APPENDIX C TO PART 4—ALPHABETICAL INDEX OF DISABILITIES—Continued

	Diagnostic code No.
Seventh (facial)	8207
Tenth (pneumogastric, vagus)	8210
Twelfth (hypoglossal)	8212
Peripheral nerves:	
All radicular groups	8513
Axillary (circumflex)	8518
Common peroneal (external popliteal)	8521
Deep peroneal (anterior tibial)	8523
Femoral (anterior crural)	8526
Ilio-inguinal	8530
Lateral cutaneous nerve of the thigh (external cutaneous)	8529
Long thoracic	8519
Lower radicular group	8512
Median	8515
Middle radicular group	8511
Musculocutaneous	8517
Obturator	8528
Posterior tibial	8525
Radial (musculospiral)	8514
Saphenous (internal saphenous)	8527
Sciatic	8520
Superficial peroneal (musculocutaneous)	8522
Tibial (internal popliteal)	8524
Ulnar	8516
Upper radicular group	8510
* * * * * * *	
Multiple sclerosis and other demyelinating diseases of the central nervous system	8018
* * * * * * *	
Optic neuropathy	6026
* * * * * * *	
Paramyoclonus multiplex (convulsive state, myoclonic type)	8104
* * * * * * *	
Parkinson's disease (paralysis agitans)	8004
Parkinson's plus, or secondary parkinsonism syndromes	8026
* * * * * * *	
Primary lateral sclerosis	8036
* * * * * * *	
Stroke (ischemic, hemorrhagic, or thrombotic), including cerebral infarction or cerebrovascular accident	8007
* * * * * * *	

[FR Doc. 2024–25665 Filed 11–8–24; 8:45 am]

BILLING CODE 8320–01–P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 51

[EPA–HQ–OAR–2023–0295; FRL–10823–01–OAR]

RIN 2060–AW00

Air Quality: Revision to the Regulatory Definition of Volatile Organic Compounds—Exclusion of (Z)-1-chloro-2,3,3,3-tetrafluoropropene (HCFO-1224yd(Z))

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The U.S. Environmental Protection Agency (EPA) is proposing to revise the EPA's regulatory definition of volatile organic compounds (VOC) under the Clean Air Act (CAA). This action proposes to add (Z)-1-chloro-2,3,3,3-tetrafluoropropene (also known as HCFO-1224yd(Z); CAS number 111512–60–8) to the list of compounds excluded from the regulatory definition on the basis that this compound makes a negligible contribution to tropospheric ozone (O_3) formation.

DATES: Comments must be received on or before January 13, 2025.

ADDRESSES: You may send comments, identified by Docket ID No. EPA–HQ–OAR–2023–0295, by any of the following methods:

- *Federal eRulemaking Portal: https://www.regulations.gov/* (our preferred method). Follow the online instructions for submitting comments.
- *Mail:* U.S. Environmental Protection Agency, EPA Docket Center, Docket No. EPA–HQ–OAR–2023–0295, Office of Air and Radiation Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- *Hand Delivery or Courier:* EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004. The Docket Center's hours of operations are 8:30 a.m.–4:30 p.m., Monday–Friday (except Federal Holidays).

Instructions: All submissions received must include the Docket ID No. for this

rulemaking. Comments received may be posted without change to *https://www.regulations.gov/,* including any personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the ''Public Participation'' heading of the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: Dr. Souad Benromdhane, Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Mail Code C539–07, Environmental Protection Agency, P.O. Box 12055, Research Triangle Park, NC 27711; telephone: (919) 541–4359; email address: *benromdhane.souad@epa.gov.*

SUPPLEMENTARY INFORMATION:

Public Participation

Written comments: Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2023–0295, at *https://www.regulations.gov* (our preferred method), or the other methods identified in the **ADDRESSES** section. Once submitted, comments cannot be edited or removed from the docket. The EPA may publish any comment received to its public docket. Do not submit to EPA's docket at *https://www.regulations.gov* any information you consider to be Confidential Business Information (CBI), Proprietary Business Information (PBI), 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). Please visit *https://www.epa.gov/dockets/commenting-epa-dockets* for additional submission methods; the full EPA public comment policy; information about CBI, PBI, or multimedia submissions; and general guidance on making effective comments.

