

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: Final rule.

SUMMARY: This action revises the 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. This action adds acetone to the list of compounds excluded from the definition of VOC on the basis that these compounds have been determined to have negligible photochemical reactivity. **DATES:** This rule is effective June 16, 1995.

ADDRESSES: 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 the U.S. Environmental Protection Agency, Air and Radiation Docket and Information Center (6102), 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying.

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

SUPPLEMENTARY INFORMATION:

I. Background . Three petitions were 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.

The petitioners point out that 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 and would support EPA's pollution prevention efforts. 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. 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 (CFC-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 for certain uses 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 provide a reduced overall risk to human health and 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).

Based on a review of the scientific material submitted by the petitioners, EPA published a notice in the **Federal Register** on September 30, 1994 (59 FR 49877) which proposed to revise EPA's definition of VOC to add acetone to the list of compounds which are considered to be negligibly photochemically reactive. In the proposal, EPA summarized the technical basis for its preliminary decision to add acetone to this list. This notice asked for comments from the public on the proposal and provided a 60-day comment period which ended November 29, 1994.

II. Comments on Proposal and EPA Responses. In accordance with section 307(d) of the Act, today's action is accompanied by a response to the significant comments, criticisms, and new data submitted in written or oral presentations during the public comment period. During

the comment period, written comments were received from 52 individuals or organizations (including several manufacturing companies, seven trade associations, two States and a local air pollution agency) in response to EPA's September 30, 1994 proposal. Copies of these comments are located in the docket (A-94-26) for this action. Significant comments and EPA's responses are summarized below. In the proposal for today's action, EPA indicated that interested persons could request that EPA hold a public hearing on the proposed action (see section 307(d)(5)(ii) of the Act). During the comment period, one company requested a public hearing, but later withdrew its request. Since no one else requested a hearing, none was held.

About 80 percent of the letters received during the comment period were in favor of the proposal. These comments listed a variety of benefits that would result if acetone is deregulated for industrial use. Other substantial comments and EPA's responses are listed below.

Comment: Several commenters pointed out that removal of restrictions on use of acetone would have a detrimental effect on companies which have invested in

research efforts to develop low solvent processes. As an example, some companies have developed low solvent cleaners which reduce the amount of VOC emitted into the air when used. Another example is processes for manufacture of polyurethane foam which do not rely on organic solvent blowing agents. Manufacturers have developed these low polluting processes for making polyurethane foam in order to avoid emission limitations on methylene chloride, methyl chloroform and other regulated organic compounds. Such low emitting polyurethane foam manufacturing processing may not be able to compete effectively if acetone is allowed unrestricted use as a foam-blowing agent. The companies that have developed these low-polluting processes say that they relied on past EPA policy which restricted emissions of acetone as a VOC when deciding to make a financial commitment to develop the processes or products. They now face loss of their research investments and future profits if acetone is no longer regarded as a VOC and, therefore, no longer restricted in use.

Response: The EPA recognizes that some companies which have developed low solvent products may find that

their products face increased competition when acetone is deregulated. It is true that companies which have spent funds in developing these products may not gain the expected financial return if these products are not able to compete successfully against acetone. However, these products are not prohibited by this action and may still compete in the market place. The EPA does not think it is good public policy to continue to restrict acetone use as an ozone precursor when current evidence indicates that it is of negligible photochemically reactivity. Acetone is a useful substance and a wide cross section of American industry stands to benefit from removal of restrictions on its use.

Comment: Some commenters assert that the scientific evidence presented in the docket for this action does not support the contention that acetone is of comparable reactivity to ethane, which is already regarded as negligibly photochemically reactive. One commenter, for example, cited a paper written by Dr. William P. L. Carter, who is the author of much of the background material in the docket. The July 1994 paper entitled "Development of Ozone Reactivity Scales for Volatile Organic Compounds" was published in the Journal of the

Air and Waste Management Association. Table III in this paper gives a list of organic compounds ranked by a maximum incremental reactivity (MIR) scale. This scale shows that ethane has a MIR value of 0.25 while acetone has a value of 0.56. These values are expressed in units of grams of ozone per gram of test compound added. Since the higher value would indicate higher ozone formation potential, the commenter concluded that this is evidence that acetone is more reactive than ethane.

