South Australia

Environment Protection (Motor Vehicle Fuel Quality) Policy 2002

under the *Environment Protection Act 1993*

Contents

1—Short title

This policy may be cited as the *Environment Protection (Motor Vehicle Fuel Quality) Policy 2002*.

2—Object

The object of this policy is to establish standards for the quality of motor vehicle fuel, in order to maintain or enhance air quality in South Australia.

3—Interpretation

(1) In this policy, unless the contrary intention appears—

the Act means the *Environment Protection Act 1993*;

ATI means the figure, calculated under sections 2 and 3 of Part 2 of Schedule 2, representing the quality of a batch of fuel;

average batch measurement means the figure, representing the volumetric average of batch measurements of a characteristic to which a standard for an average batch measurement applies, calculated for the period specified in Schedule 1 in relation to the characteristic;

AVSR additive means an additive to petrol for the purpose of reducing valve seat recession in internal combustion engines;

batch means a quantity of diesel or a particular grade of petrol, manufactured or imported by a fuel supplier, in which the batch measurement of each characteristic remains constant throughout the entire quantity;

batch measurement means the figure, calculated under section 1 of Part 2 of Schedule 2, representing the value of a characteristic in a batch of fuel;

characteristic means a property of fuel listed in Schedule 1 under the heading "Characteristics";

date of supply means—

(a) if the batch is supplied as a whole, the date on which the batch is received by the person to whom it is supplied; or

(b) if the batch is supplied in portions, the date on which the first portion is received by the person to whom it is supplied;

diesel means a petroleum or shale product that is used or capable of being used to power an internal combustion engine with compression ignition in a motor vehicle;

ETBE means ethyl tertiary butyl ether;

E200 means the 200 degrees Fahrenheit distillation fraction of fuel in terms of volume percent;

E300 means the 300 degrees Fahrenheit distillation fraction of fuel in terms of volume percent;

fuel means petrol or diesel;

fuel distributor means a person, other than a fuel supplier, who carries on the business of supplying fuel;

fuel supplier means a person who produces fuel in or imports fuel into South Australia for supply in the course of business;

grade means type of petrol, by reference to the following types:

(a) LP; and

(b) LRP; and

(c) PULP; and

(d) ULP;

LP means leaded petrol, that is, petrol containing more than 0.013 grams per litre of lead;

LRP means lead replacement petrol, that is, petrol that is supplied as a substitute for LP by using an AVSR additive;

motor vehicle means any machine that is designed or used for the purpose of transporting goods, materials or persons and is propelled by an internal combustion engine, but does not include an aircraft;

MTBE means Methyl Tertiary Butyl Ether;

octane extender means any substance, not normally produced in the oil refining process, that increases the octane in petrol to which it is added, including, but not limited to, ethers, ethanol, and methanol;

petrol means any petroleum or shale product that is used or capable of being used to power an internal combustion engine with positive or spark ignition in a motor vehicle;

pool average ATI means the figure, calculated under section 4 of Part 2 of Schedule 2, representing the average ATI for all fuel supplied by a fuel supplier over a rolling period;

PULP means premium unleaded petrol, that is, premium petrol containing not more than 0.013 grams per litre of lead;

record means the record referred to in clause 6;

reporting period means the three month period that begins on the first day of the month immediately following the month during which this policy comes into operation, and each successive three month period;

rolling period means the three month period ending on the date of supply of a batch of fuel;

RVP means Reid Vapour Pressure;

standard means a standard, set out and subject to any conditions specified in Schedule 1, applying to a batch measurement or average batch measurement of a characteristic, or the pool average ATI;

supply means sell, deliver, give or provide to a person for that person's use, or to a fuel distributor;

TAME means tertiary amyl methyl ether;

test method means the method, set out in Schedule 2, to be used to calculate batch measurements and average batch measurements of characteristics, the ATI and the pool average ATI;

ULP means unleaded petrol, that is, non-premium petrol containing not more than 0.013 grams per litre of lead.

(2) In this policy, the expression ***Mandatory Provision*** followed by a statement as to the category of an offence is to be taken to mean that contravention of the provision at whose foot the expression appears will be an offence of the category so stated for the purposes of Part 5 of the Act.

Note—

Unless the contrary intention appears, terms used in this policy that are defined in the Act have the respective meanings assigned to those terms by the Act.

4—Offence for fuel supplier to supply fuel that exceeds standard

(1) A fuel supplier—

(a) must not supply fuel with a characteristic that has a batch measurement that breaches a standard;

(b) must ensure that fuel supplied by the fuel supplier is such that a standard for an average batch measurement of a characteristic or the pool average ATI is not breached.

Mandatory Provision: Category A offence.

(2) This clause does not apply to the supply of fuel to an area listed in Schedule 4.

5—Offence for fuel supplier to supply fuel that exceeds certain standards to particular areas

A fuel supplier must not supply to an area listed in Schedule 4 fuel with a characteristic that has a batch measurement that breaches a standard established by paragraphs (c), (g) or (k) of Part 1 of Schedule 1.

Mandatory Provision: Category A offence.

6—Fuel supplier to keep record

(1) A fuel supplier must not supply a batch of fuel or fuel from a batch of fuel unless the fuel supplier makes a record specifying for that batch the following:

(a) the batch measurements of the characteristics;

(b) the test methods used in the calculation of the batch measurements of the characteristics;

(c) the volume;

(d) the type of fuel and, if the fuel is petrol, the grade of the petrol;

(e) the date of supply in respect of the batch.

Mandatory Provision: Category A offence.

(2) A fuel supplier must keep the record for each batch of fuel it supplies for 24 months from the date of supply in respect of the batch.

Mandatory Provision: Category A offence.

7—Fuel supplier to submit copies of records to the Authority

(1) A fuel supplier must, within 15 days after the end of a reporting period, submit to the Authority a copy of the record for each batch of fuel the whole or a portion of which has been supplied by the fuel supplier during the reporting period.

Mandatory Provision: Category A offence.

(2) A fuel supplier must, within 10 days after receiving a notice from the Authority, comply with a requirement of the notice that the fuel supplier submit to the Authority a copy of a record specified in the notice.

Mandatory Provision: Category A offence.

8—Fuel supplier must provide fuel distributor with statement

(1) A fuel supplier who supplies fuel to a fuel distributor must provide the fuel distributor with a written statement—

(a) accurately identifying the batch of fuel from which the fuel is supplied; and

(b) certifying that, in the supplier's estimation, the RVP levels in the fuel will achieve compliance with the standard established by paragraph (i) of Part 1 of Schedule 1; and

(c) truthfully stating whether the fuel does or does not comply with all of the requirements of this Policy.

Mandatory Provision: Category A offence.

(2) However, a fuel supplier who supplies fuel to a fuel distributor in an area listed in Schedule 4 is not required to provide the certification referred to in subclause (1)(b).

(3) For the purposes of subclause (1)(b), the estimation provided by the supplier must be based on average levels, calculated using the RVP level of each batch manufactured or imported by the supplier in the rolling period relating to the batch of fuel referred to in subclause (1)(a).

(4) A fuel distributor must not supply fuel unless the fuel distributor has received a copy of the statement in relation to the fuel and the statement indicates that the fuel complies with all of the requirements of this Policy.

Mandatory Provision: Category B offence.

(5) A fuel distributor must keep the statement for 24 months from the date of supply of the fuel by the fuel supplier to the fuel distributor.

Mandatory Provision: Category B offence.

(6) A fuel distributor must not supply fuel if the fuel distributor knows or suspects, or should know or suspect, that the statement indicating that the fuel complies with all of the requirements of this Policy cannot not be relied on.

Mandatory Provision: Category B offence.

9—Fuel distributor supplying fuel to another fuel distributor must provide statement

A fuel distributor who supplies fuel to another fuel distributor must provide the fuel distributor with a written statement—

(a) certifying that no substance has been added to the fuel by the fuel distributor; or

(b) notifying the fuel distributor to whom the fuel is supplied of any substance added to the fuel by the fuel distributor and certifying that addition of the substance is permitted by clause 10.

Mandatory Provision: Category B offence.

10—Fuel distributor must not alter fuel

A fuel distributor must not add any substance to fuel supplied by a fuel supplier or another fuel distributor unless the substance is included in the list of permissible additives in Schedule 6.

Mandatory Provision: Category B offence.