Table of Contents

I. 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 HCFO-1224yd(Z) for use in foam blowing, refrigeration, as well as applications in solvents and aerosol propellants, and other minor uses. Potential entities that may be affected by this action include the following:

TABLE 1—POTENTIALLY AFFECTED ENTITIES BY NORTH AMERICAN INDUSTRIAL CLASSIFICATION SYSTEM (NAICS) CODE

Category	NAICS code	Description of regulated entities
Industry	333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.
Industry	811310	Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance.
Industry	221116	Geothermal Electric Power Generation.
Industry	221117	Biomass Electric Power Generation.
Industry	221118	Other Electric Power Generation.

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.

II. Background

A. The EPA's VOC Exemption Policy

Tropospheric O_3, commonly known as smog, is formed when VOC and nitrogen oxides (NO_X) 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. VOC 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 form different amounts of O_3. Some VOC react more 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 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) (''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) (''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 that a comparison to ethane's MIR on the mass basis strikes the right balance between a threshold that is low enough to capture chemicals that significantly affect ozone formation and a threshold that is high enough to allow for the exemption of some other chemicals that may usefully substitute for more reactive compounds. The guidance also stated that EPA will continue to compare chemicals to ethane using k_{OH} expressed on a molar basis and MIR values expressed on a mass basis during the review of suggested chemicals for VOC-exempt status.[1] The 2005 Interim Guidance notes that the EPA will consider a compound to be negligibly reactive if it is equally reactive as or less reactive than ethane based on either k_{OH} expressed on a molar basis *or* MIR values expressed on a mass basis (70 FR 54046).

The molar comparison of MIR is more consistent with the original smog chamber experiments, which compared equal molar concentrations of individual VOC, 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 less restrictive than the molar-based comparison in that more compounds would qualify as negligibly reactive.

Given the two goals of the exemption policy articulated in the 2005 Interim Guidance, the EPA believes that ethane continues to be an appropriate threshold for defining negligible reactivity. And, to encourage the use of environmentally beneficial substitutions, the EPA continues to believe 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 O_3 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.

The EPA has provided the foregoing discussion of its VOC exemption policies as background for its assessment of the petition to list HCFO-1224yd(z) as an exempt compound and its proposed action to grant the petition. However, the EPA is not reopening the 2005 Interim Guidance or other aspects of its VOC exemption policy in this proposed rule and is not seeking comment on these issues.

B. Petition To List HCFO-1224yd(Z) as an Exempt Compound

The AGC Chemicals Americas, Inc. (''AGC'') submitted a petition to the EPA on July 29, 2020, requesting that (Z)-1-chloro-2,3,3,3-tetrafluoropropene (also known as HCFO-1224yd(Z); CAS number 111512–60–8) be exempted from the regulatory definition of VOC. The petition stated that HCFO-1224yd(Z) has low reactivity (*i.e.,* 0.052 ± 0.011g of O_3/g of HCFO-1224yd(Z))

[1] Interim Guidance on Control of Volatile Organic Compounds in Ozone State Implementation Plans, 2005, US Environmental Protection Agency, Document Number 05–18015 (70 FR 54046). And could be found at this link: *https://www.govinfo.gov/content/pkg/FR-2005-09-13/pdf/05-18015.pdf.*

compared to the MIR of ethane (0.28 g O_3/g). The petitioner indicated that HCFO-1224yd(Z) may be used in refrigeration which uses a turbo-type refrigerator, a binary generator, a heat recovery heat pump, etc. As a refrigerant, this compound will not be generally emitted into the atmosphere on a continuous basis in significant amounts. Refrigerators will be initially charged and then serviced with HCFO-1224yd(Z) with minimal losses of refrigerant to the atmosphere over time, and they will be subject to EPA's regulations related to servicing and ''venting.'' HCFO-1224yd(Z) has been approved by EPA through its Significant New Alternatives Policy (SNAP) program as an acceptable substitute for use in new and retrofitted centrifugal chillers, positive displacement chillers and industrial process refrigeration.[2]

