or imported was supplied only to a smaller number of covered areas.

(4) Adjusted standards apply to all averaged reformulated gasoline produced by a refinery or imported by an importer identified in this paragraph (q), except:

(i) In the case of adjusted VOC standards for a covered area located in VOC Control Region 1, the adjusted VOC standards apply only to averaged reformulated gasoline designated as VOC-controlled intended for use in VOC Control Region 1; and

(ii) In the case of adjusted VOC standards for a covered area located in VOC Control Region 2, the adjusted VOC standards apply only to averaged reformulated gasoline designated as VOC-controlled intended for use in VOC Control Region 2.

(r) *Definition of PADD.* For the purposes of this section only, the following definitions of PADDs apply:

(1) The following States are included in PADD I:

Connecticut	New Hampshire
Delaware	New Jersey
District of Columbia	North Carolina
Florida	Pennsylvania
Georgia	Rhode Island
Maine	South Carolina
Maryland	Vermont
Massachusetts	Virginia
New York	West Virginia

(2) The following States are included in PADD II:

Illinois	Nebraska
Indiana	North Dakota
Iowa	Ohio
Kansas	Oklahoma
Kentucky	South Dakota
Michigan	Tennessee
Minnesota	Wisconsin
Missouri	

(3) The following States are included in PADD III:

Alabama	Mississippi
Arkansas	New Mexico
Louisiana	Texas

(4) The following States are included in PADD IV:

Colorado	Utah
Idaho	Wyoming
Montana	

(5) The following States are included in PADD V:

Arizona	Oregon
California	Washington
Nevada	

[59 FR 7813, Feb. 16, 1994, as amended at 59 FR 36958, July 20, 1994; 61 FR 12041, Mar. 25, 1996; 62 FR 68205, Dec. 31, 1997; 64 FR 37689, July 13, 1999; 66 FR 37164, July 17, 2001; 71 FR 74566, Dec. 15, 2005; 71 FR 8972, Feb. 22, 2006; 71 FR 26698, May 8, 2006; 72 FR 8543, Feb. 26, 2007]

§ 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×(1−(0.127/2.7)×OXCON)
EVPVOCS1 = 0.7952−0.2461×RVP +0.02293×RVP×RVP
RLVOCS1 = −0.734+0.1096×RVP +0.002791×RVP×RVP
REFVOCS1 = 0.04×((0.1667×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 × (1 − (0.127/2.7) × OXCON)
EVPVOCS2 = 0.813 − 0.2393 × RVP + 0.021239 × RVP × RVP
RLVOCS2 = 0.2963 − 0.1306 × RVP + 0.016255 × RVP × RVP
REFVOCS2 = 0.04 × ((0.1667 × RVP) − 0.45)

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

EXHVOCW = 0.656 × (1 − (0.127/2.7) × 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 × (55.5 − EXHBEN − FORM − ACET − BUTA − POM) / 55.5
EXHBEN = [(1.884 + 0.949 × FBEN + 0.113 × (FAROM − FBEN)) / 100] × 1000 × EXHVOCW
BUTA = 0.00556 × EXHVOCW × 1000
POM = 2.13 × EXHVOCW

(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)(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
ETB = Ethyl tertiary butyl ether content of the target fuel in terms of weight percent oxygen
TAM = Tertiary amyl methyl ether content of the target fuel in terms of weight percent oxygen
ETH = Ethanol content of the target fuel in terms of weight percent oxygen
exp = The function that raises the number e (the base of the natural logarithm) to the power in its domain
Phase I = The years 1995–1999
Phase II = Year 2000 and beyond

(b) *Weightings and baselines for the complex model.* (1) The weightings for normal and higher emitters (w_1 and w_2, respectively) given in table 1 shall be used to calculate the exhaust emission performance of any fuel for the appropriate pollutant and Phase:

TABLE 1—NORMAL AND HIGHER EMITTER WEIGHTINGS FOR EXHAUST EMISSIONS

	Phase I		Phase II	
	VOC & toxics	NO_X	VOC & toxics	NO_X
Normal Emitters (w_1)	0.52	0.82	0.444	0.738
Higher Emitters (w_2)	0.48	0.18	0.556	0.262

(2) The following properties of the baseline fuels shall be used when determining baseline mass emissions of the various pollutants:

TABLE 2—SUMMER AND WINTER BASELINE FUEL PROPERTIES

Fuel property	Summer	Winter
Oxygen (wt %)	0.0	0.0
Sulfur (ppm)	339	338
RVP (psi)	8.7	11.5
E200 (%)	41.0	50.0
E300 (%)	83.0	83.0
Aromatics (vol %)	32.0	26.4
Olefins (vol %)	9.2	11.9
Benzene (vol %)	1.53	1.64

(3) The baseline mass emissions for VOC, NO_X and toxics given in tables 3, 4 and 5 of this paragraph (b)(3) shall be used in conjunction with the complex model during the appropriate Phase and season:

TABLE 3—BASELINE EXHAUST EMISSIONS

Exhaust pollutant	Phase I		Phase II	
	Summer (mg/mile)	Winter (mg/mile)	Summer (mg/mile)	Winter (mg/mile)
VOC	446.0	660.0	907.0	1341.0
NO_X	660.0	750.0	1340.0	1540.0
Benzene	26.10	37.57	53.54	77.62
Acetaldehyde	2.19	3.57	4.44	7.25
Formaldehyde	4.85	7.73	9.70	15.34
1,3-Butadiene	4.31	7.27	9.38	15.84
POM	1.50	2.21	3.04	4.50