6560-50-P

**ENVIRONMENTAL PROTECTION AGENCY**

**40 CFR Part 51**

**[EPA-HQ-OAR-2017-0175; FRL-9977-28-OAR]**

**RIN 2060-AT52**

# Air Quality: Revision to the Regulatory Definition of Volatile Organic Compounds – Exclusion of *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z)

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Proposed rule.

**SUMMARY:** The Environmental Protection Agency (EPA) is proposing to revise the regulatory definition of volatile organic compounds (VOC) under the Clean Air Act (CAA). This action proposes to add *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (also known as HFO-1336mzz-Z; CAS number 692-49-9) to the list of compounds excluded from the regulatory definition of VOC on the basis that this compound makes a negligible contribution to tropospheric ozone ($O_3$) formation.

**DATES:** Written comments must be received on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

**ADDRESSES:** Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2017-0175, at *http://www.regulations.gov*. Follow the online instructions for submitting comments. Once submitted, comments cannot be edited or removed from *Regulations.gov*. The EPA may publish any comment received to its public docket. Do not submit electronically any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment.

The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (i.e., on the Web, Cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit *http://www2.epa.gov/dockets/commenting-epa-dockets*.

**FOR FURTHER INFORMATION CONTACT:** Souad Benromdhane, Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Mail Code C539-07, Environmental Protection Agency, Research Triangle Park, NC 27711; telephone: (919) 541-4359; fax number: (919) 541-5315; email address: *benromdhane.souad@epa.gov*.

**SUPPLEMENTARY INFORMATION:**

*Docket.* The EPA has established a docket for this rulemaking under Docket ID No. EPA-HQ-OAR-2017-0175. All documents in the docket are listed in the *Regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *Regulations.gov* or in hard copy at the EPA Docket Center, Room 3334, EPA WJC West Building, 1301 Constitution Avenue, NW, Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The

telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the EPA Docket Center is (202) 566-1742.

*Instructions.* Direct your comments to Docket ID No. EPA-HQ-OAR-2017-0175. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be CBI or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or email. The *http://www.regulations.gov* Web site is an "anonymous access" system, which means the EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an email comment directly to the EPA without going through *http://www.regulations.gov,* your email address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, the EPA may not be able to consider your comment. Electronic files should not include special characters or any form of encryption and be free of any defects or viruses. For additional information about the EPA's public docket, visit the EPA Docket Center homepage at *http://www.epa.gov/dockets.*

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## I. General Information

*A. Does this action apply to me?*

Entities potentially affected by this proposed rule include, but are not necessarily limited to, the following: state and local air pollution control agencies that adopt and implement regulations to control air emissions of VOC; and industries manufacturing

and/or using HFO-1336mzz-Z for use in polyurethane rigid insulating foams, and refrigeration and air conditioning. Potential entities that may be affected by this action include:

**Table 1—Potentially Affected Entities by North American Industrial Classification System (NAICS) Code**

| Category | NAICS code | Description of regulated entities |
|---|---|---|
| Industry | 326140 | Polystyrene Foam Product Manufacturing |
| Industry | 326150 | Urethane and Other Foam Product (except Polystyrene) Manufacturing |
| Industry | 333415 | Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing |
| Industry | 3363 | Motor Vehicle Parts Manufacturing |
| Industry | 336611 | Ship Building and Repairing |
| Industry | 336612 | Boat Building |
| Industry | 339999 | All other Miscellaneous Manufacturing |

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities that might be affected by this deregulatory action. This table lists the types of entities that the EPA is now aware of that could potentially be affected to some extent by this action. Other types of entities not listed in the table could also be affected to some extent. To determine whether your entity is directly or indirectly affected by this action, you should consult your state or local air pollution control and/or air quality management agencies.

