from increasing their emission rate beyond the existing rate as of the effective date of the regulations. This rule was referred to as the "cap rule" because it "capped" emissions at current levels. The version of the cap rule included in the January 6, 1978, Agency proposal would have required that any source which increased its firing rate or *emission rate after the effective date of the Rule* be considered a modified source and, thus, subject to new source performance standards. Industry representatives expressed opposition to this proposal (R.2130, 2143-2149, 2199-2201). The Board finds that there is insufficient support in the record to prove that such a restrictive provision is necessary to protect air quality. We have not, therefore, included a "cap" provision in the adopted regulations.

However, as mentioned previously, Section 163 of the Clean Air Act as amended in 1977 requires that for any given area the maximum allowable increase in concentrations of SO_2 over the baseline concentration of SO_2 not exceed a certain amount, commonly known as the PSD increment. The U.S. Environmental Protection Agency, the Agency and Commonwealth Edison Co. expressed concern in public comments (P.C. #'s 52, 51 and 42, respectively) that the proposed regulations could in some cases allow sources to increase emissions and, therefore, possibly violate the PSD increment. Three rules which could conceivably result in increased emissions are the new Rule 204(e)(1) formula (see Ex. 25), Rule 204(e)(3) and the 6.8 lbs./MBTU optional standard for sources burning less than 250 MBTU/hr. Rule 204(e)(3) includes a requirement that sources seeking an *alternate standard prove that they will not violate the PSD* increment. We have also included in our adopted regulations Rule 204(e)(4), which precludes sources complying with the Rule 204(e)(1) formula or the 6.8 lbs./MBTU standard from increasing emissions without first obtaining a new operating permit from the

Agency based on an application which proves that the PSD increment will not be violated. The Agency shall have the authority, as it does with other permit applications, to determine the details of what such an application should include. The Board notes that this record does not provide a basis for determining a method of allocating the increment among sources.

INTERMITTENT CONTROL SYSTEMS

As mentioned previously, the Illinois legislature in 1975 amended the Environmental Protection Act to include Section 10(h), which requires the Board to adopt regulations prescribing the conditions under which sources may use intermittent control systems (ICS's) in lieu of compliance with SO_2 standards. An ICS is a system whereby a source determines, based on modeling and monitoring, the conditions under which air quality violations may occur. The source adopts a strategy such as fuel switching, load reduction, or temporary shutdown to prevent the occurrence of a predicted violation. The Agency's original proposal in R75-5 included an extensive ICS provision allowing existing sources located outside the three MMA's to use an ICS, under certain conditions, for several years in lieu of compliance with specific SO_2 standards. Much of the testimony and exhibits submitted at the hearings focused on the merits of ICS (R.589-529, 745-811, 966-986, 933-1036, 1363, 1387, 1396-1418, 1471-1473, 1545-1556, 1656, Exs.29,34,65).

The Clean Air Act Amendments of 1977, adopted after these proceedings were well under way, specifically prohibit the use of intermittent control systems as a method of compliance with emission limitations. Section 123 of the Clean Air Act specifically defines intermittent control systems as dispersion enhancement techniques, which, as has been discussed, cannot be used to comply with emission standards. The Agency, therefore, in its January 6, 1978, revisions proposed a much abbreviated version of the ICS rule which would have provided for use of an ICS only in addition to constant emission controls and as a result of a Board Order or a condition attached by the Agency to the source's permit. Industry representatives expressed opposition to this proposal (R.214,224).

In the Board's final Order, we have eliminated the ICS Rule entirely and have, in accordance with Section 123 of the Clean Air Act, defined ICS as a dispersion enhancement technique. The change was in large part based upon a comment by the U.S. Environmental Protection Agency (P.C. #52) which indicated that ICS was impermissible, even in addition to constant controls, if it was used as an aid to achieve an ambient air quality standard. The Board could, of course, in a compliance order in a situation where constant emission controls have not been installed order the operation of an ICS in the interim period.

