U.S. ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[FRL-4895-4]

Air Quality: Revision to Definition of Volatile Organic Compounds - Exclusion of Acetone

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The EPA is proposing to revise its definition of volatile organic compounds (VOC) for purposes of preparing State implementation plans (SIP's) to attain the national ambient air quality standards (NAAQS) for ozone under title I of the Clean Air Act (Act) and for the Federal implementation plan for the Chicago ozone nonattainment area. The proposed revision would add acetone to the list of compounds excluded from the definition of VOC on the basis that these compounds have negligible contribution to tropospheric ozone formation.

DATES: Comments on this proposal must be received by [insert date 60 days from date of publication in the Federal Register].

ADDRESSES: Comments should be submitted in duplicate (if possible) to: Air and Radiation Docket and Information Center (6102), Attention: Docket No. A-94-26, U.S. Environmental Protection Agency, 401 M Street, SW.,

Washington, DC 20460. Comments should be strictly limited to the subject matter of this proposal, the scope of which is discussed below.

Public Hearing: If anyone contacts EPA requesting a public hearing, it will be held at Research Triangle Park, North Carolina. Persons wishing to request a public hearing, wanting to attend the hearing or wishing to present oral testimony should notify Mr. William Johnson, Air Quality Management Division (MD-15), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone (919) 541-5245. The EPA will publish notice of a hearing, if a hearing is requested, in the Federal Register . Any hearing will be strictly limited to the subject matter of the proposal, the scope of which is discussed below.

This action is subject to the procedural requirements of section 307(d)(1)(B), (J), and (U) of the Act, and 42 U.S.C. 7607(d)(1)(B), (J), and (U). Therefore, EPA has established a public docket for this action, A-94-26, which is available for public inspection and copying between 8 a.m. and 4 p.m., Monday through Friday, at EPA's Central Docket Section, room M-1500, 401 M Street, SW., Washington, DC 20460. A reasonable fee

may be charged for copying.

FOR FURTHER INFORMATION CONTACT: William Johnson, Office of Air Quality Planning and Standards, Air Quality Management Division (MD-15), Research Triangle Park, NC 27711, phone (919) 541-5245.

SUPPLEMENTARY INFORMATION:

I. Background

Three petitions have been received by the EPA asking that acetone be added to the list of negligibly-reactive compounds in the definition of VOC at 40 CFR 51.100(s). These petitions were submitted by Eastman Chemical Company and Hoechst Celanese Corporation on April 26, 1993, Hickory Springs Manufacturing Company on May 6, 1993, and the Chemical Manufacturers Association on May 14, 1993. Along with their petitions and in supplemental submissions, these organizations submitted a variety of scientific materials which support the assertion that acetone is of negligible photochemical reactivity. These materials have been added to the docket for this rulemaking.

The petitioners based their request for the exclusion of acetone on a demonstration that the photochemical reactivity of acetone is not appreciably

different from that of ethane, which is the most reactive compound on the current list of compounds which are named in the definition of VOC as being of negligible reactivity. Acetone's photochemical reactivity arises through two chemical pathways: through reaction with hydroxyl (OH) radicals (k_{OH} reactivity) and through photolysis. Data on the reaction of OH radicals with various organic compounds are reported in a review article (Atkinson, R. (1990), "Gas - Phase Tropospheric Chemistry of Organic Compounds: A Review." Atmospheric Environment, 24 A:1-41) which gives the following rate constants for reactions of ethane and acetone with OH:

Ethane: 2.68×10^{-13} cc/molecule/sec.

Acetone: 2.26×10^{-13} cc/molecule/sec.

Thus, if the k_{OH} reactivities alone are considered, acetone is less reactive than ethane. Unlike ethane, however, acetone undergoes photodecomposition, or photolysis, in the atmosphere to form radicals, which tend to cause increased rates of ozone formation. Total reactivity of acetone, considering both k_{OH} reactivity and photolysis, was the subject of a special study reported recently (Carter, W. P. L. et al., "An Experimental and Modeling Study of the Photochemical Ozone Reactivity of

Acetone," University of California/Riverside, December 10, 1993).