11—Fuel supplier may add certain octane extenders

(1) A fuel supplier must not add an octane extender to petrol or petrol in the process of production that is to be supplied by the fuel supplier unless the octane extender is listed in Schedule 3.

Mandatory Provision: Category A offence.

(2) A fuel supplier must not supply petrol to which an octane extender not listed in Schedule 3 has been added.

Mandatory Provision: Category A offence.

(3) If a fuel supplier adds an octane extender listed in Schedule 3 to petrol or petrol in the process of production that is to be supplied by the fuel supplier, the fuel supplier must comply with the condition or conditions, if any, specified in Schedule 3 in relation to the addition of that octane extender.

Mandatory Provision: Category A offence.

12—Fuel supplier must not add ETBE, MTBE and TAME

A fuel supplier—

(a) must not add ETBE, MTBE or TAME to petrol or petrol in the process of production that is to be supplied by the fuel supplier; and

(b) must take reasonable precautions against the mixing of ETBE, MTBE or TAME and petrol to be supplied by the fuel supplier; and

(c) must not supply petrol to which ETBE, MTBE or TAME has been added in the process of production undertaken by the fuel supplier.

Mandatory Provision: Category A offence.

13—Limited application of policy

This policy does not apply to fuel supplied or to be supplied for the uses listed in Schedule 5.

14—Application of policy during period of restriction

(1) In this clause—

period of restriction means a period declared under section 33 of the *Petroleum Products Regulation Act 1995* to be a period of restriction.

(2) The standards established by paragraphs (h) and (i) of Part 1 of Schedule 1 do not apply during a period of restriction.

(3) Fuel supplied by fuel suppliers to fuel distributors during a period of restriction is deemed, for the purpose of determining pool average ATI, to possess a maximum ATI of 22 or 22.5, as determined by the Authority.

15—Minister may make amendments

(1) The Minister may amend this policy by amending any of the following:

(a) the characteristics; and

(b) the pool average ATI; and

(c) the standards; and

(d) the requirements in relation to records and statements; and

(e) the test method; and

(f) the requirements in relation to the addition of octane extenders to petrol or petrol in the process of production by fuel suppliers; and

(g) the areas in which all or part of this policy does not apply; and

(h) the uses of fuel for which supply is allowed; and

(i) the additives permitted to be added to fuel by fuel distributors.

(2) If the Minister amends this policy under subclause (1), the Minister may also make amendments to this policy that are incidental to the amendments made.

(3) An amendment under subclause (1) or (2) is a change that may be made to this policy by amendment under section 32(1)(c) of the Act.

(4) In this clause—

amend includes add to, delete entirely or in part, and replace entirely or in part.

Schedule 1—Characteristics of fuel, and standards for batch measurements, average batch measurements, and the pool average ATI

Part 1—Petrol

CHARACTERISTICS

(a) Aromatics: no standard

(b) Benzene: maximum percentage proportion by volume of 4.9%

(c) ETBE: maximum percentage proportion by volume of 1%

Subject to—

(i) clause 12

(ii) if a batch contains a combination of two or more of the characteristics referred to in clause 12, the sum of the batch measurements of each of those characteristics must not exceed 1%

(d) E200: no standard

(e) E300: no standard

(f) Lead: maximum of 0.2 grams per litre

(g) MTBE: maximum percentage proportion by volume of 1%

Subject to—

(i) clause 12

(ii) if a batch contains a combination of two or more of the characteristics referred to in clause 12, the sum of the batch measurements of each of those characteristics must not exceed 1%

(h) Olefins: maximum percentage proportion by volume of 18%

(i) RVP: maximum average of 67 kPa for the period 30 November to 31 March in any year

Note—

For the purposes of calculating the average RVP, an RVP below 62kPa must be considered as an RVP of 62 kPa

(j) Sulphur: maximum of 500 mg per kilogram

(k) TAME: maximum percentage proportion by volume of 1%

Subject to—

(i) clause 12

(ii) if a batch contains a combination of two or more of the characteristics referred to in clause 12, the sum of the batch measurements of each of those characteristics must not exceed 1%

POOL AVERAGE ATI

(a) Pool average ATI: maximum of 22 for the rolling period in relation to a supply of fuel made between 1 February and 1 April in any year

(b) Pool average ATI: maximum of 22.5 for the rolling period in relation to a supply of fuel at all other times

Part 2—Diesel

CHARACTERISTICS

(a) Sulphur: maximum of 1300 mg per kilogram

(b) Cetane Index: minimum of 46

Schedule 2—Test method to determine batch measurements, average batch measurements, and the pool average ATI

PART 1—INTERPRETATION

In this Schedule—

"**ASTM**" means, when followed by a reference code, the test designated by that reference code in the 1999 Annual Book of ASTM Standards published by the American Society for Testing and Materials, Pennsylvania, USA, as amended from time to time;

"**complex model**" means the mathematical model set out in section 2 of Part 2;

"**emission factors**" means the emission rates of Acetaldehyde, Exhaust Benzene, Non-Exhaust Benzene, 1,3 Butadiene and Formaldehyde as determined by the complex model;

"**IP**" means, when followed by a reference number, the test designated by that reference number in the Standard "Methods for Analysis and Testing of Petroleum and Related Products and British Standard 2000 Parts 1999" published by The Institute of Petroleum, London.

PART 2—TEST METHOD

1 Calculate the batch measurement of the following characteristics using the appropriate test from the following tests:

Substance	Tests	Test Name
Aromatics	ASTM D1319-99	D1319-99 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
	ASTM D5134-98	D5134-98 Standard Test Method for Detailed Analysis of Petroleum Naphthas through n-Nonane by Capillary Gas Chromatography – for <2% olefins
	ASTM D5443-93	D5443-93(1998) Standard Test Method for Paraffin, Naphthene, and Aromatic Hydrocarbon Type Analysis in Petroleum Distillates Through 200°C by Multi-Dimensional Gas Chromatography
	ASTM D5580-95	D5580-95 Standard Test Method for Determination of Benzene, Toluene, Ethylbenzene, p/m-Xylene, o-Xylene, C_9 and Heavier Aromatics and Total Aromatics in Finished Gasoline by Gas Chromatography
Benzene	ASTM D3606-99	D3606-99 Standard Test Method for Determination of Benzene and Toluene in Finished Motor and Aviation Gasoline by Gas Chromatography
	ASTM D4420-94	D4420-94(1999)e1 Standard Test Method for Determination of Aromatics in Finished Gasoline by Gas Chromatography
	ASTM D5580-95	D5580-95 Standard Test Method for Determination of Benzene, Toluene, Ethylbenzene, p/m-Xylene, o-Xylene, C_9 and Heavier Aromatics and Total Aromatics in Finished Gasoline by Gas Chromatography

Cetane Index	ASTM D976-91(2000)e1	D976-91(2000)e1 Standard Test Methods for Calculated Cetane Index of Distillate Fuels
	ASTM D4737-96a	D4737-96a Standard Test Method for Calculated Cetane Index by Four Variable Equation
	IP 380/98*	380/98* Calculation of Cetane Index (ST-L-1)
ETBE, MTBE and TAME	ASTM D4815-99	D4815-99 Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, Tertiary-Amyl Alcohol and C1 to C4 Alcohols in Gasoline by Gas Chromatography
	ASTM D5845-95	D5845-95 Standard Test Method for Determination of MTBE, ETBE, TAME, DIPE, Methanol, Ethanol and tert-Butanol in Gasoline by Infrared Spectroscopy
E200/E300	ASTM D86-00	D86-00 Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
	IP 123/99	123/99 Distillation Characteristics of Petroleum Products (ST-B-9)
Lead	ASTM D3237-97	D3237-97 Standard Test Method for Lead in Gasoline by Atomic Absorption Spectroscopy
	ASTM D3341-91	D3341-91 Standard Test Method for Lead in Gasoline-Iodine Monochloride Method
	ASTM D3348-98	D3348-98 Standard Test Method for Rapid Field Test for Trace Lead in Unleaded Gasoline (Colorimetric Method)
	ASTM D5059-98	D5059-98 Standard Test Methods for Lead in Gasoline by X-Ray Spectroscopy
	IP 352/84(96)	352/84(96) Total Lead Content of Gasoline—Non-dispersive X-Ray Fluorescence Spectrometry Method (ST-G-3)
	IP 224/68(96)	224/68(96) Lead Content of Light Petroleum Distillates-Dithizone Extraction Colorimetric Method (ST-G-3)
Olefins	ASTM D1319-99	D1319-99 Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption (same as first one on list)
	ASTM D5443-93	D5443-93(1998) Standard Test Method for Paraffin, Naphthene, and Aromatic Hydrocarbon Type Analysis in Petroleum Distillates Through 200°C by Multi-Dimensional Gas Chromatography
Reid Vapour Pressure	ASTM D323-99a	D323-99a Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)
	ASTM D5190-99	D5190-99 Standard Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
	ASTM D5191-99	D5191-99 Standard Test Method for Vapor Pressure of Petroleum Products (Mini Method)

