Appendices

Appendix A

"Air Quality: Revision to Definition of Volatile Organic Compounds-Exclusion of HFC 43-10mee and HCFC 225ca and cb," Federal Register, 61, 196, United States Environmental Protection Agency, Final Rule, October 8, 1996.

Federal Register

Tuesday
October 8, 1996

Part III

Environmental Protection Agency

40 CFR Part 51

Air Quality: Volatile Organic Compounds Definition Revision; Exclusion of HFC 43–10mee, HCFC 225ca, and cb; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[FRL–5466–9]

Air Quality: Revision to Definition of Volatile Organic Compounds—Exclusion of HFC 43–10mee and HCFC 225ca and cb

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This action revises EPA's 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 (FIP) for the Chicago ozone nonattainment area. This action adds HFC 43–10mee and HCFC 225ca and cb to the list of compounds excluded from the definition of VOC on the basis that these compounds have negligible contribution to tropospheric ozone formation. These compounds are solvents which could be used in electronics and precision cleaning.

EFFECTIVE DATE: This rule is effective November 7, 1996.

ADDRESSES: The EPA has established a public docket for this action, A–95–37, which is available for public inspection and copying between 8 a.m. and 4 p.m., Monday through Friday, at EPA's 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: 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: *Regulated entities.* Entities potentially regulated by this action are those which use and emit VOC's and States which have programs to control VOC emissions.

Category	Examples of regulated entities
Industry	Industries that do solvent cleaning, e.g. electronics or precision cleaning.
States	States which have regulations to control volatile organic compounds.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by State regulation initiated pursuant to this action. States may use this revised definition of VOC in promulgating new or revising existing reasonably available control technology requirements for stationary sources. If you have further questions regarding the applicability of this action to a particular entity, you may consult the person listed in the **FOR FURTHER INFORMATION CONTACT** section of this notice or contact your State or local air pollution control agency.

I. Background

Petitions have been received from two organizations asking for certain compounds to be added to the list of compounds which are considered to be negligibly reactive in the definition of VOC at 40 CFR 51.100(s). On December 12, 1994, Asahi Glass America, Inc., submitted a petition for HCFC 225ca and cb isomers. These compounds are chemically named 3,3-dichloro-1,1,1,2,2-pentafluoropropane (CAS number 422–56–0) and 1,3-dichloro-1,1,2,2,3-pentafluoropropane (CAS number 507–55–1), respectively. On March 13, 1995, the E.I. du Pont de Nemours and Company submitted a petition for the compound HFC 43–10mee. This compound has the chemical name 1,1,1,2,3,4,4,5,5,5-decafluoropentane (CAS number 138495–42–8).

In support of their petitions, these organizations supplied information on the photochemical reactivity of the individual compounds. This information consisted mainly of the rate constant for the reaction of the compound with the hydroxyl (OH) radical. This rate constant (k_{OH} value) is commonly used as one measure of the photochemical reactivity of compounds. The petitioners compared the rate constants with that of other compounds which have already been listed as photochemically, negligibly reactive (e.g., ethane which is the compound with the highest k_{OH} value that is currently regarded as negligibly reactive). Reported k_{OH} rate constants for ethane and the compounds for which petitions were submitted are listed in Table 1.

TABLE 1.—REACTION RATE CONSTANTS WITH OH RADICAL REPORTED RATE CONSTANT AT 25°C

Compound	cm^3/molecule/sec
Ethane	2.4×10^{-13}
HCFC–225ca	2.5×10^{-14}
HCFC–225cb	8.6×10^{-15}
HFC 43–10mee	3.87×10^{-15}

The scientific information which the petitioners have submitted in support of their petitions has been added to the docket for this rulemaking. This information includes references for the journal articles where the rate constant values are published.

In regard to the petition for HCFC 225ca and HCFC 225cb, existing data support that the reactivities of these compounds with respect to reaction with OH radicals in the atmosphere are considerably lower than that of ethane. This would indicate that these compounds are less reactive than ethane which is already classified as negligibly reactive. Similarly, for HFC 43–10mee, the rate constant of reaction with the OH radical is considerably less than that for ethane.

In each of the above petitions, the petitioners did not submit reactivity data with respect to other VOC loss reactions (such as reaction with O-atoms, nitrogen trioxide (NO_3)-radicals, and ozone (O_3), and for photolysis). However, there is ample evidence in the literature that halogenated paraffinic VOC, such as these compounds, do not participate in such reactions significantly.

II. Comments on the Proposal and EPA Responses

Based on a review of the scientific material submitted by the petitioners, EPA published a notice in the Federal Register on May 1, 1996 (61 FR 19231) which proposed to revise EPA's definition of VOC to add HFC 43–10mee and HCFC 225ca and cb 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 these compounds to this list. That notice asked for comments from the public on the proposal and provided a 30-day comment period which ended May 31, 1996. 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 one company in response to EPA's May 1, 1996 proposal. This comment letter supported the proposed action. A copy of that comment letter is located in the docket (A–95–37) for this action.

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, no one requested a public hearing, therefore none was held.

III. Final Action

Based on its review of the material in Docket No. A–95–37, the EPA hereby amends its definition of VOC at 40 CFR 51.100(s) to exclude HCFC 43–10mee, HCFC 225ca and HCFC 225cb as VOC for ozone SIP and ozone control purposes. The revised definition also applies in the Chicago ozone nonattainment area pursuant to the 40 CFR 52.741(a)(3) definition of volatile organic material or VOC. States are not obligated to exclude from control as a VOC those compounds that EPA has found to be negligibly reactive. However, States should not include these compounds 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 these compounds in their ozone control strategy.

IV. Administrative Requirements

A. Docket

The docket is an organized and complete file for all information submitted or otherwise considered by EPA in the development of this rulemaking. The principle purposes of the docket are to allow interested parties to identify and locate documents so that they can effectively participate in the rulemaking process and to serve as the record in case of judicial review (except for interagency review materials) (section 307(d)(7)(A)).

B. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether a regulatory action is ''significant'' and therefore subject to Office of Management and Budget (OMB) review and the requirements of this Executive Order. The order defines ''significant regulatory action'' as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligation of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, it has been determined that this rule is not ''significant'' because none of the listed criteria apply to this action. Consequently, this action was not submitted to OMB for review under Executive Order 12866.

C. Unfunded Mandates Act

Section 202 of the Unfunded Mandates Reform Act of 1995 (Unfunded Mandates Act) (signed into law on March 22, 1995) requires that the Agency prepare a budgetary impact statement before promulgating a rule that includes a Federal mandate that may result in expenditure by State, local, and tribal governments, in aggregate, or by the private sector of $100 million or more in any 1 year. Section 204 requires the Agency to establish a plan for obtaining input from and informing, educating, and advising any small governments that may be significantly or uniquely affected by the rule.

Under section 205 of the Unfunded Mandates Act, the Agency must identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a budgetary impact statement must be prepared. The Agency must select from those alternatives the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule, unless the Agency explains why this alternative is not selected or the selection of this alternative is inconsistent with law.

Because this rule is estimated to result in the expenditure by State, local and tribal governments or the private sector of less than $100 million in any 1 year, the Agency has not prepared a budgetary impact statement or specifically addressed the selection of the least costly, most cost-effective, or least burdensome alternative. Because small governments will not be significantly or uniquely affected by this rule, the Agency is not required to develop a plan with regard to small governments.

D. Regulatory Flexibility Act

For proposed and final rules, the Regulatory Flexibility Act of 1980 requires the Agency to perform a regulatory flexibility analysis, identifying the economic impact of the rule on small entities. 5 U.S.C. 601 et. seq. In the alternative, if the Agency determines that the rule will not have a significant economic impact on a substantial number of small entities, the Agency can make a certification to that effect. Because this rule relieves a restriction, it will not impose and any adverse economic impact on small entities. Therefore, 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.

E. Paperwork Reduction Act

This rule does not change any information collection requirements subject to OMB under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

F. Submission to Congress and the General Accounting Office

Under 5 U.S.C. 801(a)(1)(A) as added by the Small Business Regulatory Enforcement Fairness Act of 1996, EPA submitted a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives and the Comptroller General of the General Accounting Office prior to publication of the rule in today's Federal Register. This rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

List of Subjects in 40 CFR Part 51

Environmental protection, 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.

Dated: September 27, 1996.

Carol M. Browner,

Administrator.

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. 7401–7641q.

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

51.100 Definitions.

* * * * *

(s) *Volatile organic compounds (VOC)* means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

(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; perchloroethylene (tetrachloroethylene); 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC–225ca); 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC–225cb); 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC 43–10mee); and perfluorocarbon compounds which fall into these classes:

(i) Cyclic, branched, or linear, completely fluorinated alkanes,

(ii) Cyclic, branched, or linear, completely fluorinated ethers with no unsaturations,

(iii) Cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations, and

(iv) Sulfur containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine.

* * * * *

[FR Doc. 96–25787 Filed 10–7–96; 8:45 am]

BILLING CODE 6560–50–P

Appendix B

"Air Quality: Revision to Definition of Volatile Organic Compounds-Exclusion of 16 Compounds," Federal Register, 62, 164, United States Environmental Protection Agency, Final Rule, August 25, 1997.

amended to implement this decision. This final rule is being made effective immediately to expedite the State program amendment process and to encourage States to bring their programs into conformity with the Federal standards without undue delay. Consistency of State and Federal standards is required by SMCRA.

VI. Procedural Determinations

1. Executive Order 12866

This rule is exempted from review by the Office of Management and Budget (OMB) under Executive Order 12866 (Regulatory Planning and Review).

