

ILLINOIS POLLUTION CONTROL BOARD
March 19, 1982

IN THE MATTER OF:)
)
PROPOSED AMENDMENTS TO CHAPTER 2:) R80-11
AIR POLLUTION RULES 309, 312 AND 405,)
NON-METHANE HYDROCARBON AND)
OZONE STANDARDS, OZONE EPISODE CRITERIA)

PROPOSED RULE. SECOND NOTICE.

OPINION OF THE BOARD (by J. Anderson):

This Opinion is being proposed to support the proposed rules as adopted for second notice by the Board's Order of March 19, 1982.

The proposal before the Board, submitted by the Illinois Environmental Protection Agency (Agency), involves three rules. Rule 309, which establishes an air quality standard for non-methane hydrocarbons, is to be deleted in its entirety. Rule 312 "Photochemical Oxidants" is to be amended throughout to refer to a) "Ozone" and b) its air quality standard raised from the 0.08 ppm (160 micrograms per cubic meter) to 0.12 ppm (235 micrograms per cubic meter). Rule 405 "Criteria For Declaring Episode Stages" is to be modified a) to provide for an "advisory" at an ozone level of 0.12 ppm, rather than at the current .07 level, and b) to provide for a "yellow alert" at an ozone level of 0.20 ppm, rather than at the current 0.17 level. Each of these amendments is being proposed in order to bring the Board's rules into conformance with the now-existing federal standards.

This rulemaking was initiated upon the Agency's June 17, 1980 proposal. This original proposal, which appeared in the Illinois Register Vol. 4, No. 39 (September 26, 1980), proposed to amend only Rules 312, and 405. On September 15, the proposal was amended to include deletion of Rule 309, and the amended proposal was published in the Environmental Register #224 (September 29, 1980).

Merit hearings were held on the amended proposal (IEPA Ex. 1) on September 26 and October 8, 1980. On April 17, 1981 the Illinois Institute of Natural Resources, now named the Department of Energy and Natural Resources (ENR) filed its "Economic Impact Analysis of Proposed Changes in IPCB Rules and Regulations, Chapter 2, Rules 312 and 405, Ozone and Episode Criteria, R80-11" IINR Doc. No. 81/17 (EcIS). Economic impact hearings were held June 2 and 17, 1981.

As the Agency's amended proposal was again slightly amended at the last hearing, albeit in a non-substantive way, and the amended proposal in its entirety had not been published in the Illinois Register, the Board re-noticed the proposal to receive written comments only (Illinois Register, Vol. 5, #33, August 14, 1981). Since the initiation of this rulemaking, the Board has received no comments on repeal of Rule 309. The four comments received concerning Rules 312 and 405 involved two general objections to relaxation of the ozone standard, a comment in support of the revisions, and a comment drawing the Board's attention to scientific articles relating to the effects of ozone on agricultural production.

THE TECHNICAL EVIDENCE

As the Board noted in its Opinion adopting the existing Rules 312 and 405 ambient air quality standards (AAQS), the Board adopted standards consistent with the federal AAQS (In the Matter of Proposed Air Quality Standards, R72-7, 18 PCB 89-92, July 10, 1975). In its most recent amendment to the ozone episode criteria, the Board also recognized and adverted to advances in federal research and practices concerning episodes (In the Matter of Amendments to Air Pollution Episode Regulations, R75-4, 21 PCB 169, 170, 173). The Agency's position at hearing in this matter, simply stated, is that the Board should continue to rely on federal research in the ozone area, and based on research advances, should relax and revise its standards in generally the same ways as has the United States Environmental Protection Agency (USEPA). The Agency presented 3 witnesses at hearing, Transportation and Energy Unit Supervisor, Frank Sherman, Health Specialist Rick Lanham, and Ambient Air Monitoring Section Manager David Kolaz. Sherman outlined the Agency's justifications for the rules generally, Lanham spoke primarily concerning the health effects of AAQS changes based on federal research, while Kolaz relayed the Agency's experience with and findings resulting from air monitoring.