Sulphur	ASTM D2622-98	D2622-98 Standard Test Method for Sulphur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
	ASTM D4045-99	D4045-99 Standard Test Method for Sulphur in Petroleum Products by Hydrogenolysis and Rateometric Colorimetry
	ASTM D5453-93	D5453-93 Standard Test Method for Determination of Total Sulphur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence
	IP 243/94	243/94 Sulphur Content of Petroleum Products - Wickbold Combustion Method (ST-G-5)
	IP 336/95	336/95 Sulphur - Energy Dispersive X-ray Fluorescence Method (ST-G-5)
	ASTM D4294-98	D4294-98 Standard Test Method for Sulphur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectroscopy

2 Using the batch measurements calculated under section 1 of this Part, calculate the emission factors using the following model:

(NOTE: A software program that performs the calculations described in this section should not be constructed, but should be obtained from the Environment Protection Agency, Department for Environment and Heritage;
The following conditions are specified for the purpose of calculating the emission factors under this section –
Phase= II
Season= Summer
Area Class= C)

(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 = Sulphur 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 deg.F distillation fraction of the target fuel in terms of volume percent
E300 = 300 deg.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
Sulphur (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

TABLE 4—BASELINE NON-EXHAUST EMISSIONS (SUMMER ONLY)

Non-exhaust pollutant	Phase I		Phase II	
	Region 1 (mg/mile)	Region 2 (mg/mile)	Region 1 (mg/mile)	Region 2 (mg/mile)
VOC.....	860.48	769.10	559.31	492.07
Benzene.....	9.66	8.63	6.24	5.50

TABLE 5—TOTAL BASELINE VOC, NO_X AND TOXICS EMISSIONS

	Summer (mg/mile)			
Pollutant	Phase I		Phase II	
	Region 1	Region 2	Region 1	Region 2
NO_X	660.0	660.0	1340.0	1340.0
VOC.....	1306.5	1215.1	1466.3	1399.1
Toxics	48.61	47.58	86.34	85.61
	Winter (mg/mile)			
Pollutant	Phase I		Phase II	
	Region 1	Region 2	Region 1	Region 2
NO_X	750.0	750.0	1540.0	1540.0
VOC.....	660.0	660.0	1341.0	1341.0
Toxics	58.36	58.36	120.55	120.55

(c) *VOC performance*

(1) The exhaust VOC emissions performance of gasolines shall be given by the following equations:

$$VOCE = VOC(b)+(VOC(b) \times Y_{voc}(t)/100)$$
$$Y_{voc}(t) = [(w_1 \times N_V) + (w_2 \times H_V)-1] \times 100$$

where
VOCE = Exhaust VOC emissions in milligrams/mile
$Y_{voc}(t)$ = Exhaust VOC performance of the target fuel in terms of percentage change from baseline
VOC(b) = Baseline exhaust VOC emissions as defined in paragraph *(b)*(2)of this section for the appropriate Phase and season

$N_v = [\exp v_1(t)]/[\exp v_1(b)]$
$H_v = [\exp v_2(t)]/[\exp v_2(b)]$
w_1 = Weighting factor for normal emitters as defined in paragraph *(b)*(1) of this section for the appropriate Phase
w_2 = Weighting factor for higher emitters as defined in paragraph *(b)*(1) of this section for the appropriate Phase
$v_1(t)$ = Normal emitter VOC equation as defined in paragraph *(c)*(1)(i) of this section, evaluated using the target fuel's properties subject to paragraphs *(c)*(1)(iii) and (iv) of this section
$v_2(t)$ = Higher emitter VOC equation as defined in paragraph *(c)*(1)(ii) of this section, evaluated using the target fuel's properties subject to paragraphs *(c)*(1)(iii) and (iv) of this section
$v_1(b)$ = Normal emitter VOC equation as defined in paragraph *(c)*(1)(i) of this section, evaluated using the base fuel's properties
$v_2(b)$ = Higher emitter VOC equation as defined in paragraph *(c)*(1)(ii) of this section, evaluated using the base fuel's properties

(i) *Consolidated VOC equation for normal emitters.*

v_1 = (-0.003641 x OXY) + (0.0005219 x SUL) + (0.0289749 x RVP) + (-0.014470 x E200) + (-0.068624 x E300) + (0.0323712 x ARO) + (-0.002858 x OLE) + (0.0001072 x E2002) + (0.0004087 x E3002) + (-0.0003481 x ARO x E300)

(ii) *VOC equation for higher emitters.*

v_2 = (-0.003626 x OXY) + (-5.40X10-\5\ x SUL) + (0.043295 x RVP) + (-0.013504 x E200) + (-0.062327 x E300) + (0.0282042 x ARO) + (-.002858 x OLE) + (0.000106 x E200\2\) + (0.000408 x E300\2\) + (-0.000287 x ARO x E300)

(*iii*) *Flat line extrapolations*

(A) During Phase I, fuels with E200 values greater than 65.83 percent shall be evaluated with the E200 fuel parameter set equal to 65.83 percent when calculating $Y_{voc}(t)$ and VOCE using the equations described in paragraphs (c)(1) (i) and (ii) of this section. Fuels with E300 values greater than E300* (calculated using the equation E300* = 80.32 + [0.390 x ARO]) shall be evaluated with the E300 parameter set equal to E300* when calculating VOCE using the equations described in paragraphs (c)(1) (i) and (ii) of this section. For E300* values greater than 94, the linearly extrapolated model presented in paragraph (c)(1)(iv) of this section shall be used.

(B) During Phase II, fuels with E200 values greater than 65.52 percent shall be evaluated with the E200 fuel parameter set equal to 65.52 percent when calculating VOCE using the equations described in paragraphs (c)(1)(i) and (ii) of this section. Fuels with E300 values greater than E300* (calculated using the equation E300* = 79.75 + [0.385 x ARO]) shall be evaluated with the E300 parameter set equal to E300* when calculating VOCE using the equations described in paragraphs (c)(1) (i) and (ii) of this section. For E300* values greater than 94, the linearly extrapolated model presented in paragraph (c)(1)(iv) of this section shall be used.

(iv) *Linear extrapolations.*

(A) The equations in paragraphs (c)(1)(i) and (ii) of this section shall be used within the allowable range of E300, E200, and ARO for the appropriate Phase, as defined in table 6:

TABLE 6—ALLOWABLE RANGES OF E200, E300, AND ARO FOR THE EXHAUST VOC EQUATIONS IN PARAGRAPHS (C)(1)(I) AND (II) OF THIS SECTION

Fuel parameter	Phase I		Phase II	
	Lower limit	Higher limit	Lower limit	Higher limit
E200	33.00	65.83	33.00	65.52
E300	72.00	Variable[1]	72.00	Variable[2]
ARO	18.00	46.00	18.00	46.00

[1]Higher E300 limit = lower of 94.0 or 80.32+[0.390 x (ARO)].
[2]Higher E300 limit = lower of 94.0 or 79.75+[0.385 x (ARO)].