2. Executive Order 12988

The Department of the Interior has conducted the reviews required by section 3 of Executive Order 12988 (Civil Justice Reform) and has determined that this rule meets the applicable standards of subsections (a) and (b) of that section. However, these standards are not applicable to the actual language of State regulatory programs and program amendments since each such program is drafted and promulgated by a specific State, not by OSM. Under sections 503 and 505 of SMCRA (30 U.S.C. 1253 and 1255) and the Federal regulations at 30 CFR 730.11, 732.15, and 732.17(h)(10), decisions on proposed State regulatory programs and program amendments submitted by the States must be based solely on a determination of whether the submittal is consistent with SMCRA and its implementing Federal regulations and whether the other requirements of 30 CFR Parts 730, 731, and 732 have been met.

3. National Environmental Policy Act

No environmental impact statement is required for this rule since section 702(d) of SMCRA (30 U.S.C. 1292(d)) provides that agency decisions on proposed States regulatory program provisions do not constitute major Federal actions within the meaning of section 102(2)(C) of the National Environmental Policy Act (42 U.S.C. 4332(2)(C)).

4. Paperwork Reduction Act

This rule does not contain information collection requirements that require approval by OMB under the Paperwork Reduction Act (44 U.S.C. 3507 *et seq.*).

5. Regulatory Flexibility Act

The Department of the Interior has determined that this rule will not have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*). The State submittal that is the subject of this rule is based upon counterpart Federal regulations for which an economic analysis was prepared and certification made that such regulations would not have a significant economic effect upon a substantial number of small entities. Accordingly, this rule will ensure that existing requirements previously promulgated by OSM will be implemented by the State. In making the determination as to whether this rule would have a significant economic impact, the Department relied upon the data and assumptions for the counterpart Federal regulations.

6. Unfunded Mandates

This rule will not impose a cost of $100 million or more in any given year on any governmental entity or the private sector.

List of Subjects in 30 CFR Part 934

Intergovernmental relations, Surface mining.

Dated: August 5, 1997.

Richard J. Seibel,

Regional Director, Western Regional Coordinating Center.

For the reasons set out in the preamble, title 30, chapter VII, subchapter T of the Code of Federal Regulations is amended as set forth below:

PART 934—NORTH DAKOTA

1. The authority citation for part 934 continues to read as follows:

Authority: 30 U.S.C. 1201 *et seq.*

2. Section 934.15 is amended in the table by adding a new entry in chronological order by ''Date of Final Publication'' to read as follows:

§ 934.15 Approval of North Dakota regulatory program amendments.

* * * * *

Original amendment submission date	Date of final publication	Citation/description
*	*	* * * * *
May 2, 1997	August 25, 1997	NDCC 38–14.1–04.1, .2, .3

[FR Doc. 97–22416 Filed 8–22–97; 8:45 am]

BILLING CODE 4310–05–M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[FRL–5880–9]

RIN 2060–AG70

Air Quality: Revision to Definition of Volatile Organic Compounds—Exclusion of 16 Compounds

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This action revises EPA's 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 any Federal implementation plan (FIP) for an ozone nonattainment area. This revision would add 16 compounds (shown in Table 2) to the list of compounds excluded from the definition of VOC on the basis that these compounds have negligible contribution to tropospheric ozone formation. These compounds have potential for use as refrigerants, aerosol propellants, fire extinguishants, blowing agents and solvents.

DATES: This rule is effective September 24, 1997.

ADDRESSES: The EPA has established a public docket for this action, A–96–36, which is available for public inspection and copying between 8 a.m. and 4 p.m., Monday through Friday, at EPA's 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: 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: *Regulated entities.* Entities potentially regulated by

this action are those which use and emit VOC and States which have programs to control VOC emissions.

Category	Examples of regulated entities
Industry	Industries that use refrigerants, blowing agents, or solvents.
States	States which have regulations to control volatile organic compounds.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

I. Background

On September 25, 1995, the Alliance for Responsible Atmospheric Policy (Alliance) submitted a petition to the EPA which requested that the compounds shown in Table 1 be added to the list of compounds which are considered to be negligibly reactive in the definition of VOC at 40 CFR 51.100(s). (The original petition also included five other compounds (CFC–111, CFC–112, CFC–112A, CFC–113a, and CFC–114a) not shown in Table 1, but the petitioner later requested that these compounds be removed from consideration.)

Potential uses for these compounds are also shown in Table 1. Blowing agent refers to products used in the manufacture of foamed plastic. The compounds for which no use is shown have no currently recognized commercial end-use. However, they may be either intermediates or unintentional byproducts resulting from the manufacture of other compounds.

TABLE 1.—COMPOUNDS PETITIONED FOR VOC EXCLUSION

[Along with potential uses of compounds]

Compound	Potential use
HFC–32	Refrigerant.
HFC–161	Aerosol propellant, blowing agent.
HFC–236fa	Fire extinguishant, refrigerant.
HFC–245ca	Refrigerant, blowing agent.
HFC–245eb	Refrigerant, blowing agent.
HFC–245fa	Refrigerant, blowing agent.
HFC–245ea	Solvent.
HFC–236ea	Refrigerant, blowing agent.
HFC–365mfc	Blowing agent.
HCFC–31	
HCFC–150a	
HCFC–151a	
HCFC–123a	Blowing agent.
$C_4F_9OCH_3$	Solvent.
$(CF_3)_2CFCF_2OCH_3$	Solvent.
$C_4F_9OC_2H_5$	Solvent.
$(CF_3)_2CFCF_2OC_2H_5$	Solvent.

In support of the petitions, the Alliance supplied information on the photochemical reactivity of the individual compounds. This information consisted mainly of the rate constant for the reaction of the compound with the hydroxyl (OH) radical. This rate constant (k_{OH} value) is commonly used as one measure of the photochemical reactivity of compounds. The petitioner compared the rate constants with that of ethane which has already been listed as photochemically negligibly reactive (ethane is the compound with the highest k_{OH} value which is currently regarded as negligibly reactive). The scientific information which the petitioner has submitted in support of the petition has been added to the docket for this rulemaking. This information includes references for the journal articles where the rate constant values are published.

For the petition submitted by the Alliance, the existing data support that the reactivities of the compounds submitted (except for HCFC–150a), with respect to reaction with OH radicals in the atmosphere, are substantially lower than that of ethane. Based on the information submitted with the petition, EPA proposed on March 17, 1997 (62 FR 12583) to add the 16 compounds shown in Table 2 below to the list of negligibly reactive compounds in EPA's definition of VOC found in 40 CFR 51.100(s). One of the compounds in the petition (HCFC–150a) was not proposed for exemption since EPA thought that the supporting information did not justify a ''negligibly reactive'' rating at this time.

II. Comments on the Proposal and EPA Response

The EPA received written comments on the proposal from four organizations. The comments were from the petitioner and three manufacturing companies. All four comment letters supported the exclusion of the 16 compounds as VOC. Copies of these comments have been added to the docket (A–96–36) for this action.

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, no one requested a public hearing so none was held.

Based on the information presented in the proposal notice and on the comments received during the public comment period, EPA has decided to list the compounds in Table 2 as negligibly reactive.

TABLE 2.—COMPOUNDS ADDED TO THE LIST OF NEGLIGIBLY REACTIVE COMPOUNDS

Compound	Chemical name
HFC–32	difluoromethane.
HFC–161	ethylfluoride.
HFC–236fa	1,1,1,3,3,3-hexafluoropropane.
HFC–245ca	1,1,2,2,3-pentafluoropropane.
HFC–245ea	1,1,2,3,3-pentafluoropropane.
HFC–245eb	1,1,1,2,3-pentafluoropropane.
HFC–245fa	1,1,1,3,3-pentafluoropropane.
HFC–236ea	1,1,1,2,3,3-hexafluoropropane.
HFC–365mfc	1,1,1,3,3-pentafluorobutane.
HCFC–31	chlorofluoromethane.
HCFC–123a	1,2-dichloro-1,1,2-trifluoroethane.
HCFC–151a	1-chloro-1-fluoroethane.
$C_4F_9OCH_3$	1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxybutane.
$(CF_3)_2CFCF_2OCH_3$	2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane.
$C_4F_9OC_2H_5$	1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane.

TABLE 2.—COMPOUNDS ADDED TO THE LIST OF NEGLIGIBLY REACTIVE COMPOUNDS—Continued

Compound	Chemical name
$(CF_3)_2CFCF_2OC_2H_5$	2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane.

Table 3 gives Chemical Abstract Service (CAS) numbers for the compounds in Table 2.

TABLE 3.—CHEMICAL ABSTRACT SERVICE (CAS) NUMBERS FOR COMPOUNDS

Compound	CAS number
HFC–32	75–10–5
HFC–161	353–36–6
HFC–236fa	690–39–1
HFC–245ca	679–86–7
HFC–245ea	24270–66–4
HFC–245eb	431–31–2
HFC–245fa	460–73–1
HFC–236ea	431–63–0
HFC–365mfc	406–58–6
HCFC–31	593–70–4
HCFC–123a	354–23–4
HCFC–151a	1615–75–4
$C_4F_9OCH_3$	163702–07–6
$(CF_3)_2CFCF_2OCH_3$	163702–08–7
$C_4F_9OC_2H_5$	163702–05–4
$(CF_3)_2CFCF_2OC_2H_5$	163702–06–5

III. Final Action

Today's action is based on EPA's review of the material in Docket No. A–96–36. The EPA hereby amends its definition of VOC at 40 CFR 51.100(s) to exclude the compounds in Table 2 as VOC for ozone SIP's and ozone control strategies for purposes of attaining the ozone NAAQS. The revised definition will also apply for purposes of any FIP's for ozone nonattainment areas (e.g. 40 CFR 52.741(a)(3)). States are not obligated to exclude from control as a VOC those compounds that EPA has found to be negligibly reactive. However, States should not include these compounds 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 these compounds in their ozone control strategy.