The Carter report describes a series of environmental chamber experiments and computer model simulations carried out to assess the tendency of acetone to promote ozone formation under atmospheric conditions, relative to that of ethane. This was done by calculating and comparing the "incremental reactivities" of acetone and ethane for a variety of atmospheric conditions representing ozone episodes in 39 urban areas throughout the United States.

"Incremental reactivity" is the most recently proposed quantitative measure of the degree to which a VOC contributes to ozone formation in a photochemical air pollution episode. It is defined as the amount of additional ozone formation resulting from the addition of a small amount of VOC to the urban emissions, divided by the amount of compound added. This measure of reactivity takes into account all of the factors by which a VOC affects ozone formation, including the effect of the environment where the VOC reacts. The latter is important because the amount of ozone formation caused by the reactions of a VOC depends significantly on the

conditions within the polluted atmosphere, such as VOC to nitrogen oxide (NOx) ratio, VOC composition, and sunlight intensity. Figure 1 shows distribution plots of the reactivity of acetone relative to that of ethane for the 39 urban scenarios used, where reactivity is defined in terms of grams of ozone formed per gram of VOC emitted. (Use of the unit grams of ozone formed per gram of VOC emitted is significant. Another way of defining reactivity is in terms of grams of ozone formed per mole of VOC emitted, which would give different results. For practicality, the EPA has elected to adopt the grams ozone per gram VOC basis, since grams (or tons), rather than moles, is the mass unit used in regulations dealing with VOC emissions.) In Figure 1, acetone/ethane reactivity ratios less than 1.0 indicate scenarios where acetone is less reactive than ethane. The acetone/ethane reactivity ratio, as reported by Carter, appears to have widely varying values among the 39 urban scenarios and to reflect, with a few exceptions, slightly lower reactivity for acetone. For one scenario, which represents unusually high NOx conditions, acetone was calculated to be over two times more reactive than ethane. This is due to the unusually low reactivity of ethane for that

particular scenario, rather than to higher acetone reactivity. Figure 2 shows the variability of ethane reactivity relative to that of a "typical" urban VOC mix. Figure 2 also shows that the reactivity range of acetone falls entirely within the range for ethane.

[INSERT FIGURE 1 AND 2 HERE]

Although there are uncertainties in acetone's atmospheric photo-oxidation mechanism and in the other aspects of ozone-related atmospheric photochemistry, one can reasonably deduce, based on the Carter report, that acetone and ethane probably have nearly the same reactivity for most sets of environmental conditions.

Additional studies have been conducted on the relative reactivity of acetone in Europe. For example, R. G. Derwent and M. E. Jenkins (Hydrocarbons and the Long-range Transport of Ozone and PAN Across Europe, Atmospheric Environment , vol 24A, p 1661-1678, 1991) used a chemical mechanism to calculate ozone impacts of acetone, ethane, and other VOC for three trajectories across Europe. The photochemical trajectory model the authors employed was developed at Harwell Laboratory (United Kingdom) and was used to calculate the

photochemical ozone creation potential (POCP) values for 69 organic compounds, including acetone. The POCP values were assigned to VOC species according to a relative scale, with ethylene having a value of 100.

Dr. Derwent reported in a letter (January 27, 1994) to EPA that: "A comparison of POCP's for ethane and acetone in the work of my colleagues at Harwell Laboratory, which incidentally updates the acetone entries in the VOC Protocol Annex, gives 8.2 ± 4.0 and 9.2 ± 2.0, respectively." The difference between these numbers is not considered to be statistically significant.

If acetone is accepted as having negligible photochemical reactivity, exempting acetone from regulation as an ozone precursor could contribute to the achievement of several important environmental goals. For example, acetone can be used as a substitute for several compounds that are listed as hazardous air pollutants (HAP) under section 112 of the Act. Methylene chloride and methyl chloroform are HAP that are used for metal cleaning and for flexible polyurethane foam blowing. Other HAP, such as toluene, are often used as solvents in paints and coatings. Acetone can substitute for these substances in some circumstances.

