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Arizona	Oregon
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§ 80.42 Simple emissions model.

(a) *VOC emissions*. The following equations shall comprise the simple model for VOC emissions. The simple model for VOC emissions shall be used only in determining toxics emissions:

Summer = The period of May 1 through September 15

Winter = The period of September 16 through April 30

EXHVOCS1 = Exhaust nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 1 during the summer period.

EXHVOCS2 = Exhaust nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 2 during the summer period.

EXHVOCW = Exhaust nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, during the winter period.

EVPVOCS1 = Evaporative nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 1 during the summer period.

EVPVOCS2 = Evaporative nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 2 during the summer period.

RLVOCS1 = Running loss nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 1 during the summer period.

RLVOCS2 = Running loss nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 2 during the summer period.

REFVOCS1 = Refueling nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 1 during the summer period.

REFVOCS2 = Refueling nonmethane, nonethane VOC emissions from the fuel in question, in grams per mile, for VOC control region 2 during the summer period.

OXCON = Oxygen content of the fuel in question, in terms of weight percent (as measured under § 80.46)

RVP = Reid vapor pressure of the fuel in question, in pounds per square inch (psi)

(1) The following equations shall comprise the simple model for VOC emissions in VOC Control Region 1 during the summer period:

$$EXHVOCS1 = 0.444\times(1-(0.127/2.7)\times OXCON)$$
$$EVPVOCS1 = 0.7952-0.2461\times RVP+0.02293\times RVP\times RVP$$
$$RLVOCS1 = -0.734+0.1096\times RVP+0.002791\times RVP\times RVP$$
$$REFVOCS1 = 0.04\times((0.1667\times RVP)-0.45)$$

(2) The following equations shall comprise the simple model for VOC emissions in VOC Control Region 2 during the summer period:

$$EXHVOCS2 = 0.444 \times (1 - (0.127/2.7) \times OXCON)$$
$$EVPVOCS2 = 0.813 - 0.2393 \times RVP + 0.021239 \times RVP \times RVP$$
$$RLVOCS2 = 0.2963 - 0.1306 \times RVP + 0.016255 \times RVP \times RVP$$
$$REFVOCS2 = 0.04 \times ((0.1667 \times RVP) - 0.45)$$

(3) The following equation shall comprise the simple model for VOC emissions during the winter period:

$$EXHVOCW = 0.656 \times (1 - (0.127/2.7) \times OXCON)$$

(b) *Toxics emissions*. The following equations shall comprise the simple model for toxics emissions:

EXHBEN = Exhaust benzene emissions from the fuel in question, in milligrams per mile

EVPBEN = Evaporative benzene emissions from the fuel in question, in milligrams per mile

HSBEN = Hot soak benzene emissions from the fuel in question, in milligrams per mile

DIBEN = Diurnal benzene emissions from the fuel in question, in milligrams per mile

RLBEN = Running loss benzene emissions from the fuel in question, in milligrams per mile

REFBEN = Refueling benzene emissions from the fuel in question, in milligrams per mile

MTBE = Oxygen content of the fuel in question in the form of MTBE, in terms of weight percent (as measured under § 80.46)

ETOH = Oxygen content of the fuel in question in the form of ethanol, in terms of weight percent (as measured under § 80.46)

ETBE = Oxygen content of the fuel in question in the form of ETBE, in terms of weight percent (as measured under § 80.46)

FORM = Formaldehyde emissions from the fuel in question, in milligrams per mile

ACET = Acetaldehyde emissions from the fuel in question, in milligrams per mile

POM = Emissions of polycyclic organic matter from the fuel in question, in milligrams per mile

BUTA = Emissions of 1,3-Butadiene from the fuel in question, in milligrams per mile
FBEN = Fuel benzene of the fuel in question, in terms of volume percent (as measured under § 80.46)
FAROM = Fuel aromatics of the fuel in question, in terms of volume percent (as measured under § 80.46)
TOXREDS1 = Total toxics reduction of the fuel in question during the summer period for VOC control region 1 in percent
TOXREDS2 = Total toxics reduction of the fuel in question during the summer period for VOC control region 2 in percent
TOXREDW = Total toxics reduction of the fuel in question during the winter period in percent

(1) The following equations shall comprise the simple model for toxics emissions in VOC control region 1 during the summer period:

TOXREDS1 = [100 × (53.2 − EXHBEN − EVPBEN − RLBEN − REFBEN − FORM − ACET − BUTA − POM)] / 53.2
EXHBEN = [1.884+0.949 × FBEN + 0.113 × (FAROM − FBEN)) / 100] × 1000 × EXHVOCS1
EVPBEN = HSBEN + DIBEN
HSBEN = FBEN × (EVPVOCS1 × 0.679) × 1000 × [(1.4448 − (0.0684 × MTBE/2.0) − (0.080274 × RVP)) / 100]
DIBEN = FBEN × (EVPVOCS1 × 0.321) × 1000 × [(1.3758 − (0.0579 × MTBE/2.0) − (0.080274 × RVP)) / 100]
RLBEN = FBEN × RLVOCS1 × 1000 × [(1.4448 − (0.0684 × MTBE/2.0) − (0.080274 × RVP)) / 100]
REFBEN = FBEN × REFVOCS1 × 1000 × [(1.3972 − (0.0591 × MTBE / 2.0) − (0.081507 × RVP)) / 100] BUTA = 0.00556 × EXHVOCS1 × 1000
POM = 3.15 × EXHVOCS1

(i) For any oxygenate or mixtures of oxygenates, the formaldehyde and acetaldehyde shall be calculated with the following equations:

FORM = 0.01256 × EXHVOCS1 × 1000 × [1 + (0.421 / 2.7) × MTBE + TAME) + (0.358 / 3.55) × ETOH + (0.137 / 2.7) × (ETBE + ETAE)]
ACET = 0.00891 × EXHVOCS1 × 1000 × [1 + (0.078 / 2.7) × (MTBE + TAME) + (0.865 / 3.55) × ETOH + (0.867 / 2.7) × (ETBE + ETAE)]

(ii) When calculating formaldehyde and acetaldehyde emissions using the equations in paragraph (b)(1)(i) of this section, oxygen in the form of alcohols which are more complex or have higher molecular weights than ethanol shall be evaluated as if it were in the form of ethanol. Oxygen in the form of methyl ethers other than TAME and MTBE shall be evaluated as if it were in the form of MTBE. Oxygen in the form of ethyl ethers other than ETBE shall be evaluated as if it were in the form of ETBE. Oxygen in the form of non-methyl, non-ethyl ethers shall be evaluated as if it were in the form of ETBE. Oxygen in the form of methanol or non-alcohol, non-ether oxygenates shall not be evaluated with the Simple Model, but instead must be evaluated through vehicle testing under the Complex Model per § 80.48.

(2) The following equations shall comprise the simple model for toxics emissions in VOC control region 2 during the summer period:

TOXREDS2 = 100 × (52.1 − EXHBEN − EVPBEN − RLBEN − REFBEN − FORM − ACET − BUTA − POM) / 52.1
EXHBEN = [(1.884 + 0.949 × FBEN + 0.113 × (FAROM − FBEN)) / 100] × 1000 × EXHVOCS2
EVPBEN = HSBEN + DIBEN
HSBEN = FBEN × (EVPVOCS2 × 0.679) × 1000 × [(1.4448 − (0.0684 × MTBE / 2.0) − (0.080274 × RVP)) / 100]
DIBEN = FBEN × (EVPVOCS2 × 0.321) × 1000 × [(1.3758 − (0.0579 × MTBE / 2.0) − (0.080274 × RVP)) / 100]
RLBEN = FBEN × RLVOCS2 × 1000 × [(1.4448 − (0.0684 × MTBE / 2.0) − (0.080274 × RVP)) / 100]
REFBEN = FBEN × REFVOCS2 × 1000 × [(1.3972 − (0.0591 × MTBE / 2.0) − (0.081507 × RVP)) / 100]
BUTA = 0.00556 × EXHVOCS2 × 1000
POM = 3.15 × EXHVOCS2

(i) For any oxygenate or mixtures of oxygenates, the formaldehyde and acetaldehyde shall be calculated with the following equations:

FORM = 0.01256 × EEXHVOCS2 × 1000 × [1 + (0.421 / 2.7) × (MTBE + TAME) + (0.358 / 3.55) × ETOH + (0.137 / 2.7) × (ETBE + ETAE)]
ACET = 0.00891 × EXHVOCS2 × 1000 × [1 + (0.078 / 2.7) × (MTBE + TAME) + (0.865 / 3.55) × ETOH + (0.867 / 2.7) × (ETBE + ETAE)]

(ii) When calculating formaldehyde and acetaldehyde emissions using the equations in paragraph (b)(2)(i) of this section, oxygen in the form of alcohols which are more complex or have higher molecular weights than ethanol shall be evaluated as if it were in the form of ethanol. Oxygen in the form of methyl ethers other than TAME and MTBE shall be evaluated as if it were in the

form of MTBE. Oxygen in the form of ethyl ethers other than ETBE shall be evaluated as if it were in the form of ETBE. Oxygen in the form of non-methyl, non-ethyl ethers shall be evaluated as if it were in the form of ETBE. Oxygen in the form of methanol or non-alcohol, non-ether oxygenates shall not be evaluated with the Simple Model, but instead must be evaluated through vehicle testing under the Complex Model per § 80.48.