IV. Administrative Requirements

A. Docket

The docket is an organized and complete file for all information submitted or otherwise considered by EPA in the development of this rulemaking. The principle purposes of the docket are: (1) To allow interested parties to identify and locate documents so that they can effectively participate in the rulemaking process; and, (2) to serve as the record in case of judicial review (except for interagency review materials) (section 307(d)(7)(A)).

B. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether a regulatory action is ''significant'' and therefore subject to Office of Management and Budget (OMB) review and the requirements of this Executive Order. The Order defines ''significant regulatory action'' as one is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligation of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, it has been determined that this rule is not ''significant'' because none of the listed criteria apply to this action. Consequently, this action was not submitted to OMB for review under Executive Order 12866.

C. Unfunded Mandates Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Pub. L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with ''Federal mandates'' that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any 1 year. Before promulgation of an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost effective, or least burdensome alternative that achieves the objective of the rule, unless EPA publishes with the final rule an explanation of why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments including tribal governments, it must have developed under section 203 of the UMRA a small government plan which informs, educates and advises small governments on compliance with the regulatory requirements. Finally, section 204 provides that for any proposed or final rule that imposes a mandate on a State, local or tribal government of $100 million or more annually, the Agency must provide an opportunity for such governmental entities to provide input in development of the proposed rule.

Since today's rulemaking is deregulatory in nature and does not impose any mandate on governmental entities or the private sector, EPA has determined that sections 202, 203, 204 and 205 of the UMRA do not apply to this action.

D. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980 requires the identification of potentially adverse impacts of Federal regulations upon small business entities. The Act specifically requires the completion of an RFA analysis in those instances where the regulation would impose a substantial impact on a significant number of small entities. Because this rulemaking imposes no adverse economic impacts, an analysis has not been conducted. Pursuant to the provision of 5 U.S.C. 605(b), I hereby certify that this rule will not have an impact on small entities because no additional costs will be incurred.

E. Paperwork Reduction Act

This action does not impose an information collection burden under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq.

F. Submission to Congress and the General Accounting Office

Under 5 U.S.C. 801(a)(1)(A) as added by the Small Business Regulatory

Enforcement Fairness Act of 1996, EPA submitted a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives and the Comptroller General of the General Accounting Office prior to publication of the rule in today's Federal Register. This rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

List of Subjects in 40 CFR Part 51

Environmental protection, 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.

Dated: August 18, 1997.

Carol M. Browner,

Administrator.

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 is revised to read as follows:

Authority: 42 U.S.C. 7401–7671q.

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

§ 51.100 Definitions.

* * * * *

(s) *Volatile organic compounds (VOC)* means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

(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; perchloroethylene (tetrachloroethylene); 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC–225ca); 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC–225cb); 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC–43–10mee); difluoromethane (HFC–32); ethylfluoride (HFC–161); 1,1,1,3,3,3-hexafluoropropane (HFC–236fa); 1,1,2,2,3-pentafluoropropane (HFC–245ca); 1,1,2,3,3-pentafluoropropane (HFC–245ea); 1,1,1,2,3-pentafluoropropane (HFC–245eb); 1,1,1,3,3-pentafluoropropane (HFC–245fa); 1,1,1,2,3,3-hexafluoropropane (HFC–236ea); 1,1,1,3,3-pentafluorobutane (HFC–365mfc); chlorofluoromethane (HCFC–31); 1-chloro-1-fluoroethane (HCFC–151a); 1,2-dichloro-1,1,2-trifluoroethane (HCFC–123a); 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane ($C_4F_9OCH_3$); 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OCH_3$); 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane ($C_4F_9OC_2H_5$); 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OC_2H_5$); and perfluorocarbon compounds which fall into these classes:

(i) Cyclic, branched, or linear, completely fluorinated alkanes;

(ii) Cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;

(iii) Cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and

(iv) Sulfur containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine.

* * * * *

[FR Doc. 97–22510 Filed 8–22–97; 8:45 am]

BILLING CODE 6560–50–M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 52

[OH104–1A; FRL–5877–9]

Approval and Promulgation of Maintenance Plan Revisions; Ohio

AGENCY: Environmental Protection Agency.

ACTION: Direct final rule.

SUMMARY: The United States Environmental Protection Agency (USEPA) is approving through ''direct final'' procedure, a June 10, 1997, request from Ohio, for State Implementation Plan (SIP) maintenance plan revisions for the following areas: Toledo area (including Lucas and Wood counties), the Cleveland-Akron-Lorain area (including Lorain, Cuyahoga, Lake, Ashtabula, Geauga, Medina, Summit and Portage counties), and the Dayton-Springfield area (including Montgomery, Clark, Greene, and Miami counties). The maintenance plan revisions are allocating to the mobile source emission budget for transportation conformity a portion of the existing ''Safety Margins.'' The safety margin is the difference between the attainment inventory level of the total emissions and the projected levels of the total emissions in the final year of the maintenance plan.

DATES: This ''direct final'' rule is effective on October 24, 1997, unless USEPA receives significant written adverse or critical comments (which have not already been addressed) by September 24, 1997. If the effective date is delayed, timely notice will be published in the Federal Register.

ADDRESSES: Copies of the documents relevant to this action are available for inspection during normal business hours at the following location: Regulation Development Section, Air Programs Branch, (AR–18J), U.S. Environmental Protection Agency, Region 5, 77 West Jackson Boulevard, Chicago, Illinois, 60604. Please contact Scott Hamilton at (312) 353–4775 before visiting the Region 5 office.

Written comments should be sent to: J. Elmer Bortzer, Chief, Regulation Development Section, Air Programs Branch, (AR–18J), U.S. Environmental Protection Agency, Region 5, 77 West Jackson Boulevard, Chicago, Illinois, 60604.

FOR FURTHER INFORMATION CONTACT: Scott Hamilton, Environmental Scientist, Regulation Development Section, Air Programs Branch (AR–18J), U.S. Environmental Protection Agency, Region 5, 77 West Jackson Boulevard, Chicago, Illinois 60604, (312) 353–4775.

SUPPLEMENTARY INFORMATION:

I. Background

The Clean Air Act in section 176(c) requires conformity of activities to an implementation plan's purpose of attaining and maintaining the National ambient air quality standards. On November 24, 1993, the USEPA promulgated a final rule establishing criteria and procedures for determining

Appendix C

"VOC Exclusion Request for HCFC-225," AGC Chemicals Americas, Inc.,
Submitted to Air Resources Board, November 12, 2004.

AGC CHEMICALS AMERICAS, INC.
Charlotte Office
2201 Water Ridge Parkway
Suite 400
Charlotte, NC 28217
Phone: (704) 329-7608
Fax: (704) 357-6308

November 12, 2004

Dongmin Luo
California Air Resources Board
1001 I Street
5th Floor
Sacramento, CA 95814

Dear Mr. Luo:

The purpose of this letter is to respectfully request that CARB extend a VOC exemption for HCFC-225.

Dr William Carter and Dr. Roger Atkinson of the University of California Riverside evaluated the HCFC-225ca and HCFC-225cb isomer. Dr. Roger Atkinson stated that the reaction rates for the two isomers of HCFC 225 were $2.5X10^{-14}$ cm^3 $molecule^{-1}$ sec^{-1} at 298 deg K for HCFC 225ca and $8.85X10^{-15}$ cm^3 molecule $^{-1}$ sec $^{-1}$ at 298 deg K for HCFC 225cb. He also stated that these reactions rates were 10 to 30 times slower than ethane, which is the standard of comparison; and acetone, which has been granted an exemption.

Dr. William Carter stated that based upon these reaction rates that HCFC 225ca and cb should not be considered VOC's and that smog chamber and photochemical reactivity studies would not be necessary.

This data, coupled with the fact that HCFC 225ca and cb have a slight ozone depletion potential of 0.03 emphasizes that HCFC 225 ca and cb reacts in the upper atmosphere, rather then at ground level.

Enclosed in the blue binder are the supporting documents to Dr Atkinson and Dr. Carter's findings.
In Addition, a copy of the PAFT assessment, AGC's toxicological summary, and technical data are enclosed.
Detailed toxicological reports can be found on the CD.

In regards to exposure analysis: two reports are provided on exposure analysis, one from vapor degreasing operations, and the second from use in aerosols.

Finally, The US EPA granted AK-225 (HCFC-225ca CAS #422-56-0 and HCFC-225cb CAS #507-55-1) a VOC exemption in 1996. The ruling was published in the Federal Register on October 8, 1996 (Volume 61, Number 196) and can be found on Pages 52847 - 52850.

South Coast AQMD has granted AK-225 (HCFC-225ca CAS #422-56-0 and HCFC-225cb CAS #507-55-1) a VOC exemption under Rule 102.

Thank you for you time and consideration in this matter. Please feel free to contact me with any questions you may have.

Sincerely,

David A. Ferguson
National Sales Manager
AGC Chemicals Americas, Inc.

Dferguson@agcchem.com
(704) 329-7603
(704) 357-6308 (Fax)

Appendix D

"Volatile Organic Compound Exemption Package for HFC 245fa," "Raymond Regulatory Resources, Submitted on Behalf of Honeywell Specialty Chemicals to Air Resources Board, February 28, 2005.

Dongmin Luo, Ph.D.
Research Division
Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, California 95812

Subject: Volatile Organic Compound exemption packet for HFC-245fa

Dear Dongmin,

Honeywell Specialty Chemicals is requesting that the Air Resources Board (ARB) take action to exempt the hydrofluorocarbon HFC- 245fa as a precursor to tropospheric ozone. This action would include revision of ARB's definition of volatile organic compounds (VOC) for the purpose of preparing a State Implementation Plan to attain air quality standards for ozone. This revision would add HFC-245fa to the list of compounds excluded from the definition of VOC on the basis that HFC-245fa has a negligible contribution to tropospheric ozone formation.