Rule 312: "Ozone"

On February 8, 1979 USEPA revised its AAQS for photochemical oxidants. The chemical designation was changed to ozone, both the primary and secondary standards were raised from 0.08 ppm to 0.12, and the form of measurement of the standard was changed from a deterministic to statistical form 44 Fed. Reg. 8207-8237 (IEPA Ex. 6). In making these changes, USEPA relied on a criteria document entitled "Air Quality Criteria for Ozone and Other Photochemical Oxidants", EPA 600/18-78-004, April, 1978 (IEPA Ex. 14). This document superseded "Air Quality Criteria for Photochemical Oxidants", US Dept. of HEW, No. AP-3, March 1970, (IEPA Ex. 2) upon which USEPA and the Board had relied in setting the first AAQS.

Chemical Designation

In brief, photochemical oxidants are not emitted directly into the atmosphere. They are the product of a series of chemical reactions taking place in sunlight between precursors. These precursors are nitrogen oxides (e.g. emitted by gas and oil fired engines) and organic compounds (e.g. hydrocarbon emissions from auto and truck exhausts, open burning, evaporation of gasoline and solvents).

The class of oxidizing agents can be divided into the groups ozone (65 to 100%), peroxyacetyl nitrate (PAN), nitrogen oxides, and other compounds. Ozone is the only member of the class which can be satisfactorily measured; aside from PAN, non-ozone oxidants remain largely unidentified, and have not been associated with ozone's adverse health effects. Because of the measurement difficulties as to other class members, the photochemical oxidant standard has, practically speaking, regulated only ozone. The proposed re-designation then would serve only to recognize this fact.

However, strategies developed to control ozone production indirectly control production of PAN, which is an eye irritant. Smog chamber tests indicate that reductions of the ozone precursors nitrogen oxide and hydrocarbons have a greater impact on lessening PAN than ozone.

The Primary Standard

As in establishing any AAQS, in order to determine a primary standard (which is designed to protect the health of the sensitive population and the general public against inquiry with a margin of safety), the threshold concentration for ozone must be determined. This threshold concentration is one between a no-effect level and the lowest at which a health effect is demonstrated. Needless to say, a precision or lack thereof in determining the threshold concentration affects the margin of safety question.

USEPA has been unable to identify the adverse health effect concentration with certainty. Lanham testified that:

"Biological reactions to pollutants are not characterized by sharp discontinuities in dose-response relationships, and that demonstration of no-effect levels is dependent upon the sensitivity of the measurement of effects and exposure, as well as the selection of the most sensitive groups and reaction systems. Most experimental studies of human subjects are performed on small numbers of relatively health persons who do not fully reflect the range of human sensitivity. Furthermore, an additive effect could result from the addition of other chemicals to ozone, causing adverse health effects at lower levels than ozone alone would cause (R. 114)."

The 1978 USEPA criteria document contained an evaluation of new health studies as well as a reevaluation of the studies upon which the 1970 criteria document was based. A summary of results in human studies is included in IEPA Ex. 6, 44 Fed. Reg. 8214. Some human studies however deserve brief mention here.

First, it is important to note that the 1961 Schoetlin and Landau study of the effects of ozone on asthmatics, which served as a primary basis for establishing the 0.08 ppm primary AAQS, has been re-evaluated. The study had originally concluded that a level of 0.10 ppm caused adverse health in this sensitive group. After resolution of an averaging time controversy, the data is now interpreted as reflecting adverse effects at a 0.25 level.

The study most heavily relied on in establishing the current 0.12 AAQS was the 1977 DeLucia and Adams study. In this study, the effects of exercise on the lung function and blood biochemistry of six men were determined after exposure to ozone via mouthpiece for one hour at 0.15 ppm and 0.30 ppm ozone. Two sensitive subjects showed markedly impaired respiratory functions after one hour exposure at each level. This study, along with a 1973 Hazucha study, further indicates that healthy subjects also demonstrate effects of pulmonary function impairment at levels as low as 0.15 ppm under more strenuous exercise protocol.

In addition to various animal studies which will not be here described, USEPA considered the limited data available concerning the effect of ozone on chromosomal structures and the effects of long term oxidant exposure. However, few or no inferences can be drawn from the few epidemiological and experimental studies which had been performed.