Acetone can also be used as a substitute for ozone depleting substances (ODS) which are active in depleting the stratospheric ozone layer. Under the London Amendments to the Montreal Protocol on substances that deplete the ozone layer ("Montreal Protocol"), the United States agreed to phase out production and consumption of certain chlorofluorocarbons (CFC) by the year 2000 and methyl chloroform by 2005 (see 58 FR 15016 (March 18, 1993)). In 1990, Congress added title VI to the Act in part to provide for the implementation of this phaseout (see 42 U.S.C. 7671 et seq.). The 1990 Amendments specified an initial list of Class I and Class II ODS, authorizing EPA to add compounds to both lists depending on a given compound's potential to contribute to stratospheric ozone depletion, (Id. §7671a.) The 1990 Amendments further required phaseout of the production and consumption of Class I ODS by 2000, methyl chloroform by 2002, and Class II ODS by 2030 (see 42 U.S.C. 7671c, 7671d). At the fourth meeting, in 1992, of the parties to the Montreal Protocol in Copenhagen, Denmark, the parties adjusted the phaseout schedules for Class I substances under the Montreal Protocol to phase out Class I CFC and methyl chloroform by 1996. In 1993, EPA

proposed to accelerate the phaseout of Class I CFC and methyl chloroform in order to discontinue use of these compounds after
January 1, 1996 (see 58 FR 15022).

As a result of these phaseout deadlines, there is a need to develop substitutes for ODS. Allowing wider use of acetone will facilitate the transition away from ODS without adversely affecting efforts to control ground level ozone concentrations. For example, chlorofluorocarbon-11 and methyl chloroform have been used as foam-blowing agents in the manufacture of polyurethane foam. These compounds are also used in metal cleaning in the aircraft manufacturing industry. Both CFC-11 and methyl chloroform are listed as Class I substances under title VI of the Act, i.e., as substances that have the highest stratospheric ozone- depleting potential. Acetone may be able to be used as a foam-blowing agent and cleaning agent in place of these chemicals.

The EPA has already listed acetone as an acceptable ozone-depleting substance substitute under the program known as the "Significant New Alternatives Policy" (SNAP) program, (59 FR 130444, March 18, 1994). Within the

context of the SNAP rule, substitutes are "acceptable" if they are technically feasible to be used as an alternative to an ODS for particular uses and give reduced overall risk to human health and the the environment compared to the ODS they replace. In the SNAP rule, EPA listed acetone as an acceptable substitute for flexible polyurethane foam blowing (59 FR 13132). The SNAP rule lists ketones (which include acetone) as an acceptable substitute for solvent cleaning in metal cleaning, electronics cleaning, and precision cleaning (59 FR 13134). Ketones are also listed in the SNAP rule as an acceptable substitute solvent for aerosols and for adhesives, coatings, and inks (59 FR 13145).

In each of these areas of concern, toxic air emissions and depletion of stratospheric ozone, adding acetone to the list of negligibly-reactive VOC will support the EPA's pollution prevention efforts. By enacting the Pollution Prevention Act of 1990, Congress established as a national policy that "pollution should be prevented or reduced at the source whenever feasible" (42 U.S.C. 13). An important part of EPA's pollution prevention strategy is encouraging companies to use substitutes in their production processes that are more

environmentally benign than the substances they currently use. For example, in its blueprint for a comprehensive national pollution prevention strategy, (56 FR 7849 (February 26, 1991)), the EPA recognized that the definition of pollution prevention includes a "switch to non-toxic or less toxic substitutes" (Id. at 7854).

National air emissions of acetone from industrial sources were estimated to be 80,000 tons per year in 1991. It should be noted that due to the high volatility of acetone, increased use of acetone for metal cleaning will most likely increase emissions of the compound to the air.

II. The EPA Response to the Petition

Based on the scientific data presented in the material submitted by the petitioners, EPA accepts the conclusion that acetone is not appreciably different from ethane in terms of photochemical reactivity. The EPA is responding to the petitions by proposing in this notice to add acetone to the list of compounds appearing in 40 CFR 51.100(s) that are considered to be negligibly reactive and are thus excluded from the definition of VOC for ozone SIP and ozone control purposes. The revised definition will apply in the Chicago ozone nonattainment area pursuant to the 40 CFR 52.741(a)(3) definition of

volatile organic material or volatile organic compound. States are not obligated to exclude from control as a VOC those compounds that EPA has found to be negligibly reactive. However, if this proposal is made final, EPA will not enforce measures controlling acetone as part of a federally-approved ozone SIP. In addition, once this proposal is made final, States should not include acetone in their VOC emissions inventories for determining reasonable further progress under the Act (e.g., section 182(b)(1)) and may not take credit for controlling acetone in their ozone control strategy. Further, after this proposal is made final, acetone may not be used for emissions netting (e.g., 40 CFR 51.166(b)(2)(c)), offsetting (40 CFR appendix S), or trading with reactive VOC (Emissions Trading Policy Statement, 51 FR 43814, December 4, 1986 and Economic Incentive Program Rules, 59 FR 16690, April 7, 1994).

