

Ventura County APCD  
Draft Staff Report  
Proposed Amendments to Rule 2,  
Definition of Exempt Organic Compounds

## EXECUTIVE SUMMARY

The EPA recently revised the definition of “Volatile Organic Compounds” in Title 40, Part 51 of the Code of Federal Regulations to include more compounds that are deemed to have negligible reactivity. The main purpose of the proposed revisions is to align the definition of “Exempt Organic Compounds” in Ventura County Air Pollution Control District (VCAPCD) Rule 2 with the EPA definition of VOC. As such, Rule 2, the definition of an “Exempt Organic Compound”, is amended to incorporate 1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE 7000), trans-1,3,3,3-tetrafluoropropene (HFO-1234ze), trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd), 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE 7300), 3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE 7500), 2,3,3,3-tetrafluoropropene (HFO-1234yf), 2-Amino-2-methyl-1-propanol (AMP), 1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2), and cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z) into the list of Exempt Organic Compounds. There are additional compounds that are considered as exempt organic compounds by the EPA but at this time, staff is not recommending the exemption of these compounds due to their potency as greenhouse gases. These compounds are 1,1,1',1'-Tetrafluorodimethyl ether (HFE 134), Bis(difluoromethoxy)difluoromethane (HFE-236cal2), 1,2-bis(difluoromethoxy)-1,1,2,2-tetrafluoroethane (HFE-338pcc13), or 1-(Difluoromethoxy)-2-[(difluoromethoxy)difluoromethoxy]-1,1,2,2-tetrafluoroethane (HFE-43-10pccc). Exempting the first group of compounds will enable industries to achieve compliance with new restriction on older compounds through substitution of more environmentally friendly products. This will benefit the environment by reducing the use of compounds with greater ground level ozone forming potential (reactivity), greater global warming potential and higher level atmospheric ozone depletion potential. Also, by exempting very low reactive compounds, VCAPCD can focus efforts on organic compounds that are significant contributors to ozone formation. Additionally, a Chemical Abstracts Service Registry Number (CAS Number) is proposed to be added for all “Exempt Organic Compounds” for ease of identification.

## BACKGROUND

Ground level ozone is a secondary pollutant formed by photochemical reactions between nitrogen oxides (NO<sub>x</sub>) and reactive organic compounds (ROC) in the presence of sunlight. Ozone is a strong irritant that adversely affects human health,

environmental systems, damages crops, and is a potent greenhouse gas. As reported by the EPA (Air Quality Criteria for Ozone and Related Photochemical Oxidants, 2006) exposure to ground level ozone irritates and damages the human respiratory system resulting in: decreased pulmonary function, development and aggravation of asthma, increased risk in cardiovascular complications such as heart attacks and strokes, and premature death.

Ventura County is currently designated as a nonattainment area for both 2008 and 2015 state and federal ozone standards. Since ROCs are a precursor to ground level ozone formation, one of VCAPCDs strategies to control ozone pollution is to reduce ROC emissions from existing sources by establishing more stringent ROC emission limits. A method for complying with low ROC emissions targets is by using organic compounds with negligible reactivity for ozone formation, also known as exempt organic compounds. Exempt organic compounds are listed in Rule 2, Definitions.

Exempt organic compounds are determined by the EPA by comparing reactivity of a compound to the reactivity levels of ethane. Compounds that are less reactive than ethane are deemed to have a negligible reactivity and are exempted by the federal definition of “Volatile Organic Compounds” (VOC, synonymous with ROC). There are three ways the reactivity of a compound is compared to ethane. The first comparison is the reaction rate with the hydroxyl ion ( $k_{OH}$ ). This hydroxyl reaction is the first step in a series of reactions in the formation of ozone, and the higher the  $k_{OH}$  value, the more quickly the compound reacts to form ozone. The second and third comparison is based on the maximum incremental reactivity (MIR) expressed either on a reactivity per gram basis (grams of ozone formed per gram of VOC) or on a reactivity per mole basis (grams of ozone formed per mole VOC). The MIR method considers the activities from all steps in the ozone formation process from a specific organic compound as opposed to just the first step of the chemical reaction. Table 1 includes the list of EPA additional exempt organic compounds, their associated CAS number, and its reactivity levels as compared with ethane.