(B) For fuels with E200, E300 and/or ARO levels outside the ranges defined in table 6, $Y_{voc}(t)$ shall be defined:

(1) For Phase I:

$$Y_{voc}(t) = 100\% \times 0.52 \times [\exp(v_1(et)) / \exp(v_1(b)) - 1] + 100\% \times 0.48 \times [\exp(v_2(et)) / \exp(v_2(b)) - 1] + \{100\% \times 0.52 \times [\exp(v_1(et)) / \exp(v_1(b))] \times [\{[(0.0002144 \times E200_{et}) - 0.014470] \times \Delta E200\} + \{[(0.0008174 \times E300_{et}) - 0.068624 - (0.000348 \times ARO_{et})] \times \Delta E300\} + \{[(-0.000348 \times E300_{et}) + .0323712] \times \Delta ARO\}]\} + \{100\% \times 0.48 \times [\exp(v_1(et)) / \exp(v_2(b))]\} \times [\{[(0.000212 \times E200_{et}) - 0.01350] \times \Delta E200\} + \{[(0.000816 \times E300_{et}) - 0.06233 - (0.00029 \times ARO_{et})] \times \Delta E300\square + \{[(-0.00029 \times E300\}) + 0.028204] \times \Delta ARO\}]\}$$

(2) For Phase II:

$$Y_{VOC}(t) = 100\% \times 0.444 \times [\exp(v_1(et)) / \exp(v_1(b)) - 1] + 100\% \times 0.556 \times [\exp(v_2(et)) / \exp(v_2(b)) - 1] + \{100\% \times 0.444 \times [\exp(v_1(et)) / \exp(v_1(b))] \times [\{[(0.0002144 \times E200_{et}) - 0.014470] \times \Delta E200\} + \{[(0.0008174 \times E300_{et}) - 0.068624 - (0.000348 \times ARO_{et})] \times \Delta E300\} + \{[(-0.000348 \times E300_{et}) + 0.0323712] \times \Delta ARO\}]\} + \{100\% \times 0.556 \times [\exp(v_2(et)) / \exp(v_2(b))] \times [\{[(0.000212 \times E200_{et}) - 0.01350] \times \Delta E200\} + \{[(0.000816 \times E300_{et}) - 0.06233 - (0.00029 \times ARO_{et})] \times \Delta E300\} + \{[(-0.00029 \times E300_{et}) + 0.028204 \times \Delta ARO\}]\}$$

(C) During Phase I, the "edge target" fuel shall be identical to the target fuel for all fuel parameters, with the following exceptions:

(1) If the E200 level of the target fuel is less than 33 volume percent, then the E200 value for the "edge target" fuel shall be set equal to 33 volume percent.

(2) If the aromatics level of the target fuel is less than 18 volume percent, then the ARO value for the "edge target" fuel shall be set equal to 18 volume percent.

(3) If the aromatics level of the target fuel is greater than 46 volume percent, then the ARO value for the "edge target" fuel shall be set equal to 46 volume percent.

(4) If the E300 level of the target fuel is less than 72 volume percent, then the E300 value for the "edge target" fuel shall be set equal to 72 volume percent.

(5) If the E300 level of the target fuel is greater than 95 volume percent, then the E300 value of the target fuel shall be set equal to 95 volume percent for the purposes of calculating VOC emissions with the Phase I equation given in paragraph (c)(1)(iv)(B) of this section.

(6) If [80.32+(0.390 x ARO)] exceeds 94 for the target fuel, then the E300 value for the "edge target" fuel shall be set equal to 94 volume percent.

(7) If the E200 level of the target fuel is less than 33 volume percent, then ΔE200 shall be set equal to (E200-33 volume percent).

(8) If the E200 level of the target fuel equals or exceeds 33 volume percent, then ΔE200 shall be set equal to zero.

(9) If the aromatics level of the target fuel is less than 18 volume percent, then ΔARO shall be set equal to (ARO-18 volume percent). If the aromatics level of the target fuel is less than 10 volume percent, then ΔARO shall be set equal to -8 volume percent.

(10) If the aromatics level of the target fuel is greater than 46 volume percent, then ΔARO shall be set equal to (ARO-46 volume percent).

(11) If neither of the conditions established in paragraphs (c)(1)(iv)(C)(9) and (10) of this section are met, then ΔARO shall be set equal to zero.

(12) If the E300 level of the target fuel is less than 72 percent, then ΔE300 shall be set equal to (E300-72 percent).

(13) If the E300 level of the target fuel is greater than 94 volume percent and [80.32+(0.390xARO)] also is greater than 94, then ΔE300 shall be set equal to (E300-94 volume percent). If the E300 level of the target fuel is greater than 95 volume percent and [80.32+(0.390 x ARO)] also is greater than 94, then ΔE300 shall be set equal to 1 volume percent.

(14) If neither of the conditions established in paragraphs (c)(1)(iv)(C)(12) and (13) of this section are met, then ΔE300 shall be set equal to zero.

(D) During Phase II, the "edge target" fuel is identical to the target fuel for all fuel parameters, with the following exceptions:

(1) If the E200 level of the target fuel is less than 33 volume percent, then the E200 value for the "edge target" fuel shall be set equal to 33 volume percent.

(2) If the aromatics level of the target fuel is less than 18 volume percent, then the ARO value for the "edge target" fuel shall be set equal to 18 volume percent.

(3) If the aromatics level of the target fuel is greater than 46 volume percent, then the ARO value for the "edge target" fuel shall be set equal to 46 volume percent.

(4) If the E300 level of the target fuel is less than 72 volume percent, then the E300 value for the "edge target" fuel shall be set equal to 72 volume percent.

(5) If the E300 level of the target fuel is greater than 95 volume percent, then the E300 value of the target fuel shall be set equal to 95 volume percent for the purposes of calculating VOC emissions with the Phase II equation given in paragraph (c)(1)(iv)(B) of this section.

(6) If [79.75+(0.385 x ARO)] exceeds 94 for the target fuel, then the E300 value for the "edge target" fuel shall be set equal to 94 volume percent.

(7) If the E200 level of the target fuel is less than 33 volume percent, then ΔE200 shall be set equal to (E200-33 volume percent).

(8) If the E200 level of the target fuel equals or exceeds 33 *volume percent, then ΔE200 shall be set equal to zero.*

(9) If the aromatics level of the target fuel is less than 18 volume percent and greater than or equal to 10 volume percent, then ΔARO shall be set equal to (ARO-18 volume percent). If the aromatics level of the target fuel is less than 10 volume percent, then ΔARO shall be set equal to -8 volume percent.

(10) If the aromatics level of the target fuel is greater than 46 volume percent, then ΔARO shall be set equal to (ARO - 46 volume percent).

(11) If neither of the conditions established in paragraphs (c)(1)(iv)(D)(9) and (10) of this section are met, then ΔARO shall be set equal to zero.

(12) If the E300 level of the target fuel is less than 72 percent, then ΔE300 shall be set equal to (E300 - 72 percent).

(13) If the E300 level of the target fuel is greater than 94 volume percent and (79.75 + (0.385 x ARO)) also is greater than 94, then ΔE300 shall be set equal to (E300 - 94 volume percent). If the E300 level of the target fuel is greater than 95 volume percent and (79.75 + (0.385 x ARO)) also is greater than 94, then "E300 shall be set equal to 1 volume percent.

(2) The winter exhaust VOC emissions performance of gasolines shall be given by the equations presented in paragraph (c)(1) of this section with the RVP value set to 8.7 psi for both the baseline and target fuels.

(3) The non-exhaust VOC emissions performance of gasolines in VOC Control Region 1 shall be given by the following equations, where:

VOCNE1 = Total non-exhaust emissions of volatile organic compounds in VOC Control Region 1 in grams per mile
VOCDI1 = Diurnal emissions of volatile organic compounds in VOC Control Region 1 in grams per mile
VOCHS1 = Hot soak emissions of volatile organic compounds in VOC Control Region 1 in grams per mile
VOCRL1 = Running loss emissions of volatile organic compounds in VOC Control Region 1 in grams per mile
VOCRF1 = Refuelling emissions of volatile organic compounds in VOC Control Region 1 in grams per mile

(i) During Phase I:

$$VOCNE1 = VOCDI1 + VOCHS1 + VOCRL1 + VOCRF1$$
$$VOCDI1 = [0.00736 \times (RVP^2)] - [0.0790 \times RVP] + 0.2553$$
$$VOCHS1 = [0.01557 \times (RVP^2)] - [0.1671 \times RVP] + 0.5399$$
$$VOCRL1 = [0.00279 \times (RVP^2)] + [0.1096 \times RVP] - 0.7340$$
$$VOCRF1 = [0.006668 \times RVP] - 0.0180$$

(ii) During Phase II:

VOCNE1 = VOCDI1 + VOCHS1 + VOCRL1 + VOCRF1
VOCDI1 = [0.007385 x (RVP^2)] - [0.08981 x RVP] + 0.3158
VOCHS1 = [0.006654 x (RVP^2)] - [0.08094 x RVP] + 0.2846
VOCRL1 = [0.017768 x (RVP^2)] - [0.18746 x RVP] + 0.6146
VOCRF1 = [0.004767 x RVP] + 0.011859