AGC has developed HCFO-1224yd(Z) to support reductions in emissions of greenhouse gases (GHGs). The global warming potential (GWP) for HCFO-1224yd(Z) is 0.88 for a time horizon of 100 years. HCFO-1224yd(Z) is relatively short-lived in the atmosphere, with a lifetime of approximately 20 days. HCFO-1224yd(Z)'s ODP is almost zero (0.00023) and, leading to an environmental impact that is estimated to be low especially when compared to the existing alternatives (Tokuhashi et al., 2018). Hence, HCFO-1224yd(Z) can serve as a replacement for compounds in several centrifugal and positive displacement chillers such as ammonia absorption, carbon dioxide, and HFO-1336mzz(Z) among others with GWP ranging between zero and 630. For industrial process refrigeration, HCFO-1224yd(Z) has a GWP lower than or comparable to that of acceptable existing substitutes for new or retrofit equipment with GWP ranging between zero and 14,800.

Toxicity of HCFO-1224yd(Z) is comparable to or lower than that of other available substitutes in the same end uses. The toxicity risks are evaluated through the SNAP program but can also be minimized through the application of recommended guidance in the Occupational Alliance for Risk Science's Workplace Environmental Exposure Level (OARS WEEL), the American Society of Heating, Refrigerating and Air-Conditioning Engineers safety standards 15 (ASHARE 15) and other industry standards, as well as the safety data sheet (SDS) and other safety precautions related to refrigeration and air conditioning industry.

To support its petition, AGC provided a document on ground-level atmospheric ozone formation potential from the reactivity of HCFO-1224yd(Z) with the hydroxyl OH based on calculations using SARPC-11 atmospheric chemical mechanism.[3] AGC's supplemental technical report supplied a MIR of HCFO-1224yd(Z) of 0.052 ± 0.011 g O_3/g HCFO-1224yd(Z) on the mass-based MIR scale. This reactivity is significantly lower than that of ethane (0.29 ± 0.07 g O_3/g ethane). The report also addressed uncertainties around the MIR value calculated and stipulated that the relative impact on ozone formation will be small when compared to variability in atmospheric conditions. The report raised a warning around the chemical mechanism used to predict ozone formation potential to caution about the need to test whether the predicted value can be observed in an environmental chamber experiment. The petition did not include a value for the rate constant k_{OH} for the gas-phase reaction with OH radicals.

To address the potential for stratospheric O_3 impacts, the petitioner specified that, because the atmospheric lifetime of HCFO-1224yd(Z) due to loss by OH reaction was estimated to be relatively short, even though HCFO-1224yd(Z) contains chlorine, it is not expected to contribute to the depletion of the stratospheric O_3 layer more than other alternatives listed acceptable by EPA's SNAP program (USEPA, 2019).

III. The EPA's Assessment of the Petition

The EPA is proposing to respond to the petition to revise the EPA's regulatory definition of VOC for exemption of HCFO-1224yd(Z). 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

The rate constant k_{OH} for the gas-phase reaction with OH radicals is measured to be $(5.84 \pm 0.030)\ 10^{-13}$ cm^3/molecule-sec at ~298 degrees Kelvin (K) (Tokuhashi *et al.,* 2018). This k_{OH} is more than twice the k_{OH} of ethane (2.4×10^{-13} cm^3/molecule-sec at ~298 K; Atkinson *et al.,* 2006) even when uncertainty is considered and, therefore, suggests that it is more reactive than ethane. In most cases, chemicals with high k_{OH} values also have high MIR values, but the products that are formed here in subsequent reactions are expected to be polyfluorinated compounds, which do not contribute to O_3 formation (Osterstrom *et al.,* 2017). In the case of HCFO-1224yd(Z), while the k_{OH} is relatively high, the calculated maximum incremental reactivity MIR is very low when compared to that of ethane based on Carter (2020), provided by the petitioner, and reviewed by EPA.