Table 1: Proposed Compounds to be listed as Exempt Organic Compounds

Federal Register Reference	CAS Number	EPA Exempt Compound	K <sub>OH</sub>	MIR (mole basis)	MIR (mass basis)
	74-84-0	Ethane	2.4 x 10 <sup>-13</sup>	8.12	0.27
69 FR 69290	375-03-1	1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE 7000)	1.2 x 10 <sup>-14</sup>	ND	ND
77 FR 37610	29118-24-9	trans-1,3,3,3-tetrafluoropropene (HFO-1234ze)	9.25 x 10 <sup>-13</sup>	11.20	0.098
78 FR 11101	102687-65-0	trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd)	4.4 x 10 <sup>-13</sup>	5.22	0.04
72 FR 2193	132182-92-4	1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE 7300)	1.5 x 10 <sup>-14</sup>	ND	ND
69 FR 69290	297730-93-9	3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE 7500)	2.2 x 10 <sup>-15</sup>	ND	ND
78 FR 62451	754-12-1	2,3,3,3-tetrafluoropropene (HFO-1234yf)	9.16 x 10 <sup>-15</sup>	ND	0.28
79 FR 17037	124-68-5	2-Amino-2-methyl-1-propanol (AMP)	ND	ND	0.25
81 FR 50330	406-78-0	1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2)	9.16 x 10 <sup>-15</sup>	<0.26	<0.0013
83 FR 19026	692-49-9	cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z)	4.91 x 10 <sup>-13</sup>	6.6	0.04

ND = Not Determined

Compounds exempted from the federal VOC definition are not automatically exempted from District rules and regulations. The District considers several factors, including potential uses, impact on human health, and environmental concerns before adding federally-exempt compounds to Rule 2.

## LEGAL MANDATES

### FEDERAL MANDATES

The District is designated “severe” nonattainment for the 2008, and 2015 federal 8-hour ozone standard. In 2017, Ventura County updated the attainment plan to achieve attainment of the 2008 ozone standard by 2020.

Clean Air Act (CAA) section 172(c)(1) specifies that State Implementation Plans for nonattainment areas must include “reasonably available control measures” (RACM), including “reasonably available control technology” (RACT), for sources of emissions. The proposed amendments to Rule 2 will allow manufacturers and sources more flexibility in developing and using low ROC products that may ultimately lead to feasible, lower ROC emission limits.

### STATE MANDATES

The District is designated nonattainment for the California state ozone standard. The California Clean Air Act requires areas designated as “serious” to adopt control measures required in Section 40919 of the California Health and Safety Code (HSC). This requires the adoption of the Best Available Retrofit Control Technology (BARCT) rules and the implementation of All Feasible Measures for all existing permitted sources. The proposed amendments to Rule 2 will allow manufacturers and sources to use more exempt compounds in meeting ROC limits, and this may lead to more stringent and feasible BARCT requirements.

## PROPOSED AMENDMENTS

### EXEMPT ORGANIC COMPOUND DEFINITIONS

Staff is proposing to amend Rule 2 to incorporate the following compounds into the list of exempt organic compounds:

- 1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE-7000)
- trans-1,3,3,3-tetrafluoropropene (HFO-1234ze)
- trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd)
- 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300)
- 3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE-7500)
- 2,3,3,3-tetrafluoropropene (HFO-1234yf)
- 2-Amino-2-methyl-1-propanol (AMP)
- 1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2)
- cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z)

Each compound is discussed in detail below:

**1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE 7000):** On November 29, 2004, EPA exempted this compound from the federal definition of VOC because the  $k_{OH}$  value of HFE-7000 is less than the  $k_{OH}$  value of ethane. HFE-7000 may be used as a refrigerant or as an aerosol propellant. HFE-7000 is listed as an acceptable replacement for trichlorofluoromethane (CFC-11) and 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113) in EPA's Significant New Alternative Policy (SNAP) program. The SNAP program evaluates and regulates substitutes for ozone-depleting chemicals that are being phased out under the stratospheric ozone protection provisions of the federal Clean Air Act. Both CFC-11 and CFC-113 are currently on the Districts list of exempt compounds in Rule 2. HFE-7000 is estimated to have a global warming potential (GWP) of 370, significantly less than either CFC-11 or CFC-113. In EPA's report "Global Mitigation of Non-CO<sub>2</sub> Greenhouse Gases: 2010-2030", hydrofluoroethers (HFE) were the primary abatement measure to mitigate the current GWP of CFCs (chlorofluorocarbons). The comparison results of replacement compounds with HFE-7000 are summarized in Table 2.

*Table 2: Comparison of replacement compounds with HFE-7000*

Compound	GWP	ODP	8-hour exposure guideline
1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE 7000)	370	0	250 ppm
(CFC-11)	4660	1	1000 ppm
(CFC-113)	5820	0.85	1000 ppm

In a report titled “Risk Screen on the Use of Substitutes for Ozone-Depleting Substances”, EPA assessed the potential health impacts of including HFE-7000 in EPA’s SNAP program. The study screened the potential risks to workers for occupational exposure and to the general public from exposure of ambient air releases of HFE-7000. EPA determined that the exposure of HFE-7000 to workers and the general population is expected to be below the level of concern for non-cancer risk. In addition, according to the final rule to exempt four compounds from the definition of VOC as published in the Federal Register, HFE-7000 is very similar in structure, toxicity and atmospheric properties to other HFE compounds such as HFE-7100 and HFE-7200. In March 2008, CARB conducted an Environmental Impact Assessment of Selected Halogenated Chemicals, where HFE-7100 and HFE-7200 are not chemical carcinogens to humans and have an acute and chronic Hazard Index of less than 1, which indicated no adverse human health effects are expected to occur. Staff expects HFE-7000 to have low health impacts, similar to that of HFE-7100 and HFE-7200.

VCAPCD is proposing to exempt HFE-7000 from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**trans-1,3,3,3-tetrafluoropropene (HFO-1234ze):** On July 23, 2012, EPA exempted this compound from the federal definition of VOC based on the MIR method. The MIR of HFO-1234ze is lower than the MIR of ethane on a mass basis. HFO-1234ze may be used as a refrigerant, a blowing agent and an aerosol propellant. HFO-1234ze is classified as a hydrofluoroolefin (HFO) and has an ozone depletion potential (ODP) of 0. In EPA’s SNAP program, HFOs, as a class, have been identified as possible substitutes for CFCs. HFO-1234ze is estimated to have a GWP of less than one. The GWP of HFO-1234ze is very low compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000. The comparison results of replacement compounds with HFO-1234ze are summarized in Table 3.

*Table 3: Comparison of replacement compounds with HFO-1234z*

Compound	GWP	ODP	8-hour exposure guideline
trans-1,3,3,3-tetrafluoropropene (HFO-1234ze)	<=1	0	800 ppm
1,1,1,2-Tetrafluoroethane (R134a)	1300	0	1000 ppm

The Material Safety Data Sheet published by Diversified CPC International states that HFO-1234ze is low toxicity and is not considered carcinogenic or mutagenic. Staff expects HFO-1234ze to have low health impacts, for its designated uses.