Based on all the evidence before it, USEPA had originally proposed adoption of a 0.10 ppm AAQS for ozone 43 Fed. Reg. 26962-26986, June 22, 1978 (IEPA Ex. 5). Following its comments period however, USEPA adopted the 0.12 standard.

Its conclusions were that:

"EPA remains convinced that at levels in the range of 0.15-0.25 ppm, adverse health effects will almost certainly be experienced by significant numbers of sensitive persons. ...There is no collection of facts or medical evidence that permits selecting an undisputed value for the standard. EPA proposed a standard of 0.10 ppm taking several factors into account in providing a margin of safety... Based on its current understanding of these [several disputed epidemiological and animal] studies, EPA has concluded that they do not dictate as wide a margin of safety as was established in the proposal. EPA does believe however that these studies do suggest the real possibility of significant human adverse health effects below 0.15 ppm. Consequently, the Administrator has determined that a standard of 0.12 ppm is necessary" (IEPA Ex. 6, p. 8217).

The Secondary Standard

The secondary AAQS is established to protection vegetation, materials, and property. The secondary ozone standard was also set by USEPA at 0.12 ppm. As it has been determined that any level of ozone in the ambient air will contribute to the deterioration of materials such as rubber, textile dyes and fibers and some types of paints and coatings, USEPA was principally concerned with the air quality required to protect vegetation from growth and yield effects.

USEPA had originally proposed a revised 0.08 ppm standard, based on a mathematical model developed to predict folial inquiry using chamber studies (which utilize the most susceptible varieties of a given species), and seeking to limit leaf injury to 3% or less as a result of short-term peak ozone exposures. During the comment period, the model was questioned as not being based on field studies. The effects of short-term ozone dosage were also said to be questionable except during the critical stages of the plant's life cycle. Based on the information available concerning growth and yield reduction in crops and indigenous vegetation exposed to ozone under field conditions, USEPA concluded that:

"there is currently no evidence indicating that a significant decrease in growth or yield or commercially important crops or indigenous flora will result from the long-term mean of the daily maximum 7-hour average ozone concentration" (IEPA Ex. 6, p. 8217).

Interpretation of the Standard

USEPA changed the form of its standard from a statistical one to a deterministic one, allowing an excursion on one day per year, rather than one excursion of one hour per year. The Agency supports the philosophy of this change. As the duration excursions are in large measure tied to uncontrollable meteorological conditions, retention of the one hour exceedance measurement would not alleviate any adverse health effects aggravated by the duration of an event. The mechanism for dealing with this properly is suggested to be actions based on the Rule 405 episode criteria.

In determining a) whether an exceedance and b) attainment has occurred, the Agency's proposal specifically does not include the federal method of determining compliance as specified in Appendix H to 40 CFR 50.9. The Appendix H procedure requires that the number of exceedances in a calendar year be adjusted for missing data and a three-year running average of exceedances be computed. Attainment is reached when the expected number of exceedances, based on this three-year average, is less than or equal to one day.

The Agency believes that the USEPA method of compensating for missing data is overly simplistic and limiting, and may be inappropriate. In this method, the number of exceedances is divided by the number of sampling days to determine the ratio at which exceedances occur, and the ratio is then multiplied by the number of missing days not bracketed by days with measured ozone values of less than 0.09 ppm. Following this procedure, if an ozone monitor is operated for only one day in a year, and measures an exceedance, the estimated number of exceedances would be 365, since the ratio would be 1 to 1. Such a result ignores the fact that the likelihood of an exceedance is dependent on meteorological factors as well as emissions.

The three-year running average attainment measurement is questioned because USEPA has provided that less than three years of data may be averaged if three years are not available. Thus, if only one year of data is available, 4 exceedances are required before the standard is violated. On the other hand, if three years of data are available, and 4 exceedances occur in the first year, but emission reductions occur so that no exceedances are measured in the next two years, an area is classified as non-attainment.

Accordingly, under the rule as proposed by the Agency the federal statistical methods are rejected. If two days are found in which a maximum hourly value of ozone in excess of 0.12 ppm is measured, the standard will be considered to have been violated.

Ozone Air Quality Levels (1975-1980)

For purposes of information only, and not in justification of the proposed changes, the Agency relayed to the Board the results of its monitoring to determine compliance with the present standard.