HFC-245fa, chemical name 1,1,1,3,3 – pentafluoropropane has the CAS number 690-39-1. HFC-245fa was exempted by the Federal Environmental Protection Agency as a VOC in 1997 due to its negligible photochemical reactivity. The reaction rate constant of HFC-245fa with an OH radical is reported as 0.66×10^{-14}. The reaction rate is lower than the reaction rate of ethane.

HFC-245fa has multiple potential applications such as in mold releases, lubricants, electronic cleaners, precision cleaners and as a carrier solvent. HFC-245fa is intended primarily as a replacement for ozone depleting solvents such as HCFC – 141b and HCFC – 225 ca/cb which are slated for phase out. HFC-245fa has no Ozone Depletion Potential, a relatively low Global Warming Potential (GWP) and is non-flammable. HFC-245fa has neither a flash point nor vapor flame limit.

HFC-245fa is considered to exhibit only a low order of toxicity. After reviewing extensive toxicity data, the American Industrial Hygiene Association (AIHA) has established a Workplace Environmental Exposure

Level (WEEL) of 300 PPM for HFC-245fa. This value is significantly higher than the PELs assigned to many alternative solvents.

The attachments included consist of physical data, reaction rates, toxicity data, multi-media impacts and global warming potential data. This information supports our request for a VOC exemption. The exclusion of HFC-245fa as a VOC will create an environmental benefit by accelerating the substitution of HFC-245fa for ozone depleting substances and other solvents.

Please review the attached documents and notify us if any additional data is needed. Any questions or comments please contact Doug Raymond at 440-474-4999 or Gary Knopeck at 716-827-6242.

Respectfully submitted on behalf of Honeywell Specialty Chemicals

Douglas J. Raymond

Douglas J. Raymond
Raymond Regulatory Resources (3R)

Appendix E

"Volatile Organic Compound Exemption Package for HFC 365mfc," "Raymond Regulatory Resources, Submitted on Behalf of Solvay Company to Air Resources Board, March 21, 2006.

March 21, 2006

Dongmin Luo, Ph.D.
Research Division
Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, California 95812

Subject: Volatile Organic Compound exemption packet for HFC 365mfc

Dear Dongmin,

The Solvay Company is requesting the Air Resources Board (ARB) take all necessary action needed to exclude the hydrofluorocarbon HFC 365mfc from the definition of volatile organic compounds (VOC's). This action would revise the definition of VOC to add HFC 365mfc to the list of compounds excluded as a VOC on the basis that HFC 365mfc has a negligible contribution to tropospheric ozone formation.

The chemical name for HFC 365mfc is 1,1,1,3,3-pentafluorobutane which has a CAS number of 406-58-6. The reaction rate constant of HFC 365mfc with an OH radical is 2.0×10^{-12} which is lower than ethane. The Federal Environmental Protection Agency exempted HFC 365mfc as a VOC in September of 1997.

HFC 365mfc is intended as a replacement for HCFC-141b which is scheduled for phase-out. HFC 365mfc will primarily be used in aerosol products for electronics cleaning and precision cleaning. HFC 365mfc has no ozone depletion potential, relatively low Global Warming potential and is not a precursor to tropospheric ozone formation. Thus HFC 365mfc could be used to replace some other chlorinated compounds with higher toxicity and hydrocarbons which are VOC's.

Studies performed by Solvay have not showed any toxicity concerns. This product has been registered in many countries already. Solvay has set a conservative exposure level at 500 ppm. All results available to date indicate that HFC 365mfc to be safe for the range of industrial applications when used in accordance with recommended standard hygiene practice and safety rules.

Enclosed in this petition are the following:

- Physical data
- Rate Constant and Global Warming Potential data
- Final Federal Rule exempting HFC 365mfc
- SNAP Approval
- Toxicity studies
- Environmental impacts
- Use data
- Near Source & Community Exposure
- Countries Registered

All of this information supports the petition to exempt HFC 365mfc. The exemption of HFC 365mfc will create an environmental benefit by accelerating the substitution of HFC 365mfc for ozone depleting substances, toxic compounds and VOC solvents.

Please review the attached documents and notify us if any additional data is needed. Any questions or comments please contact Doug Raymond at 440-474-4999 or e-mail djraymond@reg-resources.com, or Ken Neugebauer at 713-525-6566 or e-mail Kenneth.Neugebauer@solvay.com.

Respectfully Submitted on behalf of Solvay Company

Doug Raymond

Doug Raymond
Raymond Regulatory Resources (3R)

Appendix F

"VOC Exemption for HFC 43-10mee," DuPont Fluoroproducts, Submitted to Air Resources Board, November 30, 2004.

Recd @ 12/6/04

November 30, 2004

Dongmin Luo, Ph.D., P.E.
Research Division
California Air Resources Board
1001 I Street, 5th floor
Sacramento, CA 95814

Re: VOC Exemption for HFC 43-10mee

Dear Dr. Luo:

The DuPont Company hereby requests the Office of the Research Division of the California Air Resources Board ("the Agency") to take all necessary and prompt action to exclude the hydrofluorocarbon HFC 43-10mee (also known as 1,1,1,2,3,4,4,5,5,5-decafluoropentane; CAS number 138495-42-8) from regulation as a precursor to tropospheric ozone by adding it to its list of "Volatile Organic Compounds of Negligible Photochemical Reactivity that Should Be Exempt from Regulation Under State Implementation Plans."

HFC 43-10mee has been used for a broad range of specialized applications including precision and electronic cleaning, film cleaning, and as a carrier solvent. Its zero ozone depletion potential (ODP) and low global warming potential (GWP) combined with low toxicity and nonflammability make it a highly preferred alternative in critical applications that now use ozone depleting substances (ODS) such as CFC-113, methyl chloroform and HCFC-141b facing production phase out or use prohibition. HFC 43-10mee is SNAP approved and TSCA listed. The EPA has classified HFC 43-10 as VOC exempt. The Agency's prompt action to this petition for VOC exemption will promote immediate and long-term environmental benefits by providing an alternative to ozone depleting substances.

In support of this petition as to the negligible photochemical reactivity for HFC 43-10mee, attached are two reports on studies of reaction rates with hydroxyl radical and estimation of atmospheric lifetime conducted by The National Institute of Standards and Technology (Reference 1) and by the National Oceanic and Atmospheric Administration (NOAA) in cooperation with the University of Colorado (Reference 2). These two independent studies show close agreement on the
measured reaction agreement on the measured reaction rates over a wide

temperature range and give calculated tropospheric lifetime of 17 years and total atmospheric lifetime of 23 years. Shown below are the reaction rates measured near or at 298° K for each study and compared with the rate for ethane (R. Atkinson, Reference 3).

	T (K)	k_{OH} (cm^3 $molecule^{-1}$ s^{-1})
HFC 43-10mee (Ref. 1)	295	$(3.87 \pm 0.38) \times 10^{-15}$
HFC 43-10mee (Ref. 2)	296	$(2.88 \pm 0.20) \times 10^{-15}$
Ethane (Ref. 3)	298	2.74×10^{-13}
HFC 134a (exempted)	298	8.4×10^{-15}
HFC 152a (exempted)	298	34×10^{-15}

The above studies show that HFC 43-10mee should not contribute to ozone formation in the troposphere and that it should be excluded as a VOC because of its very low photochemical reactivity, much lower in fact, than compounds already excluded.

In the Agency's SNAP Program Final Ruling issued on the Federal Register, March 18, 1994, HFC 43-10mee appears in the ODS substitutes listings under "Pending Substitutes" for electronics and precision cleaning and is the only hydrofluorocarbon (HFC) presently listed for solvent cleaning (Reference 4). We understand that you (the Agency) recognize the importance of bringing HFCs to market ad ODS substitutes. From the EPA publication on ODS solvents and their substitutes (Reference 5) we quote:

> "HFCs are of interest not just for precision and electronics cleaning, but also for other targeted applications such as film cleaning and as a carrier solvent. In addition, since HFCs generally have much shorter lifetimes and global warming potential than PFCs, they are appealing prospective alternatives for cleaning applications where PFCs currently are the only viable substitutes.

HFC 43-10mee has been subjected to extensive toxicity testing, including acute, subchronic with 90 day inhalation, developmental, genotoxicity and cardiac sensitization. Overall HFC 43-10mee has low toxicity. It is only a slight skin and eye irritant and has low inhalation toxicity. Based on these studies, DuPont has established an Acceptable Exposure Limit (AEL) of 200 ppm (8 & 12 hour TWA) and a 15 minute 400 ppm Short Term Exposure Limit. Attached is the DuPont Material Safety Data Sheet for HFC 43-10mee (Reference 7). A complete documentation of the toxicity studies and assessment has been filed with the PMN.

Extensive evaluations of HFC 43-10mee as to its suitability as a ODS replacement in critical cleaning and other applications have been in progress within carefully selected U.S. industry segments under the provisions of the TSCA R&D Exemption. These industry segments include: Aerospace, Telecommunications, Inertial Guidance Systems, Computer, Optical and Film Cleaning.

In light of the above, DuPont respectfully requests that the Agency add HFC 43-10mee to is list of VOC compounds exempt from mandatory regulations under State Implementation Plans Respecting Ozone. If you need further information or have questions regarding HFC 43-10mee or this request, please contact me at (302) 999-5135 or by Fax at (302) 999-2093.

Sincerely,

Melodie A. Schweitzer

MAS/paf
Attachments

REFERENCES/ATTACHMENTS

1. "Rate Constants for the Reactions of Hydroxyl Radical with $CHF_2CF_2CF_2CHF_2$ and $CF_3CHFCHFCF_2CF_3$" by Z. Zhang, R.D. Saini, M.J. Kurylo and R. E. Huie, Chemical Kinetics and Thermodynamics Division, National Institute of Standards and Technology, Gaithersburg, MD 20889, Chemical Physics Letters, Vol. 200, No. 3, Dec. 4, 1992, pp 230-234.