ECONOMIC IMPACT STUDY (STUDY)

The Study that was filed with the Board (Ex.90) analyzed part of the proposed regulation. Specifically, the Study examined both the current and (then) proposed mass emission limitations, the six-pound standard of old Rule 204(c)(1)(B)(i), and the proposed "cap rule" (Ex. 90, pp. 1-4). The Study's analysis did not consider intermittent control systems, the prohibition on the use of dispersion enhancement techniques, or the provision for a determination of a site-specific emission limitation. Also not considered were the "grandfathering" provision and the change for small sources (Rule 204(c)(1)(B)). Because of the discrepancy between what was analyzed and what was adopted, many of the findings of the Study do not apply to the adopted regulation. However, the findings did present some implications for what was proposed at the time and were of use to the Board in its analysis.

The study initially examined 54 sources; thirty-six sources were determined to comply with both the existing and proposed mass emission limitations (R.1962). The incremental costs and benefits of the proposed regulation were designated as zero for these 36 sources (Ex. 90, p.51). The Board, however, recognizes that there may be some loss of flexibility for these sources.

The remaining 18 sources were examined in some detail. Estimates of control costs were made, although the author of the study emphasized that these costs should be viewed in the aggregate and not as site-specific approximations (R.1970). Furthermore, these estimates of control costs do not consider the possibility of combining two or more control stragegies (Ex.90,pp.56-7). It is clear that the greatest impact was determined to be additional control costs for sources which complied with the existing emission rate but not the proposed rate (R.1976; Ex.99; Ex.90, p.58, Table 46). Since the rule as adopted "grandfathers in" these sources, as well as sources which were in compliance with a Board Order as of April 1, 1978, they will not incur any additional control costs. The author of the Study concluded that "...if those sources that are already in compliance with current emission limits are exempt from the proposed revisions of proposed amendments, then the two - the current and the proposed regulations - are almost identical, economically" (R.1976). Some sources which, due to non-compliance with the old emission limitation, are not "grandfathered" may be required to control to a greater extent under Rule 204(e)(1) than under Rule 204(e)(2); other sources may have a looser emission limitation under 204(e)(1) than under 204(e)(2). To sources which would have a tighter limitation under Rule 204(e)(1), additional costs may be incurred (Ex.99; Ex.90, p.58, Table 4-6).

Benefits were examined by using a damage function to express the effects of sulfur dioxide levels in monetary terms. The damage function considered changes in mortality rates, morbidity,

materials soiling and corrosion, and crop yields; changes in aesthetics, visibility, animal mortality and morbidity (Ex.90, p. ix), corrosion to certain industrial and commercial equipment, damages to works of art, and damage to goods in retail stores were not considered (R.2298). The monetary calculations were based on dispersion modeling predictions of ambient SO_2 levels under the different emission limitations. The sources that are "grandfathered" will not reduce emissions, and there will be no increase in benefits due to lower ambient SO_2 levels. Sources which do increase emissions will effect a lowering in ambient SO_2 levels, and some benefits will accrue (Ex.99; Ex.90, p.58).

Rule 204(e)(3) introduces additional uncertainty into the economic analysis. Since a source might obtain a site-specific emission limitation which is less stringent than the emission rate modeled in the Study, the control costs and monetized benefits could differ significantly from those predicted. However, despite the limitations of the study, the Board finds that the proposed regulation will not have a significant adverse economic impact on the people of the State of Illinois.

TECHNICAL FEASIBILITY AND ECONOMIC REASONABLENESS

Section 27(a) of the Environmental Protection Act requires that, in promulgating substantive regulations, the Board take into account the technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution regulated, in this case SO_2. In order to assess the technical feasibility and economic reasonableness of the regulation, we must examine what the impact will be on the sources it is intended to regulate.