Ozone is currently monitored at 37 fixed sites, 68% of which are located in the Illinois portion of the Chicago and St. Louis Major Metropolitan Areas. Supplemental sites have also been used to define ozone levels in rural areas. Information concerning number of hours of exceedance and ozone levels was introduced in table form (IEPA Ex. 13).

In summary, all sites exceed the 0.08 ppm standard, and most do so frequently (Table 2). A significant number of sites would be in compliance with a 0.12 ppm standard (Table 3). In this context, it should be noted that data from the nine sites for which data exists from 1977 through 1980 show a total number of days of exceedance of 0.12 ppm of 93 in 1977 as compared to 30 in 1980.

Ozone levels have been improving on the whole, although Chicago and St. Louis remain principal areas of concern. In 1975 through 1978, one or more sites recorded ozone levels above 0.20 ppm. In contrast, the highest value in 1979 was 0.186 ppm and in 1980 was 0.170 ppm.

Rule 405 Episode Criteria

The Agency proposes that the ozone advisory level be raised from .07 to .12 ppm, and that the yellow alert level be raised from 0.17 to 0.20.

The purpose of the advisory is, of course, to set the levels at which persons susceptible to lung ailments and heart problems are warned through the news media to restrict their activity. Currently, the advisory is given at 0.07 ppm, a level below that at which the 0.08 ppm standard is reached. The Agency proposes to establish the advisory level at the level of the standard itself to avoid several problems experienced under the current system.

In the years from 1976 to August 31, 1980, the number of advisories issued has been respectively 381, 794, 506, 426, and 615. Some of these advisories would have been unnecessary had the advisory level been set at the level of the primary health standard. Some members of the public have become confused, thinking that the advisory level is in fact the health standard, and therefore unnecessarily alarmed. Others, who are not confused in this manner, pay less attention to the numerous advisories since they do not reflect the health standard. If the proposed rule were to be adopted, the average yearly number of advisories would decrease from 554 to 108.

In light of a recent new federal requirement, retention of the existing rule would multiply the potential for public confusion. USEPA has adopted a uniform air quality reporting scheme, to be implemented without variation, called the Pollution Standards Index (PSI) codified at 40 CFR 58, Appendix G. The PSI is required to be implemented in the Chicago and St. Louis areas by January 1, 1981 and in the Rockford and Quad Cities areas by January 1, 1983.

The PSI is prepared by comparing real-time monitoring data against cut off levels for each pollutant, which levels then define an Index range and corresponding descriptor category. Descriptor words are Good, Moderate, Healthy, Unhealthy, Very Unhealthy, and Hazardous. By way of example, ozone values of 0.0 to 0.06 would correspond to a PSI value of 0 to 50, and the Good descriptor, while ozone values of 0.12 ppm to 0.2 ppm have a PSI value of 100 to 200, and the Unhealthy descriptor. Thus, the PSI is calculated to switch from a Moderate to Unhealthy level at the 0.12 AAQS level.

If present Rule 405 is retained, the Agency would be required to issue a state ozone advisory, while transmitting the federal PSI noting that ozone was moderate. The Agency believes that issuance of such seemingly contradictory information by the same Agency would not be in the public's best interest.

The rationale behind raising the Yellow Alert level from 0.17 ppm is much the same. A 0.20 ppm ozone level corresponds to the PSI value where the Descriptor category switches from Unhealthful to Very Unhealthful. This, again, would allow for integration of the Illinois episode system with the federal PSI system.

Rule 309: Non-Methane Hydrocarbons

In the criteria document which served as the basis for USEPA and subsequent Board adoption of this standard, it was explicitly noted that

"It is important to recognize that the criteria for hydrocarbons rest almost entirely on their role as precursors of other compounds formed in the atmospheric photochemical system and not upon the direct effects of the hydrocarbons themselves." (Air Quality Criteria for Hydrocarbons, US Dept. HEW, AP-64, March, 1970, IEPA Ex. 7)

USEPA does not require the states to monitor for non-methane hydrocarbons, as they do for other pollutants. The Agency did such monitoring in the Chicago and Springfield areas from 1975-1979, producing data showing that the standard was violated 90% of the time in Chicago and 44% of the time in Springfield. The Agency ceased monitoring due to data uncertainties arising from recurring instrumental problems and reports that the monitors were unreliable.