2. "Rate Coefficients for Reactions of Several Hydrofluorocarbons with OH and $O(^1D)$ and Their Atmospheric Lifetimes", A.M. Schmoltner, A.R. Ravishankara et al., National Oceanic and Atmospheric Administration, Aeronomy Laboratory, Boulder, CO 80303 and The Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309, J. Phys. Chem., Vol. 97, No. 35, 1993, pp 8976-8982.

3. "Kinetics and Mechanisms of the Gas-Phase Reactions of the Hydroxyl Radical with Organic Compounds under Atmospheric Conditions" by Roger Atkinson, Statewide Air pollution Research Center, University of California, Riverside, CA 92521, Chemical Reviews, Vol. 85, No. 1, 1985, pp 69-201.

4. "Significant New Alternative Policy (SNAP) Program: Summary of Final Rule", United States Environmental Protection Agency, Office of Air and Radiation, Stratospheric Protection Division, March 1994. (With Attachments: Acceptability Lists for SNAP Program, Federal Register, Vol. 59, No. 53, Friday, March 18, 1994, pp 13134-13137.)

5. "Qs and As on Ozone-Depleting Solvents and Their Substitutes" United States Environmental Protection Agency, Air and Radiation, Stratospheric Protection Division, 6205J, February 1994, Rev. 3.

6. "HFC 43-10mee Material Safety Data Sheet (MSDS)", DuPont MSDS Number DU008057, Revised 14-Dec-1994.

Appendix G

"VOC Exclusion Request for 3M Hydrofluoroethers," 3M Company, Submitted to Air Resources Board, October 20, 1997.

3M General Offices

3M Center
St. Paul, MN 55144-1000
612 733 1110

3M

October 20, 1997

Mr. Peter Venturini
California Air Resources Board
2020 L Street
Sacramento, CA 95814

Dear Mr. ~~Venturini~~ Peter:

ARB per call from Dennis

3M Company respectfully requests the District expedite the process to exclude five compounds from the definition of volatile organic compounds (VOCs) in District regulations. Four of these chemicals are based on 3M™ Hydrofluoroether (HFE) technology and the fifth is a fluorinated paraffin. They are:

C4F9OCH3	1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxybutane
(CF3) 2CFCF2OCH3	2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane
C4F9OC2H5	1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane
(CF3) 2CFCF2OC2H5	2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane
HFC-236fa	1,1,1,3,3,3-hexaflouropropane

The first four compounds represent two HFE products used primarily in cleaning applications and as a carrier solvent: 3M™ HFE-7100 and 3M™ HFE-7200. The fifth compound, HFC-236fa is used as a refrigerant in closed loop systems.

The action requested is based on and warranted by the United States Environmental Protection Agency's (EPA) decision to delist these compounds from VOC status. Specifically, EPA promulgated a final rule that revised its regulations at 40 CFR Section 51.100(s) to include the five aforementioned compounds, as well as eleven other compounds, in the group of compounds that are not VOCs. 62 Fed. Reg. 44900 (Aug. 25, 1997).

Many cleaning operations in your District currently may be using chlorinated hydrocarbons that are ozone depleters or hazardous air pollutants. Without the delisting of HFEs, users considering HFEs as an alternative to chlorinated hydrocarbons are faced with the dilemma of

needing to replace a non-VOC with a VOC. This creates permit, facility cap, new source review, command and control VOC limit, etc. issues for potential users, which may make it difficult or impossible for a user to change to HFEs.

Delisting of the HFEs would therefore allow many cleaning operations the flexibility to consider substituting HFEs for their current chlorinated hydrocarbon containing products. HFEs are non-ozone depleting, are not hazardous air pollutants, are non-VOC, and have minimal direct contribution to global warming. EPA listed 3M™ HFE-7100 as "acceptable, without restrictions" under the Significant New Alternatives Policy (SNAP) program on September 5, 1996 (61 Fed. Reg. 47012). In addition, EPA has provided advance notice in a letter to 3M that HFE-7200 is acceptable under the SNAP program for solvents and aerosols. Because of the advantages of the HFE's over chlorinated hydrocarbons, we believe it is in the best interest of the environment to delist the aforementioned compounds as soon as possible.

HFC-236fa is a by-product of a manufacturing process and is a substitute for CFC-114, which, per the Montreal Protocol, can no longer be manufactured. Per the EPA, "HFC-236-fa is the only alternative submitted to date that is safe for the ozone layer, is low in toxicity and can be substituted in industrial process heat pumps." Since HFC-236fa is a non-ozone depleting alternative to CFC-114, we believe it is in the best interest of the environment to delist this compound as soon as possible.

Enclosed please find a packet of information that provides the following:

1. Federal Register Notice exempting subject compounds
2. Federal Register Notice of the SNAP for HFE-7100
3. EPA letter advising of SNAP approval for HFE-7200
4. product toxicity summary sheet for HFE-7100
5. product toxicity summary sheet for HFE-7200
6. an October 21, 1996 paper on "The Role of Hydrofluoroethers in Stratospheric Ozone Protection."
7. Federal Register Notice of the SNAP for HFC-236fa
8. product toxicity summary sheet for HFC-236fa

Again, 3M requests that the process to delist the HFEs as a VOC in the District be started as soon as possible.

Appendix H

"Profiles of Exemption Replacement Compounds," Stationary Source Division,
Air Resources Board, September 2006.

Profiles of Exemption Replacement Compounds

Perchloroethylene profile:

Category	# products	Emissions	Range
Adhesives	6	0.086tpd	65.8% - 71.7%
Automotive Brake Cleaner	11	0.042tpd	0.5% - 100%
Belt Dressing	1	0.000104tpd	45.20%
Carpet & Upholstery Cleaner	2	0.0016tpd	48.3% - 67.9%
Electrical Cleaner	*17*	*0.199tpd*	*8.64% - 100%*
Energized Electrical Cleaner	*3*	*0.01tpd*	*10% - 82.9%*
Engine Degreaser	1	0.0015tpd	25%
Fabric Protectant	1	0.0008tpd	45.10%
General Purpose Degreaser	20	0.47tpd	6.8% - 100%
Graffiti Remover	5	0.007tpd	10% - 44.6%
Lubricant	23	0.065tpd	4% - 82.5%
Multipurpose Remover	1	0.019tpd	100%
Penetrant	13	0.013tpd	35.8% - 82.5%
Sealants	7	0.25tpd	18% - 49.6%
Spot Remover	10	0.0044tpd	1.2% - 97%
Tire Sealant & Inflators	2	0.118tpd	49.3% - 73.2%
Totals	*123*	*1.29tpd*	

Methylene Chloride profile:

Category	# products	Emissions	Range
Adhesive Remover	6	0.137tpd	66.8% - 100%
Adhesives	12	0.009tpd	26.7% - 81%
Automotive Body Wash	1	0.00000066tpd	1% - 19.5%
Automotive Brake Cleaner	7	0.0008tpd	13.6% - 38.6%
Belt Dressing	1	0.000013tpd	81.80%
Brush Cleaner	4	0.011tpd	1% - 19.5%
Carb/Fuel-Injection Cleaner	6	0.043tpd	43% - 50.6%
Cold-process Roof Cement	2	0.00019tpd	31.8% - 38.7%
Electrical Cleaner	*4*	*0.0166tpd*	*15% - 57.9%*
General Purpose Degreaser	7	0.019tpd	14.4% - 70.9%
Graffiti Remover	5	0.015tpd	40% - 62.7%
Lubricants	14	0.006tpd	5% - 78.1%
Multipurpose Remover	1	0.00006tpd	66.90%
Other solvent & thinning product	1	0.000063tpd	18%
Oven Cleaner	1	0.00059tpd	74.30%
Penetrant	4	0.01tpd	26% - 80%
Sealants	9	0.0057tpd	9% - 75.7%
Totals	*85*	*0.27tpd*	

Trichloroethylene profile

Category	# products	Emissions	Range
Adhesive	1	0.00015tpd	15%
Automotive Brake Cleaner	3	0.0019tpd	45% - 100%
Belt Dressing	3	0.0002tpd	23.9% - 74.5%
Carb/Fuel-Injection Cleaner	1	0.0019tpd	41.80%
Clean Up Solvent	1	0.00004tpd	52.60%
Electrical Cleaner	*15*	*0.2tpd*	*94.9% - 100%*
Electronic Cleaner	*1*	*0.0004tpd*	*96%*
Energized Electrical Cleaner	*5*	*0.03tpd*	*90% - 97.5%*
Fabric Care Product	1	0.0016tpd	48.30%
General Purpose Degreaser	22	0.36tpd	9.8% - 100%
Graffiti Remover	2	0.003tpd	30.7% - 45%
Lubricants	21	0.023tpd	3.9% - 93.9%
Multipurpose Remover	1	0.0038tpd	100%
Packaged Solvent	1	0.0023tpd	100%
Penetrant	4	0.0059tpd	33.7% - 53.2%
Sealants	2	0.00002tpd	8% - 15%
Solvent & Thinning Products	1	0.00034tpd	100%
Spot Remover	7	0.0005tpd	2% - 29.1%
Totals	*92*	*0.635tpd*	

HCFC-225ca/cb profile

Category	# products	Emissions	Range
General Purpose Degreaser	1	0.000089tpd	51.10%

HFC-4310mee profile

Category	# products	Emissions	Range
Other Electronic-related cleaning products	*3*	*0.000092tpd*	*26% - 37.5%*

HFE-7100 profile

Category	# products	Emissions	Range
General Purpose Degreaser	1	0.0000016tpd	23.10%

HCFC-141b profile

2003 Survey: 13 products, 0.023tpd; 7% - 97%

Category	# products	Emissions	Range
Other Electronic related cleaning products	*7*	*0.022tpd*	*72.1% - 97%*
Multipurpose Lubricant	5	0.000155tpd	7% - 95%
Fabric Protectant	1	0.00079tpd	92.50%
Totals	*13*		

2001 Survey: 57 products, 0.29 tpd; 15.4% - 99.8%

Category	# products	Emissions	Range
Electronic Cleaner	*31*	*0.16tpd*	*42% - 99.8%*
Electrical Cleaner	*21*	*0.036tpd*	*15.4% - 97.2%*
Energized Electrical Cleaner	*5*	*0.096tpd*	*93% - 97%*
Totals	*57*	*0.29tpd*	

Appendix I

"Estimated Health Indices Using HCFC-141b Modeling Data," Office of Environmental Health Hazard Assessment, Memorandum to Air Resources Board, August 14, 2006.