Exhibit 25 of R75-5 lists 17 power plants and 31 industrial fuel combustion sources which are affected by this rule change. For each source, the exhibit contains the generating capacity, firing rate, calculated maximum emissions, allowable emissions under the old Rule 204(e), and allowable emissions under new Rule 204(e)(1). Although the list does not include all affected sources and may no longer be totally accurate due to possible changes in coal supply or other conditions, it has been useful in arriving at a very rough estimate of the impact of the adopted regulations. (The Agency submitted an updated version of this exhibit in public comment #51).

Exhibit 25 indicates that 36 sources are already complying with the new, in some cases tighter, emission limitation. Such sources must continue such compliance. Voluntary compliance to this degree is indicative of both the technical feasibility and economic reasonableness of this level of control for these sources. Some loss of flexibility may result, since these sources no longer have the option of emitting at levels allowed under the old emission limitation; however, this loss of flexibility does not render control at the existing level

unreasonable. We note that several sources will be allowed to increase their emissions under the new formula and will, if they intend to increase them beyond the level allowed under the old formula, have to prove in a permit application that the emissions will not violate the applicable PSD increment.

Approximately 5 power plants and 4 industrial sources were, according to Exhibit 25, in compliance with the old emission limitation, now in Rule 204(e)(2), but are not in compliance with the new emission limitation found in Rule 204(e)(1). The author of the economic impact study found that the additional costs for bringing such sources into compliance with the new rule, compared to the benefits derived from compliance, resulted in costs from the Agency's proposal exceeding benefits. Exhibits 90 and 99 provide estimates of control costs. Concern about these additional expenditures was expressed at the hearings (R.191). Although the Board finds that there are limitations inherent in these estimates, we find that the record in this matter indicates that it is economically unreasonable to require sources which have already spent the funds necessary to comply with the old formula to spend significant additional funds to meet the new formula, particularly in light of the fact that the old formula, though no longer state-of-the-art, was based upon maintaining ambient air quality and that ambient air quality standards for SO_2 have generally been attained. Hence, Rule 204(e)(2) now "grandfathers in" these sources by allowing them to choose between continuing to meet the old limitation or reducing emissions further and meeting the new limitation.

Two of the 17 power plants and 18 of the 31 industrial sources listed in Exhibit 25 have firing rates of less than 250 MBTU/hr. and thus under Rule 204(c)(1)(B) would be eligible to choose between the 6.8 lbs. of SO_2/MBTU standard and the pounds per hour standard determined by Rule (204(e). All 20 of these smaller sources should be able to meet the 6.8 lb. rule by using coal benefication (coal "washing"), which was discussed fairly extensively in the record (R.465-477, 478-493, Exs. 22,23,19 and 31; R74-2, Ex.56). In fact, calculations based upon information in the record indicate that half of the Illinois coal for which we have test results available could meet this limit without washing (Ex.23; R74-2, Ex.56(c)). Even so, according to Exhibit 25, for 9 of these 18 industrial sources and both the power plants Rule 204(e)(1) is less restrictive than the 6.8 lbs./MBTU rule. Our decision to allow such sources to choose between the standards is based upon a determination that it is economically reasonable to give some leeway to them in light of their relatively minor impact on air quality in the areas involved, since these areas are not highly industrialized and have generally achieved attainment of the SO_2 ambient air quality standards. We again note that sources that elect the 6.8 lb. limit as their standard must apply for a permit and prove they will not violate the PSD increment if they intend to increase emissions beyond the limit allowable under the old Rule 204(e).