VCAPCD is proposing to exempt HFO-1234ze from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd):** On May 16, 2013, EPA exempted this compound from the federal definition of VOC based on the MIR method. The MIRs of HFO-1233zd are lower than the MIRs of ethane on both a mass and mole basis. HFO-1233zd may be used as a refrigerant, a blowing agent, and a solvent. HFO-1233zd is classified as a hydrofluoroolefin and has an ODP of 0. In EPA’s SNAP program, HFOs, as a class, have been identified as possible substitutes for CFCs. HFO-1233zd is estimated to have a GWP of one. The GWP of HFO-1233zd is very low compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000. The comparison results of replacement compounds with HFO-1233zd are summarized in Table 4.

*Table 4: Comparison of replacement compounds with HFO-1233zd*

Compound	GWP	ODP	8-hour exposure guideline
trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd)	1	0.00	800 ppm
1,1,1,2-Tetrafluoroethane (R134a)	1300	0	1000 ppm
Difluoromethane (R32)	677	0	1000 ppm

The Material Safety Data Sheet published by Honeywell states that HFO-1233zd is low toxicity and is not considered carcinogenic or mutagenic. Staff expects HFO-1233zd to have low health impacts for its designated uses.

VCAPCD is proposing to exempt HFO-1233zd from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE 7300):** On January 18, 2007, EPA exempted this compound from the federal definition of VOC because the  $K_{OH}$  value of HFE-7300 was less than the  $K_{OH}$  value of ethane. HFE-7300 may be used in a variety of applications, including heat transfer, lubricant deposition, electronic testing, and cleaning applications. Similar to HFE-7000, this compound is classified as a HFE and has an ODP of zero. Under EPA’s SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-7500 is estimated to have a GWP of 440. According to EPA’s analysis, HFE-7300 could be used to reduce GHG by substituting for other compounds with higher GWP, such as replacing CFCs. In EPA’s report “Global Mitigation of Non-CO2 Greenhouse Gases: 2010-2030”, HFEs were the primary abatement measure to mitigate the current GWP of CFCs. The comparison results of replacement compounds with HFE-7300 are summarized in Table 5.

*Table 5: Comparison of replacement compounds with HFE-7300*

<b>Compound</b>	<b>GWP</b>	<b>ODP</b>	<b>8-hour exposure guideline</b>
1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300)	440	0	100 ppm
1,1-dichloro-1fluoroethane (HCFC-141b)	523	0.11	500 ppm
Chlorodifluoromethane (HCFC-22)	1760	0.055	1000 ppm

The Product Specification Sheet published by 3M indicates that HFE-7300 has low toxicity. In addition, according to the final rule to exempt HFE-7300 from the definition of VOC as published in the Federal Register, HFE-7300 is very similar in structure, toxicity, and atmospheric properties to other HFE compounds such as HFE-7100 and HFE-7200. As previously discussed, HFE-7100 and HFE-7200 are not expected to adversely impact human health, and staff expects that HFE-7300 will have similarly low impacts on human health.

Staff is proposing the exempt HFE-7300 from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment.



In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE-7500):** On November 29, 2004, EPA exempted this compound from the federal definition of VOC because the  $K_{OH}$  value of HFE-7500 was less than the  $K_{OH}$  value of ethane. HFE-7500 may be used as a refrigerant. Similar to HFE-7000 and HFE-7300 this compound is classified as an HFE and has an ODP of zero. In EPA’s SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-7500 is estimated to have a GWP of 12. The GWP of HFE-7500 is low compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000. In EPA’s report “Global Mitigation of Non-CO2 Greenhouse Gases: 2010-2030”, HFEs were the primary abatement measure to mitigate the current GWP of CFCs. The comparison results of replacement compounds with HFE-7500 are summarized in Table 6.