Carter (2020) estimates that HCFO-1224yd(Z) has a MIR value of 0.052 ± 0.011 g O_3/g VOC versus 0.29 ± 0.07 g O_3/g VOC for ethane. Therefore, the EPA considers HCFO-1224yd(Z) to be negligibly reactive and eligible for VOC-exempt status following 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 HCFO-1224yd(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 by Carter (2020). The EPA has assessed the Carter study provided by the petitioner and believes the calculated MIR value is reliable.[4]

Table 2 presents three reactivity metrics for HCFO-1224yd(Z) as they compare to ethane.

[2] 84 FR 64765 (Nov. 25, 2019): *https://www.federalregister.gov/documents/2019/11/25/2019-25412/protection-of-stratospheric-ozone-determination-35-for-significant-new-alternatives-policy-program.*

[3] Carter, W. P. L. 2020. Estimation of the ground-level atmospheric ozone formation potential of isomers of 1-chloro-2,3,3,3-tetrafluoro-1-propene, HFCO-1224YD(Z), Report to AGC Chemicals Americas Company, Exton, PA, USA.

[4] Supporting memo is included in the docket.

TABLE 2—REACTIVITIES OF ETHANE AND HCFO-1224yd(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	2.4×10^{-13}	8.4	0.28 ± 0.07
HCFO-1224yd(Z)	$(5.84 \pm 0.030) \times 10^{-13}$	7.7	0.052 ± 0.011

Notes:
k_{OH} value at 298 K for ethane is from Atkinson *et al.* (2006; page 3626).
k_{OH} value at 300 K for HCFO-1224yd(Z) is from Tokuhashi *et al.,* 2018 (table 1).
Mass-based MIR value (g O_3/g VOC) of ethane is from Carter (2011).
Mass-based MIR value (g O_3/g VOC) of HCFO-1224yd(Z) is from Carter 2020.
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 HCFO-1224yd(Z) with the OH radical (k_{OH}) has been measured to be $(5.84 \pm 0.030) \times 10^{-13}$ cm^3/molecule-sec (Tokuhashi *et al.,* 2018); other reactions with O_3 and the nitrate radical were negligibly small. The corresponding reaction rate of ethane with OH is 2.4×10^{-13} cm^3/molecule-sec (Atkinson *et al.,* 2006). The data in table 2 show that HCFO-1224yd(Z) has a higher k_{OH} value than ethane, meaning that it initially reacts more than twice as fast in the atmosphere as ethane. However, the resulting unsaturated fluorinated compounds in the atmosphere are short lived and react more slowly to form O_3 (Baasandorj *et al.,* 2011). The modeled reactivity based on the mechanism considered by Carter resulted in a very low maximum incremental reactivity on a mass basis. When compared to ethane, HCFO-1224yd(Z) has a MIR of 0.052 ± 0.011 g O_3/g VOC. Hence HCFO-1224yd(Z)'s MIR is less than the fifth of that of ethane at 0.28 ± 0.07 g O_3/g ethane. As shown in table 2, HCFO-1224yd(Z)'s MIR on a molar basis is also somewhat lower than that of ethane. Considering the uncertainty and variability in the MIR modeling, as described by Carter (2020), we are confident that the MIR of HCFO-1224yd(Z) is less than that of ethane.

A molecule of HCFO-1224yd(Z) is considerably 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. Likewise, one gram of HCFO-1224yd(Z) has a lower capacity than one gram of ethane to form O_3 in terms of a mass-based MIR. Thus, following the 2005 Interim Guidance, the EPA finds HCFO-1224yd(Z) to be eligible for exemption 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 decision to exempt HCFO-1224yd(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 does not find that exemption of HCFO-1224yd(Z) would result in an increase of risk to human health or the environment, regarding stratospheric O_3 depletion, toxicity, and climate change. More information on these topics is provided in the following sections.

1. Contribution to Stratospheric Ozone Depletion

The SNAP program is the EPA's program to evaluate and regulate substitutes for end-uses historically using O_3-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 O_3-depleting substances. Per the SNAP program findings, the ODP of HCFO-1224yd(Z) is zero, which is significantly less than the ODPs for the [ozone depleting substances] ODS subject to the phase out of production and consumption under regulations issued under sections 601–607 of the CAA and consistent with the Montreal Protocol on Substances that Deplete the Ozone Layer. The SNAP program has listed HCFO-1224yd(Z) as an acceptable substitute for chillers and other industrial process refrigeration end-uses provided in 84 FR 64765, November 25, 2019 (USEPA, 2019).