Finally, exhibit 25 indicates that only seven out of 17 power plants and four out of 31 industrial sources will in effect have to reduce emissions or prove that an alternate emission limitation under Rule 204(e)(3) would be more appropriate. These numbers may be overestimates since some of these facilities may have become eligible for "grandfathering" since exhibit 25 was prepared. In addition, at least one power plant has already been granted a site-specific emission limitation. Illinois Power Co. v. EPA, PCB 79-7. Because these sources have been operating in violation of the old rule, the Board need only consider the technical feasibility and economic reasonableness of requiring such sources to reduce their emissions by the additional amount required by Rule 204(e)(1) over and above that which was required by the old Rule 204(e). The precise amount of additional control required varies from source to source. In some cases, the new formula may be less restrictive than the old. We find that the record indicates that, for sources for whom the new rule is more restrictive than the old, requiring the additional control necessary to meet the new Rule 204(e)(1) is economically reasonable (Ex.90, p.58; Ex.99). Furthermore, the record indicates numerous methods for reducing sulfur dioxide emissions, including the use of low sulfur western coal or Illinois coal which has been beneficiated or "washed" as discussed above or the reduction of sulfur dioxide in the flue gasses by any of several methods which we find are demonstrated and available. These methods include lime/limestone scrubbers, double alkali systems, magnesium oxide and catalytic oxidation (R.311-313, 321-24, 838-906, 1101-1316, 1329-1360, Exs. 11,58,71,79,81; R74-2, 418-425, 474-485, 630-653, 1276-1281, 1289-90, 1614, 1617-1651, 2338-2343, Exs. 38,40,42,69). We find that the additional degree of emission control required by Rule 204(e)(1) for some sources is technically feasible.

We have considered the impact of these regulations on the affected sources. Based upon the information developed in the record herein, we conclude that these regulations represent a technically feasible and economically reasonable approach to controlling sulfur dioxide emissions.

RULE-BY-RULE-EXPLANATION

Rule 101: Definitions

We have added a citation to the Clean Air Act and a *definition of "PSD Increment"* to Rule 101. The PSD Increment definition is intended to correspond to the definition determined by Section 163 of the Clean Air Act and implementing regulations.

Rules 204(c)(1)(B), (C), and (D)

Rule 204(c)(1)(B) as adopted provides a choice for existing fuel combustion emission sources with actual heat input less than, or equal to, 250 million BTU per hour located outside the Chicago, St. Louis (Illinois), and Peoria major metropolitan areas. These small sources may choose an emission limitation of 6.8 lbs./MBTU or the pounds per hour emission limit provided by Rule 204(e). These smaller sources are subject to Rule 204(e)(4) which prohibits any increase in total emissions over the level allowed by the previous Rule 204(e) unless the source obtains a new operating permit and demonstrates that no applicable PSD increment will be violated.

Rule 204(c)(1)(C) requires sources with heat input greater than 250 MBTU/hr. to meet the Rule (204(e) formula. Rule 204(c)(1)(D) is merely a renumbering of what was Rule 204(c)(1)(B)(ii). The Board has proposed deletion of this Rule in a separate proceeding, docketed R78-17.

Rule 204(e)

Rule 204(e) previously applied to fuel combustion emission sources statewide. It has been rewritten to apply only to sources outside the Chicago, Peoria and St. Louis (Illinois) MMA's. Because the Rule 204(e) formulas contain no provisions for concentrations of SO_2 from multiple sources (R.86), the formulas would not be sufficient to prevent violations of ambient air qualtiy standards in the highly industrialized Chicago, St. Louis and Peoria metropolitan areas. We note that the Rule 204(e) formulas apply to both new and existing sources but that new sources must also meet New Source Performance Standards. See R78-18, Resolution and Order of the Board, December 14, 1978.

The basis for adopting a revised formula has been discussed previously. However, certain details of the wording of Rule 204(e)(1) require explanation. Rule 204(e)(1) includes a definition of each of the variables used in the formula. "H" is defined as physical stack height in feet. However, the value used for "H" in the formula cannot exceed good engineering practice as defined by Section 123 of the Clean Air Act and implementing regulations unless the source demonstrates that a *greater height is necessary to prevent downwash or fumigation* conditions. The term "good engineering practice" when applied to