*Table 6: Comparison of replacement compounds with HFE-7500*

Compound	GWP	ODP	8-hour exposure guideline
3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE-7500)	12	0	100 ppm
1,1,1,2-Tetrafluoroethane (R134a)	1300	0	1000 ppm
Difluoromethane (R32)	677	0	1000 ppm

The Product Specification Sheet published by 3M states that HFE-7500 has a very low overall toxicity. In addition to the final rule to exempt four compounds from the definition of VOC as published in the Federal Register. HFE-7500 is very similar in structure, toxicity and atmospheric properties to other HFE compounds such as HFE-7100 and HFE-7200. As previously discussed, HFE-7100 and HFE-7200 are not expected to adversely impact human health, and staff expects that HFE-7500 will have similar low impacts on human health.

Staff is proposing the exempt HFE-7500 from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment.

In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**2,3,3,3-tetrafluoropropene (HFO-1234yf):** On October 22, 2013, EPA exempted this compound from the federal definition of VOC based on the MIR method and because the  $K_{OH}$  value of HFO-1234yf was less than the  $K_{OH}$  value of ethane. The MIR of HFO-1234yf is equal to the MIR of ethane on a mass basis. HFO-1234yf may be used as a refrigerant. HFO-1234yf is classified as a hydrofluoroolefin and has an ODP of 0. In EPA's SNAP program, HFOs, as a class, have been identified as possible substitutes for CFCs. HFO-1234yf is estimated to have a GWP of 4. The GWP of HFO-1233zd is very low compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000. The comparison results of replacement compounds with HFO-1234yf are summarized in Table 7.

*Table 7: Comparison of replacement compounds with HFO-1234yf*

Compound	GWP	ODP	8-hour exposure guideline
2,3,3,3-tetrafluoropropene (HFO-1234yf)	4	0	500 ppm
1,1,1,2-Tetrafluoroethane (R134a)	1300	0	1000 ppm
Difluoromethane (R32)	677	0	1000 ppm

An industry update published by Honeywell and Dupont states that HFO-1234yf is low toxicity and is not considered carcinogenic or mutagenic. Staff expects HFO-1234yf to have low health impacts for its designated uses.

Staff is proposing to exempt HFO-1234yf from the District's definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**2-Amino-2-methyl-1-propanol (AMP):** On March 27, 2014, EPA exempted this compound from the federal definition of VOC based on the MIR method. The MIR of AMP is less than the MIR of ethane on a mass basis. AMP may be used in a variety of applications, including adhesives and sealants, paints and coatings and in cosmetics. AMP has an ODP of 0 and is estimated to have a GWP of less than one.

A Safety Data Sheet published by Angus Chemical Company states AMP is low toxicity and is not considered carcinogenic or mutagenic. Exposure levels are expected to be minimal due to its low volatility at room temperature. Staff expects AMP to have low health impacts for its designated uses.

Staff is proposing to exempt AMP from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2):** On July 20, 2016 EPA exempted this compound from the federal definition of VOC based on the MIR method and because the  $K_{OH}$  value of HFE-347pcf2 was less than the  $K_{OH}$  value of ethane. The MIRs of HFE-347pcf2 is less than the MIRs of ethane on both a mass and mole basis. HFE-347pcf2 may be used for a variety of applications, including cleaning electronic components, precision cleaning, dewatering of electronic components and a lubricant carrier. HFE-347pcf2 has a ODP of zero, and an estimated GWP of 580. According to EPA’s analysis, HFE-347pcf2 could be used to reduce GHG by substituting for other compounds with higher GWP, such as replacing HFCs and CFCs. The comparison results of replacement compounds with HFE-347pcf2 are summarized in Table 8.

*Table 8: Comparison of replacement compounds with HFE-347pcf2*

Compound	GWP	ODP	8-hour exposure guideline
1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2)	580	0	50 ppm
HFC-4310mee	1640	0	200 ppm
HFC-365mfc	794	0	500 ppm

The report by EPA titled “HFE-347pcf2 Direct Final Rule” described HFE-347pcf2 is toxic by inhalation with mortality observed at levels of 2000ppm and above. HFE-347pcf2 is not commonly used outside of industrial settings, and other compounds in the same industrial uses have similar health and environmental risks. The SNAP program anticipates that users will be able to use the compound in precision cleaning without significantly greater health risks than presented with the use of available substitutes. Staff does not expect a significant increase in health risks from the use of this compound.