Response: The MIR values of 0.25 for ethane and 0.56 for acetone are also given in Table 4 in "An Experimental and Modeling Study of the Photochemical Ozone Reactivity of Acetone" by Dr. Carter, et al., which is included in the docket for this action. This journal article explains that the MIR scale is based on a scenario derived by adjusting the nitrogen oxide (NO_x) emissions in a base case scenario to yield the highest incremental reactivity of the base reactive organic gas (ROG) mixture. Ozone yield for a VOC depends significantly on the conditions within the polluted atmosphere in which it reacts, such as VOC to NO_x ratio, VOC composition, and sunlight intensity. The MIR value presented in these studies relies on a set of conditions

adjusted for maximum ozone incremental reactivity.

In addition to calculating this value, Dr. Carter also calculated values for conditions actually occurring in 39 cities in the United States. His calculations showed that the reactivity of acetone, relative to that of ethane, varied widely with conditions, ranging from substantially higher to substantially lower than that of ethane, although the 39-city study indicated that on average acetone is less reactive on a weight basis than ethane for conditions found in these cities. In the face of such variation, Dr. Carter reasonably concluded that his results did not support a higher acetone reactivity relative to that of ethane. After examining these data, EPA continues to believe that, based on currently existing evidence, a "negligibly reactive" rating for acetone is justified.

Comment: One commenter stated that general principles of organic photochemistry support the conclusion that acetone will be more reactive than ethane. Two commenters point out that acetone undergoes photolysis to form free radicals which would cause an increase in photochemical reactivity of acetone as compared to ethane.

Response: It has been recognized that acetone, unlike ethane, 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 reactivity rate constant with hydroxyl radicals and photolysis, was the subject of a study (Carter, W.P.L., et al., "An Experimental and Modeling Study of the Photochemical Ozone Reactivity of Acetone," December 10, 1993) which is included in the docket for this action. The findings of this report take into account the potential for acetone to undergo photolysis, and this information has been included in comparisons of acetone with ethane. The 39-city study which is included in this report shows that acetone reactivity is on average lower than that of ethane for the conditions in these cities. This study indicates that situations represented by conditions typically found in these cities do not support the contentions made in the comments. Therefore, although acetone may undergo photolysis, in these conditions, its reactivity is not dissimilar to ethane's.

Comment: One commenter stated that some experimental values reported in "An Experimental and

Modeling Study of the Photochemical Ozone Reactivity of Acetone" indicate that the incremental photochemical reactivity of acetone is up to 10 times that of ethane.

Response: The referenced data are in Table 2 of that report, "Summary of Conditions and Results of the Incremental Reactivity and Direct Reactivity Comparison Experiments," in the column labeled IR for incremental reactivity. One value of 0.059 is given for acetone and a value of 0.006 for ethane. The units of these values are moles of ozone per mole of test compound added. A mole of acetone weighs almost twice as much as a mole of ethane. If the results are reported on a basis of grams of ozone per gram of test compound added, the difference between the two values is about half the difference indicated above. The EPA has chosen to use the weight basis rather than a mole basis for comparing results since emissions are regulated on a weight basis.

In addition, the report adds that it should be emphasized that since incremental reactivities are dependent on environmental conditions and since it is not practical to duplicate in the chamber all the environmental factors which might affect magnitudes of incremental reactivities, incremental reactivities

measured in chamber experiments should not be assumed to be quantitatively the same as incremental reactivities in the atmosphere. According to the report, the latter can only be estimated using computer airshed model calculations. The 39-city study is such a study which predicts that acetone will be less reactive on a weight basis than ethane for most conditions found in these cities. Averages from this 39-city study give a reactivity value (in grams of ozone/gram of VOC) for ethane of 0.166 and for acetone of 0.126. The value for a typical urban mix of reactive organic gases is 1.13. These values are reported in Table 5 of the report.