stack heights generally means that the stack is tall enough to prevent downwash of the plume due to eddies in the lee of the building or from other nearby obstructions (Ex. 4, ref. 9; Ex. 5, ref. 24). The general rule of thumb guide for stack heights is that the stack should be from 1-1/2 to 2-1/2 times the height of the nearest obstruction, depending on the building's dimensions (Ex. 5, ref. 30). Exact details of maximum allowable stack heights, in accordance with the Clean Air Act Amendments of 1977, have been proposed by the U.S. Environmental Protection Agency. 44 Fed.Reg.2608-2614 (January 12, 1979). Two signs of poor stack design (too short) are that a substantial portion of the upper end of the stack is blackened by soot or the plume centerline is continuously observed to slope downward (R.75). (For additional discussion of stack heights see testimony starting on R.1855 and Ex. 46). Although the Agency's proposal specified that stack height up to 2-1/2 times the height of the nearest obstruction could be used as the value of "H", we have directly defined allowable stack heights in accordance with the Clean Air Act and Regulations adopted thereunder because in some cases a stack height value of less than 2-1/2 times the nearest obstruction may be required. We note that the values used for exit temperature, exit velocity and percentage of total emissions are to be those which occur during operating conditions which would cause maximum emissions. Finally, Rule 204(e)(1) as adopted differs from the proposed rule in that it has been written in the English rather than the metric system.

Rule 204(e)(2), the "grandfather" provision, allows sources in compliance with the old Rule 204(e) but not in compliance with the new Rule 204(e)(1) to choose between the two formulas. A recent past date (April 1, 1978) was chosen as the date for compliance with either the old standard or a Board Order so that only sources which had complied in good faith, and not at the last minute in order to receive a lower standard, would be eligible. Furthermore, the phrase "during normal cyclical variations in firing rate and fuel" has been used to describe the conditions under which a source must be unable to comply with the Rule 204(e)(1) formula in order to qualify for Rule 204(e)(2). Recognizing that firing rate and, consequently, emissions vary within any given year for many sources, the Board has included this phrase in order to exclude peak emissions that may occur due to a process upset or other abnormal operating conditions or due to an effort by a source to increase its emissions in order to qualify for a looser Rule 204(e)(2) emission limitation. We note that the phrase "normal cyclical variations" also appears in the Rule 101 definition of "modification".

The theory behind Rule 204(e)(3), the mechanism for obtaining a site-specific emission limitation as an alternate to the Rule 204(e)(1) or (e)(2) limitations, has been discussed in detail previously. Although this Rule maintains the basic concept proposed by the Agency, it has been revised in several

respects. Under the Agency's proposals, sources would have applied to the Agency for an alternate standard by means of a permit application. Citizens groups objected to this procedure because no hearing was required and, therefore, the opportunity for citizen output prior to the grant of an alternate standard was not insured (R.1645-1655). Furthermore, U.S. EPA indicated that all site-specific emission limitations must be submitted as revisions to the Illinois SIP (R.2256). We have changed the Agency's proposal to provide for a hearing before the Board in order to allow for citizen participation and to satisfy the requirement of Section 110(a)(3) of the Clean Air Act that any revisions to a SIP be adopted only after public hearing.

Rule 204(e)(3) is largely self-explanatory. The burden of proof is on the petitioning source to prove that under any potential meteorological conditions or any foreseeable operating conditions the source will not cause or contribute to a violation of air quality standards or violate any applicable PSD increment. Only meteorological conditions which can occur in the area in which the source is located need be considered. All forseeable operating conditions, including maximum and less than maximum firing rate, must be considered because a source's maximum impact on ground level concentrations may occur under operating conditions other than maximum firing rate. Procedures applicable to sources petitioning for an alternate standard pursuant to Rule 204(e)(3) were proposed by the Board on January 18, 1979, in R78-6, In the Matter of Procedural Rules Revisions. The proposed procedural rules are based primarily on Exhibit 64 in R75-5, which was the proposed Agency guidelines for sources applying for an alternate standard.

We note that the Rule requires sources granted an alternate standard to conduct an ambient monitoring and dispersion modeling program for one year. At the end of this program, the results are to be submitted to the Agency in a new operating permit application. If the results indicate that the source could prevent the attainment or maintenance of an air quality standard, then the Agency is mandated to deny the permit based upon a potential violation of Rule 102.