*B. What should I consider as I prepare my comments for the EPA?*

*Submitting CBI.* Do not submit information containing CBI to the EPA through *http://www.regulations.gov* or email. Clearly mark the part or all of the information that you claim to be CBI. For CBI information on a disk or CD-ROM that you mail to the EPA, mark the outside of the disk or CD-ROM as CBI and then identify electronically within the disk or CD-ROM the specific information that is claimed as CBI. In addition

to one complete version of the comments that includes information claimed as CBI, you must submit a copy of the comments that does not contain the information claimed as CBI for inclusion in the public docket. If you submit a CD-ROM or disk that does not contain CBI, mark the outside of the disk or CD-ROM clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket and the EPA's electronic public docket without prior notice. Information marked as CBI will not be disclosed except in accordance with procedures set forth in 40 Code of Federal Regulations (CFR) part 2. Send or deliver information identified as CBI only to the following address: OAQPS Document Control Officer (C404-02), OAQPS, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention Docket ID No. EPA-HQ-OAR-2017-0175.

## II. Background

### *A. The EPA's VOC Exemption Policy*

Tropospheric $O_3$, commonly known as smog, is formed when VOC and nitrogen oxides (NOx) react in the atmosphere in the presence of sunlight. Because of the harmful health effects of $O_3$, the EPA and state governments limit the amount of VOC that can be released into the atmosphere. Volatile organic compounds form $O_3$ through atmospheric photochemical reactions, and different VOC have different levels of reactivity. That is, different VOC do not react to form $O_3$ at the same speed or do not form $O_3$ to the same extent. Some VOC react slowly or form less $O_3$; therefore, changes in their emissions have limited effects on local or regional $O_3$ pollution episodes. It has been the EPA's policy since 1971 that certain organic compounds with a negligible level of reactivity should be excluded from the regulatory definition of VOC in order to focus VOC control

efforts on compounds that significantly affect $O_3$ concentrations. The EPA also believes that exempting such compounds creates an incentive for industry to use negligibly reactive compounds in place of more highly reactive compounds that are regulated as VOC. The EPA lists compounds that it has determined to be negligibly reactive in its regulations as being excluded from the regulatory definition of VOC (40 CFR 51.100(s)).

The CAA requires the regulation of VOC for various purposes. Section 302(s) of the CAA specifies that the EPA has the authority to define the meaning of "VOC" and, hence, what compounds shall be treated as VOC for regulatory purposes. The policy of excluding negligibly reactive compounds from the regulatory definition of VOC was first laid out in the "Recommended Policy on Control of Volatile Organic Compounds" (42 FR 35314, July 8, 1977) (from here forward referred to as the 1977 Recommended Policy) and was supplemented subsequently with the "Interim Guidance on Control of Volatile Organic Compounds in Ozone State Implementation Plans" (70 FR 54046, September 13, 2005) (from here forward referred to as the 2005 Interim Guidance). The EPA uses the reactivity of ethane as the threshold for determining whether a compound has negligible reactivity. Compounds that are less reactive than, or equally reactive to, ethane under certain assumed conditions may be deemed negligibly reactive and, therefore, suitable for exemption from the regulatory definition of VOC. Compounds that are more reactive than ethane continue to be considered VOC for regulatory purposes and, therefore, are subject to control requirements. The selection of ethane as the threshold compound was based on a series of smog chamber experiments that underlay the 1977 Recommended Policy.

The EPA has used three different metrics to compare the reactivity of a specific compound to that of ethane: (i) the rate constant for reaction with the hydroxyl radical (OH) (known as $k_{OH}$); (ii) the maximum incremental reactivity (MIR) on a reactivity per unit mass basis; and (iii) the MIR expressed on a reactivity per mole basis. Differences between these three metrics are discussed below.

The $k_{OH}$ is the rate constant of the reaction of the compound with the OH radical in the air. This reaction is often, but not always, the first and rate-limiting step in a series of chemical reactions by which a compound breaks down in the air and contributes to $O_3$ formation. If this step is slow, the compound will likely not form $O_3$ at a very fast rate. The $k_{OH}$ values have long been used by the EPA as metrics of photochemical reactivity and $O_3$-forming activity, and they were the basis for most of the EPA's early exemptions of negligibly reactive compounds from the regulatory definition of VOC. The $k_{OH}$ metric is inherently a molar-based comparison, *i.e.*, it measures the rate at which molecules react.

The MIR, both by mole and by mass, is a more updated metric of photochemical reactivity derived from a computer-based photochemical model, and it has been used as a metric of reactivity since 1995. This metric considers the complete $O_3$-forming activity of a compound over multiple hours and through multiple reaction pathways, not merely the first reaction step with OH. Further explanation of the MIR metric can be found in Carter (1994).