HCFO-1224yd(Z) is unlikely to contribute to the depletion of the stratospheric O_3 layer. The O_3 depletion potential (ODP) of HCFO-1224yd(Z) is expected to be negligible based on several lines of evidence (Tokuhashi *et al.,* 2018; Guo *et al.,* 2019). Because HCFO-1224yd(Z)'s atmospheric lifetime is short (20 days according to Tokuhashi *et al.,* 2018) compared to the timescale for mixing within the troposphere, it will decay before it has a chance to reach the stratosphere and, thus, will not participate in O_3 destruction (Guo *et al.,* 2019).

2. Toxicity

Based on screening assessments of the health and environmental risks of HCFO-1224yd(Z), the SNAP program expected that users will be able to use the compound without significantly greater health risks than presented using other available substitutes for the same end uses (USEPA, 2019).

The EPA anticipates that HCFO-1224yd(Z) will be used consistent with the recommendations specified in the manufacturer's SDS (AGC, 2017). According to the SDS, potential health effects from inhalation of HCFO-1224yd(Z) include drowsiness or dizziness, irritation of the skin or eyes, or frostbite. These potential health effects are common to many refrigerants. However, HCFO-1224yd(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 1000 parts per million (ppm) (6700 mg/m^3)[5] time-weighted average (TWA) for an 8-hour workday, as later published in 2019 in *Toxicology and Industrial Health* (''(Z)-I-Chloro-2,3,3,3-tetrafluoropropene,'' 2020).[6] This WEEL was derived based

[5] *Occupational Alliance for Risk Science (OARS–WEELs)–* HCFO-1224yd(Z)), *2017: https://www.tera.org/OARS/PDF_documents/09_hcfo-1224yd(z)-weel-document-final-2017.pdf.*

[6] (''(Z)-I-Chloro-2,3,3,3-tetrafluoropropene (HCFO-1224yd(Z)) (2017). (2019). Toxicology and Industrial Health, 36(5), 305–309. *https://doi.org/10.1177/0748233720930548.*

on a 4-week, GLP-compliant inhalation toxicity study in rats (AGC, 2016), based on the point of departure a NOAEL of 40,000 ppm. This was also the NOAEL for the developmental toxicity study where developmental effects were only observed in female rats. The EPA expects 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.

HCFO-1224yd(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, among other things, to evaluate and, if necessary, address risks of injury to health or the environment from new chemical substances before such substances may be manufactured (including imported). Section 5 of TSCA requires manufacturers and importers to notify the EPA before manufacturing a new chemical substance or manufacturing or processing any chemical substance for a use which the Administrator has determined is a significant new use. When EPA receives such notice, it assesses whether sufficient information is available to permit a reasoned evaluation of the health and environmental effects of the substance or use and whether manufacturing, processing, distribution in commerce, use, or disposal of the substance (or any combination of such activities) presents, may present, or is not likely to present an unreasonable risk. Based on its review of a premanufacture notice (PMN) for HCFO-1224yd(Z), the EPA signed a consent order under TSCA section 5(e) to protect against an unreasonable risk of injury to health or the environment. EPA also subsequently issued a Significant New Use Rule (SNUR) under TSCA that requires submission of a Significant New Use Notice (SNUN) to the EPA at least 90 days before manufacturing or processing of HCFO-1224yd(Z) for any significant new use. The required notification will provide the EPA with the opportunity to evaluate any intended significant new use before it occurs and, if necessary, to issue orders to address any potential unreasonable risk to human health or the environment.