(3) The following equations shall comprise the simple model for toxics emissions during the winter period:

$$TOXREDW = 100 \times (55.5 - EXHBEN - FORM - ACET - BUTA - POM) / 55.5$$

$$EXHBEN = [(1.884 + 0.949 \times FBEN + 0.113 \times (FAROM - FBEN)) / 100] \times 1000 \times EXHVOCW$$

$$BUTA = 0.00556 \times EXHVOCW \times 1000$$

$$POM = 2.13 \times EXHVOCW$$

(i) For any oxygenate or mixtures of oxygenates, the formaldehyde and acetaldehyde shall be calculated with the following equations:

$$FORM = 0.01256 \times EXHVOCS1 \times 1000 \times [1 + (0.421 / 2.7) \times (MTBE + TAME) + (0.358 / 3.55) \times ETOH + (0.137 / 2.7) \times (ETBE + ETAE)]$$

$$ACET = 0.00891 \times EXHVOCS1 \times 1000 \times [1 + (0.078 / 2.7) \times (MTBE + TAME) + (0.865 / 3.55) \times ETOH + (0.867 / 2.7) \times (ETBE + ETAE)]$$

(ii) When calculating formaldehyde and acetaldehyde emissions using the equations in paragraph (b)(3)(i) of this section, oxygen in the form of alcohols which are more complex or have higher molecular weights than ethanol shall be evaluated as if it were in the form of ethanol. Oxygen in the form of methyl ethers other than TAME and MTBE shall be evaluated as if it were in the form of MTBE. Oxygen in the form of ethyl ethers other than ETBE shall be evaluated as if it were in the form of ETBE. Oxygen in the form of non-methyl, non-ethyl ethers shall be evaluated as if it were in the form of ETBE. Oxygen in the form of methanol or non-alcohol, non-ether oxygenates shall not be evaluated with the Simple Model, but instead must be evaluated through vehicle testing under the Complex Model per § 80.48.

(4) If the fuel aromatics content of the fuel in question is less than 10 volume percent, then an FAROM value of 10 volume percent shall be used when evaluating the toxics emissions equations given in paragraphs (b)(1), (b)(2), and (b)(3) of this section.

(c) *Limits of the model.* (1) The model given in paragraphs (a) and (b) of this section shall be used as given to determine VOC and toxics emissions, respectively, if the properties of the fuel being evaluated fall within the ranges shown in this paragraph (c). If the properties of the fuel being evaluated fall outside the range shown in this paragraph (c), the model may not be used to determine the VOC or toxics performance of the fuel:

Fuel parameter	Range
Benzene content	0.0–4.9 vol %.
RVP	6.6–9.0 psi.[1]
Oxygenate content	0–4.0 wt %.
Aromatics content	0–55 vol %.

[1] For gasoline sold in California, the applicable RVP range shall be 6.4–9.0 psi.

(2) The model given in paragraphs (a) and (b) of this section shall be effective from January 1, 1995 through December 31, 1997, unless extended by action of the Administrator.

[59 FR 7813, Feb. 16, 1994, as amended at 59 FR 36958, July 20, 1994; 61 FR 20738, May 8, 1996]

§§ 80.43–80.44 [Reserved]

§ 80.45 Complex emissions model.

(a) *Definition of terms.* For the purposes of this section, the following definitions shall apply:

Target fuel = The fuel which is being evaluated for its emissions performance using the complex model

OXY = Oxygen content of the target fuel in terms of weight percent

SUL = Sulfur content of the target fuel in terms of parts per million by weight

RVP = Reid Vapor Pressure of the target fuel in terms of pounds per square inch

E200 = 200 °F distillation fraction of the target fuel in terms of volume percent

E300 = 300 °F distillation fraction of the target fuel in terms of volume percent

ARO = Aromatics content of the target fuel in terms of volume percent

BEN = Benzene content of the target fuel in terms of volume percent

OLE = Olefins content of the target fuel in terms of volume percent

MTB = Methyl tertiary butyl ether content of the target fuel in terms of weight percent oxygen