Estimated Hazard Indices using HCFC-141b modeling data

Based on an annual emission rate of 950 kg of HCFC-141b, the maximum annual concentration near a high use facility was estimated to be up to 10 $\mu g/m^3$ and the maximum one-hour concentration was estimated to be approximately 2,800 $\mu g/m^3$.

Acute Reference Exposure Levels (RELs) for four chemicals (for which VOC exemption is being requested) were calculated with a health conservative methodology. The four are HFC 245fa, HFC 43-10mee, HCFC 225, and HFE-7200. The available acute studies on the compounds were mainly determining lethality (LC_{50}) rather than mild acute effects. Lethality is not an appropriate endpoint for developing an acute REL. Thus the acute REL was based on results from 2-week inhalation studies, which expose rats for 6 hours per day. Also the calculations for both acute and chronic RELs used OEHHA's draft approaches for protecting children. Table 1 below shows estimated acute and chronic hazard indices for each of the four chemicals based on the concentration modeled for HCFC-141b.

Table 1. Estimation of acute and chronic hazard indices

Chemical	1 hour Conc. $\mu g/m^3$	Acute REL $\mu g/m^3$	"Acute HI"	Annual Conc. $\mu g/m^3$	Chronic REL, $\mu g/m^3$	"Chronic HI"
HCFC-141b	2800	-		10	-	
HFC 245fa	(2800)	33,000	0.08	(10)	250	0.04
HFC 43-10mee	(2800)	6000	0.47	(10)	1500	0.007
HCFC 225	(2800)	1600	**1.75**	(10)	80	0.13
HFE-7200	(2800)	380,000	0.007	(10)	3000	0.003

The acute and chronic "hazard indices" for HCFC-225 are the highest. HCFC 225 showed adverse effects on the liver in both the 2 week and 13 week studies. The calculations of the acute and chronic RELs for HCFC-225 are in Tables 3 and 5, respectively. As noted above, derivation of these draft RELs used the NOAELs or LOAELs obtained from the available data, and uncertainty factors reflecting the nature of these data and the presence of data gaps, inter-individual variability, and mechanistic uncertainties. A feature of the revised methodology used in this derivations is the subdivision of inter-and intra-species uncertainty factors into toxicokinetic and toxicodynamic components. Except where information exists to support different values in specific cases (as noted in the individual derivation summaries), the default values shown in Table 2 were used:

Table 2. Explanations and Default Values of Uncertainty Factors

Uncertainty factor type	Explanation	Default value
LOAEL uncertainty factor	Used if the study did not find a NOAEL: for a mild effect for a severe effect	 3[a] 10
Interspecies uncertainty factor – toxicokinetic (TK)[b]	Difference between animal and human toxicokinetics: HEC methodology[c] used HEC methodology not used	 2 3
Interspecies uncertainty factor-toxicodynamic (*TD)*	Difference between animal and human toxicodynamics.	3
Intraspecies uncertainty factor-TK[b]	Variability in toxicokinetics in the human population, including infants.	10
Intraspecies uncertainty factor-TD	Variation in human toxicodynamics.	3
Developmental uncertainty factor	This data deficiency factor is used when no developmental toxicity data are available	3
Subchronic uncertainty factor	Used in deriving a chronic REL from a subchronic study	3

[a] Standard intermediate values of UFs are defined as $10^{0.5}$ or 3.16, but this is rounded 3 for presentation.

[b] In the absence of compound-specific information, the TK uncertainty factors have the default values shown, but may be reduced to a value of 1.0 (or some intermediate value if this is considered more appropriate) when compound- and species-specific toxicokinetic models are available.

[c] For a systemically acting gas or vapor the HEC adjustment ratio is 1.0. For other sites of impact, and for particles, a calculated adjustment factor is applied.

Toxicity of HCFC-225 isomer mixture and Interim Draft Reference Exposure Levels

The toxicity following repeated inhalation of an HCFC-225 isomer mixture was assessed in male Crl:CDBR rats (Frame *et al*., 1992). Three groups of 10 male rats were exposed to the test compound in air at design concentrations of 500, 5000, and 13,000 ppm. Rats were exposed 6 hr/day, 5 days/week for 2 weeks. A control group of 10 male rats was exposed to air only. Decreased serum cholesterol, triglycerides, and glucose, dose-related increased mean absolute and relative liver weights, and microscopic hepatocellular hypertrophy were present at all exposure concentrations. Hepatocellular hypertrophy correlated ultrastructurally to proliferation of peroxisomes. Clinical chemical parameters and organ weight and morphologic changes in the liver were reversible following 14 days of recovery.

Table 3. DRAFT Acute REL for HCFC-225 (MW = 202.9)

Study	Frame *et al*. 1992
Study population	male Crl:CDBR rats
Exposure method	Inhalation of 0, 500, 5000, 13000 ppm of HCFC-225ca/HCFC-225cb
Critical effects	Liver effects
LOAEL	500 ppm
NOAEL	not found
Exposure duration	6 hr/day, 5 d/wk for 2 wk
Extrapolation to 1 hour	$C^n * T = K$, where n = 2 (Ten Berge *et al*., 1986)
Extrapolated 1 hour concentration	1200 ($500^2 \times 6 = 1200^2 \times 1$)
Human equivalent concentration	1200 ppm (HEC ratio 1 for gas, systemic)
LOAEL uncertainty factor	10 (histological change: severe)
Interspecies uncertainty factor-TK	2 (HEC used)
Interspecies uncertainty factor-TD	3
Intraspecies uncertainty factor-TK	10
Intraspecies uncertainty factor-TD	3
Developmental uncertainty factor	3 (no developmental data)
Cumulative uncertainty factor	6000
Acute Reference Exposure Level	0.2 ppm (200 ppb, 1600 $\mu g/m^3$)

Groups of 10 male and 10 female Alpk:Ap_fSD (Wistar-derived) rats, 6-7 weeks old when received at the laboratory, were exposed to 0, 1000, 3000, or 10,000 ppm 6 h/d, 5 d/wk for 13 weeks. Additional groups were exposed to 0 or 10,000 ppm for 13 weeks, then allowed to recover for 4 weeks. Results of concern to OEHHA are shown in Table 4.

Table 4. Adverse effects of 90 day exposure to HCFC-225ca/HCFC225cb in rats

Sex/endpoint	0 ppm	1000 ppm	3000 ppm	10,000 ppm
M/liver wt (g)	19.2	26.9**	28.6**	30.6**
F/liver wt (g)	10.5	11.6	12.4**	14.6**
M/hepatitis (total)	3/10	9/10	10/10	10/10
F/hepatitis (total)	0/10	0/10	1/10	0/10
M/alkaline phosphatase	179	523*	635*	729**
F/alkaline phosphatase	100	133	148*	227*
M/alanine aminotransferase	74.7	276.3*	313.5**	233.9
F/alanine aminotransferase	63.8	57.9	71.1	73.4
M/aspartate aminotransferase	102.3	245.1**	264.8**	202.2
F/aspartate aminotransferase	102.0	90.7	108.1	95.1

* $p<0.05$; ** $p<0.01$

It is known that halothane, and HCFCs 123 and 124 produce a chemical hepatitis (Hoet *et al.*, 1997). Since there is no evidence to the contrary, and supported by this structural analogy, we assume that the hepatitis reported by Frame *et al*. (1992) is related to exposure to HCFC-225. Most changes were reversible following 28 days of recovery in the absence of the chemicals. However, chronic RELs assume a long-term exposure to a low level of the chemical. The chronic REL calculation is summarized in Table 5.

Table 5. DRAFT Derivation of a Chronic REL for HCFC-225

Study	Central Toxicology Laboratory, 1998
Study population	Male and female (10/sex/group)
Exposure method	Inhalation of 0, 1000, 3000, or 10,000 ppm
Critical effects	Liver damage; hepatitis (in males) (Table 4)
LOAEL	1000 ppm
NOAEL	Not determined
Exposure continuity	6 h/d, 5 d/wk (for 13 weeks)
Average experimental exposure	178 ppm (1000 ppm x 6/24 x 5/7)
Human equivalent concentration	178 ppm (HEC ratio = 1: gas, systemic)
Exposure duration	90 days
LOAEL uncertainty factor	10 (severe effect)
Subchronic uncertainty factor	3 (exposure duration was only 13 weeks)
Interspecies uncertainty factor TK	2 (HEC used)
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	3 (no developmental data available)
Cumulative uncertainty factor	20,000*
Chronic Reference Exposure Level	0.01 ppm (10 ppb, 80 $\mu g/m^3$)

* Earlier a value of 3000 was considered to be the maximum cumulative uncertainty factor. This is being reconsidered because several uncertainty factors are being increased in order to protect infants and children. The very large uncertainty factor reflects the lack of data on the toxicity of HCFC-225.