Staff is proposing to exempt HFE-347pcf2 from the District’s definition of ROC because the use of HFE-347pcf2 is expected to have no increased adverse impacts on health or the environment over available substitutes. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

**Cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z):** On November 16, 2018 EPA exempted this compound from the federal definition of VOC based on the MIR method. The MIRs of HFO-1336mzz-Z is less than the MIRs of ethane on both a mass and mole basis. HFO-1336mzz-Z may be used for a variety of applications, including as a refrigerant, foam-blowing agent, fire extinguishant and solvent. HFO-1336mzz-Z is classified as a hydrofluoroolefin and has an ODP of 0. In EPA’s SNAP program, HFOs, as a class, have been identified as possible substitutes for CFCs. HFO-1336mzz-Z has a ODP of zero, and an estimated GWP of 2. This is much lower GWP value than HCFCs which are usually above 500. The comparison results of replacement compounds with HFE-1336mzz-Z are summarized in Table 9.

*Table 9: Comparison of replacement compounds with HFE-1336mzz-Z*

Compound	GWP	ODP	8-hour exposure guideline
cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z)	2	0	500 ppm
HFC-4310mee	1640	0	200 ppm
HFC-365mfc	794	0	500 ppm

A Safety Data Sheet published by DuPont states HFO-1336mzz-Z is low toxicity and is not expected to be carcinogenic or mutagenic. Staff expects HFO-1336mzz-Z to have low health impacts for its designated uses.

Staff is proposing the exempt HFO-1336mzz-Z from the District’s definition of ROC because this compound would not have an adverse impact on human health, or the environment. In addition, this compound may have significant benefits to stratospheric ozone depletion and global warming concerns.

### COMPOUNDS NOT RECOMMENDED FOR EXEMPTION

Staff is proposing to not incorporate, at this time, the following compounds into the list of exempt organic compounds:

- 1,1,1',1'-Tetrafluorodimethyl ether (HFE-134)
- Bis(difluoromethoxy)difluoromethane (HFE-236cal2)
- 1,2-bis(difluoromethoxy)-1,1,2,2-tetrafluoroethane (HFE-338pcc13)
- 1-(Difluoromethoxy)-2-[(difluoromethoxy)difluoromethoxy]-1,1,2,2-tetrafluoroethane (HFE 43-10-pccc)

In addition to the compounds discussed above, EPA has exempted HFE 134, HFE-236cal2, HFE-338pcc13, and HFE-43-10pccc from the federal definition of VOC. Staff,

however, is not proposing to incorporate these compounds into the District's list of exempt compounds either because Staff does not have adequate information to evaluate these compounds or has concerns regarding the adverse impact to human health or the environment. Staff may recommend exempting these compounds in the future when more information becomes available and/or additional health and environmental assessment has been completed. Each compound is discussed below:

**1,1,1',1'-Tetrafluorodimethyl ether (HFE-134):** On February 12, 2013 EPA exempted this compound from the federal definition of VOC because the  $K_{OH}$  value of HFE-134 was less than the  $K_{OH}$  value of ethane. HFE-134 may be used as a heat transfer agent (secondary-loop refrigerants) and as a fire suppressant. HFE-134 is classified as an HFE and has an ODP of zero. In EPA's SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-134 is estimated to have a GWP of 6320. The GWP of HFE-134 is high compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000.

EPA determined that HFE-134 has low acute toxicity, no irritation or skin sensitization, no detectible genotoxic activity, and low potential for developmental toxicity. Staff expects HFE-134 to have low health impacts for its designated uses.