HCFO-1224yd(Z) is one of the class of substances generally referred to as per- and polyfluoroalkyl substances (PFAS). Many PFAS compounds represent a public health concern due to their toxicity and persistence in the environment. As a class, they are also highly varied, and variations in structure may result in (yet unknown) differences in environmental mobility and toxicity. The agency's ongoing work addressing PFAS does not currently address HCFO-1224yd(Z) specifically; however, the exposure limits and SNAP screening assessment noted above give us confidence that the use of this compound will not pose an unreasonable risk to human health. EPA also believes that the impacts of PFAS will be adequately addressed by regulatory and non-regulatory programs specifically designed to address those impacts.[7]

3. Contribution to Climate Change

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC AR5) does not provide an estimate for HCFO-1224yd(Z)'s global warming potential (GWP).[8] The HCFO-1224yd(Z) GWP on a 100-year time horizon was calculated to be 5.4 in one study by Tokuhashi *et al.* (2018), but the same study reported an experimental chamber value of 0.88 and a lifetime of 20 days. This is consistent with the Scientific Assessment of Ozone Depletion by the chemical sciences laboratory (NOAA, 2022) where the GWP was found to be smaller than one under all reactivity efficiencies and recommended adjustments. These authors also calculated an inflated radiation or IR spectrum from a theoretical model using density functional theory (DFT) for HCFO-1224yd(Z). That calculation gives a GWP of 5.4. While the theoretical value differs substantially on a percentage basis from the measured value, the GWP based on the experimental measurement is expected to be the more accurate given the large uncertainties in the calculated molecular model which tend to be unknown and high. Either value is 1–2 orders of magnitude lower than the GWP for the refrigerant(s) that HCFO-1224yd(Z) is designed to replace. HCFO-1224yd(Z) has a GWP below one indicating that it has less radiating impact than that of CO_2 over a 100-year time period (GWP_{100}). Species with double bonds assembled in the Intergovernmental Panel on Climate Change Fifth Assessment Report (table 8.A.1) show lower GWP than species without a double bond. According to the SNAP rule, HCFO-1224yd(Z)'s GWP is smaller than one and is comparable to or lower than those of some of the substitutes such as used in new chillers, ammonia absorption, carbon dioxide (CO_2), and hydro-fluoro-olefin (HFO–1336mzz(Z)), and for new and retrofit chillers with GWPs ranging from 0 to 630. (USEPA, 2019). Both the calculated and the observed values of HCFO-1224yd(Z)'s GWP are lower than that of ethane determined to be 10.2.[9]

C. Conclusions

The EPA finds that HCFO-1224yd(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). HCFO-1224yd(Z) has been listed as acceptable for use in new and retrofitted centrifugal chillers, positive displacement chillers and industrial process refrigeration under the SNAP program (USEPA, 2019). The EPA has also determined that exemption of HCFO-1224yd(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, HCFO-1224yd(Z) has a similar or lower stratospheric O_3 depletion potential than available substitutes in those end-uses, and the toxicity risk from using HCFO-1224yd(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 HCFO-1224yd(Z) are adequately managed by SNAP. The EPA does not expect significant use of HCFO-1224yd(Z) in applications not covered by the SNAP program. To the extent that

[7] Interim Guidance on Control of Volatile Organic Compounds in Ozone State Implementation Plans, 2005, US Environmental Protection Agency, Document Number 05–18015 (70 FR 54046). And could be found at this link: *https://www.govinfo.gov/content/pkg/FR-2005-09-13/pdf/05-18015.pdf.*

[8] IPCC, 2013: Climate Change 2013: Chapter 8, Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. *https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf.*

[9] Lifetimes, direct and indirect radiative forcing, and global warming potentials of ethane (C2H6), propane (C3H8), and butane (C4H10): *https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/asl.804.*

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 SNUN. Any significant new use of HCFO-1224yd(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 Action

The EPA is responding to the petition by proposing to revise its regulatory definition of VOC at 40 CFR 51.100(s) to add HCFO-1224yd(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. As a result of this action, if an entity uses or produces this compound and is subject to the 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. 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 bound 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 or in demonstrating attainment of the O_3 NAAQS.

V. Statutory and Executive Order Reviews

Additional information about these statutes and Executive orders can be found at *https://www.epa.gov/laws-regulations/laws-and-executive-orders.*

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 14094: Modernizing Regulatory Review

This action is not a significant regulatory action as defined in Executive Order 12866, as amended by Executive Order 14094, and was therefore not subject to a requirement for Executive Order 12866 review.