Comment: One commenter stated that the photochemical reactivity of acetone was as much as 48 percent of the photochemical reactivity of other VOC.

Response: The commenter reported that he derived the value based on calculations he performed using the data in Table 2 of the report referred to in the previous comment. He did not submit the calculation, however. The EPA calculations using these data have not yielded as high a value. It should be noted that, as reported before, the data in Table 2 are in moles of ozone per mole of test compound. The report also compares acetone

reactivity with the base ROG mixture on a gram of ozone per gram of test compound basis. Page 71 of the report summarizes this comparison, stating that acetone is no more than 20 percent as reactive as the base ROG mixture in terms of peak ozone, or 15 percent as reactive in terms of integrated ozone.

Comment: A commenter noted that the report "An Experimental and Modeling Study of the Photochemical Ozone Reactivity of Acetone" reports laboratory measurements of photochemical reactivities of acetone and ethane in "side by side" laboratory experiments in which it was found that the photochemical reactivity was slightly higher for acetone. This commenter went on to complain that when this report studied the photochemical reactivity of acetone in 39 urban areas, the results were based on use of computer models derived from experimental data. This commenter believed that results should be based on direct experimental data and not on computer models which might contain assumptions and uncertainties.

Response: The EPA agrees that direct experimental data are desirable, provided that direct experimental comparison data exist for a variety of ambient conditions. Existing data, however, are very limited.

Such data, for example, were obtained by Dr. H. Jeffries at the University of North Carolina, in a study referenced in the Carter report. Through a direct "side by side" experimental comparison of the reactivities of acetone and ethane, Dr. Jeffries observed no measurable difference in the amount of ozone formed in the acetone and ethane sides of the chamber. These experimental data confirm that, essentially, the difference in reactivity between ethane and acetone is not significant. In regard to the use of computer models to predict ozone formation, this is a common, well justified practice in reactivity work, and EPA sees no reason to doubt the approach taken in this analysis.

Comment: One commenter states that the Derwent and Jenkins study shows that acetone produces 12 percent more ozone than does ethane.

Response: Dr. R. G. Derwent reported to EPA, in a January 27, 1994 letter which is contained in the docket, that a comparison of the photochemical ozone creation potential (POCP) for ethane and acetone gives 8.2 ± 4.0 for ethane and 9.2 ± 2.0 for acetone. The commenter is apparently referring to the difference between 8.2 and 9.2, which is 12 percent. The commenter does not appear

to consider the measure of variability of the data, expressed as a standard deviation for each number. The difference between these numbers is not considered to be statistically significant, considering the standard deviation of each value.

Comment: One commenter said that EPA has previously stated that ". . .EPA has found that almost all non-methane VOC are photochemically reactive and that low reactivity VOC eventually form as much ozone as highly reactive VOC," 40 CFR Subpart 51 (Appendix S, Section IV(C)(4)). Another commenter said that because acetone is not nonreactive, excluding acetone from the definition of VOC would reduce the ability of States to attain the national ambient air quality standard for ozone in a timely manner.

Response: The CFR section quoted above is part of a discussion of credit for VOC substitution. The above quote is followed by the statement that no emission credit may be allowed for replacing one VOC with another of lesser reactivity, except for those listed in Table I of the policy statement "Recommended Policy on Control of Volatile Organic Compounds" (42 FR 35314, July 8, 1977). In that 1977 policy statement, EPA recognized a class of

organic compounds that has been determined to have negligible photochemical reactivity and is not required to be controlled under State implementation plans (SIP). Ethane was one of the four compounds on the negligibly reactive list in the 1977 policy statement. Over the years, several other compounds have been recognized as being negligibly reactive and have been added to the list. This list of negligibly reactive compounds was incorporated into EPA's definition of volatile organic compounds which appears in 40 CFR 51.100(s). Today's action adds acetone to that list.