(4) The non-exhaust VOC emissions performance of gasolines in VOC Control Region 2 shall be given by the following equations, where:

VOCNE2 = Total non-exhaust emissions of volatile organic compounds in VOC Control Region 2 in grams per mile
VOCDI2 = Diurnal emissions of volatile organic compounds in VOC Control Region 2 in grams per mile
VOCHS2 = Hot soak emissions of volatile organic compounds in VOC Control Region 2 in grams per mile
VOCRL2 = Running loss emissions of volatile organic compounds in VOC Control Region 2 in grams per mile
VOCRF2 = Refuelling emissions of volatile organic compounds in VOC Control Region 2 in grams per mile

(i) During Phase I:

VOCNE2 = VOCDI2 + VOCHS2 + VOCRL2 + VOCRF2
VOCDI2 = [0.006818 x (RVP2)] - [0.07682 x RVP] + 0.2610
VOCHS2 = [0.014421 x (RVP^2)] - [0.16248 x RVP] + 0.5520
VOCRL2 = [0.016255 x (RVP^2)] - [0.1306 x RVP] + 0.2963
VOCRF2 = [0.006668 x RVP] - 0.0180

(ii) During Phase II:

VOCNE2 = VOCDI2 + VOCHS2 + VOCRL2 + VOCRF2
VOCDI2 = [0.004775 x (RVP^2)] - [0.05872 x RVP] + 0.21306
VOCHS2 = [0.006078 x (RVP^2)] - [0.07474 x RVP] + 0.27117
VOCRL2 = [0.016169 x (RVP^2)] - [0.17206 x RVP] + 0.56724
VOCRF2 = [0.004767 x RVP] + 0.011859

(5) Winter VOC emissions shall be given by VOCE, as defined in paragraph (c)(2) of this section, using the appropriate baseline emissions given in paragraph (b)(3) of this section. Total non-exhaust VOC emissions shall be set equal to zero under winter conditions.

(6) *Total VOC emissions.*

(i) Total summer VOC emissions shall be given by the following equations:

VOCS1 = (VOCE / 1000) + VOCNE1
VOCS2 = (VOCE / 1000) + VOCNE2
VOCS1 = Total summer VOC emissions in VOC Control Region 1 in terms of grams per mile
VOCS2 = Total summer VOC emissions in VOC Control Region 2 in terms of grams per mile

(ii) Total winter VOC emissions shall be given by the following equations:

VOCW = (VOCE/1000)
VOCW = Total winter VOC emissions in terms of grams per mile

(7) *Phase I total VOC emissions performance.*

(i) The total summer VOC emissions performance of the target fuel in percentage terms from baseline levels shall be given by the following equations during Phase I:

VOCS1% = [100% x (VOCS1-1.306 g/mi)]/(1.306 g/mi)
VOCS2% = [100% x (VOCS2-1.215 g/mi)]/(1.215 g/mi)
VOC1% = Percentage change in VOC emissions from baseline levels in VOC Control Region 1
VOC2% = Percentage change in VOC emissions from baseline levels in VOC Control Region 2

(ii) The total winter VOC emissions performance of the target fuel in percentage terms from baseline levels shall be given by the following equations during Phase I:

VOCW% = [100% x (VOCW-0.660 g/mi)]/(0.660 g/mi)
VOCW% = Percentage change in winter VOC emissions from baseline levels

(8) *Phase II total VOC emissions performance.*

(i) The total summer VOC emissions performance of the target fuel in percentage terms from baseline levels shall be given by the following equations during Phase II:

VOCS1% = [100% x (VOCS1-1.4663 g/mi)]/(1.4663 g/mi)
VOCS2% = [100% x (VOCS2-1.3991 g/mi)]/(1.3991 g/mi)

(ii) The total winter VOC emissions performance of the target fuel in percentage terms from baseline levels shall be given by the following equation during Phase II:

VOCW% = [100% x (VOC -1.341 g/mi)] / (1.341 g/mi)

(d) *NO_X performance.*

(1) The summer NO_X emissions performance of gasolines shall be given by the following equations:

$NO_X = NO_X(b)+[NO_X(b) \times Y(t)/100]$
$Y_{NOX}(t) = \beta(w_1 \times N_n)+(w_2 \times H_n)-1\alpha \times 100$

where
NO_X = NO_X emissions in milligrams/mile
$Y_{NOx}(t)$ = NO_X performance of target fuel in terms of percentage change from baseline
$NO_X(b)$ = Baseline NOX emissions as defined in paragraph (b)(2) of this section for the appropriate phase and season
N_n = exp n1(t)/exp n1(b)
H_n = exp n2(t)/exp n2(b)
w_1 = Weighting factor for normal emitters as defined in paragraph (b)(1) of this section for the appropriate Phase
w_2 = Weighting factor for higher emitters as defined in paragraph (b)(1) of this section for the appropriate Phase
$n_1(t)$ = Normal emitter NO_X equation as defined in paragraph (d)(1)(i) of this section, evaluated using the target fuel's properties subject to paragraphs (d)(1)(iii) and (iv) of this section

$n_2(t)$ = Higher emitter NO_X equation as defined in paragraph (d)(1)(ii) of this section, evaluated using the target fuel's properties subject to paragraphs (d)(1)(iii) and (iv) of this section

$n_1(b)$ = $_{Normal}$ emitter NO_X equation as defined in paragraph (d)(1)(i) of this section, evaluated using the base fuel's properties

$n_2(b)$ = $_{Higher}$ emitter NO_X equation as defined in paragraph (d)(1)(ii) of this section, evaluated using the base fuel's properties

(i) Consolidated *equation for normal emitters.*

$$n_1 = (0.0018571 \times OXY) + (0.0006921 \times SUL) + (0.0090744 \times RVP) + (0.0009310 \times E200) + (0.0008460 \times E300) + (0.0083632 \times ARO) + (-0.002774 \times OLE) + (-6.63X10^{-7} \times SUL^2) + (-0.000119 \times ARO^2) + (0.0003665 \times OLE^2)$$

(ii) *Equation for higher emitters.*

$$n_2 = (-0.00913 \times OXY) + (0.000252 \times SUL) + (-0.01397 \times RVP) + (0.000931 \times E200) + (-0.00401 \times E300) + (0.007097 \times ARO) + (-0.00276 \times OLE) + (0.0003665 \times OLE^2) + (-7.995x10^{-5} \times ARO^2)$$

(iii) *Flat line extrapolations.*

(A) During Phase I, fuels with olefin levels less than 3.77 volume percent shall be evaluated with the OLE fuel parameter set equal to 3.77 volume percent when calculating NO_X performance using the equations described in paragraphs (d)(1)(i) and (ii) of this section. Fuels with aromatics levels greater than 36.2 volume percent shall be evaluated with the ARO fuel parameter set equal to 36.2 volume percent when calculating NO_X performance using the equations described in paragraphs (d)(1)(i) and(ii) of this section.

(B) During Phase II, fuels with olefin levels less than 3.77 volume percent shall be evaluated with the OLE fuel parameter set equal to 3.77 volume percent when calculating NO_X performance using the equations described in paragraphs (d)(1)(i) and (ii) of this section. Fuels with aromatics levels greater than 36.8 volume percent shall be evaluated with the ARO fuel parameter set equal to 36.8 volume percent when calculating NO_X performance using the equations described in paragraphs (d)(1)(i) and (ii) of this section.