At this time, staff is proposing to not exempt HFE-134 from the District's definition of ROC because this compound would have an adverse impact on the environment, due to the high GWP of HFE-134.

**Bis(difluoromethoxy)difluoromethane (HFE-236cal2):** On February 12, 2013 EPA exempted this compound from the federal definition of VOC because the  $K_{OH}$  value of HFE-236cal2 was less than the  $K_{OH}$  value of ethane. HFE-236cal2 may be used as a heat transfer agent (secondary-loop refrigerants) and as a fire suppressant. HFE-236cal2 is classified as an HFE and has an ODP of zero. In EPA's SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-236cal2 is estimated to have a GWP of 2800. The GWP of HFE-236cal2 is high compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000.

EPA determined that HFE-236cal2 has low acute toxicity, no irritation or skin sensitization, no detectible genotoxic activity, and low potential for developmental toxicity. Staff expects HFE-236cal2 to have low health impacts for its designated uses. At this time, staff is proposing to not exempt HFE-236cal2 from the District's definition of ROC because this compound would have an adverse impact on the environment, due to the high GWP of HFE-236cal2.

**1,2-bis(difluoromethoxy)-1,1,2,2-tetrafluoroethane (HFE-338pcc13):** On February 12, 2013 EPA exempted this compound from the federal definition of VOC because the

K<sub>OH</sub> value of HFE-338pcc13 was less than the K<sub>OH</sub> value of ethane. HFE-338pcc13 may be used as a heat transfer agent (secondary-loop refrigerants) and as a fire suppressant. HFE-338pcc13 is classified as an HFE and has an ODP of zero. In EPA's SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-338pcc13 is estimated to have a GWP of 1500. The GWP of HFE-338pcc13 is high compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000.

EPA determined that HFE-338pcc13 has low acute toxicity, no irritation or skin sensitization, no detectible genotoxic activity, and low potential for developmental toxicity. Staff expects HFE-338pcc13 to have low health impacts for its designated uses.

At this time, staff is proposing to not exempt HFE-338pcc13 from the District's definition of ROC because this compound would have an adverse impact on the environment, due to the high GWP of HFE-338pcc13.

**1-(Difluoromethoxy)-2-[(difluoromethoxy)difluoromethoxy]-1,1,2,2-tetrafluoroethane (HFE-43-10-pccc):** On February 12, 2013 EPA exempted this compound from the federal definition of VOC because the K<sub>OH</sub> value of HFE-43-10-pccc was less than the K<sub>OH</sub> value of ethane. HFE-43-10-pccc may be used as a heat transfer agent (secondary-loop refrigerants) and as a fire suppressant. HFE-43-10-pccc is classified as an HFE and has an ODP of zero. In EPA's SNAP program, HFEs, as a class, have been identified as possible substitutes for CFCs. HFE-43-10-pccc is estimated to have a GWP of 2820. The GWP of HFE-43-10-pccc is high compared to CFCs. In general, CFCs have very high GWPs, usually greater than 1000.

USEPA determined that HFE-43-10-pccc has low acute toxicity, no irritation or skin sensitization, no detectible genotoxic activity, and low potential for developmental toxicity. Staff expects HFE-43-10-pccc to have low health impacts for its designated uses.

At this time, staff is proposing to not exempt HFE-43-10-pccc from the District's definition of ROC because this compound would have an adverse impact on the environment, due to the high GWP of HFE-43-10-pccc.

### CAS REGISTRY NUMBERS

For ease of identification, the VCAPCD is also proposing to attach a chemical abstract service (CAS) number to each corresponding compound. Please note that CAS Registry Numbers (CAS RN or CAS Numbers) are universally used to provide a unique,

unmistakable identifier for chemical substances. A CAS number itself has no inherent chemical significance but provides an unambiguous way to identify a chemical substance or molecular structure when there are many possible systematic, generic, proprietary, or trivial names.