The EPA has considered the choice between MIRs with a molar or mass basis for the comparison to ethane in past rulemakings and guidance. In the 2005 Interim Guidance, the EPA stated:

> [A] comparison to ethane on a mass basis strikes the right balance between a threshold that is low enough to capture compounds that significantly affect ozone concentrations and a threshold that is high enough to exempt some compounds that may usefully substitute for more highly reactive compounds.
>
> When reviewing compounds that have been suggested for VOC-exempt status, EPA will continue to compare them to ethane using $k_{OH}$ expressed on a molar basis and MIR values expressed on a mass basis.

The 2005 Interim Guidance notes that the EPA will consider a compound to be negligibly reactive if it is equal to or less reactive than ethane based on either $k_{OH}$ expressed on a molar basis *or* MIR values expressed on a mass basis.

The molar comparison of MIR is more consistent with the original smog chamber experiments, which compared equal molar concentrations of individual VOCs, supporting the selection of ethane as the threshold, while the mass-based comparison of MIR is consistent with how MIR values and other reactivity metrics are applied in reactivity-based emission limits. It is, however, important to note that the mass-based comparison is slightly less restrictive than the molar-based comparison in that a few more compounds would qualify as negligibly reactive.

Given the two goals of the exemption policy articulated in the 2005 Interim Guidance, the Agency believes that ethane continues to be an appropriate threshold for defining negligible reactivity. And, to encourage the use of environmentally beneficial substitutions, the EPA believes that a comparison to ethane on a mass basis strikes the right balance between a threshold that is low enough to capture compounds that significantly affect ozone concentrations and a threshold that is high enough to exempt some compounds that may usefully substitute for more highly reactive compounds.

The 2005 Interim Guidance also noted that concerns have sometimes been raised about the potential impact of a VOC exemption on environmental endpoints other than

$O_3$ concentrations, including fine particle formation, air toxics exposures, stratospheric $O_3$ depletion, and climate change. The EPA has recognized, however, that there are existing regulatory or non-regulatory programs that are specifically designed to address these issues, and the EPA continues to believe in general that the impacts of VOC exemptions on environmental endpoints other than $O_3$ formation can be adequately addressed by these programs. The VOC exemption policy is intended to facilitate attainment of the $O_3$ National Ambient Air Quality Standards (NAAQS) and VOC exemption decisions will continue to be based primarily on consideration of a compound's contribution to $O_3$ formation. However, if the EPA determines that a particular VOC exemption is likely to result in a significant increase in the use of a compound and that the increased use would pose a significant risk to human health or the environment that would not be addressed adequately by existing programs or policies, then the EPA may exercise its judgment accordingly in deciding whether to grant an exemption.

*B. Petition to List HFO-1336mzz-Z as an Exempt Compound*

DuPont Chemicals & Fluoroproducts (DuPont) submitted a petition to the EPA on February 14, 2014, requesting that *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z; CAS number 692-49-9) be exempted from the regulatory definition of VOC. The petition was based on the argument that HFO-1336mzz-Z has low reactivity relative to ethane. The petitioner indicated that HFO-1336mzz-Z may be used in a variety of applications as a replacement for foam expansion or blowing agents with higher global warming potential (GWP) (>700 GWP) for use in polyurethane rigid insulating foams, among others. It is also a new developmental refrigerant as a potential working fluid for

Organic Rankine Cycles (ORC).[1]