Since acetone will no longer be treated as a VOC, a State should revise its base year inventory and plans that rely on that inventory (e.g., the 15 percent plan) to remove acetone and the VOC emissions reduction credit taken from controlling acetone. To avoid unnecessary work, however, States may account for the fraction of the

VOC inventory that acetone comprises or the amount of reduction claimed for controlling acetone. If the acetone fraction in the inventory or the amount of control claimed is not significant for a particular area, EPA would not expect a State to revise its emissions inventory or a plan based on that inventory to account for the revised VOC definition.

In addition, corrections are made to the names of three compounds which have previously been exempted from the definition of VOC; 1,1,1-trichloro-2,2,2-trifluoroethane (CFC-113) is changed to 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113); chlorodifluoromethane (CFC-22) is changed to chlorodifluoromethane (HCFC-22); and trifluoromethane (FC-23) is changed to trifluoromethane (HFC-23). These changes are corrections to nomenclature only and are not substantive.

Pursuant to 5 U.S.C. 605(b), I hereby certify that this action will not have a significant economic impact on a substantial number of small entities because it relaxes current regulatory requirements rather than imposing new ones. The EPA has determined that this rule is not "significant" under the terms of Executive Order 12866 and is, therefore, not subject to Office of

Management and Budget (OMB) review. This action does not contain any information collection requirements subject to OMB review under the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.).

Assuming this rulemaking is subject to section 317 of the Act, the Administrator concludes, weighing the Agency's limited resources and other duties, that it is not practicable to conduct an extensive economic impact

assessment of today's action since this rule will relax current regulatory requirements. Accordingly, the Administrator simply notes that any costs of complying with today's action, any inflationary or recessionary effects of the regulation, and any impact on the competitive standing of small businesses, on consumer costs, or on energy use, will be less than or at least not more than the impact that existed before today's action.

List of Subjects in 40 CFR Part 51

Administrative practice and procedure, Air pollution control, Carbon monoxide, Intergovernmental relations, Lead, Nitrogen dioxide, Ozone, Particulate matter,

Reporting and recordkeeping requirements, Sulfur oxides, Volatile organic compounds.

Date

Carol M. Browner
Administrator

Billing Code: 6560-50-P

For reasons set forth in the preamble, part 51 of Chapter I of title 40 of the Code of Federal Regulations is proposed to be amended as follows:

Part 51-REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS.

1. The authority citation for Part 51 continues to read as follows:

Authority: 42 U.S.C. 7410(a)(2), 7475(e), 7502(a) and (b), 7503, 7601(a)(1), and 7620.

2. Section 51.100 is amended by revising paragraph (s)(1) introductory text to read as follows:

§51.100 Definitions.

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(s) * * *

(1) This includes any such organic compound other than the following, which have been determined to have negligible photochemical reactivity: methane; ethane; methylene chloride (dichloromethane); 1,1,1-trichloroethane (methyl chloroform); 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113); trichlorofluoromethane (CFC-11); dichlorodifluoromethane (CFC-12); chlorodifluoromethane (HCFC-22); trifluoromethane (HFC-23); 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC-114);

chloropentafluoroethane (CFC-115); 1,1,1-trifluoro 2,2-dichloroethane (HCFC-123); 1,1,1,2-tetrafluoroethane (HFC-134a); 1,1-dichloro 1-fluoroethane (HCFC-141b); 1-chloro 1,1-difluoroethane (HCFC-142b); 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124); pentafluoroethane (HFC-125); 1,1,2,2-tetrafluoroethane (HFC-134); 1,1,1-trifluoroethane (HFC-143a); 1,1-difluoroethane (HFC-152a); acetone; and perfluorocarbon compounds which fall into these classes:

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