B. 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.

C. 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 removes HCFO-1224yd(Z) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users of the compound from tropospheric O_3 requirements to control emissions of the compound.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain an 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.

E. 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.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have Tribal implications, as specified in Executive Order 13175. This proposed rule removes HCFO-1224yd(Z) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users from tropospheric O_3 requirements to control emissions of the compound. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

Executive Order 13045 directs Federal agencies to include an evaluation of the health and safety effects of the planned regulation on children in Federal health and safety standards and explain why the regulation is preferable to potentially effective and reasonably feasible alternatives. This action is not subject to Executive Order 13045, because it is not economically significant as defined in Executive Order 12866, and because the EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. Our assessment is consistent with the SNAP finding that the conditional use of this chemical will guarantee the reduction of exposure risks to the general population particularly the most sensitive population (*e.g.,* children). Since HCFO-1224yd(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 removes HCFO-1224yd(Z) from the regulatory definition of VOC and, thereby, relieves manufacturers, distributers, and users from tropospheric O_3 requirements to control emissions of the compound.

H. 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.

I. National Technology Transfer and Advancement Act (NTTAA)

This rulemaking does not involve technical standards.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations and Executive Order 14096: Revitalizing Our Nation's Commitment to Environmental Justice for All

The EPA believes that the human health and environmental conditions that exist prior to this action do not result in disproportionate and adverse effects on communities with EJ concerns. As we found no data available to support the opposite, we addressed the human health and environmental risks by this proposed action to the greatest ability feasible. This action was developed in accordance with agency guidance on environmental justice.

The EPA believes that this action in not likely to result in new disproportionate and adverse effects on communities with environmental justice concerns. This action removes HCFO-1224yd(Z) from the regulatory definition

of VOC and, thereby, relieves manufacturers, distributers, and users of the compound from tropospheric O_3 requirements to control emissions of the compound. It will in fact help States focus on more photochemically reactive chemicals preventing more formation of Ozone and consequently more adverse related health and environmental effects.

K. Judicial Review

Under section 307(b)(1) of the CAA, petitions for judicial review of this action must be filed in the United States Court of Appeals for the District of Columbia Circuit Court within 60 days from the date the proposed action is published in the **Federal Register**. Filing a petition for review by the Administrator of this proposed action does not affect the finality of this action for the purposes of judicial review nor does it extend the time within which a petition for judicial review must be filed and shall not postpone the effectiveness of such action. Thus, any petitions for review of this action related to the exemption of HCFO-1224yd(Z) from the regulatory definition of VOC must be filed in the Court of Appeals for the District of Columbia Circuit within 60 days from the date proposed action is published in the **Federal Register**.

VII. References

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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.

Michael S. Regan,

Administrator.

For reasons stated in the preamble, title 40, chapter I of the Code of Federal Regulations is proposed to be amended as follows:

PART 51—REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS

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

Authority: 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.

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(s) * * *

(1) This includes any such organic compound other than the following, which have been determined to have negligible photochemical reactivity: methane; ethane; methylene chloride (dichloromethane); 1,1,1-trichloroethane (methyl chloroform); 1,1,2-trichloro-1,2,2-trifluoroethane (CFC–113); trichlorofluoromethane (CFC–11); dichlorodifluoromethane (CFC–12); chlorodifluoromethane (HCFC–22); trifluoromethane (HFC–23); 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC–114); chloropentafluoroethane (CFC–115); 1,1,1-trifluoro 2,2-dichloroethane (HCFC–123); 1,1,1,2-tetrafluoroethane (HFC–134a); 1,1-dichloro 1-fluoroethane (HCFC–141b); 1-chloro 1,1-difluoroethane (HCFC–142b); 2-chloro-1,1,1,2-tetrafluoroethane (HCFC–124); pentafluoroethane (HFC–125); 1,1,2,2-tetrafluoroethane (HFC–134); 1,1,1-trifluoroethane (HFC–143a); 1,1-difluoroethane (HFC–152a); 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); (Z)-1-chloro-2,3,3,3-tetrafluoropropene (HCFO-1224yd(Z)); and perfluorocarbon compounds which fall into these classes:

* * * * *

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