To support its petition, DuPont referenced several documents, including one peer-reviewed journal article on HFO-1336mzz-Z reaction rates (Baasandorj, M. *et al*., 2011). DuPont also provided a supplemental technical report on the MIR of HFO-1336mzz-Z (Carter, 2011a). Per this report, the MIR of HFO-1336mzz-Z is 0.04 gram (g) $O_3$/g HFO-1336mzz-Z on the mass-based MIR scale. This reactivity rate is 86 percent lower than that of ethane (0.28 g $O_3$/g ethane). The reactivity rate $k_{OH}$ for the gas-phase reaction of OH radicals with HFO-1336mzz-Z ($k_{OH}$) has been measured to be 4.91 x $10^{-13}$ centimeter $(cm)^3$/molecule-seconds at ~296 degrees Kelvin (K) (Pitts *et al.*, 1983, Baasandorj *et al.*, 2011). This $k_{OH}$ rate is twice as high as that of ethane ($k_{OH}$ of ethane = 2.4 x $10^{-13}$ $cm^3$/molecule-sec at ~298 K) and, therefore, suggests that HFO-1336mzz-Z is twice as reactive as ethane. In most cases, chemicals with high $k_{OH}$ values also have high MIR values, but for HFO-1336mzz-Z, the products that are formed are expected to be mostly smaller perfluorinated compounds, which are not reactive in the atmosphere and do not form ozone (Baasandorj *et al.*, 2011). Based on the current scientific understanding of tetrafluoroalkene reactions in the atmosphere, it is unlikely that the actual $O_3$ impact on a mass basis would equal or exceed that of ethane in the scenarios used to calculate VOC reactivity (Baasandorj *et al.*, 2011; Carter, 2011a).

To address the potential for stratospheric $O_3$ impacts, the petitioner contended that, because the atmospheric lifetime of HFO-1336mzz-Z due to loss by OH reaction

[1] Konstantinos Kontomaris, 2014, HFO-1336mzz-Z High Temperature Chemical Stability and Use as a Working Fluid in Organic Rankine Cycles. International Refrigeration and Air Conditioning Conference. Perdue University: *https://www.chemours.com/Refrigerants/en_US/products/Opteon/Stationary_Refrigeration/assets/downloads/2014_Purdue-Paper-Opteon-MZ.pdf.*

was estimated to be ~20 days and it does not contain chlorine or bromine, it is not expected to contribute to the depletion of the stratospheric $O_3$ layer.

## III. The EPA's Assessment of the Petition

The EPA is responding to the petition by proposing to exempt HFO-1336mzz-Z from the regulatory definition of VOC. This action is based on consideration of the compound's low contribution to tropospheric $O_3$ and the low likelihood of risk to human health or the environment, including stratospheric $O_3$ depletion, toxicity, and climate change. Additional information on these topics is provided in the following sections.

### *A. Contribution to Tropospheric Ozone Formation*

As noted in studies cited by the petitioner, HFO-1336mzz-Z has a MIR value of 0.04 g $O_3$/g VOC for "averaged conditions," versus 0.28 g $O_3$/g VOC for ethane (Carter, 2011). Therefore, the EPA considers HFO-1336mzz-Z to be negligibly reactive and eligible for VOC-exempt status in accordance with the Agency's long-standing policy that compounds should so qualify where either reactivity metric ($k_{OH}$ expressed on a molar basis or MIR expressed on a mass basis) indicates that the compound is less reactive than ethane. While the overall atmospheric reactivity of HFO-1336mzz-Z was not studied in an experimental smog chamber, the chemical mechanism derived from other chamber studies (Carter, 2011) was used to model the complete formation of $O_3$ for an entire single day under realistic atmospheric conditions (Carter, 2011a). Therefore, the EPA believes that the MIR value calculated in the Carter study submitted by the petitioner is reliable.

Table 2 presents three reactivity metrics for HFO-1336mzz-Z as they compare to ethane.

| Table 2—Reactivities of Ethane and HFO-1336mzz-Z | | | |
|---|---|---|---|
| **Compound** | **$k_{OH}$ ($cm^3$/molecule-sec)** | **Maximum incremental reactivity (MIR) (g $O_3$/mole VOC)** | **Maximum incremental reactivity (MIR) (g $O_3$/g VOC)** |
| Ethane | $2.4 \times 10^{-13}$ | 8.4 | 0.28 |
| HFO-1336mzz-Z | $4.91 \times 10^{-13}$ | 6.6 | 0.04 |

Notes:

1. $k_{OH}$ value at 298 K for ethane is from Atkinson *et al*., 2006 (page 3626).
2. $k_{OH}$ value at 296 K for HFO-1336mzz-Z is from Baasandorj, 2011.
3. Mass-based MIR value (g $O_3$/g VOC**)** of ethane is from Carter, 2011.
4. Mass-based MIR value (g $O_3$/g VOC**)** of HFO-1336mzz-Z is from a supplemental report by Carter, 2011a.
5. Molar-based MIR (g $O_3$/mole VOC) values were calculated from the mass-based MIR (g $O_3$/g VOC) values using the number of moles per gram of the relevant organic compound.