(iv) *Linear extrapolations.*

(A) The equations in paragraphs (d)(1)(i) and (ii) of this section shall be used within the allowable range of SUL, OLE, and ARO for the appropriate Phase, as defined in the following table 7:

TABLE 7—ALLOWABLE RANGES OF SUL, OLE, AND ARO FOR THE NO_X EQUATIONS IN PARAGRAPHS/(D)(1)(I) AND (II) OF THIS SECTION

Fuel parameter	Phase I		Phase II	
	Low end	High end	Low end	High end
SUL.....	10.0	450.0	10.0	450.0
OLE.....	3.77	19.0	3.77	19.0
ARO.....	18.0	36.2	18.0	36.8

(B) For fuels with SUL, OLE, and/or ARO levels outside the ranges defined in table 7 of paragraph (d)(1)(iv)(A) of this section, $Y_{nox}(t)$ shall be defined as:

(1) For Phase I:

$$Y_{Nox}(t) = 100\% \times 0.82 \times [\exp(n_1(et)) / \exp(n_1(b))-1] + 100\% \times 0.18 \times [\exp(n_2(et))/\exp(n_2(b))-1] + \{100\% \times 0.82 \times [\exp(n_1(et)) / \exp(n_1(b))] \times [\{[(-0.00000133 \times SUL_{et}) + 0.000692] \times \Delta SUL\} + \{[(-0.000238 \times ARO_{et}) + 0.0083632] \times ARO\} + \{[(0.000733 \times OLE_{et}) - 0.002774] \times \Delta OLE\}]\} + \{100\% \times 0.18 \times [\exp(n_2(et)) / \exp(n_2(b))] \times [\{0.000252 \times \Delta SUL\} + \{[(-0.0001599 \times AROet) + 0.007097] \times \Delta ARO\} + \{[(0.000732 \times OLE_{et}) - 0.00276] \times \Delta OLE\{]\}$$

(2) For Phase II:

(C) For both Phase I and Phase II, the "edge target" fuel is identical to the target fuel for all fuel parameters, with the following exceptions:

(1) If the sulphur level of the target fuel is less than 10 parts per million, then the value of SUL for the "edge target" fuel shall be set equal to 10 parts per million.

(2) If the sulphur level of the target fuel is greater than 450 parts per million, then the value of SUL for the "edge target" fuel shall be set equal to 450 parts per million.

(3) If the aromatics level of the target fuel is less than 18 volume percent, then the value of ARO for the "edge target" fuel shall be set equal to 18 volume percent.

(4) If the olefins level of the target fuel is greater than 19 volume percent, then the value of OLE for the "edge target" fuel shall be set equal to 19 volume percent.

(5) If the E300 level of the target fuel is greater than 95 volume percent, then the E300 value of the target fuel shall be set equal to 95 volume percent for the purposes of calculating NO_X emissions with the equations given in paragraph (d)(1)(iv)(B) of this section.

(6) If the sulphur level of the target fuel is less than 10 parts per million, then ΔSUL shall be set equal to (SUL-10 parts per million).

(7) If the sulphur level of the target fuel is greater than 450 parts per million, *then ΔSUL shall be set equal to (SUL-450 parts per million).*

(8) If the sulphur level of the target fuel is neither less than 10 parts per million nor greater than 450 parts per million, ΔSUL shall be set equal to zero.

(9) If the aromatics level of the target fuel is less than 18 volume percent and greater than 10 volume percent, then ΔARO shall be set equal to (ARO-18 volume percent). If the aromatics level of the target fuel is less than 10 volume percent, then ΔARO shall beset equal to -8 volume percent.

(10) If the aromatics level of the target fuel is greater than or equal to 18 volume percent, then ΔARO shall be set equal to zero.

(11) If the *olefins* level of the target fuel is greater than 19 volume percent, then ΔOLE shall be set equal to (OLE-19 volume percent).

(12) If the *olefins* level of the target fuel is less than or equal to 19 volume percent, then ΔOLE shall be set equal to zero.

(2) The *winter* NO_X emissions performance of gasolines shall be given by the equations presented in paragraph (d)(1) of this section with the RVP value set to 8.7 psi.

(3) The NO_X emissions performance of the target fuel in percentage terms from baseline levels shall be given by the following equations:

For Phase I:

Summer NO_X% = [100% x (NO_X-0.660 g/mi)]/(0.660 g/mi)
Winter NO_X% = [100% x (NO_X-0.750 g/mi)]/(0.750 g/mi)

For Phase II:

Summer NO_X% = [100% x (NO_X-1.340 g/mi)]/(1.340 g/mi)
Winter NO_X% = [100% x (NO_X-1.540 g/mi)]/(1.540 g/mi)
Summer NO_X% = Percentage change in NO_X emissions from summer baseline levels
Winter NO_X% = Percentage change in NO_X emissions from winter baseline levels

(e) *Toxics performance*

(1) *Summer toxics performance*

(i) Summer toxic emissions performance of gasolines in VOC Control Regions 1 and 2 shall be given by the following equations:

TOXICS1 = EXHBZ + FORM + ACET + BUTA + POM + NEBZ1
TOXICS2 = EXHBZ + FORM + ACET + BUTA + POM + NEBZ2

where
TOXICS1 = Summer toxics performance in VOC Control Region 1 in terms of milligrams per mile.
TOXICS2 = Summer toxics performance in VOC Control Region 2 in terms of milligrams per mile.
EXHBZ = Exhaust emissions of benzene in terms of milligrams per mile, as determined in paragraph (e)(4) of this section.
FORM = Emissions of formaldehyde in terms of milligrams per mile, as determined in paragraph (e)(5) of this section.
ACET = Emissions of acetaldehyde in terms of milligrams per mile, as determined in paragraph (e)(6) of this section.
BUTA = Emissions of 1,3-butadiene in terms of milligrams per mile, as determined in paragraph (e)(7) of this section.
POM = Polycyclic organic matter emissions in terms of milligrams per mile, as determined in paragraph (e)(8) of this section.
NEBZ1 = Non-exhaust emissions of benzene in VOC Control Region 1 in milligrams per mile, as determined in paragraph (e)(9) of this section.
NEBZ2 = Non-exhaust emissions of benzene in VOC Control Region 2 in milligrams per mile, as determined in paragraph (e)(10) of this section.

(ii) The percentage change in summer toxics performance in VOC Control Regions 1 and 2 shall be given by the following equations:

For Phase I:

TOXICS1% = [100% x (TOXICS1 -48.61 mg/mi)] / (48.61 mg/mi)
TOXICS2% = [100% x (TOXICS2 - 47.58 mg/mi)] / (47.58 mg/mi)

For Phase II:

TOXICS1% = [100% x (TOXICS1 - 86.34 mg/mi)] / (86.34 mg/mi)
TOXICS2% = [100% x (TOXICS2 - 85.61 mg/mi)] / (85.61 mg/mi)

where
TOXICS1% = Percentage change in summer toxics emissions in VOC Control Region 1 from baseline levels.
TOXICS2% = Percentage change in summer toxics emissions in VOC Control Region 2 from baseline levels.

(2) *Winter toxics performance.*

(i) Winter toxic emissions performance of gasolines in VOC Control Regions 1 and 2 shall be given by the following equation, evaluated with the RVP set at 8.7 psi:

TOXICW = [EXHBZ + FORM + ACET + BUTA + POM]

where
TOXICW = Winter toxics performance in VOC Control Regions 1 and 2 in terms of milligrams per mile.
EXHBZ = Exhaust emissions of benzene in terms of milligrams per mile, as determined in paragraph (e)(4) of this section.
FORM = Emissions of formaldehyde in terms of milligrams per mile, as determined in paragraph (e)(5) of this section.
ACET = Emissions of acetaldehyde in terms of milligrams per mile, as determined in paragraph (e)(6) of this section.
BUTA = Emissions of 1,3-butadiene in terms of milligrams per mile, as determined in paragraph (e)(7) of this section.
POM = Polycyclic organic matter emissions in terms of milligrams per mile, as determined in paragraph (e)(8) of this section.

(ii) The percentage change in winter toxics performance in VOC Control Regions 1 and 2 shall be given by the following equation:

For Phase I:

TOXICW% = [100% x (TOXICW-58.36 mg/mi)] / (58.36 mg/mi)

For Phase II:

TOXICW% = [100% x (TOXICW-120.55 mg/mi)] / (120.55 mg/mi)

where
TOXICW% = Percentage change in winter toxics emissions in VOC Control Regions 1 and 2 from baseline levels.