Toxicity of HCFC-245a and Interim Draft Reference Exposure Levels

The key study (Rusch *et al*., 1999) used 14 consecutive snout-only exposures at 0, 5000, 15,000 and 50,000 ppm. There were no treatment-related effects on body weight, survival, or histologic parameters. BUN (blood urea nitrogen) and GOT (glutamic oxalacetate transaminase, a liver enzyme) levels were elevated compared to controls at all three exposure levels. Cholesterol levels were lowered. The calculation of the acute and chronic RELs for HCFC-245fa are in Tables 6 and 7, respectively.

Table 6. DRAFT Derivation of Acute REL for HFC 245fa (MW = 134)

Study	Rusch *et al*., 1999
Study population	SD rats
Exposure method	Inhalation of 0, 5000, 15000, 50000 ppm
Critical effects	Liver (BUN and GOT)
LOAEL	5000 ppm
NOAEL	not found
Exposure duration	6 hours/d for 2 weeks
Extrapolation to 1 hour	$C^n * T = K$, where n = 2 (Ten Berge *et al*., 1986)
Extrapolated 1 hour concentration	12,000 ppm (5000^2 x 6 = $12,000^2$ x 1)
Human equivalent concentration	12,000 ppm (HEC ratio = 1: gas, systemic)
LOAEL uncertainty factor	10 (severe effect – liver injury)
Interspecies uncertainty factor TK	2
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	2000
Acute Reference Exposure Level	6 ppm (6000 ppb, 33,000 $\mu g/m^3$)

Rusch *et al*. (1999) also carried out whole-body exposures at 0, 500, 2000, 10,000 or 50,000 ppm HCFC-245fa 5 days per week for 13 weeks. There were no treatment-related effects on survival, clinical observations, body weight gain, or food consumption. Urine volumes were increased, urinary fluoride levels were elevated, and increases were seen in red blood cell counts, and related parameters and increases were seen in AP, GOT, GPT and CPK activities in the 10,000 and 50,000 ppm exposure level groups. Histopathologic examination did not show any effects on the kidney, liver, or lungs. There was an increased incidence of myocarditis in all animals exposed at 50,000 ppm and the majority exposed at 10,000 ppm. There were increased white blood cells (WBC) in males, decreased urinary protein concentration and increased urinary volume in females at 500 ppm.

Table 7. DRAFT Inhalation chronic REL calculation for HFC 245fa

Study	Rusch *et al*., 1999
Study population	10 male and 10 female SD rats per conc.
Exposure method	Inhalation of 0, 500, 2000, 10,000 or 50,000 ppm
Critical effects	Increased WBC in males, decreased urinary protein concentration and increased urinary volume in females
LOAEL	500 ppm
NOAEL	None
Exposure continuity	6 h/d, 5 d/wk for 13 weeks
Average experimental exposure	89.3 ppm (500 ppm x 6/24 x 5/7)
Human equivalent concentration	89.3 ppm (HEC ratio = 1: gas, systemic)
Exposure duration	90 days
LOAEL uncertainty factor	3 (mild effect)
Subchronic uncertainty factor	3 (study duration was 13 weeks)
Interspecies uncertainty factor TK	2 (HEC calc used)
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	2000
Chronic Reference Exposure Level	0.045 ppm (250 μg/m^3)

Toxicity of HCFC-43-10mee and Interim Draft Reference Exposure Levels

A two-week inhalation toxicity study with HFC-43-10mee in male rats used 10 rats/group at 0, 500, 1000, and 4000 ppm (Warheit, 1992). Significantly lower mean body weights in the 500 ppm and 4000 ppm groups were measured in the initial part of the exposure. Functional Observational Battery (FOB) observations were generally normal. However, three of 10 rats exposed to 500 ppm had exaggerated reactions to an auditory stimulus after the eighth exposure and three of 10 rats from the 4000 ppm group showed either no or an exaggerated reaction to an approach and touch stimulus after the eighth exposures. The FOB results did not appear to be dose-dependent. Clinical pathology results showed decreased mean total white blood cell counts due to decreases in neutrophils, lymphocytes, and monocytes. The calculation of the acute REL for HCFC-43-10mee is in Table 8.

Table 8. DRAFT Derivation of Acute REL for HFC 43-10mee (MW = 252.1)

Study	Warheit (DuPont), 1992
Study population	male rats (10/group)
Exposure method	Inhalation of 0, 500, 1000, 4000 ppm
Critical effects	CNS, blood
LOAEL	500 ppm
NOAEL	not found
Exposure duration	6 hours/d, 10 days
Extrapolation to 1 hour	$C^n * T = K$, where n = 2 (Ten Berge *et al*., 1986)
Extrapolated 1 hour concentration	1200 ppm (500^2 x 6 = 1200^2 x 1)
Human equivalent concentration	1200 ppm (HEC ratio = 1: gas, systemic)
LOAEL uncertainty factor	10 (severe effect)
Interspecies uncertainty factor TK	2 (HEC used)
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	2000
Acute Reference Exposure Level	0.6 ppm (600 ppb, 6000 $\mu g/m^3$)

Male and female rats were exposed 6 hours per day, five days per week to 0, 500, 2000, or 3500 ppm HFC 43-10mee for 90 days. During the 6-hour exposure period rats exposed to 2000 or 3500 ppm HFC 43-10mee showed clinical signs of central nervous system (CNS) effects including jerking/jumping, pawing the air, flinching, abnormal gait, convulsions, tremors, excessive grooming, and elevated activity level.

Table 9. DRAFT inhalation chronic REL calculation for HFC 43-10mee

Study	Malley (DuPont), 1994
Study population	Male and female Crl:CD®BR rats (20/group)
Exposure method	Inhalation of 0, 500, 2000, or 3500 ppm
Critical effects	CNS (tremors, etc.)
LOAEL	2000 ppm
NOAEL	500 ppm
Exposure continuity	6 h/d, 5 d/wk
Average experimental exposure	89.3 ppm (500 ppm x 6/24 x 5/7)
Human equivalent concentration	89.3 ppm (HEC ratio = 1: gas, systemic)
Exposure duration	90 days
LOAEL uncertainty factor	1
Subchronic uncertainty factor	3 (Subchronic – 13 weeks)
Interspecies uncertainty factor TK	2 (HEC calculation used)
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	600
Chronic Reference Exposure Level	0.15 ppm (1500 $\mu g/m^3$)

Toxicity of HFE-7200 and Interim Draft Reference Exposure Levels

Male and female Sprague-Dawley rats (5/sex/exposure group; 180 – 191 g body weight) were exposed to target concentrations of 0, 1000, 3000, 9000 or 25,000 ppm (10.8, 32.4, 97.2 and 270 g/m^3, respectively) HFE-7200 for 6 hours/day, 5 days/week for four weeks. Both the acute and chronic RELs were estimated for HFE-7200 based on changes in blood (increases in blood alkaline phosphatase, decreases in blood cholesterol), and liver (increased liver/body weight ratios) in rats in the four week study. The calculation of the acute and chronic RELs for HFE-7200 are in Tables 10 and 11, respectively.

Table 10 DRAFT Derivation of Acute REL for HFE-7200 (MW = 250.05)

Study	Huntingdon Life Sciences Ltd., 1997a
Study population	male and female SD rats
Exposure method	Inhalation
Critical effects	liver and kidney
LOAEL	9000 ppm
NOAEL	3000 ppm
Exposure duration	6 hours/day, 5d/wk for 4 weeks
Extrapolation to 1 hour	$C^n * T = K$, where n = 2 (Ten Berge *et al*., 1986)
Extrapolated 1 hour concentration	7348 ppm (3000^2 x 6 = 7348^2 x 1)
Human equivalent concentration	89.3 ppm (HEC ratio = 1: gas, systemic)
LOAEL uncertainty factor	1
Interspecies uncertainty factor TK	2 (HEC used)
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	200
Acute Reference Exposure Level	37 ppm (37,000 ppb, 380,000 $\mu g/m^3$)

Table 11. DRAFT inhalation chronic REL estimate for HFE-7200

Study	Huntingdon Life Sciences, 1997a
Study population	Male and female Sprague-Dawley rats
Exposure method	Inhalation of 0, 1000, 3000, 9000, or 25,000 ppm
Critical effects	Blood and liver changes
LOAEL	9000 ppm
NOAEL	3000 ppm
Exposure continuity	6 hours/day, 5 days/week
Exposure duration	4 weeks
Average experimental exposure	536 ppm
Human equivalent concentration	536 ppm (HEC ratio = 1: gas, systemic)
LOAEL uncertainty factor	1
Subchronic uncertainty factor	10 (study was only 4 weeks)
Interspecies uncertainty factor TK	2
Interspecies uncertainty factor TD	3
Intraspecies uncertainty factor TK	10
Intraspecies uncertainty factor TD	3
Developmental uncertainty factor	1
Cumulative uncertainty factor	2000
Chronic Reference Exposure Level	0.27 ppm (270 ppb, 3000 $\mu g/m^3$)

References

Central Toxicology Laboratory. 1998. HCFC-225ca/HCFC-225cb mixture: 90 day inhalation toxicity study in the rat with recovery phase. Report No: CTL/P/5728. Cheshire, United Kingdom.

Frame SR, Carakostas MC, Warheit DB. 1992. Inhalation toxicity of an isomeric mixture of hydrochlorofluorocarbon (HCFC) 225 in male rats. Fundam Appl Toxicol. 18(4):590-5.

Hoet P, Graf MLM, Bourdi M, Pohl LR, Duray PH, Chen W, Peter RM, Nelson SD, Verlinden N, Lison D. 1997. Epidemic of liver disease caused by hydrochlorofluorocarbons used as ozone-sparing substitutes for chlorofluorcarbons. Lancet 350: 556-559.