The reaction rate of HFO-1336mzz-Z with the OH radical ($k_{OH}$) has been measured to be $4.91 \times 10^{-13}$ $cm^3$/molecule-sec (Baasandorj *et al.*, 2011); other reactions with $O_3$ and the nitrate radical were negligibly small. The corresponding reaction rate of ethane with OH is $2.4 \times 10^{-13}$ $cm^3$/molecule-sec (Atkinson *et al.*, 2006). The data in Table 2 show that HFO-1336mzz-Z has a slightly higher $k_{OH}$ value than ethane, meaning that it initially reacts faster in the atmosphere than ethane. However, a molecule of HFO-1336mzz-Z is less reactive than a molecule of ethane in terms of complete $O_3$-forming activity as shown by the molar-based MIR (g $O_3$/mole VOC) values. Additionally, one gram of HFO-1336mzz-Z has a lower capacity than one gram of ethane to form $O_3$. Thus, following the 2005 Interim Guidance, HFO-1336mzz-Z is eligible to be exempted from the regulatory definition of VOC based on both the molar- and mass-based MIR.

*B. Potential Impacts on Other Environmental Endpoints*

The EPA's proposed decision to exempt HFO-1336mzz-Z from the regulatory definition of VOC is based on our findings above. However, as noted in the 2005 Interim Guidance, the EPA reserves the right to exercise its judgment in certain cases where an exemption is likely to result in a significant increase in the use of a compound and a

subsequent significantly increased risk to human health or the environment. In this case, the EPA is proposing to find that exemption of HFO-1336mzz-Z would not result in an increase of risk to human health or the environment, with regard to stratospheric $O_3$ depletion, toxicity and climate change. Additional information on these topics is provided in the following sections.

1. Contribution to Stratospheric Ozone Depletion

HFO-1336mzz-Z is unlikely to contribute to the depletion of the stratospheric $O_3$ layer. The $O_3$ depletion potential (ODP) of HFO-1336mzz-Z is expected to be negligible based on several lines of evidence: the absence of chlorine or bromine in the compound and the atmospheric reactions described in Carter (2008). Because HFO-1336mzz-Z has a $k_{OH}$ value that is twice as high as that of ethane (see section III.A "Contribution to Tropospheric Ozone Formation"), it will decay before it has a chance to reach the stratosphere and, thus, will not participate in $O_3$ destruction.

2. The Significant New Alternatives Policy (SNAP) Program Acceptability Findings

The SNAP program is the EPA's program to evaluate and regulate substitutes for end-uses historically using ozone-depleting chemicals. Under section 612(c) of the CAA, the EPA is required to identify and publish lists of acceptable and unacceptable substitutes for class I or class II ozone-depleting substances. Per the SNAP program findings, the ODP of HFO-1336mzz-Z is zero. The SNAP program has listed HFO-1336mzz-Z as an acceptable substitute for a number of foam blowing end-uses provided in 79 FR 62863, October 21, 2014 (USEPA, 2014), and as an acceptable substitute in the refrigeration and air conditioning sector in heat transfer, as well as in chillers and

industrial process air conditioning provided in 81 FR 32241, May 23, 2016 (USEPA, 2016).

3. Toxicity

Based on screening assessments of the health and environmental risks of HFO-1336mzz-Z, the SNAP program anticipated that users will be able to use the compound without significantly greater health risks than presented by use of other available substitutes for the same uses (USEPA, 2014, 2016).