(3) Not Applicable

(4) Exhaust benzene emissions shall be given by the following equation, subject to paragraph (e)(4)(iii) of this section:

$EXHBZ = BENZ(b) + (BENZ(b) \times Y_{BEN}(t)/100)$
$Y_{BEN}(t) = \beta(w_1 \times N_b) + (w_2 \times H_b) - 1\alpha \times 100$

where
EXHBZ = Exhaust benzene emissions in milligrams/mile
$Y_{BEN}(t)$ = Benzene performance of target fuel in terms of percentage change from baseline.
BENZ(b) = Baseline benzene emissions as defined in paragraph (b)(2) of this section for the appropriate phase and season.
$N_b = \exp b_1(t)/\exp b_1(b)$
$H_b = \exp b_2(t)/\exp b_2(b)$
w_1 = Weighting factor for normal emitters as defined in paragraph (b)(1) of this section for the appropriate Phase.
w_2 = Weighting factor for higher emitters as defined in paragraph (b)(1) of this section for the appropriate Phase.
$b_1(t)$ = Normal emitter benzene equation, as defined in paragraph (e)(4)(i) of this section, evaluated using the target fuel's properties subject to paragraph (e)(4)(iii) of this section.
$b_2(t)$ = Higher emitter benzene equation as defined in paragraph (e)(4)(ii) of this section, evaluated using the target fuel's properties subject to paragraph (e)(4)(iii) of this section.
$b_1(b)$ = Normal emitter benzene equation as defined in paragraph (e)(4)(i) of this section, evaluated for the base fuel's properties.
$b_2(b)$ = Higher emitter benzene equation, as defined in paragraph (e)(4)(ii) of this section, evaluated for the base fuel's properties.

(i) *Consolidated equation for normal emitters.*

$b_1 = (0.0006197 \times SUL) + (-0.003376 \times E200) + (0.0265500 \times ARO) + (0.2223900 \times BEN)$

(ii) *Equation for higher emitters.*

$b_2 = (-0.096047 \times OXY) + (0.0003370 \times SUL) + (0.0112510 \times E300) + (0.0118820 \times ARO) + (0.2223180 \times BEN)$

(iii) If the aromatics value of the target fuel is less than 10 volume percent, then an aromatics value of 10 volume percent shall be used when evaluating the equations given in paragraphs (e)(4) (i) and (ii) of this section. If the E300 value of the target fuel is greater than 95 volume percent, then an E300 value of 95 volume percent shall be used when evaluating the equations in paragraphs (e)(4)(i) and (ii) of this section.

(5) Formaldehyde mass emissions shall be given by the following equation, subject to paragraphs (e)(5) (iii) and (iv) of this section:

$FORM = FORM(b) + (FORM(b) \times Y_{FORM}(t) / 100)$
$Y_{FORM}(t) = [(w_1 \times N_f) + (w_2 \times H_f) - 1] \times 100$

where
FORM = Exhaust formaldehyde emissions in terms of milligrams/mile.
$Y_{FORM}(t)$ = Formaldehyde performance of target fuel in terms of percentage change from baseline.
FORM(b) = Baseline formaldehyde emissions as defined in paragraph (b)(2) of this section for the appropriate Phase and season.
$N_f = \exp f_1(t)/\exp f_1(b)$
$H_f = \exp f_2(t)/\exp f_2(b)$

w_1 = Weighting factor for normal emitters as defined in paragraph (b)(1) of this section for the appropriate Phase.
w_2 = Weighting factor for higher emitters as defined in paragraph (b)(1) of this section for the appropriate Phase.
$f_1(t)$ = Normal emitter formaldehyde equation as defined in paragraph (e)(5)(i) of this section, evaluated using the target fuel's properties subject to paragraphs (e)(5)(iii) and (iv) of this section.
$f_2(t)$ = Higher emitter formaldehyde equation as defined in paragraph (e)(5)(ii) of this section, evaluated using the target fuel's properties subject to paragraphs (e)(5)(iii) and (iv) of this section.
$f_1(b)$ = Normal emitter formaldehyde equation as defined in paragraph (e)(5)(i) of this section, evaluated for the base fuel's properties.
$f_2(b)$ = Higher emitter formaldehyde equation as defined in paragraph (e)(5)(ii) of this section, evaluated for the base fuel's properties.

(i) *Consolidated equation for normal emitters.*

$$f_1 = (-0.010226 \times E300) + (-0.007166 \times ARO) + (0.0462131 \times MTB)$$

(ii) *Equation for higher emitters.*

$$f_2 = (-0.010226 \times E300) + (-0.007166 \times ARO) + (-0.031352 \times OLE) + (0.0462131 \times MTB)$$

(iii) If the aromatics value of the target fuel is less than 10 volume percent, then an aromatics value of 10 volume percent shall be used when evaluating the equations given in paragraphs (e)(5) (i) and (ii) of this section. If the E300 value of the target fuel is greater than 95 volume percent, then an E300 value of 95 volume percent shall be used when evaluating the equations given in paragraphs (e)(5) (i) and (ii) of this section.

(iv) When calculating formaldehyde emissions and emissions performance, 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.

(6) Acetaldehyde mass emissions shall be given by the following equation, subject to paragraphs (e)(6) (iii) and (iv) of this section:

$$ACET = ACET(b) + (ACET(b) \times Y_{ACET}(t)/100)$$
$$Y_{ACET}(t) = [(w_1 \times N_a) + (w_2 \times H_a)\text{-}1] \times 100$$

where
ACET = Exhaust acetaldehyde emissions in terms of milligrams/mile
$Y_{ACET}(t)$ = Acetaldehyde performance of target fuel in terms of percentage change from baseline
ACET(b) = Baseline acetaldehyde emissions as defined in paragraph (b)(2) of this section for the appropriate phase and season
$N_a = \exp a_1(t)/\exp a_1(b)$
$H_a = \exp a_2(t)/\exp a_2(b)$
w_1 = Weighting factor for normal emitters as defined in paragraph (b)(1) of this section for the appropriate phase
w_2 = Weighting factor for higher emitters as defined in paragraph (b)(1) of this section for the appropriate phase

$a_1(t)$ = Normal emitter acetaldehyde equation as defined in paragraph (e)(6)(i) of this section, evaluated using the target fuel's properties, subject to paragraphs (e)(6)(iii) and (iv) of this section

$a_2(t)$ = Higher emitter acetaldehyde equation as defined in paragraph (e)(6)(ii) of this section, evaluated using the target fuel's properties, subject to paragraphs (e)(6) (iii) and (iv) of this section

$a_1(b)$ = Normal emitter acetaldehyde equation as defined in paragraph (e)(6)(i) of this section, evaluated for the base fuel's properties

$f_2(b)$ = Higher emitter acetaldehyde equation as defined in paragraph (e)(6)(ii) of this section, evaluated for the base fuel's properties

(i) *Consolidated equation for normal emitters.*

$$a_1 = (0.0002631 \times SUL) + (0.0397860 \times RVP) + (-0.012172 \times E300) + (-0.005525 \times ARO) + (-0.009594 \times MTB) + (0.3165800 \times ETB) + (0.2492500 \times ETH)$$

(ii) *Equation for higher emitters.*

$$a_2 = (0.0002627 \times SUL) + (-0.012157 \times E300) + (-0.005548 \times ARO) + (-0.055980 \times MTB) + (0.3164665 \times ETB) + (0.2493259 \times ETH)$$

(iii) If the aromatics value of the target fuel is less than 10 volume percent, then an aromatics value of 10 volume percent shall be used when evaluating the equations given in paragraphs (e)(6) (i) and (ii) of this section. If the E300 value of the target fuel is greater than 95 volume percent, then an E300 value of 95 volume percent shall be used when evaluating the equations given in paragraphs (e)(6) (i) and (ii) of this section.

(iv) When calculating acetaldehyde emissions and emissions performance, 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.

(7) 1,3-butadiene mass emissions shall be given by the following equations, subject to paragraph (e)(7)(iii) of this section:

$$BUTA = BUTA(b) + (BUTA(b) \times Y_{BUTA}(t)/100)$$
$$Y_{BUTA}(t) = [(w_1 \times N_d) + (w_2 \times H_d) - 1] \times 100$$

where

BUTA = Exhaust 1,3-butadiene emissions in terms of milligrams/mile

$Y_{BUTA}(t)$ = 1,3-butadiene performance of target fuel in terms of percentage change from baseline

BUTA(b) = Baseline 1,3-butadiene emissions as defined in paragraph (b)(2) of this section for the appropriate phase and season

$N_d = \exp d_1(t)/\exp d_1(b)$

$H_d = \exp d_2(t)/\exp d_2(b)$

w_1 = Weighting factor for normal emitters as defined in paragraph (b)(1) of this section for the appropriate phase

w_2 = Weighting factor for higher emitters as defined in paragraph (b)(1) of this section for the appropriate Phase.

$d_1(t)$ = Normal emitter 1,3-butadiene equation as defined in paragraph (e)(7)(i) of this section, evaluated using the target fuel's properties, subject to paragraph (e)(7)(iii) of this section.