Huntingdon Life Sciences Ltd. 1997a. T-6333 28-Day Repeat Dose Inhalation Toxicity Study in Rats. For: 3M Toxicology Services, St. Paul, MN.

Malley LA. 1994. Subchronic inhalation toxicity: 90-Day study with H-20255. Inhalation study in rats. DuPont HLR 24-94.

Rusch GM, Coombs D, Hardy C. 1999. The acute, genetic, developmental, and inhalation toxicology of 1,1,1,3,3-pentafluoropropane (HFC 245fa). Toxicol Sci. 52(2):289-301.

ten Berge WF, Zwart A, Appelman LM. 1986. Concentration-time mortality response relationship of irritant and systemically acting vapours and gases. J Hazard Mater 13:301-309.

Warheit DB. 1992. Two-week inhalation toxicity study with HFC-43-10mee in male rats. Haskell Laboratory report No. 819-91.(DuPont).

Appendix J

"Estimated Health Indices for HFC-365mfc," Office of Environmental Health Hazard Assessment, Memorandum to Air Resources Board, February 26, 2006.

HFC 365mfc (CAS# 406-58-6) (Solkane® 365mfc)

ARB asked OEHHA to review the toxicity of HFC-365mfc (1,1,1,3,3-pentaflurobutane) (CF_3-CH_2-CF_2-CH_3). No peer-reviewed or any other article on the chemical was cited on the National Library of Medicine PubMed database and there was no entry in the Hazardous Substances Data Base (HSDB). A Google search found that the chemical is cited >20,000 times on the Internet. At the fluorocarbons and sulfur hexafluoride website (www.fluorocarbons.org/en/families/hfcs/toxicological_profile_hfc_365mfc.html), the following "Toxicological profile" was found:

HFC-365mfc (1,1,1,3,3-pentafluorobutane)

Acute toxicity	
Oral route, LD 50, rat Inhalation, LC 50, 4 h, rat	> 2,000 mg/kg > 10 %
Irritation	Rabbit, non irritant (eyes) Rabbit, slightly irritant (eyes)
Sensitization	Guinea Pig, non sensitizing (skin)
Chronic toxicity Inhalation, after repeated exposure, rat	Target organ: skeleton, 50,000 ppm, observed effect
No mutagenic effect Inhalation, after a single exposure, dog	>= 7.5 %, cardiac sensitization following adrenergic stimulation
Comments	According to these toxicological results HFC 365mfc can be considered not hazardous in normal conditions of handling and use

Source: Safety Data Sheet of Solvay

According to these data the chemical is practically non-toxic acutely. The chronic toxicity at 50,000 ppm is probably due to fluoride (see below). According to the Solvay Chemicals web site, the chemical has zero ozone depletion potential. Also, "Long term evaluation of Solkane® 365mfc has been finished and showed no toxicity concern, even less effect than HCFC 141b. Based on these encouraging results, the registration of the product has been done in Europe. Solkane® 365mfc is registered in ELINCS under the number 430-250-1."

ARB sent OEHHA a package of materials on the chemical. The package included a cover letter from the manufacturer's representative Doug Raymond, the 28-day repeat dose inhalation toxicity study in rats, a group of six articles related to environmental impacts, and other reports addressing global warming, USEPA exemption as a VOC, other toxicity studies, and use data. The animal toxicity and ecotoxicity studies include:

1. 28-day Repeat Dose Inhalation Toxicity Study in Rats. Huntingdon Life Sciences, 1998. (*increased incidence of ameloblastic dysplasia in the incisors in both sexes at the high dose*)
2. 1,1,1,3,3-Pentafluorobutane: Assessment of Mutagenic Potential in Histidine Auxotrophs of *Salmonella typhimurium* (the Ames test). Pharmaco LSR, 1994. (*devoid of mutagenic activity in the vapor phase up to 7.5%*)
3. Mouse Micronucleus Test. Huntingdon, 1999. (*inactive at 20,000 and 50,000 ppm for 6 hr*)
4. An Inhalation Study to Investigate the Cardiac Sensitisation Potential in the Beagle Dog. Huntingdon, 1998. (*NOAEL = 4.68% v/v; LOAEL = 7.51% v/v*)
5. Study of the Acute Oral Toxicity of 1,1,1,3,3-Pentafluorobutane in Rats. Solvay, 1993. (*The acute LD_{50} was greater than 2000 mg/kg body weight; i.e., practically non-toxic*.)
6.: 14-day Orientating Study in Male Sprague-Dawley Rats. Solvay, 1998. (*The study used 50,000 ppm 1,1,1,3,3-Pentafluorobutane*.)
7. 1,1,1,3,3-Pentafluorobutane (HFC 365MFC) Skin Irritation in the Rabbit. Huntingdon, 1998. (*no dermal irritation following 0.5 ml occlusive application for 4 hours*)
8. 1,1,1,3,3-Pentafluorobutane (HFC 365MFC) Eye Irritation to the Rabbit. Huntingdon, 1998. (*A single 0.1 ml instillation elicited transient, very slight conjunctival irritation.*)
9. HFC 365MFC Skin Sensitization to the Guinea-Pig (Magnusson & Kligman Method). Huntingdon, 1998. (*no evidence of skin sensitization in any of 10 animals*)
10. 1,1,1,3,3-Pentafluorobutane: Acute Inhalation Study in Male and Female Sprague Dawley rats. Solvay, 1997. (The *4-hour LC_{50} is greater than 100,000 ppm.*)
11. The Acute Toxicity of Pentafluorobutane to Zebra Fish (*Brachydenio rerio*). Solvay, 1998. (*No Observed Effect Concentration (NOEC) = 150 mg/liter for 96 hours*)
12. The Acute Toxicity of Pentafluorobutane to *Daphnia magna.* Solvay, 1998. (*NOEC > 100 mg/liter*)
13. The Determination of the Toxicity of Pentafluorobutane to Algae (*Selenastrum capricornutum*). Solvay, 1998. (*NOEC = 13.2 mg/liter*)
14. Determination of the Ready Biodegradability of Pentafluorobutane (HFA 365mfc) in the Closed Bottle Test. Solvay, 1999. (*degraded 14% within 28 days*)
15. Statement of the Hydrolysis of Pentafluorobutane (HFA 365mfc). Solvay, 1999.
16. Adsorption/Desorption of Pentafluorobutane (HFA 365mfc) in Three Types of Soil. Solvay, 1999.

In the 28 day toxicity study sponsored by Huntingdon Life Sciences, groups of 5 male and 5 female Sprague-Dawley rats were exposed snout-only to 0, 10,000, 25,000, or 50,000 ppm HFC 365mfc for six hours/day, five days a week (Monday-Friday) for 4 weeks. On the Monday following the last exposure, the animals were necropsied and a variety of biochemical tests and histological examinations and other observations were performed. All animals survived the exposures. The only remarkable toxicologic effect was an increased incidence of ameloblastic dysplasia (abnormal development of enamel tissue) in the incisor teeth in both sexes in the high dose group. Body weight gain was also reduced in the high dose group.

Calculation of a chronic Reference Exposure Level for 1,1,1,3,3-pentaflurobutane

Study	Huntingdon Life Sciences, 1998
Study population	Male and female Sprague-Dawley rats (5/sex/exposure level)
Exposure method	Inhalation of 0, 10,000, 25,000, or 50,000 ppm (snout only)
Critical effects	Ameloblastic dysplasia in the incisor teeth
LOAEL	50,000 ppm
NOAEL	25,000 ppm
Exposure continuity	6 h/d, 5 d/wk
Average experimental exposure	4464 ppm (25,000 x 6/24 x 5/7)
Human equivalent concentration	4464 ppm
Exposure duration	28 days
LOAEL uncertainty factor UF_L	1
Subchronic uncertainty factor UF_S	10
Interspecies uncertainty factor	10
Intraspecies uncertainty factor	10
Cumulative uncertainty factor	1000
Inhalation chronic reference exposure level	4.5 ppm (4500 ppb)

The NOAEL of 25,000 ppm is equivalent to a continuous exposure of 4464 ppm. Since the study was only one month, a maximal UF_S of 10 was used. The interspecies and intraspecies Uncertainty Factors were the default factors. The limitations of the study for deriving a chronic REL include its short duration and the small numbers of animals used. Its strength is that adverse effects occurred mainly at the highest dose and were not severe.

Calculation of an acute Reference Exposure Level for 1,1,1,3,3-pentaflurobutane

Study	Huntingdon Life Sciences, 1998
Study population	Male and female Sprague-Dawley rats (5/sex/exposure level)
Exposure method	Inhalation of 0, 10,000, 25,000, or 50,000 ppm (snout only)
Critical effects	Ameloblastic dysplasia in the incisor teeth
LOAEL	50,000 ppm
NOAEL	25,000 ppm
Exposure continuity	6 h/d, 5 d/wk for 28 days
Average daily exposure	25,000 ppm for 6 h
Equivalent 1 h concentration	61,000 ppm ($25{,}000^2 \times 6 = C^2 \times 1$)
LOAEL uncertainty factor UF_L	1
Interspecies uncertainty factor	10
Intraspecies uncertainty factor	10
Cumulative uncertainty factor	100
Inhalation acute reference exposure level	61 ppm

Because there the only acute toxicity study was for lethality, there was not an appropriate study for determining an acute REL. Thus a very health conservative value of 61 ppm was estimated using the 28 day study.

The limitations of the database make the acute and chronic REL very uncertain. The only acute inhalation study was to determine lethality. There is no subchronic 90-day study and no chronic or lifetime study. There are no data on reproductive or developmental toxicity which are needed to see if infants and children are exceptionally susceptible. There is a great deal of uncertainty in extrapolating the effects of a 28 day study of 40 rats to the risks from chronic exposure to some fraction of 36,000,000 Californians.