Comment: Two commenters stated that the docket materials show that the photochemical reactivity of acetone is increased by the presence of NO_x and other VOC. If the proposal to exempt acetone from the VOC list is accepted, the urban areas with the worst pollution would be the areas to suffer most from that decision.

Response: Under high NO_x conditions, the modeling results predict that acetone is slightly more reactive than ethane, though the reactivity on the MIR scale is quite low when compared to the reactivity of the weighted average of all emitted VOC and especially when compared to more reactive solvents such as xylene. Under the type

of NO_x conditions occurring in most cities, the modeling results indicate the reactivity of acetone is comparable to or less than that of ethane (Table 5 in the Carter report). The 39 cities examined in the modeling studies exhibit air quality ranging from ozone attainment to extreme nonattainment. The modeling results as a whole do not demonstrate an appreciable difference between acetone and ethane in terms of their respective potential to contribute to tropospheric ozone levels. Modeling results for those 39 cities show that acetone reactivity is on average lower than ethane for the actual conditions existing in them and much lower than for the typical urban mix of reactive organic gases.

Comment: Three commenters were concerned that the proposal stated that when this action is made final, acetone may not be used for emission netting, offsetting, or trading with reactive VOC emissions. Two of these commenters supported acetone being reclassified as negligibly reactive, but were concerned that past emission reduction credits be retained in the future. There are two aspects of concern. First, would permits obtained in the past that are based on netting transactions involving acetone still be valid? Secondly,

could acetone reductions that have been made in the past, with the expectation that they would be available for future netting, still be used? The commenters say they could suffer financial damages if they are not allowed to use or sell emission reduction credits for past reductions of acetone.

Response: The EPA is currently developing an open market trading rule which will deal with issues of netting, offsetting, and trading transactions. The EPA is deferring its decision concerning whether credits for acetone, which were banked prior to today's action, may be used in future netting, offsetting or trading transactions with reactive VOC. Because of the potential impact that banked emissions could have on attainment demonstrations and reasonable further progress showings, EPA needs to conduct further discussions with States on this issue.

III. Final Action . The EPA concludes that acetone is not appreciably different from ethane in terms of photochemical reactivity. Today's final action is based upon the material in Docket A-94-26 and EPA's review and consideration of all comments received during the public comment period. As proposed in EPA's September 30, 1994

notice, EPA hereby amends its definition of VOC at 40 CFR 51.100(s) to add acetone to the list of compounds that have been determined to have negligible photochemical reactivity. This will have the effect of excluding acetone as a VOC for ozone control purposes. The revised definition will also apply in the Chicago ozone nonattainment area pursuant to the 40 CFR 52.741(a)(3) definition of volatile organic material or VOC compound. States are not obligated to exclude from control as a VOC those compounds that EPA has found to be negligibly reactive. However, after the effective date of this final action, EPA will not enforce measures controlling acetone as part of a federally-approved ozone SIP. In addition, once this proposal is made final, States may 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 strategies.

This action is effective on the date of publication rather than the more usual date 30 days after publication. There is good cause to choose this earlier effective date; this action relieves a restriction on users of acetone (42 U.S.C. section 553 (d)(1)).

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.).

Under sections 202, 203, and 205 of the Unfunded Mandates Reform Act of 1995 ("Unfunded Mandates Act"), signed into law on March 22, 1995, the EPA must undertake various actions in association with proposed or final rules that include a Federal mandate that may result in estimated costs of \$100 million or more to the private sector, or to State, local and/or tribal government(s) in the aggregate. Since today's action is deregulatory in nature and does not impose any mandate upon any source, the cost of such mandates will not result in estimated annual costs of \$100 million or more.

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 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.

* * * * *

(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); parachlorobenzotrifluoride (PCBTF); cyclic, branched, or linear completely methylated siloxanes; acetone; and perfluorocarbon compounds which fall into these classes:

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BILLING CODE 6560-50-P