$d_2(t)$ = Higher emitter 1,3-butadiene equation as defined in paragraph (e)(7)(ii) of this section, evaluated using the target fuel's properties, subject to paragraph (e)(7)(iii) of this section.

$d_1(b)$ = Normal emitter 1,3-butadiene equation as defined in paragraph (e)(7)(i) of this section, evaluated for the base fuel's properties.

$d_2(b)$ = Higher emitter 1,3-butadiene equation as defined in paragraph (e)(7)(ii) of this section, evaluated for the base fuel's properties.

(i) *Consolidated equation for normal emitters.*

$$d_1 = (0.0001552 \times SUL) + (-0.007253 \times E200) + (-0.014866 \times E300) + (-0.004005 \times ARO) + (0.0282350 \times OLE)$$

(ii) *Equation for higher emitters.*

$$d_2 = (-0.060771 \times OXY) + (-0.007311 \times E200) + (-0.008058 \times E300) + (-0.004005 \times ARO) + (0.0436960 \times OLE)$$

(iii) If the aromatics value of the target fuel is less than 10 volume percent, then an aromatics value of 10 volume percent shall be used when evaluating the equations given in paragraphs (e)(7) (i) and (ii) of this section. If the E300 value of the target fuel is greater than 95 volume percent, then an E300 value of 95 volume percent shall be used when evaluating the equations given in paragraphs (e)(7) (i) and (ii) of this section.

(8) Polycyclic organic matter mass emissions shall be given by the following equation:

POM = 0.003355 x VOCE

POM = Polycyclic organic matter emissions in terms of milligrams per mile

VOCE = Non-methane, non-ethane exhaust emissions of volatile organic compounds in grams per mile.

(9) Non-exhaust benzene emissions in VOC Control Region 1 shall be given by the following equations for both Phase I and Phase II:

NEBZ1 = DIBZ1 + HSBZ1 + RLBZ1 + RFBZ1

HSBZ1 = 10 x BEN x VOCHS1 x [(-0.0342 x MTB) + (-0.080274 x RVP) + 1.4448]

DIBZ1 = 10 x BEN x VOCD11 x [(-0.0290 x MTB) + (-0.080274 x RVP) + 1.3758]

RLBZ1 = 10 x BEN x VOCRL1 x [(-0.0342 x MTB) + (-0.080274 x RVP) + 1.4448]

RFBZ1 = 10 x BEN x VOCRF1 x [(-0.0296 x MTB) + (-0.081507 x RVP) + 1.3972

where

NEBZ1 = Non-exhaust emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile.

DIBZ1 = Diurnal emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile.

HSBZ1 = Hot soak emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile.

RLBZ1 = Running loss emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile.

RFBZ1 = Refuelling emissions of volatile organic compounds in VOC Control Region 1 in grams per mile.

VOCDI1 = Diurnal emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile, as determined in paragraph (c)(3) of this section.

VOCHS1 = Hot soak emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile, as determined in paragraph (c)(3) of this section.

VOCRL1 = Running loss emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile, as determined in paragraph (c)(3) of this section.

VOCRF1 = Refuelling emissions of volatile organic compounds in VOC Control Region 1 in milligrams per mile, as determined in paragraph (c)(3) of this section.

(10) Non-exhaust benzene emissions in VOC Control Region 2 shall be given by the following equations for both Phase I and Phase II:

NEBZ2 = DIBZ2 + HSBZ2 + RLBZ2 + RFBZ2
HSBZ2 = 10 x BEN x VOCHS2 x [(-0.0342 x MTB) + (-0.080274 x RVP) + 1.4448]
DIBZ2 = 10 x BEN x VOCD12 x [(-0.0290 x MTB) + (-0.080274 x RVP) + 1.3758]
RLBZ2 = 10 x BEN x VOCRL2 x [(-0.0342 x MTB) + (-0.080274 x RVP) + 1.4448]
RFBZ2 = 10 x BEN x VOCRF2 x [(-0.0296 x MTB) + (-0.081507 x RVP) + 1.3972

where
NEBZ2 = Non-exhaust emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile.

DIBZ2 = Diurnal emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile.

HSBZ2 = Hot soak emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile.

RLBZ2 = Running loss emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile.

RFBZ2 = Refuelling emissions of volatile organic compounds in VOC Control Region 2 in grams per mile.

VOCDI2 = Diurnal emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile, as determined in paragraph (c)(4) of this section.

VOCHS2 = Hot soak emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile, as determined in paragraph (c)(4) of this section.

VOCRL2 = Running loss emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile, as determined in paragraph (c)(4) of this section.

VOCRF2 = Refuelling emissions of volatile organic compounds in VOC Control Region 2 in milligrams per mile, as determined in paragraph (c)(4) of this section.

(f) *Limits of the model.*

(1) The equations described in paragraphs (c), (d), and (e) of this section shall be valid only for fuels with fuel properties that fall in the following ranges for reformulated gasolines and conventional gasolines:

(i) For reformulated gasolines:

Fuel property	Acceptable range
Oxygen.....	0.0-4.0 weight percent.
Sulphur	0.0-500.0 parts per million by weight.
RVP.....	6.4-10.0 pounds per square inch.
E200	30.0-70.0 percent evaporated.
E300	70.0-100.0 percent evaporated.
Aromatics	0.0-50.0 volume percent.
Olefins.....	0.0-25.0 volume percent.
Benzene	0.0-2.0 volume percent.

(ii) For conventional gasoline:

Fuel property	Acceptable range
Oxygen.....	0.00-4.0 weight percent.
Sulphur	0.0-1000.0 parts per million by weight.
RVP.....	6.4-11.0 pounds per square inch.
E200	30.0-70.0 evaporated percent.
E300	70.0-100.0 evaporated percent.
Aromatics	0.0-55.0 volume percent.
Olefins.....	0.0-30.0 volume percent.
Benzene	0.0-4.9 volume percent.

(2) Fuels with one or more properties that do not fall within the ranges described in above shall not be certified or evaluated for their emissions performance using the complex emissions model described in paragraphs (c), (d), and (e) of this section.

3 Using the emission factors calculated under section 2 of this Part, calculate the ATI using the following model:

$$ATI = AC \times 0.016 + (NB + EB) \times 0.17 + BU \times 1.0 + FO \times 0.035$$

where
NB is the non exhaust benzene emission factor
EB is the exhaust benzene emission factor
BU is the 1,3 butadiene emission factor
AC is the acetaldehyde emission factor
FO is the formaldehyde emission factor

4 Using the ATI for each batch of fuel, determine the Pool Average ATI using the following formula:

$$\text{Pool Average ATI} = [(ATI_1 \times V_1) + (ATI_2 \times V_2) + \ldots\ldots + (ATI_n \times V_n)] / V_x$$

where
ATI_i is the ATI of batch i
ATI_n is the ATI of the last batch supplied during the rolling period
V is volume
V_i is the volume of batch i
V_n is the volume of the last batch supplied during the rolling period
V_x is the total volume of all batches supplied during the rolling period, such that $V_x = V_1 + V_2 + \ldots\ldots + V_n$

Schedule 3—Octane extenders that may be added to petrol

For the purposes of clause 11(1), the following octane extenders are octane extenders that may be added to petrol:

Lead : provided that the standard for the batch measurement of lead is not exceeded

Methylcyclopentadienyl manganese tricarbonyl : may be added to LRP only

Schedule 4—Areas in which clause 4 of this policy does not apply to supply of fuel

The following areas are areas in which clause 4 of this policy does not apply to the supply of fuel:

Area of the Berri Barmera Council

Area of the District Council of Grant

Area of the District Council of Loxton Waikerie

Area of the District Council of Renmark Paringa

Unincorporated area of Riverland

Area of the City of Mt Gambier

Area of the Wattle Range Council

Schedule 5—Uses of fuel for which supply is allowed

For the purposes of clause 13, fuel supplied or to be supplied for the following uses is fuel to which this policy does not apply:

Motor vehicle racing competitions

Motor vehicle speed or performance trials

Schedule 6—Additives that may be added to fuel

For the purposes of clause 10, the following additives are additives that may be added to fuel by fuel distributors:

Legislative history

Notes

- For further information relating to the Act and subordinate legislation made under the Act see the Index of South Australian Statutes.

Principal policy

Notice	Provision under which notice is made	Publication of policy in Gazette	Commencement
Gazette 28.2.2002 p1131	s 28	—	1.3.2002