The EPA anticipates that HFO-1336mzz-Z will be used consistent with the recommendations specified in the manufacturer's safety data sheet (SDS) (DuPont, 2011). According to the SDS, potential health effects from inhalation of HFO-1336mzz-Z include skin or eye irritation or frostbite. Exposure to high concentrations of HFO-1336mzz-Z from misuse or intentional inhalation abuse may cause irregular heartbeat. In addition, HFO-1336mzz-Z could cause asphyxiation if air is displaced by vapors in a confined space. The Workplace Environmental Exposure Limit (WEEL) committee of the Occupational Alliance for Risk Science (OARS) reviewed available animal toxicity data and recommends a WEEL for the workplace of 500 parts per million (ppm) (3350 $mg/m^3$) time-weighted average (TWA) for an 8-hour workday (OARS, 2014). This WEEL was derived based on reduced male body weight in the 13-week rat inhalation toxicity study (Dupont, 2011). The WEEL is also protective against skeletal fluorosis, which may occur at higher exposures because of metabolism. The EPA anticipates that users will be able to meet the WEEL and address potential health risks by following requirements and recommendations in the SDS and other safety precautions common to the refrigeration and air conditioning industry.

HFO-1336mzz-Z is not regulated as a hazardous air pollutant (HAP) under title I of the CAA. Also, it is not listed as a toxic chemical under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA).

The Toxic Substances Control Act (TSCA) gives the EPA authority to assess and prevent potential unreasonable risks to human health and the environment before a new chemical substance is introduced into commerce. Section 5 of TSCA requires manufacturers and importers to notify the EPA before manufacturing or importing a new chemical substance by submitting a Premanufacture Notice (PMN) prior to the manufacture (including import) of the chemical. Under the TSCA New Chemicals Program, the EPA then assesses whether an unreasonable risk may, or will, be presented by the expected manufacturing, processing, distribution in commerce, use, and disposal of the new substance. The EPA has determined, however, that domestic manufacturing, use in non-industrial products, or use other than as described in the PMN may cause serious chronic health effects. To mitigate risks identified during the PMN review of HFO-1336mzz-Z, the EPA issued a Significant New Use Rule (SNUR) under TSCA on June 5, 2015, to require persons to submit a Significant New Use Notice to the EPA at least 90 days before they manufacture or process HFO-1336mzz-Z for uses other than those described in the PMN (80 FR 32003, 32005, June 5, 2015). The required notification will provide the EPA with the opportunity to evaluate the intended use and, if necessary, to prohibit or limit that activity before it occurs. The EPA, therefore, believes that existing programs address the risk of toxicity associated with the use of HFO-1336mzz-Z.

4. Contribution to Climate Change

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC AR5) estimated the lifetime of HFO-1336mzz-Z to be approximately 22 days (Baasandorj *et al.*, 2011), and the gas-phase degradation of HFO-1336-mzz-Z is not expected to lead to a significant formation of atmospherically long-lived species. The radiative efficiency of HFO-1336-mzz-Z was calculated to be 0.38 watts per square meter at the earth's surface per part per billion concentration of the material ($W\ m^{-2}\ ppb^{-1}$) based on Baasandorj *et al.*, 2011. The report estimated the resulting 100-year GWP to be 9, meaning that, over a 100-year period, one ton of HFO-1336mzz-Z traps 9 times as much warming energy as one ton of carbon dioxide ($CO_2$) (IPCC, 2013). HFO-1336mzz-Z's GWP of 9 is lower than those of some of the substitutes in a variety of foam blowing end-uses and in centrifugal and positive displacement chillers, heat transfer, and industrial process air conditioning. HFO-1336mzz-Z was developed to replace other chemicals used for similar end-uses with GWP ranging from 725 to 5,750 such as CFC-11, CFC-113, HCFC-141b and HCFC-22. The petitioner claims that HFO-1336mzz-Z is a better alternative to other substitutes in foam expansion or blowing agents for use in polyurethane rigid insulating foams. Thermal test data and energy efficiency trials indicate that HFO-1336mzz-Z will provide superior insulating value and, thus, reduces climate change impacts both directly by its low GWP and indirectly by decreasing energy consumption throughout the lifecycle of insulated foams in appliances, buildings, refrigerated storage and transportation.