Rule 204(f): Sulfur Standards for Process Emission Sources

In accordance with the Agency's proposal, Rule 204 (f)(1)(D) has been amended to delete the requirement that existing processes designed to remove sulfur compounds from the flue gases of petroleum and petro-chemical processes meet the SO_2 emission limitation determined by Rule 204(e). Testimony indicated that Rule 204(e) is not an appropriate rule to apply to these sources (R.12).

Rule 204(g): Measurement Methods

Rule 204(g)(3) describes a method of averaging which is to be used in order to determine compliance with subparagraphs (a), (b), (c), and (d) of Rule 204. The Agency had proposed that the coverage of Rule 204(g)(3) be extended to subparagraph (e) of

Rule 204. Illinois Power Co. suggested that Rule 204(g)(3) be modified (R.2193-2199). The U.S. Environmental Protection Agency also indicated that Rule 204(g)(3) should be changed in order to prevent disapproval of the SIP revisions for nonattainment areas (R.2259). The Board makes no change to 204(g)(3). The record in this matter, voluminous though it is, does not contain sufficient support for any change.

Rule 204(h): Compliance Dates

Rule 204(h) specifies compliance dates applicable to all paragraphs in Rule 204. The Rule is largely a reorganiation of the previous Rule 204(h). The only paragraphs of Rule 204 for which substantive changes in compliance dates are intended are the paragraphs modified by R75-5 specifically: Rules 204(c)(1)(B), 204(c)(1)(C), 204(e)(1), 204(e)(2) and Rule 204(e)(3). The modified compliance dates for these specified rules are self-explanatory. The Agency's proposal had allowed sources which had complied with the previous Rule 204(e) formula three years from the effective date of the regulation to comply with the new Rule 204(e)(1) formula. However, because Rule 204(e)(2) has "grandfathered in" such sources, the need for the three year delay has been eliminated. We note that, although the compliance date under Rule 204(e)(3) is, for sources not in compliance with the previous Rule 204(e), the date of approval of the alternate standard, such sources are subject to enforcement actions for violation of Rule 204(e)(1) if not in compliance with that rule as of December 14, 1978.

Rule 204(i): Dispersion Enhancement Techniques

Rule 204(i) states that the following dispersion enhancement techniques shall not be used as a means of complying with the Rule 204(e) mass emissions limitations. The Rule generally parallels the Agency's proposal. Certain clarifying changes have been made, however. First of all, we have specifically defined intermittent control systems as a dispersion enhancement technique, in accordance with Section 123 of the Clean Air Act Amendments of 1977. Secondly, the Agency's proposal was subject to the interpretation that any stack height increase was a dispersion enhancement technique and, thus, prohibited as a method of complying with Rule 204(e). Several industry representatives expressed concern over the wording of the Agency's proposal, particularly in light of the Clean Air Act Amendments which allow stack heights up to good engineering practice to be included in determining emission limitations (R.2125, 2242). Recognizing that an increase in stack height may be environmentally sound, we have specified that increases in stack height "in excess of good engineering practice necessary to prevent downwash or fumigation conditions" are dispersion enhancement techniques. However, the Rule also contains the proviso "except as provided by Section 123 of the Clean Air Act and Regulations promulgated thereunder," which is intended to

provide that any inconsistencies between this Rule and Section 123 of the Clean Air Act be resolved in favor of the Clean Air Act. The Rule also defines an increase in exit gas temperature as a dispersion enhancement technique. However, because certain types of air pollution control equipment, such as wet scrubbers, may decrease the exit gas temperature, which in turn results in a reduction in plume rise, sources will be allowed to reheat the flue gas to the pre-scrubbing temperature.

Mr. Dumelle Concurs.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the above Opinion was adopted on the 15th day of February, 1979 by a vote of 3-0.

Christan L. Moffett, Clerk
Illinois Pollution Control Board