## IMPACT OF PROPOSED RULE

### COST EFFECTIVENESS

The proposed revisions to Rule 2 are intended to expand the definition of “Exempt Organic Compounds” to include 1,1,1,2,2,3,3-heptafluoro-3-methoxypropane (HFE 7000), trans-1,3,3,3-tetrafluoropropene (HFO-1234ze), trans-1-chloro-3,3,3-trifluoropropene (HFO-1233zd), 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE 7300), 3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)hexane (HFE 7500), 2,3,3,3-tetrafluoropropene (HFO-1234yf), 2-Amino-2-methyl-1-propanol (AMP), 1,1,2,2-Tetrafluoro-1-(2,2,2-trifluoroethoxy) ethane (HFE-347pcf2), and cis-1,1,1,4,4,4-hexafluorobut-2-ene (HFO-1336mzz-Z). In general, the rule action is not expected to produce additional emission limitations. Therefore, a cost-effective analysis is not required. Further, this rule action provides additional options for compliance with ROC limits.

### SOCIOECONOMIC IMPACTS

The provisions of Section 40728.5 of the California Health and Safety Code requires a socioeconomic impact analysis whenever the air quality or emissions limitations will be significantly affected. The proposed amendment to Rule 2 updates the existing VCAPCD list of exempt compounds to include nine additional compounds that have been exempted by the EPA. These amendments do not establish emission limitations, and because these compounds have negligible reactivity, their exemption will not harm air quality. Therefore, the provisions of Section 40728.5 of the California Health and Safety Code do not apply to the proposed amendments to Rule 2, and a socioeconomic impact analysis is not required.

### ENVIRONMENTAL IMPACTS OF METHODS OF COMPLIANCE

California Public Resources Code Section 21159 requires the District to perform an environmental analysis of the reasonably foreseeable methods of compliance. The analysis must include the following information on proposed new amendments to Rule 2.

- 1) An analysis of the reasonably foreseeable alternative means of compliance with the rule or regulation.



- 2) An analysis of the reasonably foreseeable environmental impacts of the methods of compliance.
- 3) An analysis of the reasonably foreseeable mitigation measures.

Proposed amendments to Rule 2 will add five organic compounds to the existing list of exempt compounds and will not establish emission limitations; however, these compounds may be used to comply with ROC limits in other district rules. Staff reviewed the five compounds and determined that the compounds have negligible or zero ODPs. Also, each compound either has a low GPW or would be used to replace other organic compounds with higher GWPs. The analysis below demonstrates that the adoption of proposed amendments to Rule 2 will not have a significant effect on the environment due to unusual circumstances. The amendments will result in reduced emissions of more potent GWP and ODP compounds and are thus categorically exempt from CEQA under Section 15307 and 15308 of the State CEQA Guidelines (as described in the California Code and Regulations, Title 14, Division 6, Chapter 3).

*Table 10: Impact Analysis of Environmental Effects*

<b>Reasonably Foreseeable Alternative Means of Compliance)</b>	<b>Reasonably Foreseeable Environmental Impacts</b>	<b>Reasonably Foreseeable Mitigation Measures</b>
Adoption of compounds in refrigeration, aerosol propellants and foam expander use.	Human Health Impacts: Adoption will result in use of more toxic chemicals, that may be more flammable.	Compliance with OSHA safety guidelines (e.g. personal protective equipment, prevention and response, emergency first aid procedures) reduces these impacts.
	Air Quality Impacts: May increase odor due to fugitive emissions.	Quantities of fugitive emissions will be small enough to not impact communities.
Will result in new cooling units designed for new HFE and HFO compounds	Solid Waste Disposal: Old units being replaced may result in more solid waste.	Old units can be recycled or retrofit to accommodate use of new refrigerants.
	Air Quality Impacts: May result in temporarily increased emissions from replacement of refrigerants.	Compliance with EPA protocols requires recycling of all refrigerants any time cooling units are serviced.



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