*C. Conclusions*

The EPA finds that HFO-1336mzz-Z is negligibly reactive with respect to its contribution to tropospheric $O_3$ formation and, thus, may be exempted from the EPA's

definition of VOC in 40 CFR 51.100(s). HFO-1336mzz-Z has been listed as acceptable for use in several industrial and commercial refrigeration and air conditioning end-uses, as well as for use as a blowing agent under the SNAP program (USEPA, 2014, 2016). The EPA has also determined that exemption of HFO-1336mzz-Z from the regulatory definition of VOC will not result in an increase of risk to human health and the environment, and, to the extent that use of this compound does have impacts on other environmental endpoints, those impacts are adequately managed by existing programs. For example, HFO-1336mzz-Z has a similar or lower stratospheric $O_3$ depletion potential than available substitutes in those end-uses, and the toxicity risk from using HFO-1336mzz-Z is not significantly greater than the risk from using other available alternatives for the same uses. The EPA has concluded that non-tropospheric $O_3$-related risks associated with potential increased use of HFO-1336mzz-Z are adequately managed by SNAP. The EPA does not expect significant use of HFO-1336mzz-Z in applications not covered by the SNAP program. To the extent that the compound is used in other applications not already reviewed under SNAP or under the New Chemicals Program under TSCA, the SNUR in place under TSCA requires that any significant new use of a chemical be reported to the EPA using a Significant New Use Notice (SNUN). Any significant new use of HFO-1336mzz-Z would, thus, need to be evaluated by the EPA, and the EPA will continually review the availability of acceptable substitute chemicals under the SNAP program.

## IV. Proposed Rule

The EPA is responding to the petition by proposing to revise its regulatory definition of VOC at 40 CFR 51.100(s) to add HFO-1336mzz-Z to the list of compounds

that are exempt from the regulatory definition of VOC because it is less reactive than ethane based on a comparison of mass-based MIR, and molar-based MIR metrics and is, therefore, considered negligibly reactive. If finalized, then for an entity which uses or produces any of this compound and is subject to EPA regulations limiting the use of VOC in a product, limiting the VOC emissions from a facility, or otherwise controlling the use of VOC for purposes related to attaining the $O_3$ NAAQS, this compound will not be counted as a VOC in determining whether these regulatory obligations have been met. Also if finalized, this action would affect whether this compound is considered a VOC for state regulatory purposes to reduce $O_3$ formation, if a state relies on the EPA's regulatory definition of VOC. States are not obligated to exclude from control as a VOC those compounds that the EPA has found to be negligibly reactive. However, no state may take credit for controlling this compound in its $O_3$ control strategy. Consequently, reductions in emissions for this compound will not be considered or counted in determining whether states have met the rate of progress requirements for VOC in State Implementation Plans (SIPs) or in demonstrating attainment of the $O_3$ NAAQS.

## V. Statutory and Executive Order Reviews

### *A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review*

This action is not a significant regulatory action and was, therefore, not submitted to the Office of Management and Budget (OMB) for review.

### *B. Executive Order 13771: Reducing Regulations and Controlling Regulatory Costs*

This action is expected to be an Executive Order 13771 deregulatory action. This proposed rule is expected to provide meaningful burden reduction by exempting HFO-

1336mzz-Z from the VOC regulatory definition and relieving manufacturers, distributers, and users from recordkeeping or reporting requirements. This action is voluntary in nature and has non-quantifiable cost savings given unpredictability in who or how much of it will be used.

*C. Paperwork Reduction Act (PRA)*

This action does not impose an information collection burden under the PRA. It does not contain any recordkeeping or reporting requirements.

*D. Regulatory Flexibility Act (RFA)*

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. This action, if finalized, removes HFO-1336mzz-Z from the regulatory definition of VOC and, thereby, would relieve manufacturers, distributers, and users of the compound from tropospheric ozone requirements to control emissions of the compound.

*E. Unfunded Mandates Reform Act (UMRA)*

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531-1538, and does not significantly or uniquely affect small governments. This action imposes no enforceable duty on any state, local or tribal governments, or the private sector.

*F. Executive Order 13132: Federalism*

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the

states, or on the distribution of power and responsibilities among the various levels of government.

*G. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments*

This action does not have tribal implications, as specified in Executive Order 13175. This action proposes to remove HFO-1336mzz-Z from the regulatory definition of VOC and, if finalized, would relieve manufacturers, distributers and users from tropospheric ozone requirements to control emissions of the compound. Thus, Executive Order 13175 does not apply to this action.