USEPA itself is of the opinion that there is "doubt that the present design generation can provide reliable NMHC data, particularly in the lower ranges near the EPA air quality standard" ("Evaluation of the EPA Reference Method for the Measurement of Non-Methane Hydrocarbons--Final Report", EPA-600/4-77-003, June, 1977, IEPA Ex. 12, Sec. 2, p. 10). USEPA has not designated an acceptable reference or equivalent device for monitoring non-methane hydrocarbon.

In short, in that this hydrocarbon standard was not based on adverse health effects caused by hydrocarbons in and of themselves, that monitoring methods are unreliable, and that USEPA has determined that attainment of the hydrocarbon standard can be achieved by the degree of emission reductions necessary to achieve the ozone AAQS (40 CFR 51.14, IEPA Ex. 6), the Agency believes that repeal of the rule will not impact the public health and will serve to remove a rule which has through time lost its original significance.

ECONOMIC IMPACT

The brief EcIS prepared concerning this proposal concludes that "adoption of R80-11 will provide some modest positive net benefit to the State of Illinois" (ENR Ex. 1, p. 16). Neither the costs nor the benefits of this proposal were quantified and assigned a dollar value in this EcIS.

The general findings in the EcIS were supplemented at hearing by the EcIS' author, Dr. Donald Bumpass, of William J. Stanley and Assoc., Inc. As to costs, reference was made to a previous ENR EcIS authored by John Yates entitled "The Economic Impact of Incorporating RACT-1 Guidelines for VOC Emissions into the Illinois Air Pollution Control Regulations R78-3 and 78-4", IINR Doc. No. 79/01. RACT-1 air modeling was done assuming an ozone standard of 0.12 and the regulations adopted by the Board reflect this.

Modification of Rule 312 to a 0.12 standard would therefore impose no additional control costs on industry, in Dr. Bumpass opinion (R. 222). Based on the Yates EcIS, it was also believed that relaxation of the standard would have no incremental cost effect on production of Illinois' three leading cash crops: corn, soy beans, and wheat, (R. 201-202), or incremental cost effect on maintenance of the public health (R. 212).

Revisions of the Rule 405 episode criteria was said to carry with it no incremental cost, but instead some unquantifiable benefits by virtue of maintenance of public confidence in air regulations as fostered by the uniformity of state and federal episode criteria.

Finally, as to deletion of Rule 309, the testimony was that it would have no adverse impact on health (R. 224).

THE ADOPTED RULES

The evidence presented in this rulemaking was uncontroverted. Participation at hearing and though comments by the industrial, agricultural, health care and general communities was virtually non-existent. Based on the record before it, the Board is adopting the Agency's proposal as drafted, finding that this regulatory change will have no adverse health or economic impact.

There is one change between the rule as it is being sent to second notice, and the rule as published in Illinois Register Vol. 5 #33. As published, Rule 312(b) provided that ozone was to be


"measured by the ozone-ethylene reaction method as described in 36 Federal Register, pp. 22392-22393, November 25, 1971 or by an equivalent method approved by the Agency".

The Agency's September 15 proposal, as published in Environmental Register #224, proposed that the Federal Register reference and page numbers be deleted, to be replaced by reference to the codified version of this measurement method "40 CFR 50, Appendix D, as amended." As this does not involve a substantive change to this rule, and references the more accessible source, the Board will adopt the rule utilizing the CFR reference, rectifying the clerical omission.

Finally, the Board wishes to observe that a recent study concerning the effect of ozone, alone and in combination with other pollutants, upon agricultural crops was introduced into this record without comment ("Economic Assessment of Air Pollution Damage to Agricultural and Silvicultural Crops in Minnesota", Prelim. Report, April 27, 1981, IPCB Ex. 1, and public comment #4). The study raises questions concerning ozone effects, including interstate effects, that may not be fully addressed in the present state/federal control strategy. However, a question of this nature is more appropriately addressed in a separate proceeding.

Board Chairman J. Dumelle concurred.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion was adopted on the 19th day of March, 1982 by a vote of 4-0.



Christan L. Moffett, Clerk
Illinois Pollution Control Board