*H. Executive Order 13045: Protection of Children from Environmental Health and Safety Risks*

This action is not subject to Executive Order 13045, because it is not economically significant as defined in Executive Order 12866, and because EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. Since HFO-1336mzz-Z is utilized in specific industrial applications where children are not present and dissipates quickly (e.g., lifetime of 22 days) with short-lived end products, there is no exposure or disproportionate risk to children. This action proposes to remove HFO-1336mzz-Z from the regulatory definition of VOC and, if finalized, would relieve manufacturers, distributers and users from tropospheric ozone requirements to control emissions of the compound.

*I. Executive Order 13211: Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution or Use*

This action is not subject to Executive Order 13211, because it is not a significant regulatory action under Executive Order 12866.

*J. National Technology Transfer and Advancement Act (NTTAA)*

This rulemaking does not involve technical standards.

*K. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*

The EPA believes that this action does not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations and/or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629, February 16, 1994). This action proposes to remove HFO-1336mzz-Z from the regulatory definition of VOC and, if finalized, would relieve manufacturers, distributers, and users of the compound from tropospheric ozone requirements to control emissions of the compound.

*L. Judicial Review*

Section 307(b)(1) of the CAA indicates which Federal Courts of Appeal have venue for petitions of review of final actions by EPA. This section provides, in part, that petitions for review must be filed in the Courts of Appeals for the District of Columbia Circuit if (i) the agency action consists of "nationally applicable regulations promulgated, or final action taken, by the Administrator," or (ii) such action is locally or regionally applicable, if "such action is based on a determination of nationwide scope or effect and if in taking such action the Administrator finds and publishes that such action is based on such a determination."

The EPA proposes to find that any final action related to this rulemaking is "nationally applicable" or of "nationwide scope and effect" within the meaning of CAA section 307(b)(1). Through this rulemaking action, the EPA interprets section 302 of the CAA, a provision which has nationwide applicability. The EPA's proposed change to the regulatory definition of VOC would affect implementation plans and national regulatory programs implicating this pollutant. For this reason, the Administrator proposes to determine that any final action related to the proposed rule is of nationwide scope and effect for purposes of CAA section 307(b)(1). Thus, pursuant to CAA section 307(b) any petitions for review of any final actions regarding the rulemaking would be filed in the United States Court of Appeals for the District of Columbia Circuit within 60 days from the date of any final action published in the *Federal Register*.

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**List of Subjects in 40 CFR Part 51**

Environmental protection, Administrative practice and procedure, Air pollution control, Ozone, Reporting and recordkeeping requirements, Volatile organic compounds.

Dated: April 23, 2018.

E. Scott Pruitt,
Administrator.

For reasons set forth in the preamble, EPA proposes to amend part 51 of chapter I of title 40 of the Code of Federal Regulations 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**: 23 U.S.C. 101; 42 U.S.C. 7401-7671q.

**Subpart F—Procedural Requirements**

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; 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 ($C_4F_9OCH_3$ or HFE-7100); 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 ($C_4F_9OC_2H_5$ or HFE-7200); 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OC_2H_5$); methyl acetate; 1,1,1,2,2,3,3-heptafluoro-3-methoxy-propane (n-C3F7OCH3, HFE-7000); 3-ethoxy- 1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl) hexane (HFE-7500); 1,1,1,2,3,3,3-heptafluoropropane (HFC 227ea); methyl formate (HCOOCH3); 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300); propylene carbonate; dimethyl carbonate; *trans*-1,3,3,3-tetrafluoropropene; $HCF_2OCF_2H$ (HFE-134); $HCF_2OCF_2OCF_2H$ (HFE-236cal2); $HCF_2OCF_2CF_2OCF_2H$ (HFE-338pcc13); $HCF_2OCF_2OCF_2CF_2OCF_2H$ (H-Galden 1040x or H-Galden ZT 130 (or 150 or 180)); *trans* 1-chloro-3,3,3-trifluoroprop-1-ene; 2,3,3,3-tetrafluoropropene; 2-amino-2-methyl-1-propanol; t-butyl acetate; 1,1,2,2- Tetrafluoro -1-(2,2,2-trifluoroethoxy) ethane; *cis*-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z); and perfluorocarbon compounds which fall into these classes:

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